ISE SFEC-2023

International Society for Ethnopharmacology

International Bioresource Conclave & Ethnopharmacology Congress

22nd International Congress of International Society for Ethnopharmacology

&

10th International Congress of Society for Ethnopharmacology

Theme: *"Reimagine Ethnopharmacology: Globalization of Traditional Medicine"*

February 24-26, 2023

Jointly organized by

Institute of Bioresources & Sustainable Development
Takyelpat, Imphal, Manipur, India
www.ibsd.gov.in

Society for Ethnopharmacology
Shaktigarh, Jadavpur, Kolkata, India
www.ethnopharmacology.in

Venue: City Convention Centre, Imphal, Manipur, India

www.isesfec2023.in

www.ibsd.gov.in

ISE SFEC-2023

International Society for Ethnopharmacology

International Bioresource Conclave & Ethnopharmacology Congress

ISE SFEC 2023

22nd International Congress of International Society for Ethnopharmacology

&

10th International Congress of Society for Ethnopharmacology

February 24-26, 2023

"Reimagine Ethnopharmacology: Globalization of Traditional Medicine"

Venue: City Convention Centre, Imphal, Manipur, India

Jointly organized by

Institute of Bioresources & Sustainable Development
Imphal, Manipur, India
www.ibsd.gov.in

Society for Ethnopharmacology
Kolkata, India
www.ethnopharmacology.in

Website: www.isesfec2023.in

National Medicinal Plants Board (NMPB)
Ministry of AYUSH, New Delhi, India

Indian Red Cross Society (IRCS)
Annexe Building, 1st & 2nd floor,
1 Red Cross Road, New Delhi-110001,
Website : www.nmpb.nic.in

International Bioresource Conclave & Ethnopharmacology Congress

22nd International Congress of International Society for Ethnopharmacology & 10th International Congress of Society for Ethnopharmacology

Reimagine Ethnopharmacology: Globalization of Traditional Medicine

February 24-26, 2023

Jointly organized by

INSTITUTE OF BIORESOURCES AND SUSTAINABLE DEVELOPMENT
Department of Biotechnology, Ministry of Science Technology, Government of India
Takyelpat, Imphal, Manipur, India
www.ibsd.gov.in
Society for Ethnopharmacology
Affiliated to: International Society for Ethnopharmacology, Switzerland
Shaktigarh, Jadavpur, Kolkata, India
www.ethnopharmacology.in

Venue: City Convention Centre, Imphal, Manipur, India

PROGRAM SCHEDULE

REGISTRATION: 08:30 – 10:00 AM

Day 1: Friday: February 24, 2023

Venue: City Convention Centre, Imphal, Manipur, India

INAUGURATION OF ISESFEC 2023 Congress at Main Auditorium of City Convention Centre, Imphal, Manipur, India: 10:00 AM - 11:30 AM

Dr. Rajkumar Ranjan Singh, *Hon'ble, Minister of State, Ministry of External Affairs and Education, Govt. of India*

Shri. Th. Biswajit Singh, *Hon'ble Minister of Environment, Forest and Climate Change and Power, Agriculture, Science & Technology, Govt. of Manipur, India*

Shri. Leishemba Sanajaoba, *Hon'ble Member of Parliament, Rajya Sabha, Govt. of India*

Dr. Rajesh S Gokhale, *Secretary, Department of Biotechnology, Ministry of Science & Technology, Govt. of India*

Shri. Sekhar Dutt, *Former Governor of Chhattisgarh, India & Former Secretary, Ministry of Defence; Ministry of AYUSH, Govt. of India*

Prof. Gunter Vollmer, *President, ISE, Emeritus Professor, Faculty of Biology, Dresden University of Technology, Germany*

Shri. Birendra K. Sarkar, *President, Society for Ethnopharmacology, India, Kolkata*

Prof. Marco Leonti, *Secretary, ISE & Dept of Biomedical Sciences, University of Cagliari, Italy*

Dr. C. K. Katiyar, *Vice President, Society for Ethnopharmacology, Kolkata, India*

Mr. Indraneel Das, *Vice President, Society for Ethnopharmacology, Kolkata, India*

Dr. Subhash C Mandal, *Secretary, Society for Ethnopharmacology, India, Kolkata.*

Dr. Nanaocha Sharma, *Organizing Secretary, ISESFEC 2023 & Scientist, Institute of Bioresources & Sustainable Development, Imphal, India*

Prof. Pulok K Mukherjee, *Chairman, ISESFEC 2023 & Director, Institute of Bioresources & Sustainable Development, Imphal, India*

HALL - 1 (SHIRUI): KEYNOTE SESSION I: 11:30 AM - 01:00 PM

"Ethnopharmacology and Drug Discovery – Paradigm Shift"

Chairpersons:

Prof. N Raj Mohan Singh, *Vice Chancellor, DM University, Manipur, India*
Dr. C. K. Katiyar, *Vice President, SFE India & CEO Health Care (Technical), Emami Ltd., Kolkata*

Speaker	Title
About the Congress:	
Prof. Pulok K Mukherjee Chairman, ISESFEC 2023 & Director, Institute of Bioresources & Sustainable Development, Imphal, India	**"Reimagine Ethnopharmacology: Globalization of Traditional Medicines"**
Prof. S K Sopory SERB Distinguished Fellow DST, Govt. of India and Senior Emeritus Scientist, ICGEB, New Delhi	**Melatonin: The dual role in Human Health and Plant Biology**
Prof. Thomas Efferth Professor Johannes Gutenberg University, Institute of Pharmaceutical and Biomedical Sciences, Mainz, Germany	**"Individual natural product-based treatment of multi-drug resistant tumors based on RNA sequencing"**
Prof. Alvaro M Viljoen Department of Pharmaceutical Sciences Tshwane University of Technology Pretoria, South Africa	**"Compiling the first South African Herbal Pharmacopoeia – an important step in the globalisation of South African medicinal plants"**

LUNCH 01:00 PM - 02:00 PM

HALL – 1 (SHIRUI): PLENARY SESSION I: 02:00 PM - 03:30 PM

"Exploring Bioresources for Development of therapeutics"

Chairpersons:

Dr. Subhra Chakraborty, *Director, National Institute of Plant Genome research, New Delhi, India*
Dr. N C Talukdar, *Vice Chancellor, Assam Down Town University, Assam, India*

Speaker	Title
Prof. Domenico Delfino Professor Dipartimento di Medicinae Chirurgia Sezione di Farmacologia Università degli Studi di Perugia, Italy	**"Ethnopharmacology of Endophytic Fungi"**
Dr. U V Babu Head- R&D Himalaya Wellness Company Bangalore, India	**"Taking traditional medicine to global markets – The Opportunities & Challenges"**
Dr. Caroline Weckerle Institute of Systematic and Evolutionary Botany University of Zurich, Switzerland	**"Patterns of medicinal plant use in Middle Europe: Analysis of use trends of 102 taxa over the last 2000 years"**

Prof. Ashwani Pareek Executive Director National Agri-Food Biotechnology Institute (NABI), Mohali, India	**"Food and nutritional security ahead: new challenges and opportunities"**

HALL – 1 (SHIRUI): PLENARY SESSION II: 03:30 PM - 05:00 PM

"Ethnopharmacology inspired Drug Development – Global Scenario"

Chairpersons:

Dr. Subhash C Mandal, *Secretary, Society for Ethnopharmacology, Kolkata, India*

Dr. Shantibala Devi, *Professor Emeritus, Manipur University, Manipur, India*

Speaker	Title
Dr. Arvind Saklani Vice President Sami-Sabinsa Group Ltd. Bengaluru, India	**"Contribution of Sami-Sabinsa Group in Establishing and Growth of Nutraceutical"**
Dr. Motlalepula G Matsabisa Professor, Department of Pharmacology University of the Free State, Bloemfontein, SA	**"The Challenges of Traditional Medicine Development for COVID-19 into Clinical Use – Case Study of PHELA, an African Traditional Medicine based Product"**
Prof. Mrinal Kanti Bhattacharyya Professor, Department of Biochemistry University of Hyderabad Hyderabad, India	**"Anti-malarial drug discovery: top-down or bottom-up approach or a combination of both?"**
Dr. Sanjay Kumar Director CSIR- Institute of Himalayan Bioresource Technology, Palampur, HP, India	**"Management and Sustained Utilization of Himalayan Bioresources"**

HALL - 2 (GINGER): PLENARY SESSION III: 02:00 PM - 03:30 PM

"Challenges for development of Traditional Medicine in the 21st Century"

Chairpersons:

Prof. Krishnan Baskar, *Director, IIIT Senapati, Manipur, India*

Dr. Ramesh Chandra Uniyal, Head, Emami Ltd., Kolkata, India

Speaker	Title
Prof. Yuan Shiun Chang Department of Chinese Pharmaceutical Sciences and Chinese Medicine Resources China Medical University, Taiwan	**"Taiwan Herbal Pharmacopeia and Quality Control of TCM Herbs and Herbal Preparations in Taiwan"**
Prof. Rajib Bandyopadhyay Professor Dept. of Instrumentation Engg., Jadavpur University, Kolkata	**"NIR and Raman Spectroscopy for rapid and non-invasive quality assessment of Medicinal Plants"**
Prof. Rudolf Bauer Professor Institute of Pharmaceutical Sciences Dept. of Pharmacognosy Karl-Franzens-Universität Graz, Austria	**"Metabolic and pharmacological profiling of the TCM formula Hanshiyi used for the treatment of COVID-19"**

Dr. Sunanda Bhattacharyya Asso. Professor Department of Biotechnology and Bioinformatics School of LifeSciences, Hyderabad University Telengana, India	**"Development of a high-throughput assay system for screening phytochemicals against plasmodium topoisomerase vi: a novel anti-malarial target**

HALL - 2 (GINGER): Panel Discussion: "Publication Ethics": 03:30 PM - 05:00 PM

Panellist	
Prof. Alvaro M. Viljoen Editor, Journal of Ethnopharmacology	**Prof. Bhushan Patwardhan** Editor, Journal of Ayurveda & Integrative Medicine
Prof. Michael Heinrich Editor, Frontiers in Pharmacology	**Dr. Tapan K Mukherjee** Former Editor, NISCAIR-IJTK
Prof. Satyajit D Sarkar Editor, Phytochemical analysis	**Prof. Thomas Efferth** Editor, Phytomedicine
Dr. C K Katiyar, Guest Editor, Journal of Ethnopharmacology	**Prof. Jacobus Nicolaas Eloff** Former Editor, South African Journal of Botany
Prof. Marco Leonti Associate Editor, Journal of Ethnopharmacology	**Prof. Alexander Shikov** Associate Editor, Journal of Ethnopharmacology
Dr. Gudrun Ulrich-Merzenich Editor, Synergy	**Dr. Dominico Delfino** Associate Guest Editor, Frontiers in Pharmacology
Prof. Pulok K Mukherjee Consulting Editor, Pharmacological Research	**Dr. Milen Georgiev** Associate Editor, Phytomedicine

HALL - 3 (SANGAI): PLENARY SESSION IV: 02:00 PM - 03:30 PM

"Metabolomics for Quality assessment and validation of botanicals"

Chairpersons:

Dr. Tapan K Mukherjee, *Former Scientist, CSIR-NISCAIR, New Delhi, India*

Dr. Rajib Gogoi, *Scientist, BSI, Sikkim, India*

Speaker	Title
Prof. Sitesh C Bachar Professor Department of Pharmacy University of Dhaka, Bangladesh	**"Export Potentiality of Bangladeshi Medicinal Plants: The Present Status"**
Dr Prakash N S Principal Scientist, Analytical Development Himalaya Wellness Company Bangalore, India	**"Parallel Approach for Mitigation of Metal Contaminants in Herbal Products-Industrial Perspective"**
Dr. Snehasikta Swarnakar Scientist CSIR-Indian Institute of Chemical Biology Kolkata, India	**"Protection against gastric inflammation by herbal treatment via metalloprotease inhibition"**

Prof. Robert Verpoorte Professor Emeritus University of Leiden Leiden, Netherlands	**"Learn from Nature, learn from our ancestors"**

HALL - 3 (SANGAI): PLENARY SESSION V: 03:30 PM - 05:00 PM

"Ethnomedicine: An invaluable source of novel drug"

Chairpersons:

Dr. Paonam Gunindro, Vice Chancellor, Manipur University of Culture, Imphal, India

Dr Harjeet Singh, Research Officer, CCRAS, New Delhi, India

Speaker	Title
Dr. Debprasad Chattopadhyay Former Director ICMR- National Institute of Traditional Medicine, Belgavi, India	**"Breaking the Barrier: Antimicrobial Resistance and Phytoantimicrobials"**
Dr. Robindra Teron Director North Eastern Institute of Ayurveda & Folk Medicine Research, Arunachal Pradesh, India	**"Folk Medicine: Unexplored healing traditions of national importance"**
Dr. Sib Sankar Roy Scientist CSIR-Indian Institute of Chemical Biology Jadavpur, Kolkata, India	**"Metabolic Reprogramming in Tumor Cell: Modulation of Metabolic Pathway as a Promising Therapeutic Strategy"**
Prof. Rainer W. Bussmann Department of Ethnobotany, Institute of Botany, Ilia State University Tbilisi, Georgia	**Quo vadis Ethnopharmacology?**

HALL - 4 (NAKUPI): PLENARY SESSION VI: 02:00 PM - 03:30 PM

"Therapeutic validation of Herbal Medicine"

Chairpersons:

Dr. Siva Ramamoorthy, *Professor, Vellore Institute of Technology, India*

Dr. S Indira Devi, Scientist, IBSD, Imphal, India

Speaker	Title
Dr. Ancuta Raclariu-Manolica Natural History Museum University of Oslo Oslo, Norway	**"DNA barcoding and metabarcoding of herbal medicines"**
Dr. Patrícia Rijo Associate Professor Universidade Lusófona Lisboa, Portugal	**"Plectranthus: from traditional medicine to building blocks for Drug Delivery Platforms"**
Dr. Bob Allkin Program Manager The Royal Botanic Gardens, Kew, United Kingdom	**"Ensuring Scientific Integrity of Ethnopharmacological Research: getting the basics right"**

Dr. Roodabeh Bahramsoltani Vice Dean of International Affairs, School of Persian Medicine Tehran University of Medical Sciences, Tehran, Iran	**"Evidence-based Persian Medicine"**

Hall - 4 (NAKUPI): PLENARY SESSION VII: 03:30 PM - 05:00 PM

"Revitalization of Traditional Medicine: Global Scenario"

Chairpersons:

Dr. Sayeed Ahmed, Professor, JAMIA HAMDARD, New Delhi, India

Dr K. Jeyaram, Scientist-E, IBSD, Imphal, India

Speaker	Title
Dr. Anastasia Karioti Assistant Professor, School of Pharmacy Aristotle University of Thessaloniki, Greece	**"Origanum dictamnus: HPLC-PDA-MS profile of the infusion, its relaxing effect on rabbit intestine and electrospun nanofibers"**
Dr. Guillermo Schmeda Hirschmann Institute of Natural Resources Chemistry University of Talca Talca, Chile	**"Assay-guided isolation allowed identification of α-glucosidase inhibitors in the leaves and a series of flavonoids and saponins in the seeds of Chilean bean (*Phaseolus vulgaris* L.) landraces"**
Dr. Mukhlesur Rahman Associate Professor School of Health, Sports and Bioscience University of East London London, UK	**"How natural products could contribute to tackle the global challenges of antimicrobial resistance (AMR)"**
Dr. K. Charles S Vairappan Institute for Tropical Biology and Conservation Universiti Maylaysia Sabah, Malaysia	**"Metabolomic profiling and bio-medical potentials of essential oils of bornean curcuma"**

POSTER HALL(1st Floor):
POSTER PRESENTATION SESSION I:
03:00 PM - 05:00 PM

SFE ANNUAL GENERAL BODY MEETING:
05:00 PM – 06:00 PM

CULTURAL PROGRAMME:
06:30 PM - 07:30 PM
(Hotel Imphal, Imphal, India)

CONFERENCE DINNER:
07:30 PM - 08:30 PM
(Hotel Imphal, Imphal, India)

Day 2: Saturday: February 25, 2023

Venue: City Convention Centre, Imphal, Manipur, India

HALL – 1 (SHIRUI): KEYNOTE SESSION II: 09:00 AM - 10:30 AM

"Globalization of Traditional: Future Perspectives"

Chairpersons:

Dr. Sudripta Das, Scientist F, IBSD, Imphal, India

Dr. Caroline Weckerle, *Institute of Systematic and Evolutionary Botany, University of Zurich, Switzerland*

Speaker	Title
Prof. Gunter Vollmer Professor Emeritus, Faculty of Biology Dresden University of Technology Dresden, Germany	**"Reflections on metabolism if taking research from cell based in vitro models into in vivo experimental animal models"**
Dr. K. Thangaraj Director Centre for DNA Fingerprinting and Diagnostics, Hyderabad, India	**"Population genomics and public health"**
Prof. Satyajit D. Sarker Director School of Pharmacy and Biomolecular Sciences, Liverpool John Moores University Liverpool, United Kingdom	**"Chemopreventive Natural Products: One of the Key Research Areas at the Centre for Natural Products Discovery"**

HALL -1 (SHIRUI): Plenary Session VIII: 10:30 AM - 12:45 PM

"Bioprospecting of Natural resources – Management of Liver health"

Chairpersons:

Dr. U V Babu, *Head- R&D, Himalaya Wellness Company, Bangalore, India*

Prof. Rajib Bandyopadhyay, *Professor, Dept. of Inst. Engg, Jadavpur University, Kolkata, India*

Prof. Goutam Sutradhar, Director, National Institute Technology, Manipur, India

Speaker	Title
Prof. Marco Leonti Professor Department of Biomedical Sciences, University of Cagliari, Italy	**"Medicines and Foods - Tastes and Uses"**
Dr. Karam Romeo Singh Regional Institute of Medical Science (RIMS),Imphal, Manipur	**"Liver Health (Hepatitis) : Beyond Boundaries"**
Prof. D K Mitra Professor All India Institute of Medical Sciences New Delhi	**"Enhancing host immunity through inhibition of Immune checkpoint inhibitors: Scope of plant derived molecules"**
Prof. Ashis K. Mukherjee Director, Institute of Advanced Study in Science and Technology (IASST) Guwahati, India	**"Therapeutic Application of Plant-derived Natural Products as Antithrombotic Drugs: Key issues and Challenges"**

Dr Sandeep Ojha Director Heyan Healthcare LLP. JAYYUSH HOSPITAL Ghatlodia, Gujarat	**"Liver Health (MAFLD) : Tradition to Translation"**
Dr. Arun Bandyopadhyay, Director CSIR-Indian Institute of Chemical Biology, (CSIR-IICB), Kolkata	**Pharmacological inhibition of human neutrophil elastase by standardized *Sonneretia apetala* Buch.-Ham. fruit extract"**

LUNCH: 12:45 PM – 01:30 PM

HALL -1 (SHIRUI): SPECIAL PROGRAM:
01:30 PM - 03:30 PM

SFE-ANNUAL AWARD CEREMONY

i-Connect program: Business Meet

Chief Guest:
Dr. Jitendra Singh, *Hon'ble Union Minister of State (Independent Charge) of the Ministry of Science & Technology, Ministry of Earth Sciences, Union Minister of State in the Prime Minister's Office, Ministry of Personnel, Public Grievances & Pensions, Minister of State in the Department of Atomic Energy and Department of Space, Govt. of India*

Guest of Honour:
Dr. Rajkumar Ranjan Singh, Hon'ble, Minister of State, Ministry of External Affairs and Education, Govt. of India

Guest of Honour:
Dr. Rajesh S. Gokhale, Secretary, Department of Biotechnology, Ministry of Science and Technology, Govt. of India, New Delhi

	Inauguration of Industry-Connect (i-connect) Programme, Inauguration of Centre for outreach activities, Student Hostel, release of book "Pictorial Check List of Plants of Manipur" developed by IBSD, Imphal and BSI, Kolkata
	Welcome Address by Prof. Pulok K Mukherjee, Chairman, ISESFEC 2023 & Director, IBSD, Imphal, Manipur, India
	Address by Dr. Rajesh S. Gokhale, Secretary, Department of Biotechnology, Ministry of Science and Technology, Govt. of India, New Delhi
	Address by: Dr. Rajkumar Ranjan Singh, Hon'ble, Minister of State, Ministry of External Affairs and Education, Govt. of India
	Address by Shri. Shekahr Dutt, Former Governor of Chhattisgarh, India & Former Secretary, Ministry of Defence; Ministry of AYUSH, Govt. of India
	Address by Prof. Marco Leonti, Secretary, ISE & Professor, Department of Biomedical Sciences, University of Cagliari, Italy
	Annual Award Ceremony of the Society for Ethnopharmacology – conducted by Shri. Indraneel Das, Vice President, Society for Ethnopharmacology, Kolkata, India
	Address by Dr. Jitendra Singh, Hon'ble Minister of State (IC), Ministry of Science & Technology and Earth Sciences.
	Address by Dr. C K Katiyar, Vice President, Society for Ethnopharmacology, Kolkata, India
	Vote of thanks by Dr. Subhash C Mandal, Secretary, Society for Ethnopharmacology, Kolkata, India
	Visit to Exhibition Hall, Poster Presentations.

Chairpersons:

Dr. Lal Hingorani, Director, Pharmanza India Pvt Ltd., Gujarat, India

Dr. C. K. Katiyar, CEO Health Care (Technical), Emami Ltd., Kolkata

Panellist	
Dr. Thangjam Dhabali Singh, MD, BABINA Healthcare and Hospitality Industries Pvt Ltd, Manipur, India	**Dr. Arvind Saklani** Vice President Sami-Sabinsa Group Ltd., Bengaluru, India
Dr. Manish Diwan DGM & HoD – SPED, BIRAC, New Delhi	**Shri. Indraneel Das** MD, Declibac Technologies. Pvt. Ltd. Kolkata
Dr. U V Babu Head, The Himalaya Drug Company Bangalore, India	**Shri. B K Sarkar** CEO, Parker Robinson Pvt. Ltd. Kolkata
Dr. Madhu Dikshit Former Director, CDRI, Lucknow.	**Ms. Eli Chaoba** Founder, Dweller Imphal, India
Shri. Shibashis Sarkar Chief Operating Officer, Ramy Group, Bangladesh	**Dr Arun Gupta** Managing Director, Ayuswasth Ltd. Faridabad, India
Dr. Mrutyunjay Suar Professor & Head R&D KIIT, Bhubaneswar, India	**Ms. Bijiyashanti Tongbram** Managing Director, Lotus Fibre Textiles Imphal, India
Dr. Sainam Yoirentomba Deputy Director, MSME Technology Centre Manipur, India	**Mr. Kartikeya Baldwa** CEO, Ixoreal Biomed. Inc, Hyderabad, India
Prof. Marco Leonti Secretary, ISE &Professor, Department of Biomedical Sciences, University of Cagliari, Italy	**Prof. Pulok K Mukherjee** Chairman, ISESFEC 2023 & Director, Institute of Bioresources & Sustainable Development, Imphal
Dr. Nanaocha Sharma Organizing Secretary, ISESFEC 2023 & Scientist, IBSD, Imphal	**Dr. T V Narayana** President Indian Pharmaceutical Association, Mumbai

HALL -2 (GINGER): Plenary Session IX: 03:30 PM - 06:00 PM

"Reimagine Ethnopharmacology: Herbs in One Health"

Chairpersons:

Smt. Homila Hongrei, *Director, Department of Science and Technology, Manipur, India*

Dr. Debprasad Chattopadhyay, Former Director, ICMR –NITM, Belagavi, India

Dr. Preeti Kothiyal, *Vice Chancellor, DBUU, Dehradun, India*

Speaker	Title
Dr. T. Senthil Kumar Professor SRM Medical College Hospital & Research Centre, Chennai, India	**"Role of Phytotherapy in Urolithiasis: Overview and clinical perspective of use of herbs."**
Prof. Hung-Rong Yen Professor, China Medical University & China Medical University Hospital, Taiwan	**"Immunological Modulation and Epigenetic Modification by Chinese Herbal Medicine for the Treatment of Asthma in Taiwan"**
Dr. T. Bilashini Devi Ex Director; Family Welfare, Govt. of Manipur Manipur, India	**"Expansion of role of traditional medicine in women's health"**

Prof. Dr. Milen I. Georgiev Head, Metabolomics Laboratory Institute of Microbiology, Bulgarian Academy of Sciences, Plovdiv, Bulgaria	**"Obesity management potential of natural compounds"**
Dr. Sanjeeb K Sahoo Scientist, Institute of Life Sciences Bhubaneswar, India	**"Ethnopharmacology and anticancer drug discovery: A journey with Nano-formulations"**
Prof. Bhushan Patwardhan National Professor Ministry of AYUSH, Govt. of India New Delhi	**"Ethnopharmacology approach: Opportunities in biomedical research"**
Dr. Gudrun Ulrich-Merzenich Cooperative Rheumacentrum Aachen-Cologne-Bonn Laboratory, Merzenich University Clinic Centre Bonn Bonn, Germany	**"The neurotrophic Activity of *Ballota nigra* L. *Crataegus oxycantha* L., *Passiflora incarnata* L., *Valeriana officinalis* L. and its Combination in vitro and in vivo"**

HALL -3 (SHANGHAI): 10:00 AM - 01:00 PM:
Traditional Healers' Conclave:
"Traditional Healthcare Practices - Exploring Ancestral Medicine"

Guest of Honour:

Dr. Lal Hingorani, Director, Pharmanza India Pvt Ltd., Gujarat, India
Dr. Mrs. Marrone Valeria, University of Cagliari, Italy
Dr. Arun Bandyopadhyay, Director, CSIR-IICB, Kolkata, India
Dr. Neeta Mehesekar, Director, NEIAH, Shillong
Dr. Th. Sabita Devi, Associate Professor, DMU, Imphal, India

Moderators:

Dr. Pardeep Kumar Bhardwaj, Scientist-E, IBSD, Imphal, India
Dr. Nanaocha Sharma, Scientist E, IBSD, Imphal, India
Dr. Sushil K Chaudhary, Project Scientist, IBSD, Imphal, India
Dr. K Ojit Singh, Project Scientist, IBSD, Imphal, India
Shri. Kalyan Nath, CIT (Appeals), Unit-1, Guwahati, India
Dr. Samar Roychowdhury, Pune, India
Mrs. Seha Singha, Society for Ethnopharmacology, India
Ms. Thokchom Biona, IBSD, Imphal, India

Lead Speakers:

Dr. Heena Tabassum, Scientist, Indian Council of Medical, New Delhi, India

Title: "Leveraging Traditional Medicine Research: Way Forward"

Panellist	
Dr. Marco Leonti Cagliari, Italy	**Mr. Nirmal Kumar Awasthi** Chhattisgarh, India
Vd. Shuklal Jharkhand, India	**Shri. Nar Bahadur Limboo** Sikkim, India
Vd. Sridhar Desai Belagavi, India	**Prof. M. G Matsabisa** Bloemfontein, South Afria
Mr. Netaji Apatwar MH, India	**Dr. Pramod H J** Belagavi, Karnataka, India

Shri. Jasper B. Manih Ri-Bhoi District, Meghalaya	**Dr. Rajesh Singh Pawar** Bhopal, MP, India
Mr. Anup K Sarkar Kolkata, India	**Shri Christopher Myrthong** South West Khasi Hills District, Meghalaya
Th. Thombiraj Manipur, India	**Dr. H. Carehome Pakyntein** West Jaintia Hills District, Meghalaya
Dr. Prasanna Kumar Patra Odisha, India	**Dr. Surendra Kumar Jena** Odisha, India
Vd. Shridhar Desai Uttara Kannada, Karnataka	**Dr Caroline Wekerle** Zurich, Switzerland
Ahongjao Soibam Bishnupur, Manipur	**Nongthombam Munindro Meitei** Imphal West District, Manipur
Laishram Bisheshwor Meitei Thoubal, Manipur	**Tarenjam Babita** Thoubal Leishangthe
Ahongjao Soibam Bishnupur, Manipur	**Dr Jatin Kalita** Jorhat, Assam
Ashem Mohori Wapokpi, Manipur	**Tomba** Keithelmanbi, Manipur
Laishram Bisheshwor Meitei Thoubal, Manipur	**Darhminglien** Churachandpur, Manipur
Dr. Chandana Barua **Guwahati, Assam**	**Ronit Yanglem** Khurai Puthiba Leikai, Manipur
Naorem Bhorot Singh Kakching, Manipur	**Tarenjam Babita** Thoubal Leishangthe, Manipur
Ningthoujam Toyai Singh Imphal West, Manipur	**Paulason Gangte** Churachandpur, Manipur
Tourangbam Arunbabu Singh Imphal West, Manipur	**Louriyam Shantani Devi** Imphal West, Manipur
Phuyam Chourajit Singh Imphal, Manipur	**Nongthombam Munindro Meitei** Imphal West, Manipur
Pu. P. C. Lalrikhuma Aizwal, Mizoram	**Ningthoukhongjam Tombiraj** Uripok, Manipur
Phuritshabam Liklainganbi Devi Imphal West, Manipur	**Krishnagopi** Thoubal, Manipur
Allimuddin Chesan Makha Leikai, Manipur	**Pu. Ngahaka** Aizwal, Mizoram
Nongthombam (o) Tombi Wangjing, Imphal, Manipur	**Ani Thokchom** Heirok Part II, Manipur
Thangzatong Churachandpur, Manipur	**Yumlembam Yaima** Sekmai Mayai Leikai, Manipur
Rakesh Khwairakpam Sekmai, Manipur	**Khwairakpam Yumjao** Khunou Leikai, Manipur
Phuritsabam Nokun Singh Khurkhul, Imphal West, Manipur	**Laishram Nabakishore** Imphal West, Manipur

LUNCH: 012:45 PM – 01:30 PM

HALL -2 (GINGER): PRESENTATION – YOUNG ETHNOPHARMACOLOGIST COMPETITION: 09:00 AM - 01:00 PM
HALL - 3 (SHANGAI): ORAL PRESENTATION SESSION: I 02:00 PM – 03:30 PM
HALL - 3 (SHANGAI): ORAL PRESENTATION SESSION: II 03:30 PM - 06:00 PM
HALL - 4 (NAKUPI): E-PRESENTATION SESSION I 10:00 AM - 01:00 PM
HALL - 4 (NAKUPI): E-PRESENTATION SESSION: II 02:00 PM - 05:00 PM
POSTER PRESENTATION SESSION II: 11:00 AM - 01:00 PM
POSTER PRESENTATION SESSION III: 02:00 PM - 04:00 PM
CULTURAL PROGRAMME: 06:00 PM - 07:00 PM **(Hotel Imphal, Imphal, India)**
SFE DINNER: 07:00 PM - 08:30 PM **(Hotel Imphal, Imphal, India)**

Day 3: Sunday: February 26, 2023
Venue: City Convention Centre, Imphal, Manipur, India

HALL -1 (SHIRUI): KEYNOTE SESSION III:
09:00 AM - 10:30 AM

"Traditional Medicine inspired drug Development"

Chairpersons:

Prof. Ashis K. Mukherjee, Director, IASST, Guwahati, India

Prof. Alvaro M Viljoen, *Department of Pharmaceutical Sciences, Tshwane University of Technology, Pretoria, South Africa*

Speaker	Title
Dr. Partha Pratim Majumder, National Science Chair SERB, Govt. of India & Former Director NIBMG, Kalyani, West Bengal, India	**"Diversity, Relationship and ancestries of population groups of India captured by genomic studies"**
Prof. Alexander Shikov St. Petersburg State Chemical Pharmaceutical University St. Petersburg, Russia	**"Medicinal plants used in Russian medicine to cure diseases of respiratory tract"**
Dr. Ashiho Asosii Mao Director Botanical Survey of India Kolkata	**"Plant Wealth of North East India and its bio-economy prospects"**

HALL -1 (SHIRUI): PLENARY SESSION X:
10:30 AM - 11:30 AM

"Ethnopharmacology, Ethnomedicine - Resources of Novel drugs"

Chairpersons:

Dr. Arvind Saklani, *Vice President, Sami-Sabinsa Group Ltd., Bengaluru, India*

Dr. Sitesh C Bachar, *Dean, Faculty of Pharmacy, Dhaka University, Bangladesh*

Speaker	Title
Dr. Rabinarayan Acharya Director General Central Council for Research in Ayurvedic Sciences Ministry of AYUSH, New Delhi, India	**"Ethnopharmacology, an aid to enrich Ayurveda Pharmacopoeia"**
Dr. Anjan Adhikari Medical Superintendent cum Vice President Principal, Medical College & Hospital Kolkata	**"Pharmaco-vigilence – the future drug development"**
Prof. Jyoti Prakash Tamang School of Life Sciences Sikkim University Tadong, Gangtok	**"Indian Fermented Foods as Medicine: Metagenomics, Metabolomics and Metagenome Assembled Genomes"**

HALL -1 (SHIRUI): PLENARY SESSION XI:
11:30 AM - 01:00 PM

"Ashwagandha- Quality evaluation and Validation"

Chairpersons:

Prof. Debananda Singh, *Professor, Manipur University, Manipur, India*

Dr. Sanjoy Gopal Sarkar, *Jt. Registrar, Jadavpur University, Kolkata*

Speaker	Title
Dr. Roy Upton Founder and Executive Director American Herbal Pharmacopoeia Scotts Valley, USA	**"Development of an Ashwagandha Monograph and Therapeutic Compendium for the American herbal Pharmacopoeia"**
Dr. Chris Kilham Medicine Hunter USA	**"Plants, People and Places Ethnobotany and Botanical Trade"**
Dr. Madhu Dikshit Former Director, CSIR-Central Drug Research Institute (CSIR-CDRI), Lucknow, India	**"Efficacy of the root extract of *Withania Somnifera* in the experimental models of SARS-CoV2, inflammation, and innate immune response"**
Dr. Mark Blumenthal Founder & Executive Director American Botanical Council Texas, USA	**"ABC-AHP-NCNPR Botanical Adulterants Prevention Program (BAPP)"**
Dr. Kartikeya Baldwa Founder & CEO, Ixoreal Biomed Inc. Hyderabad, India	

LUNCH: 01:00 PM – 02:00 PM

HALL -2 (GINGER): 10:00 AM - 01:00 PM
PANEL DISCUSSION on "Reimagine Ethnopharmacology"

Chairperson:

Dr. USN Murthy, Director, NIPER, Guwahati, India

Dr. Lal Hingorani, Director, Pharmanza India Pvt Ltd., Gujarat, India

Moderators:

Shri. Shibashis Sarkar, Chief Operating Officer, Ramy Group, Bangladesh

Dr. Nanaocha Sharma, Organizing Secretary, ISESFEC 2023 & Scientist, IBSD, Imphal

Dr. Pardeep K Bhardwaj, Organizing Secretary & Scientist, IBSD, Imphal, India

Prof. Pulok K Mukherjee, Chairman, ISESFEC 2023 & Director, IBSD, Imphal, India

Speaker	Title
Dr. G. Narahari Sastry Director CSIR- North East Institute of Science and Technology (CSIR-NEIST), Jorhat, Assam, India	**"Industry 5.0 driven polypharmacology"**
Dr. Siva Ramamoorthy Dean School of Bio Sciences and Technology, Vellore Institute of Technology Tamil Nadu, India	**"Bioprospecting of natural pigments- An avenue of immense potential"**

Prof. Sayeed Ahmad Coordinator, Delhi, Local Chapter, SFE & Professor, School of Pharmaceutical Education and Research, Jamia Hamdard, New Delhi	HPTLC MS based bioprofiling of medicinal plants and traditional formulations using effect direct analysis
Dr Pramod J. Hurkadale Coordinator, Belgaum, Local Chapter, SFE & Head-Pharm. Biotechnology KLE University, Belgaum Karnataka, India	Utilization Indian Traditional Medicinal Plants for Globalization
Dr Sanjay M Jachak Coordinator Mohali Local Chapter, SFE & Professor, Department of Natural Products, NIPER, Mohali, India	**"Natural Products as source of Anti-Diabesity Agents"**
Prof. K. Mruthunjaya Coordinator, Mysuru, Local Chapter, SFE & Head, Dept. of Pharmacognosy JSS College of Pharmacy, JSS Academy of Higher Education and Research, Mysuru, India	**"Traditional plants as memory enhancing agents: An attempt to relate phospholipids and memory"**
Dr. Sanjay Tamoli Director, Target Institute of Medical Education & Research, Mumbai, India	**"New dimension to holistic herbal extract"**
Dr. Chandana Barua Coordinator, Guwahati, Local Chapter, SFE & Professor, Dept. of Pharmacology & Toxicology College of Veterinary Science Khanapara, Guwahati, India	**"Traditional herbal medicinal sources for clinical purpose: importance, challenges and future"**
Dr. Sagar K. Mishra Associate Professor Utkal University, Odisha, India	**"Antidiabetic evaluation of α-amyrine acetate isolated from *Streblus asper* lour stem bark and its quantification by HPTLC method"**
Dr. Satyanshu Kumar Coordinator, Gujarat, Local Chapter, SFE & Principal Scientist Directorate of Medicinal and Aromatic Plants Research, Boriavi 387310, Anand, Gujarat, India	
Dr. Sathiyanarayanan L. Coordinator, Pune Local Chapter, SFE & Dept of Pharmaceutical Chemistry, Bharati Vidyapeeth University Poona College of Pharmacy, Pune, MH, India	**"Research Potential of Indian Bee Products"**
Dr Jatin Kalita Coordinator, Jorhat Local Chapter, SFE & Principal Scientist, CSIR-North East Institute of Science and Technology, Jorhat, India	**"Ethnopharmacological prospects of insect bioresources in managing metabolic disorders."**
Dr. Prosoon K. Gupta Coordinator, Jammu Local Chapter, SFE & Principal Scientist, CSIR- Indian Institute of Integrative Medicine, Jammu-180001, India	**Discovery of Novel Steroidal Saponins from rhizomes of Trillium govanianum and their Potential Anticancer Activity**
Dr. Rajesh Singh Pawar Coordinator, Bhopal, Local Chapter, SFE & Professor& Principal, Faculty of Pharmacy TRUBA College of Pharmacy, Bhopal, India	
LUNCH: 01:00 PM – 02:00 PM	

HALL -3 (SANGAI): PLENARY SESSION XII: 10:00 AM - 11:30 PM

"Ethnobotany and Biotechnology- development of natural products"

Chairpersons:

Prof. R. Varatharajan, *Dean, School of Life Sciences, Manipur University, Imphal, Manipur*

Dr. Sunil Dubey, *Emami Ltd., Kolkata*

Speaker	Title
Prof. Jacobus Nicolaas Eloff Phytomedicine Programme Faculty of Veterinary Medicine University of Pretoria, South Africa	**"The interaction between activity of plant extracts against animal pathogens/ pests; a dilemma and a possible solution"**
Dr. Subarna Roy Director, ICMR- National Institute Traditional Medicine (ICMR-NITM) Belagavi, India	**"ICMR-National Institute of Traditional Medicine's contributions to TM research"**
Prof. Pallab Kanti Haldar Director School of Natural Product Studies Jadavpur University, Kolkata	**"Roll of medicinal plants to combat metabolic disorder with special emphasis on diabetes and related pathological complications"**
Prof. Michael Heinrich The School of Pharmacy University of London London, UK	**"Why bother about 'best practice'? Or, why we need a consensus on good methodological approaches"**

HALL -3 (SANGAI): PLENARY SESSION XIII: 11:30 AM - 01:00 PM

"Recent approaches for drug development from Botanicals"

Chairpersons:

Dr. Khuraijam Rajanjana Devi, Dept. of Microbiology, RIIMS, Imphal, India

Dr. H. Sunitibala Devi, *Scientist, IBSD, Imphal, India*

Speaker	Title
Dr. K. Suresh Babu Senior Principal Scientist CSIR- Indian Institute of Chemical Technology, Telangana, Hyderabad, India	**"Recent Approaches in Natural Products Research for Drug Discovery"**
Dr. Dilip Ghosh Director, Nutriconnect Sydney, Australia	**"Obesity and lifestyle-related disorders beyond the stethoscope: Role of evidence-based botanicals"**
Dr. Dinesh Kumar Scientist, CSIR-IHBT Palampur, India	**"Metabolomics: A way towards metabolic information and quality control of Traditional medicine"**
Dr. Sumeet Gairola Principal Scientist CSIR-Indian Institute of Integrative Medicine Canal Road, Jammu, J&K, India	**"Ethnomedicinal plants used by the indigenous communities of Ladakh, India"**
Dr. Arulmozhi. S Department of Pharmacology, Poona College of Pharmacy, Bharati Vidyapeeth, Pune, India	**"Repurposing Indian Traditional Formulations for Treatment of Neurodegenerative Diseases"**

HALL -4 (NAKUPI): PLENARY SESSION XIV: 10:00 AM - 11:30 AM

"Quality, safety and efficacy of Traditionally used medicinal plants"

Chairpersons:

Dr. Y. Rajasekhar, Scientist, IBSD, Imphal, Manipur, India
Dr. Biseshwori Thongam, Scientist, IBSD, Imphal, India

Speaker	Title
Prof. Geoffrey A. Cordell College of Pharmacy University of Florida, FL, USA	**"L.O.V.E., R.E.S.P.E.C.T., and the Future of Natural Products in Society"**
Dr. Min Ye Vice Dean, School of Pharmaceutical Sciences Peking University, China	**"The effective component of Chinese herbal medicines and their biosynthesis"**
Dr. Rabea Parveen Bioactive Natural Products Laboratory, JAMIA HAMDARD, New Delhi, India	**"Nanoformulation approach for delivery of Combination of silymarin and 5-fu for treatment of solid tumor"**
Prof. Gertrude Morlock Justus Liebig University Giessen, Germany	**"Healthy oils are not necessarily healthy"**
Dr. Krystyna Skalicka-Woźniak Department of Pharmacognosy Medical University of Lublin, Poland	
Prof. M. Fawzi Mahomoodally Head, University of Mauritius, Réduit, Mauritius	

HALL -4 (NAKUPI): PLENARY SESSION XV: 11:30 AM - 01:00 PM

"Traditional system of Medicines- Global perspectives "

Chairpersons:

Dr. R K Pritamjit Singh, *Scientific Officer, MASTEC, Manipur, India*
Dr. S Rajan, Senior Scientist and Head, R&D, Kalpavriksha Agrisciences Pvt. Ltd., Ooty

Speaker	Title
Dr. Diamanto M. Lazari Department of Pharmaceutical Chemistry Aristotle University of Thessaloniki, Greece	**"Exploring the medicinal potential of plants of the genus Achillea L. (Asteraceae)"**
Dr. Rawiwan Charoensup Department of Applied Thai Traditional Medicine, Mae Fah Luang University, Chiang Rai, Thailand	**"Herbal Technology to sustain climate change and Circular Bio-economy"**
Dr. Sri Fatmawati Institute Teknologi Sepuluh Nopember (ITS), Surabaya, Indonesia	**"Jamu: Indonesian Traditional Medicines"**
Dr. Julieta Z. Dungca Dean, School of Science and Technology Centro Escolar University, Philippines	
Prof. Zhao Zhongzhen Associate Dean Hong Kong Baptist University, Hong Kong	

LUNCH: 01:00 PM – 02:00 PM

Day 2: Saturday: February 25, 2023

ORAL PRESENTATIONS

Evaluators

Prof. Sitesh C Bachar, Professor, Department of Pharmacy, University of Dhaka, Bangladesh
Prof. Domenico Delfino, Professor, Farmacologia, Università degli Studi di Perugia, Italy
Dr. Subhash C Mandal, Secretary, Society for Ethnopharmacology, Kolkata
Prof. Alexander Shikov, St. Petersburg State Chemical Pharmaceutical University, St. Petersburg, Russia
Dr. Rituraj Konwar, Principal Scientist, CSIR-NEIST, Jorhat, India
Prof. N Mohilal Meitei, Head, Dept of Zoology, Manipur University, Imphal
Dr. Santanu Bhadra, Global Information Manager, GSK, Bengaluru, India
Dr. Sushil K Chaudhary, Project Scientist, IBSD, Imphal, Manipur, India

YOUNG ETHNOPHARMACOLOGIST COMPETITION: 09:00 AM – 01:00 PM

Abstract No	Presenting Author	Title of Abstract
ISESFEC/23/O-002	Monika Binwal	*Taxus wallichiana* needle extracts alleviates high-fat diet-induced insulin resistance in C57BL/6 mice; A Chemico - Pharmacological study
ISESFEC/23/O-005	Raktimava Das Sarkar	Ethnobotanical insulin plant *Costus igneus* as a novel herbal transdermal patch
ISESFEC/23/O-009	Pritam Saha	Piperine attenuates cigarette smoke-induced oxidative stress, lung inflammation and epithelial-mesenchymal transition by modulating SIRT1/Nrf2 axis
ISESFEC/23/O-010	Deepika N.P	Neuroprotective effects of Ayurvedic edible crab rasayana in a rotenone-induced Parkinson's rat model
ISESFEC/23/O-011	Anshuly Tiwari	Kashmir saffron based enriched carotenoids botanical supplement and its role in women's health
ISESFEC/23/O-016	Hiranmoy Barman	Anti-viral efficacy of selected ethnomedicinal allium sp. of north east india against SARS-COV-2 infection
ISESFEC/23/O-017	Mir Ekbal Kabir	Ethnic fermented soybean food of North East India with promising antidiabetic potential
ISESFEC/23/O-019	Nikunjana Patel	A ready-to-use galactagogue nutraceutical
ISESFEC/23/O-020	Bhaskar Das	Metabolite profiling and safety evaluation of semi-aquatic edible herbs as potential inhibitors of cholinesterase and β-secretase
ISESFEC/23/O-021	Sandeep Sankaran	Integrated network-based analysis, molecular docking, and bioautography methods to decipher the protective role of Indian propolis in Alzheimer's disease
ISESFEC/23/O-023	Pankaj Barman	Exploration of traditional fermented beverages of Assam for pharmacological activities
ISESFEC/23/O-024	Vishal Gokul Beldar	An improved method for separating asiatic acid and asiaticoside rich fraction from *Centella asiatica* and Its investigation with amyloidogenic proteins
ISESFEC/23/O-025	Amlan Jyoti Ghosh	Hypoglycemic and probiotic attributes of *Lactobacillus brevis*: an in-vitro and in-vivo study

ISESFEC/23/O-027	Maria-Eleni Grafakou	Effect of upper intestinal tract digestion on *Hypericum perforatum* extract using the infogest protocol
ISESFEC/23/O-028	Ramkishan Jatoth	Novel hydroalcoholic polyherbal formulation development and (HPLC-UPLC) ultra-performance liquid chromatographic separation, estimation of gallic acid in *Terminalia chebula* dried fruits, and a marketed siddha-based polyherbal formulation “kabusura kudineer”
ISESFEC/23/O-030	Nikena Khwairakpam	Bioactivities of insect associated bacteria from beetle species of Manipur
ISESFEC/23/O-035	Rupesh Banerjee	Phytochemical analysis and Anti-microbial potential of *Ayapana triplinervis* Vahl. hydroalcoholic leaf extract
ISESFEC/23/O-036	Anna-Mari Kok	*In vitro* herb-drug interaction potential of an indigenous South African polyherbal as a possible adjuvant during tuberculosis treatment
ISESFEC/23/O-038	Nalini Singh	Antimalarial activity of traditional medicinal plants from northeast India (Manipur)
ISESFEC/23/O-048	Deepthy M	Wild edibles used by the tribes in Kerala, their documentation and genetic analysis using ISSR markers
ISESFEC/23/O-050	Rikraj Loying	Promising anti-inflammatory potential of ethnomedicinal hill pepper from North East India
ISESFEC/23/O-053	Maria Mukherjee	Evaluating the chemotherapeutic potential of helicase and chaperone axis as novel antimalarial target
ISESFEC/23/O-054	Duyu Taaza	Pharmacological evaluation of hesperidin on olanzapine-induced weight gain, dyslipidemia and insulin resistance in rats
ISESFEC/23/O-056	Kabrambam Dasanta	Study of biofumigant property of enriched fraction of *Dillenia indica* L. Leaves along with its mode of action against stored grain insect pests
ISESFEC/23/O-057	Anjali Yadav	Anti-Microbial activity of medicinal plant *Zanthoxylum armatum* against gastric pathogen *Helicobacter pylori*
ISESFEC/23/O-059	Mannu Dwivedi	Multifacet utility and phytochemical validation of *Taverniera cuneifolia* as a potential alternative of *Glycyrrhiza glabra*
ISESFEC/23/O-060	Shalini Gurumayum	Flavone enriched extract of *Osbeckia nepalensis* Hook.f. ameliorates elevated hepatic gluconeogenesis *via* AMPK phosphorylation in diabetic models
ISESFEC/23/O-061	Gopi Chand Babare	Effect of poly herbal formulation on ethanol induced gastric ulcers in rats
ISESFEC/23/O-062	M. Bidyarani Devi	A potential probiotic *Lactobacillus plantarum* isolated from fermented ethnic food of manipur alleviates TNF-α by regulating adam-17 protein
ISESFEC/23/O-063	Smita Mishra	Enrichment of *Glycyrrhiza glabra* root extract for Phytopharmaceutical ingredient development as an anti-diabetic drug candidate
ISESFEC/23/O-065	Barun Das Gupta	LC-QTOFMS-based metabolite profiling and evaluation of α-glucosidase and α-amylase inhibitory potential of combined plant extract-based nutraceutical formulation from NER

Hall 3 (Shanghai): ORAL SESSION: I
(02:00 PM – 03:30 PM)

Evaluators

Dr. Motlalepula G Matsabisa, Professor, Department of Pharmacology University of the Free State, Bloemfontein, SA
Dr. Rajesh Kumawat, Head - Medical Services & Clinical Development Himalaya Wellness Company, Bengaluru, India
Dr. Th. Sobita Debi, Associate Prof. Dhanamanjuri University, Imphal, India
Prof. Potsangbam Albino Kumar, Dean, NIT Manipur, India
Dr. C. Brajakishor Singh, Scientist, IBSD Node Mizoram, India
Dr. Sabeela Beevi Ummalyma, Scientist, IBSD, Imphal, Manipur, India
Dr. Biseshwori Thongam, Scientist, IBSD, Imphal, Manipur, India
Dr. Amit Kar, Project Scientist, IBSD, Imphal

Abstract No	Presenting Author	Title of Abstract
ISESFEC/23/O-001	Mohammad Mehedi Masud	Phytochemical, Computational and Biological Studies on the roots of *Leea macrophylla* (Family:Vitaceae)
ISESFEC/23/O-003	Rinku Baishya	Prooxidant potential of *Citrus macroptera*: a folklore plant of northeast India
ISESFEC/23/O-004	Subarna Thakur	Integrating network pharmacology, molecular docking and md simulation approach to elucidate the underlying pharmacological mechanisms of *Drynaria quercifolia* in the treatment of rheumatoid arthritis
ISESFEC/23/O-006	Silvia Yumnam	Targeting dihydrolipoyl dehydrogenase, dld suppressed in vivo melanoma tumor growth and proliferation
ISESFEC/23/O-007	Archana S	Scientific validation of an ethnoveterinary formulation used for wound healing
ISESFEC/23/O-008	Komal S. Patel	Supplementation of standardized kashmiri saffron extract attenuates chronic scopolamine induced cognitive impairment and neurofibrillary tangles (NFT) accumulation in rat brain
ISESFEC/23/O-012	Anant Kumar	Pharmacological profile of selected flavonoids present in fruit peels against inflammation induced insulin resistance in adipocytes
ISESFEC/23/O-013	Niyati S Acharya	Evaluation of the neuroprotective effect of cannabidiol in Alzheimer's disease
ISESFEC/23/O-014	Pradip Debnath	Exploration of metabolic profiles and antidiabetic potential of the different varieties of cucumber (*Cucumis sativus* L.) fruit
ISESFEC/23/O-015	Deepak Kumar	Anticancer organosulfides from *Ferula assa-foetida* gum: isolation, characterization and pre-formulation studies
ISESFEC/23/O-018	Chowdhury Faiz Hossain	Anti-hyperglycemic and hepatoprotective effects of arjunic acid isolated from *Terminalia arjuna* in streptozotocin-induced type 1 diabetic mice

Hall 3 (Shanghai): ORAL SESSION: II
(03:30 PM – 06:00 PM)

Evaluators

Prof. Marco Leonti, Secretary, ISE & Department of Biomedical Sciences, University of Cagliari, Italy
Dr, Rafiq Mohamed, Principal Research Scientist, Preclinical Services, Himalayan Drugs, Bengaluru, India.
Dr. Y. Rajasekhar, Scientist, IBSD, Imphal, Manipur, India
Dr. Snehasikta Swarnakar, Scientist, CSIR-IICB, Kolkata, India
Dr. Shyamnarayan, Scientist, ICMR- RMRIMS, Patna, India
Dr. K H. Rakesh, Senior Scientific Officer, MASTEC, Imphal, India
Dr. N Sateesh Kuamr, Associate Professor, NIPER, Kolkata, India
Dr. Amit Kar, Project Scientist, IBSD, Imphal, Manipur, India

Abstract No	Presenting Author	Title of Abstract
ISESFEC/23/O-022	Namisha Sharma	Virus under siege: unraveling novel defense mechanism in plants
ISESFEC/23/O-026	Rambir Singh	Antibiotic-Medicinal Plant Extracts Synergy for Biofilm and Quorum Sensing Inhibition in *Pseudomonas aeruginosa*
ISESFEC/23/O-029	Asem Mipeshwaree Devi	Transcriptomic time-series analysis of genes involved in anthocyanin biosynthesis in the rice grain of black scented rice, chakhao
ISESFEC/23/O-031	Hanamant Gadad	Species diversity of wasps in tasar ecosystem
ISESFEC/23/O-032	Akoijam Ranjita Devi	*Kaempferia rotunda* L: evaluation of genotypes, phytochemical and pharmacological properties
ISESFEC/23/O-033	Sushil Kumar Chaudhary	Evaluation of antioxidant, anti-inflammatory, anti-HMG-COa reductase activity and simultaneous determination of phenolic compounds in hydroalcoholic extract of *Ficus cunia* fruits by RP-HPLC
ISESFEC/23/O-034	Chhaya Gadgoli	Studies on bioavailability of antiasthamatic orodispersible tablets containing extracts of *Glycyrrhiza glabra* and *Curcuma longa*
ISESFEC/23/O-037	Sunil S Thorat	In Silico screening of phytochemicals having anti-viral properties belonging to family Zingerberaceae against COVID-19
ISESFEC/23/O-039	Siddharth J. Modi	Assessment of *Withania somnifera* based botanical supplement in healthy human aging
ISESFEC/23/O-040	Anil Mukund Limaye	Partial estrogen-like effects of karanjin: a transcriptomic study using MCF-7 cell lines
ISESFEC/23/O-041	Lokesh Deb	Folklore healthcare system of eastern Himalaya bio-region of west Sikkim, North-East India
ISESFEC/23/O-042	Mohammad Salim Hossain	Adiposity and adipocyte inflammation combating potentials of *Alpinia calcarata* leaves: in-silico and in-vivo approach
ISESFEC/23/O-043	Prasenjit Manna	Glucose-Sensitive Delivery of Vitamin D by Dextran-gated Multi-Functional Mesoporous Silica Nanoparticles to Mitigate Hyperglycemia
ISESFEC/23/O-044	Rejina Afrin	Evaluation of pharmacological activities of ethyl acetate fraction of *Ceraceomyces tessulatus*
ISESFEC/23/O-045	Sandhya Parameswaran	Microencapsulation of essential oils from lavender and anise and study of its Anti-epileptic activity.

ISESFEC/23/O-046	Stéphane SAVRIAMA,	Nôti and Tolsi against COVID 19: two Hindou's sacred plants in Reunion Island traditional medicine
ISESFEC/23/O-047	Reena Haobam	Traditionally used medicinal plants of manipur protect against rotenone-induced neurotoxicity model of parkinson's disease in sh-sy5y cells.
ISESFEC/23/O-049	Claude MARODON	The plants of Indian's indenture in Reunion Island: an ethnopharmacological approach
ISESFEC/23/O-051	Daniel Umereweneza	Bioactive secondary metabolites from Rwandese medicinal plants
ISESFEC/23/O-052	Narendra Kumar	A comprehensive investigation of hemp (*Cannabis sativa* L.) for identification of CBD-rich genotype.
ISESFEC/23/O-055	Md. Zakir Sultan	Investigation of Anti-hypercholesterolemic Medicinal Plants
ISESFEC/23/O-058	Shaikh Jamal Uddin	Antibacterial peptides from Bangladeshi plants of solanaceae family
ISESFEC/23/O-064	Prasanna Kumar Patra	Importance of tribal traditional ethnomedicinal knowledge system in addressing contemporary disease burden
ISESFEC/23/O-066	Atul Gupta	Phytochemical investigation of *Pterocarpus marsupium* Roxb. for value addition
ISESFEC/23/O-067	Rajlakshmi Devi	A study on the medicinal plants used in northeast India for curing various cardiovascular disorders
ISESFEC/23/O-068	Kapil Dev	Identification of osteogenic agents from *Spinacia oleracea* leaves and development of therapeutic formulation for osteoarthritis
ISESFEC/23/O-069	Keithellakpam Sanatombi	In vitro culture of *Artemisia parviflora* Robx. Ex d. Don for artemisinin production
ISESFEC/23/O-070	Surendra Kumar Jena	Exploring the social, ecological and economic impact on conservation of sacred groves of the indigenous communities of northeast India
ISESFEC/23/O-071	Mayurika Goel	Development of Endophytic fungi as a bio-cell factory for sustainable production of extracellular red pigment with potential pharmaceutical potential
ISESFEC/23/O-072	Dilip Sing	Application of AI-based Raman spectrometer for rapid safety and quality assessment of traditional rice beer
ISESFEC/23/O-073	Herbert Riepl	Indigo yielding plants in medicine and Quindainones chemistry
ISESFEC/23/O-074	Anand Srivastava	Identification of plant extracts active against acaricide-resistant ticks and mosquito larva
ISESFEC/23/O-075	Md. Shah Amran	In-silico and in-vivo assessment of diabetes ameliorating potentiality and safety profile of Gynura procumbens: a breakthrough approach to combat diabetes mellitus
ISESFEC/23/O-076	Anshuman Dixit	Network pharmacology study on *Morus Alba* phytoconstituents as a possible therapeutic option for oral cancer

Day 1: Friday: February 24, 2023

POSTER PRESENTATIONS SESSION I : 03:00 – 05:00 PM

Evaluators

Prof. Hung-Rong Yen, Professor, China Medical University & China Medical University Hospital, Taichung, Taiwan
Dr. J.K. Shukla, Scientist, IBSD Node Meghalaya, India
Mr. Amitavo Das, EC Member, SFE, Kolkata, India
Dr. Surendra Kumar Jena, State Lead, MAMTA- Health Institute for Mother and Child, Bhubaneswar (Odisha)
Shri. KL. Warson Anal, Lecturer, MahaUnion Govt. Higher Secondary School, Chandel, India
Dr. Kakali Mukherjee, EC Member, Society for Ethnopharmacology, Kolkata, india
Dr Alok Pal Jain, Director, BITS, Bhopal, India
Dr. (Mrs.) Rajlakshmi Devi, Scientist, IASST, Guwahati, India
Dr. Rajkumari Jobina, Project Scientist, IBSD, Imphal, Manipur, India
Dr. Neeta Pathaw, Research Associate, IBSD Node Meghalaya, India
Dr. Evanylla Kharlyngdoh, Scientist, IBSD Node Meghalaya, India
Dr. Ch. Sarat Singh, Scientific Officer, MASTEC, Imphal, India

Abstract No	Presenting Author	Title of abstract
ISESFEC/23/P-001	Thokchom Biona	An Ethnobotanical study of medicinal plants in different regions of Thoubal District, Manipur
ISESFEC/23/P-002	Vanlalhruaii Famhawite	Antiinflammatory and antiproliferative activity of *Meyna spinosa* Roxb., an unexplored ethnomedicinal plant
ISESFEC/23/P-003	Deep Jyoti Das	Antibacterial and antiproliferative potential of Akhuni/Axone, a fermented food of Northeast India
ISESFEC/23/P-004	Ningombam Bishwamitra Singh	GC-MS phytoconstituent analysis of essential oil of *Cinnamomum tamala* from Manipur, India
ISESFEC/23/P-005	Rajkumari Bonysana	Evaluation of antioxidants, anti-inflammatory activities and chemical composition *of Coridius chinensis* (Dallas), an edible insect species of North-East India
ISESFEC/23/P-006	Saini Mayanglambam	Phytochemical contents and antifeedant effects of *Ageratina adenophora* (Spreng.) Against three cabbage pests.
ISESFEC/23/P-007	Priyanka Mohapatra	Nimbolide-based nanomedicine enhances paclitaxel activity against triple-negative breast cancer by targeting cancer stem-like cells
ISESFEC/23/P-008	Tonjam Bidyasana Chanu	Documentation of indigenous ethnomedicinal plants in imphal west district, Manipur, India - an approach for conservation and sustainable use of plant wealth
ISESFEC/23/P-009	Sumati Sen	Insulin resistance reversible potential of selected phytosteroids in skeletal muscle cell: A preliminary study
ISESFEC/23/P-010	Nikki Konthoujam	Headspace spme/gc-ms volatile organic compounds analysis in cinnamomum tamala leaves from manipur, india
ISESFEC/23/P-011	Thongam Sofianandi Devi	Phytochemical analysis of essential oil of *Elsholtzia griffithii* by GC-MS spectroscopy from Manipur, India\
ISESFEC/23/P-012	Lalnun Hruaitluangi	Investigation of phytoconstituents of unexplored aganope thyrsiflora plant of mizoram: an approach for scientific evidence-based research

ISESFEC/23/P-013	Nameirakpam Bunindro Singh	Essential oil compositions *from Artemisia vulgaris* L. With antifungal activities against Fusarium oxysporum and Sclerotium oryzae
ISESFEC/23/P-015	Soumik Dutta	Herbalisation of oral matrix tablets using *Abroma augusta* seeds
ISESFEC/23/P-017	Dipti B. Patel	Pharmacognostical and phytochemical evealuation of *Balanite aegyptiaca*
ISESFEC/23/P-018	Mridula Singh Thakur	*Murraya koenigii* (L.) Spreng.: a potential phytotherapy to treat diabesity
ISESFEC/23/P-020	Shweta Rai	HPTLC analysis and α-amylase inhibitory potential of oreocnide integrifolia (gaudich.) Miq. – an ethnomedicinally relevant plant from Northeastern India
ISESFEC/23/P-025	Sarangthem Dinamani Singh	Network pharmacology and molecular docking analysis of active phytochemical constituents of pyrus pashia and its molecular mechanism against liver disease
ISESFEC/23/P-026	Pronami Gogoi	Characterization and bioactivity evaluation of the Biosurfactants from the seed pods of *Gymnocladus assamicus* (leguminosae)
ISESFEC/23/P-027	Devpratim Koch	Assessment of bioactive compounds and nutritional profiling of *Etlingera linguiformis (roxb) r.m.sm.*
ISESFEC/23/P-028	Akash Dey	Phytochemical analysis and prediction of anti-SARS-COV-2 activity through in-silico approach of Dasamoola ashtak kwath
ISESFEC/23/P-029	Anish N.P	Ethnobotanical exploration of medicinal plants and promotion of tribal health care practices
ISESFEC/23/P-030	Bipankar Hajong	A study of the genus berberis l. (berberidaceae) in Arunachal Pradesh
ISESFEC/23/P-033	Thoithoisana Soibam	Anticancer activity of *Garcinia xanthochymus* fruit extract against colon cancer through apoptosis
ISESFEC/23/P-034	Suparna Ghosh	Comparative antioxidant and anti-cholinesterase Potential of ginger varieties of north-east India in respect to variation of 6-gingerol contents
ISESFEC/23/P-036	Aabir Pramanik	Stevia: a review of analytical methods for major bioactive
ISESFEC/23/P-037	Salem Lalvenhimi	In vitro antimicrobial activity and HPTLC analysis of hydroalcoholic fruit pod extract of *Parkia speciosus*
ISESFEC/23/P-038	Saravanakumar Venkatesan	*Aegle marmelos* leaf extract protects against diabetic kidney injury in mice by augmenting gasotransmitters and subjugating oxidative stress
ISESFEC/23/P-039	Nahakpam Surjalata,	Comparative study on chemical profiling and antimicrobial properties of essential oils of Cinnamon bark collected from different location of Manipur
ISESFEC/23/P-040	Parismita Borgohain	Antifungal activity of C*roton tiglium* used by agricultural workers to treat onychomycosis
ISESFEC/23/P-041	Khomdram Khedashwori Devi	A comparative study on morphological and biochemical characters of umorok and sirarakhong chili
ISESFEC/23/P-042	Srijon Gayen	RP-HPLC analysis and in-vivo antidiabetic potential of *Bruguiera cylindrica (l.) Bl.* - a mangrove of the sundarban region
ISESFEC/23/P-043	Soma Chowdhury	Metabolite profiling and investigation of *in-vitro* α-glucosidase enzyme inhibition assay of *Paris Polyphylla* SM.
ISESFEC/23/P-044	Seha Singha	Assessment of in-vivo adaptogenic activity of *Trichosanthes dioica* roxb. Fruit extract
ISESFEC/23/P-045	Sandipan Jana	Evaluation of in-vitro and in-vivo anti-diabetic potential of *Gomphogyne cissiformis* fruit from Cucurbitaceae family

ISESFEC/23/P-046	Kishor Basor	Seed germination study in *Bixa orellana* (Annatto) a potent medicinal plant from North East India
ISESFEC/23/P-047	Sonia Sougrakpam	Investigation of the potential toxicity and therapeutic effects of *Ficus cunia* using zebrafish model
ISESFEC/23/P-048	Anuradha Moirangthem,	Black ginger extract promotes caudal fin regeneration in zebrafish
ISESFEC/23/P-050	Nambam Bonika Devi	Phytochemical properties and free radical scavenging activity of *Kaempferia parviflora* (black ginger).
ISESFEC/23/P-051	Rasmita Rani Das	Genomics of panicum sumatrense to develop viable genomic resources for a climate resilient crop
ISESFEC/23/P-052	P Sushree Shyamli	Deciphering the regulation of nutritive value and abiotic stress response in *Moringa oleifera* through genomic approach
ISESFEC/23/P-053	Mitrabinda Panda	Generating Genomic Resources for *Coccinia grandis* and identification of genes regulating fruit morphology
ISESFEC/23/P-055	Rakesh Sanabam	Micrografting as tool to rejuvenate the disease crippled citrus industry in Manipur and North east india
ISESFEC/23/P-056	Yengkhom Linthoingambi	Omega-6 fatty acid-rich crosses of Safflower for future health security
ISESFEC/23/P-057	Archana Mahapatra[1],	*In vitro* screening of selected indian medicinal plant extracts for potent anti-viral activity.
ISESFEC/23/P-058	Amita Dhargalkar,	Studies on optimization of oslation process for bakuchiol from *Psoralea carylifolia* seeds
ISESFEC/23/P-059	Sadokpam Shreekant	Bioactivity screening of medicinal plants against sepsis-causing multidrug-resistant bacteria
ISESFEC/23/P-060	Surmani Huidrom	Anti-quorum sensing activity potential of lactic acid bacteria isolated from fermented fruit beverages
ISESFEC/23/P-062	Laikangbam Lamyanba	Phytochemical screening and indentification of phytochemical constituents of *Piper mullesua* using chromatography-mass spectrometry (GC-MS) analysis.
ISESFEC/23/P-064	Aditi Chatterjee	Antimalarial activity of *mentha spicata* and *tithonia diversifolia* leaf extracts against *plasmodium falciparum* and *plasmodium berghei*
ISESFEC/23/P-065	Soumya Shree Nayak	Generating genomic resources for an invasive halophyte, *Phragmites karka*
ISESFEC/23/P-066	Sandhya Suranjika	Transcriptomics of *Vigna aconitifolia* for developing a gene expression atlas
ISESFEC/23/P-070	Ritesh Sharma[a]	Chemical analysis *of Dactylorhiza hatagirea's* nutritional and antioxidant potentials
ISESFEC/23/P-071	Reparani Thokchom	Phytochemical screening, antioxidant activity and analysis of chemical composition using SPME/GC-MS spectroscopy of *Ilicium griffithi* fruits
ISESFEC/23/P-072	Khaidem Kennedy Singh	GC-MS analysis of phytoconstituents present in wild and cultivated zingiberaceae plants extract and their antioxidant activity.
ISESFEC/23/P-073	Amrita Ray	Evaluation of antiviral activity of the holy Basil (*Ocimum sanctum*) and the Indian gooseberry (*Phyllanthus emblica*) against Chikungunya virus
ISESFEC/23/P-074	Kshetrimayum Vimi	*Paris polyphylla* Sm. Induces ROS and caspase 3 mediated apoptosis in colorectal cancer cells *in vitro* and potentiates the therapeutic significance of 5FU and Cisplatin
ISESFEC/23/P-075	Lalbuatsaiha Fanai	Documentation of traditional foods of Lunglei, Lawngtlai and Siaha districts of mizoram.
ISESFEC/23/P-076	Heisnam Haripriyari Devi	Collection of citrus genetic resources of Manipur and its potential uses
ISESFEC/23/P-077	Supriya Suman Keshry	Antiviral activity of plant extracts from Cameroon pharmacopeia against Chikungunya Virus

ISESFEC/23/P-079	Kikrusenuo Kiewhuo	Digitalisation of medicinal plants data: A computational effort to probe traditional therapeutic practices
ISESFEC/23/P-081	Sachin Vashisath	Comparative Study and α-glucosidase activity in Essential Oils of *Callistemon citrinus* (Syn. *Melaleuca citrina*) from Indian Himalaya
ISESFEC/23/P-082	Esther Jamir	Identification of therapeutics for SARS-CoV2: A Polypharmacological and Drug Repurposing Approach
ISESFEC/23/P-083	Ngasheppam Malemnganbi Chanu	Orchids of Manipur: A wellspring of bioeconomy
ISESFEC/23/P-084	Rana Kamei	Comparative studies on the lectins found in *Meizotropis buteiformis* and *Butea monosperma*
ISESFEC/23/P-089	Sarvada Dhage	Phytochemical & pharmacological investigation on the fruits of *ficus racemosa*
ISESFEC/23/P-090	Selvaraman Nagamani	Integration of Chemoinformatics and Machine Learning for Drug Discovery
ISESFEC/23/P-091	Govind Yadav	Exploring the Himalayan plants with Immunomodulant and galactagogue properties

Day 2: Saturday: February 25, 2023

POSTER PRESENTATIONS SESSION II : 11:00 AM – 01:00 PM

Evaluators

Dr. Caroline Weckerle, Institute of Systematic and Evolutionary Botany, University of Zurich, Switzerland
Md. Shah Amran, Faculty of Pharmacy, University of Dhaka, Bangladesh
Prof. Yuan Shiun Chang, Department of Chinese Pharmaceutical Sciences and Chinese Medicine Resources, China Medical University, Taiwan
Prof. M. Damayanti Devi, Head, Dept. of Botany, Manipur University, Imphal, Manipur, India
Dr. Pardeep K Singour, Professor, VNS Group of Institution, Faculty of Pharmacy, Bhopal
Dr. Pradip Debnath, Associate Prof.**,** Comilla University, Bangladesh
Dr. Bhaskar Das, Research Associate, IBSD, Imphal, Manipur, India
Dr. Subrata Pandit, Scientist, TCG Life Sciences, Kolkata, India
Dr. Tapan K Mukherjee, Former Editor, NISCAIR-IJTK
Dr Ch. Shivaji, Scientific Officer, MASTEC, Imphal, India
Dr K. Balaeshwer Singh, DST, Manipur, India

Abstract No	Presenting Author	Title of abstract
ISESFEC/23/P-092	Khaidem Devika Chanu	*Ageratina adenophora* (Spreng.) King & H.Rob leaf extract as antidiabetic agent: In-vitro and in-vivo evaluation and quantification of chlorogenic and caffeic acids
ISESFEC/23/P-093	Naorem Manglembi Devi	Green Synthesis, Characterization of Nanoscale Silver Nanoparticles and Studies on Bioactivity using *Alpinia calcarata*
ISESFEC/23/P-094	Gayathri K	Network pharmacological evaluation of *Centella asiatica* for antifibrotic properties.
ISESFEC/23/P-095	Mukta Satsangi	Impact of post harvesting conditions on the quality of raw herbs
ISESFEC/23/P-096	Shweta Joshi	Analytical method development for simultaneous estimation of herbal drugs
ISESFEC/23/P-097	Ramesh Uniyal	Ethnobotanical uses and commercial perspectives of some important high-altitude spices and condiments in Western Himalaya, Uttarakhand
ISESFEC/23/P-098	Vijay Kant Purohit	Propagation & Cultivation: A promising way to conservation of rare, endangered & threatened medicinal plants as well as the economic empowerment of local inhabitants

ISESFEC/23/P-100	Rounak Chourasia	Production and characterization of bioactive and multifunctional peptides in chhurpi cheese produced using *Lactobacillus delbrueckii ws4*
ISESFEC/23/P-101	Md Minhajul Abedin offline	Characterization of bioactive peptides in traditional fermented soft chhurpi consumed in different season of the sikkim Himalayan region
ISESFEC/23/P-102	Sultan Zahiruddin	Immunomodulator and antibacterial activity of a polyherbal formulation, derived from traditional indian medicinal plants
ISESFEC/23/P-105	Nandan Kumar	Drug repurposing for antiviral drug discovery and membrane permeability
ISESFEC/23/P-106	M. Amelia Devi	A study on traditional home remedial measures for the control of gastritis
ISESFEC/23/P-107	Aftab Alam	Scientific validation of traditional claims of nephroprotective unani drugs
ISESFEC/23/P-112	Abdur Rahman	Scientific validation of traditional claims of anti-viral unani formulations
ISESFEC/23/P-113	Jobina Rajkumari	Phytochemical analysis and antifungal activity of essential oils of some traditionally used medicinal herbs against skin dermatophytes
ISESFEC/23/P-114	Uzma Jabeen	A network pharmacology study of unani medicinal plants to explore its multi-compound and multi target mode of action in urinary tract infection
ISESFEC/23/P-118	Anuradha Shee	Systematic review on *Dolichos biflorus* (kulthi) and *foeniculum vulgare* (baadiyaan) for their nephroprotective potential
ISESFEC/23/P-120	Anita Kachari	Arbuscular mycorrhizal fungi and other beneficial microorganisms in the rhizosphere soil of *Garcinia lanceifolia* (g.don) roxb.
ISESFEC/23/P-122	Sushree Ankita Mohapatra	Deciphering the in-vitro anticancer potential of selected marine extracts of chilika lagoon
ISESFEC/23/P-123	Ajay Kakati	*Caselpenia bonducella* L. extract with antioxidant potential improves etiological conditions in an experimental diabetic neuropathic rat model
ISESFEC/23/P-124	SM Abdul Aziz Barbhuiya	Aqueous extract of *Ficus racemosa* l. Ameliorates diabetic neuropathy in an experimental wistar rat model
ISESFEC/23/P-125	Chingtham Thanil Singh	Potential probiotic properties of ethnic food-derived bacteria
ISESFEC/23/P-126	Anupam Bhattacharya	Study on the bacterial diversity and metabolite profiles of ethnic fermented bamboo shoots of North east India
ISESFEC/23/P-127	Eagle Yi-Kung Huang	Yangonin, one of the kavalactones isolated from *Piper methysticum*, acts through cannabinoid 1 (cb1) receptors to induce an intrathecal anti-hyperalgesia in rats
ISESFEC/23/P-128	Roshani A. Patel	UV spectrophotometric method for simultaneous estimation of donepezil HCl and memantine hcl in tablet after prederivatization process by simultaneous equation method
ISESFEC/23/P-130	Prajisha Jayaprakash	Exploiting dfg in and out conformation of kinase inhibitors against CDK2 targets- an *in silico* approaches
ISESFEC/23/P-131	Disianliu Gangmei	"In-vitro microrhizome induction of *Kaempferia parviflora* (Family Zingiberaceae): a potent medicinal plant of India."
ISESFEC/23/P-132	Sourav Sarkar	Assessment of anti-inflammatory and anti-arthritic properties of equisetum diffusum d. Don whole plant methanolic extract as a complementary medication in rheumatoid arthritis.
ISESFEC/23/P-133	Richa Dhakal	Role of Non-Mulberry Silkworm Pupae Oil in Lipid metabolism

ISESFEC/23/P-135	Chanam Melody Devi	Evaluation of the antioxidant, anti-inflammatory and anti-arthritic potential of essential oil (nerolidol) by in vitro and in vivo analysis
ISESFEC/23/P-136	Debabrata Modak	Revealing anti-rheumatoid properties of *Drynaria quercifolia* rhizome methanolic extracts combining experimental and molecular docking strategies
ISESFEC/23/P-137	Rupamoni Thakur	GC-MS based untargeted metabolite profile, phytochemical analysis and in vitro antioxidant activity of the methanolic extract of *Solanum indicum* fruit
ISESFEC/23/P-138	Sangeeta Saikia	Phytochemical properties of selected four plant extracts used traditionally and phytosome formulation
ISESFEC/23/P-139	Dipshikha Gogoi	Development of Herbal Formulation Database
ISESFEC/23/P-140	Nazim Uddin Afzal	Can vitamin D and K co-supplemntation help to reduce obesity better than individual?
ISESFEC/23/P-142	Priyanka Gogoi	PGPR mediated induction of systemic resistance in Bhut Jolokia (*Capsicum chinense* Jacq.) Against collar rot disease
ISESFEC/23/P-143	Rejuan Islam	Studies on the effect of *Abutilon indicum* (L.) Sweet seed extract on insulin-resistance caused polycystic ovarian syndrome in wistar rats
ISESFEC/23/P-144	Sam Alex	Phytochemical profiling and anti-diabetic efficacy of *Antidesma alexiteria L.* - an endemic plant to southern India and Srilanka
ISESFEC/23/P-145	Parishmita Gogoi	Gut bacterial xylanase an emerging green tool from potential strain of eri silkworm (samia ricini donovan) from North east India
ISESFEC/23/P-147	Dipal M. Gandhi	Validated HPTLC method for quantification of bioactive markers and evaluation of hepatoprotective effect of ayurvedic polyherbal formulation
ISESFEC/23/P-148	Neeta Pathaw	Comparative phyto-metabolite studies of different Phlogacanthus sp. And evaluation of their antioxidant and enzyme activities
ISESFEC/23/P-149	Neha Verma	Potential aspect of *Asimina triloba* methanolic extract-an anticancerous property in lung cancer cell lines
ISESFEC/23/P-150	Kanu Priya	Plant-mediated synthesis of iron nanoparticles using extract of *Cedrus deodar* and its anti-cancer activity against lung cancer
ISESFEC/23/P-151	Moirangthem Goutam Singh	Traditional fermented bamboo shoot mitigates the diversity loss of gut microbiota induced by atherogenic diet in C57BL/6ntac mice
ISESFEC/23/P-152	N. Malemnganbi Chanu	DNA barcoding of traditionally used medicinal and edible plant from North East Region of India
ISESFEC/23/P-153	Shilpa Kumari	Green synthesis of iron oxide nanoparticles from *Jateorhiza palmata* root extract
ISESFEC/23/P-154	Shanu V	Ethnopharmacological survey on the medicinal plants used by urali tribes from the periyar tiger reserve, kerala, india
ISESFEC/23/P-156	Seema Pradhan	Genomic resources in vigna radiata: an important legume of india
ISESFEC/23/P-157	Asheesh Kumar	Useful insights on the cellular details of how the human body responses for coronavirus infections in the light of human proteins and genes
ISESFEC/23/P-158	Urvashi Dhiman	High throughput identification of bioactive natural products isolated from *Magnolia grandiflora* that impact human embryonic stem cell growth
ISESFEC/23/P-159	Pratikshya Sa	Piperlongumine-loaded smart polymeric nanoparticles suppress cancer progression and metastasis by regulating foxo signaling
ISESFEC/23/P-161	Dipanwita Banik	CSIR-NEIST herbarium, a national repository of more than half a century aiding in the correct identification of plants

ISESFEC/23/P-165	Paran Baruah	Therapeutic potential of bioactive compounds from the Edible Mushroom to Attenuate SARS-COV-2 Infection and Complications in Coronavirus Disease.
ISESFEC/23/P-166	Lutrika Moirangthem	Headspace GCMS analysis and phytochemical profiling from the leaves of *Perilla frutescens* (l.) Britton.
ISESFEC/23/P-168	Zohra Batool	Exploration of ethnomedicinal knowledge to treat various diseases prevalent in the region of Ladakh
ISESFEC/23/P-169	Sweety Parmar	Anti-pathogenic potential of a polyherbal formulation Enteropan® against *Staphylococcus aureus* and multidrug resistant *Pseudomonas aeruginosa*
ISESFEC/23/P-171	Angamba Meetei Potshangbam	Medpserver 2.0. A cadd and machine learning approaches for therapeutic targets and novel natural product lead discovery.
ISESFEC/23/P-172	Archana Naik	Bioanalytical method development for simultaneous estimation of herbal drugs and its application for bioavailability studies
ISESFEC/23/P-173	Kavya Bangera	Formulation and standardization of orodispersible tablets containing extracts of *Glycyrrhiza glabra* and *Curcuma longa*
ISESFEC/23/P-175	Nandeibam Samarjit Singh	Ethnomedicinal use of animals and animal products by the Meitei community in Manipur, North East India
ISESFEC/23/P-176	Thangjam Surchandra Singh	Nutraceutical properties of fruit extract of *Myrica esculenta* an underutilized fruit of North east India
ISESFEC/23/P-177	Dinesh Kumar Yadav	Synthetic trioxanes having potential antimalarial activity against multidrug-resistant plasmodium *Yoelii nigeriensis* in a swiss mice model
ISESFEC/23/P-184	Mahendra Kumar Chouhan	"DNA fragmentation and anti-angiogenesis potential of ethnomedicinal plant from western ghats"
ISESFEC/23/P-189	Tanumoy Chatterjee	Phytochemical evaluation and in-vitro α-glucosidase enzyme inhibitory activity of *Houttuynia cordata* thunb
ISESFEC/23/P-191	Okram Ronibala Devi	In vitro antioxidant activity, phytochemical screening and Hptlc fingerprint of *Eupatorium birmanicum DC.*

POSTER PRESENTATIONS SESSION III : 03:00 AM – 5:00 PM

Evaluators

Prof. Gunter Vollmer, Emeritus Professor, Faculty of Biology, Dresden University of Technology, Germany
Prof. Satyajit D. Sarker, Director, Liverpool John Moores University, Liverpool, United Kingdom
Mr. Prabir Banerjee, EC Member, Society for Ethnopharmacology, Kolkata, India
Dr. Prasanna Kumar Patra, Department of Anthropology, Utkal University, Vani Vihar, Bhubaneswar, Odisha
Dr. K. Ojit Singh, Project Scientist, IBSD, Imphal, Manipur, India
Dr. Asis Bala, IASST, Guwahati, Assam, India
Khaidem Kennedy Singh, Research Associate, IBSD, Imphal, Manipur, India
Dr. M. Anuradha, Project Scientist, IBSD, Imphal, Manipur, India
Smt. H. Jina Sharma, DST, Manipur, India
Dr. Surendra Kumar Jain, Director, Truba College of Pharmacy, Bhopal, India

Abstract no	Presenting Author	Title of abstract
ISESFEC/23/P-192	Rikesh Mangang	Traditional dietary practice to control acidity and stomach related problems of meitei community
ISESFEC/23/P-193	Premi Devi Pukhrambam	RNA sequencing and transcriptome assembly of *Polygonum posumbu* to identify genes involved in flavonoid biosynthesis pathway
ISESFEC/23/P-194	Sumi Pait	Antioxidant and anti-glycation potentials of different plant parts viz., pulp, inflorescence, pseudostem and root of *Musa balbisiana* Colla
ISESFEC/23/P-195	Pragati Singh	Antioxidant activity and chemical characterization of *Bunium persicum* seeds extract

ISESFEC/23/P-196	Deepsikha Swargiary	Bioactive fraction of Phyllanthus niruri L. Enhances free radical scavenging activity and stimulates glucose uptake through SIRT1 induction followed by GLUT4 translocation in C_2C_{12} myotubes and streptozotocin induced Wistar rats
ISESFEC/23/P-197	Alaka Sahoo	Ethnomedicinal treatment approach against oral lichen planus: a case-series study in a tertiary care teaching hospital
ISESFEC/23/P-198	Devi Basumatary	Role of *G. Morella* (Gaertn.) Desr. Marker compounds in preventing disrupted intestinal barrier integrity in CACO-2 cells.
ISESFEC/23/P-199	Semim Akhtar Ahmed	Xanthosine, a purine glycoside ameliorates hyperglycemia via the AMPK/AKT/GSK3β signaling pathways in type 2 diabetic rats and CC1 hepatocytes
ISESFEC/23/P-201	Abhipsha Saikia	Anti-diabetic potential of Vitex negundo L. By modulating hepatic Glucose homeostasis in CC1 hepatocytes
ISESFEC/23/P-202	Pranamika Sarma	Evaluation of the therapeutic effect of *Leucaena leucocephala*. (Lam.) De Wit. In the regulation of insulin resistance associated oxidative stress in C_2C_{12} muscle cell
ISESFEC/23/P-203	Md Yunus Sheikh	Anti-diabetic and anti-oxidant activities of some selected medicinal plants used by ST/SC communities of the North East India
ISESFEC/23/P-204	Auromira Khuntia	Reprogramming tumor associated macrophages towards a tumoricidal M1-like phenotype with phytochemical loaded mannose coated GMO-mnps (Phyto@Man-GMO-mnps) for cancer immunotherapy
ISESFEC/23/P-205	Susmita Nath	Future Strategies for the Advancement of Ethno-medicines for the Treatment of Scorpion Stings
ISESFEC/23/P-206	Birendra Kumar	Stability analysis for major economic traits in *Uraria picta*- a critically endangered medicinal plant
ISESFEC/23/P-207	Robinson C. Jose	Intrinsic grain characteristics of black rice protect it from false-smut of rice (*Oryza sativa* L.) Even under favorable conditions for *Ustilaginoidea virens*
ISESFEC/23/P-208	Thangjam Kanchal	Novel Paraclostridium spp. With potential industrial applications from Ngari -a fermented food of Manipur
ISESFEC/23/P-209	Ningthoujam Singthoi Singh	Production of Xylan and Xylo-Oligoscharides as a prebiotics from rice straw residues of Manipur
ISESFEC/23/P-211	Pyari Payal Beura	Phytochemical profiling and ftir analysis of *Ixora coccinea* crude extract from munda communities of sambalpur district of Odisha
ISESFEC/23/P-212	Amruta Balekundri	Quality assessment and HPTLC fingerprinting of talisadi churna a classical Ayurvedic preparation
ISESFEC/23/P-214	Himshikha Gusain	Review on potential, prospects and research needs of a rare medicinal plant Shyonak (*Oroxylum indicum*) in Indian subcontinent
ISESFEC/23/P-215	Laishram Shandyarani Devi	Anti-obesity effect of cinnamom extract using zebrafish models
ISESFEC/23/P-216	Rishikesh Chakor	Bioautography guided isolation and characterization of major phytoconstituents from *Psoralea corylifolia* Linn.
ISESFEC/23/P-217	Maibam Beebina Chanu	Antidiabetic activity and subacute toxicity study of Schima wallichi (DC.) Korth
ISESFEC/23/P-220	Dinesh Kumar	Tissues specific metabolomics study of *Trillium govanianum* Wall. Ex D. Don
ISESFEC/23/P-224	Athokpam Pinokiyo	Phytosociological study of the ethnomedicinally significant wetland plants from thanga area, Manipur, NE., India

ISESFEC/23/P-225	Chirom Martina	Insight into legumes and associated rhizobia for enhanced crop production and soil fertility
ISESFEC/23/P-226	Premchandra Oinam	New reports on the ethnomedicinal use of *Actinostemma tenerum* and *Hydrocharis dubia*
ISESFEC/23/P-227	Momota P	Exploring the unexplored endophytes from cereal crops and its biotechnological applications
ISESFEC/23/P-228	Ch. Umabati Devi	Therapeutic potential of aquatic macrophytes used as traditional salad food (singju) in the freshwater Ecosystems of canchipur, Manipur (India)
ISESFEC/23/P-231	Shasank S. Swain	Amalgamation of bioprospective and combinatorial drug chemistry to develop novel 'isoniazid-phytochemical' hybrid drugs against *Mycobacterium tuberculosis*
ISESFEC/23/P-232	Heisnam Rameshwari Devi	Tolypothrix column fraction exhibits anti-cancer efficacy against human cervical cancer cells due to G0/G1 cell cycle arrest and caspase-3-dependent cell death.
ISESFEC/23/P-233	Nonibala Gurumayum	Effect of *Musa balbisiana* seed on brain and liver redox imbalance and intestinal barrier dysfunction induced by D-galactose in rats
ISESFEC/23/P-235	Narges Tajik	Ali ibn Sahl Rabban al-Tabari " A graduated of the Indian School of Medicine"
ISESFEC/23/P-236	Shivankar Agarwal	Phytoconstituents and antimicrobial activity of *Gardenia resinifera* flower extract
ISESFEC/23/P-237	Himakshi Sharma	Unravelling the Mechanism of Protein-Protein Interactions in Selected Viral Diseases and Breast Cancer
ISESFEC/23/P-238	Atom Annupama Devi	Bioeconomy from banana biowaste
ISESFEC/23/P-239	Charulata T. Nemade	Anti-asthma activity and phytoconstituents analysis of *Quisqualis indica* extracts in mice
ISESFEC/23/P-240	Dipayan Ghosh	Standardization and Quality Control Evaluation of Herbal Drugs for Assessments of Indian Traditional Herbal Medicines
ISESFEC/23/P-241	Gayatri Gogoi	Phytochemistry and therapeutic potential of *Piper peepuloides* roxb.
ISESFEC/23/P-242	Bashir Ahmad Ione	Discovery of Two New Furostane type Steroidal Saponins from Rhizomes of Trillium Govanianum and their Potential to treat Lung and Colon Cancer.
ISESFEC/23/P-243	Masoom Saikia	The Nutritional and Anti-Hyperglycaemic Activity of The Edible Insect Brachytrupes Orientalis
ISESFEC/23/P-244	Sukanya Borthakur	Nutritional and antioxidant property of *Oecophylla smaragdina* : a traditional edible insect of n.e. India
ISESFEC/23/P-245	Dipanneeta Das Gupta	Valorisation of Bio-Wastes Generated From Indian Silk Industry for Development of Economically Viable Products
ISESFEC/23/P-247	Saakshi Saini	Ayurvedic polyherbal formulation induces anti-anxiety activity in hippocampal neurons by effectuating SOD2 mediated protection against oxidative stress.
ISESFEC/23/P-248	Ruksana Sultana Ahmed	The Nutritional And Antioxidant Potential of *Vespa affinis* L.: A Traditional Edible Insect of North East India
ISESFEC/23/P-249	Chandrachur Ghosh	Role of monosaccharides present in indian honey in stimulating hepatic glucose uptake in type 2 diabetes mellitus by regulating chrebp/glut4 axis.
ISESFEC/23/P-250	Nikysana Mayengbam	Therapeutic Potential of Bamboo Shoots: A Systematic Review
ISESFEC/23/P-251	Khalida Shahni	Neutraceuticals Potential of Fermented Foods: A Systematic Review
ISESFEC/23/P-254	Namit Kudatarkar	Role of chrysin nanoformulation in cytotoxicity study of Colon cancer

ISESFEC/23/P-255	Vandana Kumari	Metabolomics study of *Ajuga parviflora* with anti-obesity and antidiabetic activity
ISESFEC/23/P-256	Rituparna Pal	Evaluation of in vitro anti-cancer activity of different extracts of mangrove from Bhitarkanika, Odisha
ISESFEC/23/P-257	Maria Adhikary	*In silico* identification and molecular characterization of flavonoid biosynthetic genes and their expression analysis in wheat (*triticum aestivum* l.) During leaf rust infection
ISESFEC/23/P-260	Isfaqul Hussain	Optimization of broth culture of *D. nodosus* under aerobic condition and development of a serogroup B specific footrot vaccine
ISESFEC/23/P-262	Ashutosh Mishra	Ichthyofaunal Diversity of Lesser Himalayan River and Its Bioeconomic Importance
ISESFEC/23/P-263	N. N. Pandey	Use of Herbs for Gonadal Maturity and Breeding of Himalayan Snow Trout Fish
ISESFEC/23/P-264	Sumit Kumar	Breeding and Seed Production of Labeo Dero
ISESFEC/23/P-266	S. L. Nonglait	Utility of Meghalaya's traditional medicine in the treatment of kidney stones disease
ISESFEC/23/P-267	Nrip Kishore Pankaj	Antimotility, anti-diarrheal and antibacterial activities of hydroalcoholic extract of *Cordia dichotoma* leaves in Wistar rat
ISESFEC/23/P-268	Rakesh Kumar	Introduction of low chilling varieties of apple (*Malus domestica* borkh.) In North east India
ISESFEC/23/P-269	Aditi Sharma	Organic production technology of *Mentha piperita*: a silver lining to increase farmer's income in the himalayan region
ISESFEC/23/P-270	Z. A. Kashoo	Occurrence and Genetic Diversity of *Mycobacterium avium* subsp. paratuberculosis in Yak and Double Humped Camel from Western Himalayas
ISESFEC/23/P-271	Zahoor A. Baba	Potential psychrophyllic mineral solubilizing bacterial strains for reducing chemical fertilizer use in north western Himalayas
ISESFEC/23/P-272	Norden Lepcha	Monitoring invasive alien plant species and exploring value-added products for community-based entrepreneurships in the Darjeeling and Kalimpong districts of West Bengal, India
ISESFEC/23/P-273	Iqtab Wani	Holistic evaluation of lignocellulosic invasive species biomass for bioenergy production using proximate and compositional studies
ISESFEC/23/P-274	Rayees A Malik	Utilization of invasive alien species for improving livelihoods of local communities in Kashmir, India
ISESFEC/23/P-276	Wahengbam Kabita Chanu	Phytochemical analysis, in-vito antimalarial activity and antioxidant activity of *Rotheca serrata* (L)
ISESFEC/23/P-277	Lhaineichong Khongsai	Green synthesis of ZnO nanoparticles using *Flemigia macrophylla* (Willd.) Ex. Kuntze Merr. and its Antioxidant, Antidiabetic and Anti-inflammatory activity
ISESFEC/23/P-278	Aleena Khaidem	Ethnomedicinal plants used for burn injury in Manipur

HALL-4 (NAKUPI): e-Presentation Session
(10:00 AM - 01:00 PM)

Evaluators:

Dr Sanjay M Jachak, Coordinator Mohali Local Chapter, SFE & Professor, Department of Natural Products, NIPER, Mohali, India
Dr Pramod J. Hurkadale, Coordinator, Belgaum, Local Chapter, SFE & Head-Pharm. Biotechnology, KLE University, Belgaum, Karnataka, India
Dr. Sunil Thorat, Scientiust, IBSD, Shillong, Meghalaya, India
Prof. K. Mruthunjaya, Coordinator, Mysuru, Local Chapter, SFE & Head, Dept. of Pharmacognosy JSS College of Pharmacy, JSS Academy of Higher Education and Research, Mysuru, India
Dr. J K Shukla, *Scientist-E, IBSD,* Shillong, Meghalaya, India
Dr. Chandana Barua, Coordinator, Guwahati, Local Chapter, SFE & Professor, Dept. of Pharmacology & Toxicology College of Veterinary Science, Khanapara, Guwahati, India
Dr. Sagar K. Mishra, Associate Professor, Utkal University, Odisha, India

Abstract No	Presenting Author	Title of Abstract
ISESFEC/23/P-014	Shivangi Borkotoky	Phytochemical Characterization and Evaluation of Antioxidant, Cytotoxic, Antimicrobial and Anti-biofilm activities of *Sphaerostephanos unitus* (L.) Holttum
ISESFEC/23/P-016	Seyede Nargess Sadati Lamardic	Evaluation of sedative and hypnotic effect of Paeonia daurica subsp. Macrophylla root extracts in mice
ISESFEC/23/P-019	Weronika Skowrońska	Anti-inflammatory activity of serpylli herba on human skin keratinocytes
ISESFEC/23/P-021	Andrzej Patyra	Phytochemical characterization of siberian ginseng roots using LC-DAD-ESI-MS/MS
ISESFEC/23/P-022	Katarzyna Kupniewska	*Eleutherococci radix* – quality assessment of herbal products
ISESFEC/23/P-023	Maciej Korczak	Bilateral interactions between gut microbiota and natural products applied in anxiety and mood disorders
ISESFEC/23/P-024	Małgorzata Kołtun-Jasion	Anti-inflammatory effects of natural raw materials as potential therapeutic enhancers for lipopolysaccharide-induced inflammation
ISESFEC/23/P-031	Sharareh Hekmat	Beneficial effects of *Urtica pilulifera* seed extract in enhancing folliculogenesis in the Diminished Ovarian Reserve (DOR) model in Balb/c mice
ISESFEC/23/P-032	Mayuri S. Kale	Isolation and characterization of therapeutically important furocoumarins from the seeds of traditional medicinal plant *Psoralea corylifolia*
ISESFEC/23/P-035	Vrushali Pawar	Formulation and in vivo evaluation of herbal emulgel for wound healing activity
ISESFEC/23/P-049	Swati Korake	Design and development of nanoparticulate drug delivery system for cancer
ISESFEC/23/P-054	Shivangi J. Patel	Trikatu, an Ayurvedic Remedy for Breast Cancer.
ISESFEC/23/P-061	Seyedeh mahnaz Karimi	Anti-osteoporotic effect of *Pistacia atlantica* Desf. Oleo-gum-resin and its nanocapsulated on biomechanical properties and bone density in ovariectomized rats
ISESFEC/23/P-063	Aaditi Kamble	Stability indicating assay method development and validation for analysis of lutein by HPTLC
ISESFEC/23/P-067	Shruti V. Kolambkar	Formulation, design, and optimization of chewable tablet from traditional plants for sore throat
ISESFEC/23/P-068	Rohini R. Kulkarni	Analytical method development and validation for simultaneous estimation of myo-inositol and d-chiro

		inositol in pharmaceutical dosage form
ISESFEC/23/P-069	Hemangi Chaudhari	Development and validation of stability indicating assay method for estimation of lumefantrine in bulk and tablets
ISESFEC/23/P-078	Sunil Kumar	Efficacy of local bioresources for augmenting reproductive efficiency and health in pigs
ISESFEC/23/P-080	Anushka Bakore	HPTLC based standardization and network analysis of poly herbal formulation used in the management of rheumatoid arthritis
ISESFEC/23/P-085	Sumit Gunjal	Design oriented formulation development of nanosponges of tenofovir disoproxil fumarate based hydrogel
ISESFEC/23/P-086	Abdul Hadi Umam	Phytosome as a novel approach for herbal medicines
ISESFEC/23/P-087	Lakhyajit Borah	Therapeutic potential of genus cymbidium: a systematic review
ISESFEC/23/P-088	Manjit Mishra	Diabetic wound healing activity of herbal formulation: a systematic review
ISESFEC/23/P-099	Teodora-Cristiana Grădinaru	Top 20 of inflammation-related molecular targets of bitter tastants
ISESFEC/23/P-103	Geeti Prabha Deka	Antioxidant activity, total phenolic and total flavonoid content of extract and fractions of *Aerides odorata* Lour (Orchidaceae)
ISESFEC/23/P-104	Rosamund Jyrwa	Biochemical analysis and proximate composition of traditional beverage of Assam, India.
ISESFEC/23/P-108	Ritu Tiwari	Enrichment and metabolomic profiling of low assayed molecules - Quinic acid, Myo-inositol, and 2,4-Di-tert-butylphenol in *Aegle marmelos* fruit and leaves
ISESFEC/23/P-109	Digbijoy Nath	*Carica papaya* seed oil demonstrated promising anti-diabetic efficacy in a battery of *in-vitro, in-silico*, and *in-vivo* assays
ISESFEC/23/P-110	Sharvari Mulik	Marker based standardization by hptlc and in-silico network analysis of polyherbal formulation in the management of ulcerative colitis.
ISESFEC/23/P-111	Pratiksha Phand	Extraction, nutraceutical evaluation and development of granules of oyster mushroom
ISESFEC/23/P-115	Ashwini Deokar	Network pharmacology and molecular docking based approaches to explore the potential bioactive components and potential targets of *Saraswata ghrita* in the treatment of alzheimers disease
ISESFEC/23/P-160	Saiyed Kamartaha	Antibacterial & antifungal activity of 'Majoon Najah': a classical UNANI formulation

HALL-4 (NAKUPI): e-Presentation Session
(02:00 PM - 05:00 PM)

Evaluators:

Dr. Satyanshu Kumar, Coordinator, Gujarat, Local Chapter, SFE & Principal Scientist Directorate of Medicinal and Aromatic Plants Research, Boriavi, Anand, Gujarat, India

Dr. Sathiyanarayanan L., Coordinator, Pune Local Chapter, SFE & Dept of Pharmaceutical Chemistry, Bharati Vidyapeeth University Poona College of Pharmacy, Pune, MH, India

Dr. Lokesh Deb, Scientist, IBSD, Sikkim, India

Dr Jatin Kalita, Coordinator, Jorhat Local Chapter, SFE & Principal Scientist, CSIR-North East Institute of Science and Technology, Jorhat-785006, Assam, India

Mr. Bharat G Somkuwar, Scientist, IBSD, Sikkim, India

Dr. Sanjeeb K Sahoo, Scientist, Institute of Life Sciences, Bhubaneswar, India

Dr. Prosoon K. Gupta, Coordinator, Jammu Local Chapter, SFE & Principal Scientist, Natural Product Chemistry Division, CSIR- IIM, Jammu, India

Dr. Rajesh Singh Pawar, Coordinator, Bhopal, Local Chapter, SFE & Professor & Principal, TRUBA College of Pharmacy, Bhopal, M.P., India

Abstract No	Presenting Author	Title of Abstract
ISESFEC/23/P-116	Niharika	Nephroprotective potential of apium graveolens and *Piper cubeba* exploring in silico, in vitro, and metabolomic approaches
ISESFEC/23/P-117	Nongmaithem Randhoni Chanu	Formulation and optimization of phytoextract loaded phytosome targeting wound
ISESFEC/23/P-119	Smruti Mukadam	In- silico study for screening of suitable phytoconstituent/s from *Boswellia serrata* for the treatment of wound healing.
ISESFEC/23/P-121	Nending Muni	Edible anomala species and its host plant as a potential source of protein and pharmacological components
ISESFEC/23/P-129	Mostafa Khursid Alam	Biochemical analysis of traditional rice beer of Arunachal Pradesh
ISESFEC/23/P-134	Sangeetha Gopal	Antibacterial and phytochemical analysis of water extracts of *Azadirachta indica* and *Ocimum tenuiflorum* leaves
ISESFEC/23/P-141	Pallab Kalita	Kolakhar- Not Just A Food Additives of Assam, India : An Introduction
ISESFEC/23/P-146	Veena Ranganathan	*Piper betle* activates nrf2-regulated antioxidant defenses, attenuates lipopolysaccharide-induced inflammation and improves survival in rotenone-induced *drosophila* model.
ISESFEC/23/P-155	Ankita G. Yelne	*In-vitro* screening of leaf extracts of *Kalanchoe pinnata* and *Moringa olifera* for anti-urolithiatic activity
ISESFEC/23/P-162	Jainee Vashi	Evaluation of polyherbal formulation on letrozole induced polycystic ovarian syndrome in experimental rat model
ISESFEC/23/P-163	Shouvik Kumar Nandy	A comparative study on *Tinospora cordifolia* (giloy) (willd.) Miers:, based on folk or traditional uses
ISESFEC/23/P-164	Mohammad Sadegh Adel-Mehraban	Antioxidative and anti-inflammatory effects of hypoglycemic herbal medicines: an in vivo/in vitro systematic review

ISESFEC/23/P-167	Niusha Esmaealzadeh	The effect of freeze-dried root extract of *Persicaria bistorta* (l.) Samp on acetic acid colitis model in rat
ISESFEC/23/P-170	Chaitrali M. Bidikar	A tool for quality control: hptlc fingerprint analysis with the presence of antioxidants by effect directed activity and quantification of biomarkers in terminalia species
ISESFEC/23/P-174	Leena Chavan	Formulation and evaluation of hydrogel for sunscreen and moisturizing effect.
ISESFEC/23/P-178	Haobijam Sanjita Devi	Prospects of zebrafish as a model in the ethno-pharmacological study
ISESFEC/23/P-179	Varda Farooqui	Evaluation of anthelmintic activity of methanolic extract of *Cajanus cajan* leaves
ISESFEC/23/P-180	Humaira Fatima	Phytochemical investigation of *Phyllanthus acidus* leaves
ISESFEC/23/P-181	Ruheena Tabassum	Phytochemical investigation of *Pupalia lappacea*
ISESFEC/23/P-182	Muzayyana Khan	Determination of anti-dengue potential of prepared unani formulation: *habb-e-tap-e-balghami*
ISESFEC/23/P-183	Saleha Sultana	Phytochemical investigation of *Terminalia catappa* fruit
ISESFEC/23/P-185	Firdous Fatima	GC-MS analysis and total phenolic and flavonoid content of leaf extract of *Ceiba pentandra*
ISESFEC/23/P-186	Nabeela Hashmeen	GC-MS analysis and total phenolic and flavonoid content of *Syzygium cumini* leaf extract
ISESFEC/23/P-187	Shaziya Tabassum	Phytochemical investigation and total phenolic and flavonoid content of flower extract of *Bauhinia purpurea*
ISESFEC/23/P-188	Maham Fatima	GC-MS analysis and anthelmintic activity of methanolic extract of *Nigella sativa* seed
ISESFEC/23/P-190	Malati Salunke	Development and characterization of novel formulation of lycopene for diabetic wound healing
ISESFEC/23/P-200	Joynath Pegu	Traditional treatment of diabetes among of tribes in mokokchung district, Nagaland, NE India
ISESFEC/23/P-210	Rohan.V Gaikwad	In-silico studies on caffeic acid phenylethyl ester (cape) against major cancer targets
ISESFEC/23/P-213	Md Anzar Alam	Understanding Disease of Children by Avicenna
ISESFEC/23/P-218	Kaveri Dhikale	Stability indicating hptlc method for estimation of *Vitex negundo* extract and its marketed formulation
ISESFEC/23/P-219	Niranjan Mali	HPTLC method development for its stability studies and antioxidant activity for estimation of *Aegle marmelos* leaves extract
ISESFEC/23/P-221	Bharti Verma	Protective effect of betulinic acid on streptozotocin induced memory dysfunction in adult zebrafish
ISESFEC/23/P-222	Nitish Kumar	Fabrication of probiotic-loaded solid lipid nanoparticles and in vitro survival in gastrointestinal conditions
ISESFEC/23/P-223	Rahul Kumar	Effect of PPAR alpha modulator ciprofibrate in aluminum chloride induced model of alzheimer's in rat
ISESFEC/23/P-229	Koushik Choudhury	Physiochemical and phytochemical screening of extracts of solanum viarum and thevetia peruviana used for diabetes by tribal people of tripura, India
ISESFEC/23/P-230	Hridya V.K.	An insight into the ethnopharmacological significances of *Sonneratia caseolaris* by isolating major compounds and its hepatoprotective efficacy with in silico methods

ISESFEC/23/P-234	Saavedra-Rodríguez Roberto	Ethnomedicine used for hemorrhages among williche people
ISESFEC/23/P-246	Desh Deepak Pandey	Chemical and biological evaluation of herbal drug Caesalpinia bonducella
ISESFEC/23/P-252	Vashkar Biswa	Pcr based identification of entomopathogenic fungi *Cordyceps spp.* Found in eastern himalayan region of India
ISESFEC/23/P-253	Archana Bagre	Osmoprotective microemulsion: new insights into the ocular drug delivery
ISESFEC/23/P-258	Avijit Ghosh	Investigation of in-vitro α-amylase enzyme inhibitory potential and oral glucose tolerance test (ogtt) of mangrove plant *Ceriops decendra*
ISESFEC/23/P-259	Jayashree Mondal	Evaluating the hypolipidemic potential of mangiferin loaded n-succinyl chitosan-alginate grafted nanoparticles against streptozotocin induced diabetes mellitus
ISESFEC/23/P-261	Minal Mahajan	A plant lignan regulates lipid metabolism in androgen independent prostate cancer cells
ISESFEC/23/P-265	Nitin Kumar	Antibacterial activity of *Aegle marmelos* extract based novel formulation
ISESFEC/23/P-275	Sanjib Das	Synthesis and biological screening of Glutamine analogues for the management of chronic myeloid leukemia

HALL-1 (SHIRUI): VALIDICTORY PROGRAM
(02:00 PM - 03:30 PM)

Dr. USN Murthy, Director, NIPER, Guwahati, India

Dr. G. Narahari Sastry, Director, CSIR- North East Institute of Science and Technology (CSIR-NEIST), Jorhat, Assam, India

Prof. N Raj Mohan Singh, *Vice Chancellor, DM University, Manipur, India*

Prof. Gunter Vollmer, *President, ISE, Emeritus Professor, Molecular Cell Physiology & Endocrinology, Faculty of Biology, Dresden University of Technology, Germany*

Shri. Birendra K. Sarkar, *President, Society for Ethnopharmacology, India, Kolkata*

Prof. Marco Leonti, *Secretary, ISE & Department of Biomedical Sciences, University of Cagliari, Italy*

Dr. Subhash C Mandal, *Secretary, Society for Ethnopharmacology, India, Kolkata.*

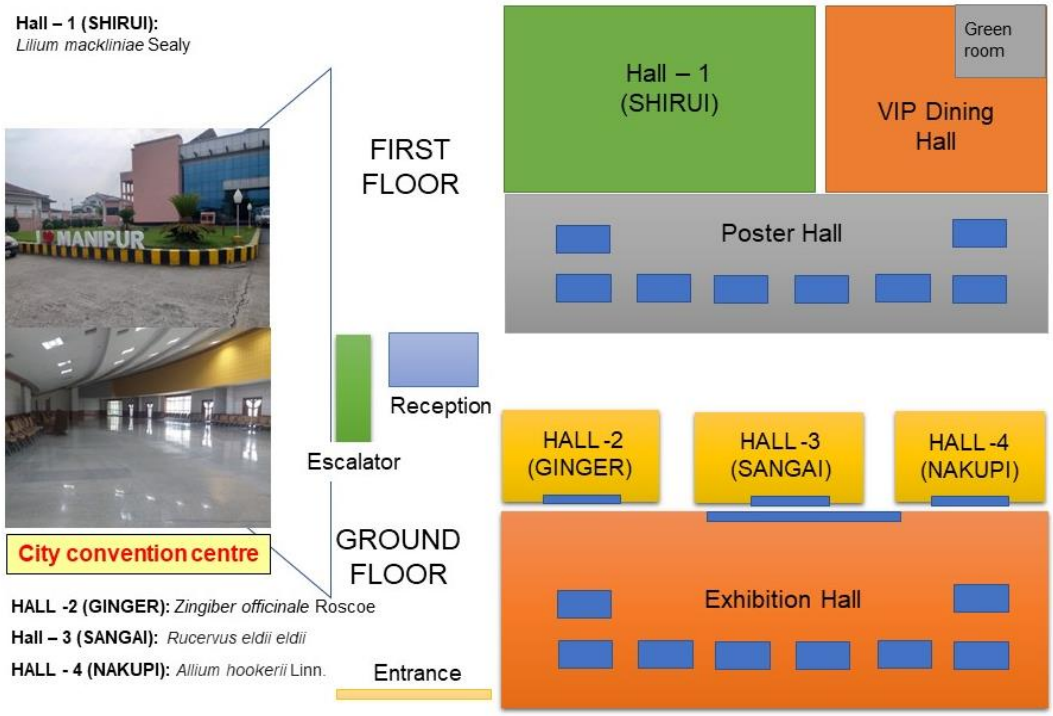
Mr. Indraneel Das, *Vice President, Society for Ethnopharmacology, Kolkata, India*

Dr. Nanaocha Sharma, *Organizing Secretary, ISESFEC 2023 & Scientist, Institute of Bioresources & Sustainable Development, Imphal, India*

Prof. Pulok K Mukherjee, *Chairman, ISESFEC 2023 & Director, Institute of Bioresources & Sustainable Development, Imphal, India*

Awards for
Young Ethnopharmacologist,
Best Oral Presentation
&
Poster Presentation

Venue: City Convention Centre, Imphal, Manipur, India



डॉ0 जितेन्द्र सिंह
राज्य मंत्री (स्वतंत्र प्रभार)
विज्ञान एवं प्रौद्योगिकी मंत्रालय;
राज्य मंत्री (स्वतंत्र प्रभार) पृथ्वी विज्ञान मंत्रालय;
राज्य मंत्री, प्रधान मंत्री कार्यालय;
राज्य मंत्री कार्मिक, लोक शिकायत एवं पेंशन मंत्रालय;
राज्य मंत्री परमाणु ऊर्जा विभाग तथा
राज्य मंत्री अंतरिक्ष विभाग
भारत सरकार

सत्यमेव जयते

D.O. No. 1678 ....MoS(I/C)/(S&T&ES)/2023
Dr. JITENDRA SINGH
Minister of State (Independent Charge)
of the Ministry of Science and Technology;
Minister of State (Independent Charge)
of the Ministry of Earth Sciences;
Minister of State in the Prime Minister's Office;
Minister of State in the Ministry of Personnel,
Public Grievances and Pensions;
Minister of State in the Department of Atomic Energy and
Minister of State in the Department of Space
Government of India

MESSAGE

I am delighted to know that Institute of Bioresources and Sustainable Development (IBSD), an institute under Department of Biotechnology, Ministry of Science & Technology, Govt. of India is organizing International Bioresource Conclave and Ethnopharmacology Congress – 22nd International Congress of International Society for Ethnopharmacology and 10th International Congress for Ethnopharmacology, India (ISE SFEC 2023) on the theme, "Reimagine Ethnopharmacology: Globalization of Traditional Medicine" in collaboration with Society for Ethnopharmacology, India during February 24 - 26, 2023 at the City Convention Centre, Imphal, Manipur.

I am happy to see that IBSD is organising this program for the development of the integrated multi-disciplinary research and innovation programs, on different research areas to identify the unique bio resources of NER and integrated study for their scientific validation and value addition for catalysing the growth of industry in the region for livelihood generation and boosting the bioeconomy. This Congress will witness scientific deliberations by experts from forty countries around the globe and provide an environment for knowledge sharing among researchers, traditional healthcare practitioners, bioentrepreneurs, and policy makers for the development of Bioeconomy from Bioresources of North Eastern Region.

I convey my best wishes to delegates from India and abroad, entrepreneurs, organizers, scientists and research scholars participating in the congress.

(Dr. Jitendra Singh)
MBBS (Stanley, Chennai)
MD Medicine, Fellowship (AIIMS, NDL)
MNAMS Diabetes & Endocrinology

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La. Ganesan
Governor of Manipur

सत्यमेव जयते

ल. गणेशन
राज्यपाल, मणिपुर

MESSAGE

I am very happy to learn that the Institute of Bio-resources and Sustainable Development (IBSD) in collaboration with the 22nd Congress of the International Society for Ethnopharmacology (Switzerland) and the 10th Congress of Society for Ethnopharmacology (India) is organizing the International Bio-resource Conclave during February 24-26, 2023 at Imphal and a Congress Book is also being published to mark the mega event.

North Eastern Region of India is one of the most bio-diversity-rich Regions of the World which is gifted with diverse flora including unique medicinal plant species. Among all the NER States, Manipur State has diverse forests including tropical to sub-tropical and temperate with rich floral diversity as well as high degree of endemism which includes valuable medicinal plants. These medicinal plants have high demand in India and abroad which can boost the economy of this Region. Geographically, Manipur State falls under Indo-Myanmar bio-diversity Hotspot and between 93 03 degree and 94 78 degree east longitude and 23 83 degree and 25 68 degree north latitude The State is inhabited by numerous ethnic groups practising their traditional healthcare practices and using a large number of wield plants for the treatment of various ailments.

It is gratifying to note that the Institute of Bio-resources & Sustainable Development and Botanical Survey of India jointly took this initiative to develop a "Compendium of Medicinal Plants of Manipur" which enlists important medicinal plants of the State including taxonomic, morphological description, distribution and the parts used a long with phytochemical and therapeutic properties. This compendium consolidates the medicinal uses as described in the traditional system of medicine and pharmacopeia. This document will serve as reference for Researchers, Scientists, Farmers, Entrepreneurs and local communities for medicinal plants of this Region. The efforts made by the Director, IBSD, Imphal and Director, BSI, Kolkata to organize such mega conclave are really commendable and praiseworthy

I wish the Conclave a grand success.

(La. Ganesan)

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सत्यमेव जयते

CHIEF MINISTER
MANIPUR

Imphal
February 1, 2023

MESSAGE

It gives me immense pleasure to learn that Institute of Bioresources and Sustainable Development (IBSD), Imphal is organizing International Bioresource Conclave and Ethnopharmacology Congress along with the 22nd International Congress of International Society for Ethnopharmacology and 10th International Congress for Ethnopharmacology, India (ISE SFEC 2023) under the theme, "Reimagine Ethnopharmacology: Globalization of Traditional Medicine" in collaboration with Society for Ethnopharmacology, India at Imphal.

It is even more delightful to know that the event is happening for the first time in the Northeast India. It is an opportunity to showcase different initiatives for promotion of bioresources of our country with special references to the Northeast Region. The North East is rich in bioresources. Its people has survived through centuries with a vast wealth of traditional knowledge passed down through generations. I am hopeful that the congress, which will be attended by scientists, research scholars and other experts, will provide a platform for knowledge sharing among researchers, traditional healthcare practitioners, bioentrepreneurs and policy makers for the development of Bioeconomy and Ethnopharmacology.

I extend my best wishes to the organisers and wish the congress a grand success.

(N. Biren Singh)

आजादी का अमृत महोत्सव

डॉ. राजकुमार रंजन सिंह
Dr. Rajkumar Ranjan Singh

सत्यमेव जयते

G20 भारत 2023 INDIA
वसुधैव कुटुम्बकम्
One Earth. One Family. One Future

विदेश राज्य मंत्री
भारत सरकार, नई दिल्ली
Minister of State for External Affairs
Government of India, New Delhi

MESSAGE

I am happy to note that the 22nd International Congress of International Society for Ethnopharmacology and the 10th International Congress of Society for Ethnopharmacology (ISE SFEC 2023) are being organised at Imphal on February 24-26, 2023 jointly by the Institute of Bioresources and Sustainable Development, Imphal and the Society for Ethnopharmacology, India.

The chosen theme, "Reimagine Ethnopharmacology : Globalization of Traditional Medicine" is apt, given our vast knowledge base in Traditional Medicine. The initiative is timely, given the urgent need to systematically make the benefits of these knowledge systems available to humanity.

I am confident that these two events, will go a long way to highlight our rich and unique local bio resources used in our traditional medical practices, invigorate integrated studies for their scientific validation, and help initiate value addition for catalysing further growth of this industry in the region.

I convey my best wishes to participating delegates.

(**Dr. Rajkumar Ranjan Singh**)

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सत्यमेव जयते

डॉ. राजेश सु. गोखले
Dr. RAJESH S. GOKHALE

सचिव
भारत सरकार
विज्ञान और प्रौद्योगिकी मंत्रालय
जैव प्रौद्योगिकी विभाग
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GOVERNMENT OF INDIA
MINISTRY OF SCIENCE & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY
Block-2, 7th Floor, CGO Complex
Lodhi Road, New Delhi-110003

Message

I am happy to know that International Bioresource Conclave and Ethnopharmacology Congress – 22nd International Congress of International Society for Ethnopharmacology and 10th International Congress for Ethnopharmacology, India (ISE SFEC 2023) is being organized jointly by Institute of Bioresources and Sustainable Development (IBSD), an institute under Department of Biotechnology, Ministry of Science & Technology, Govt. of India and Society for Ethnopharmacology, India with the theme, *"Reimagine Ethnopharmacology: Globalization of Traditional Medicine"* during February 24-26, 2023 at Imphal, Manipur.

North East Region is India's richest reservoir of plants, animals and microbial diversity and is amongst the top 10 Biodiversity Hotspots in the World. The region is endowed with a wealth of endemic medicinal plants used over centuries by more than 150 tribal communities in their traditional healthcare practices. It is indeed very timely to organize the event in North East Region of India. The Congress will provide an ideal platform and unique opportunity for knowledge sharing among researchers, healthcare practitioners, industrialists, potential entrepreneurs and policy makers representing over 40 countries for globalization of local rich bioresources and traditional knowledge as well as localizing global technologies towards developing the bioeconomy in North East Region.

The rich bioresources of North East Region have tremendous potential for developing globally acceptable nutraceuticals, phytopharmaceuticals and as a source of modern medicine through advanced technological interventions. The Congress will also provide a mechanism to establish the linkages between academia and industry for promotion of local start-ups for developing the above products from bioresources towards "Atmanirbhar Bharat".

I congratulate the organizers, delegates from India and abroad, scientists and research scholars, traditional healers and entrepreneurs participating in the congress. I convey my best wishes for the success of the congress.

(Dr. Rajesh S. Gokhale)

Phone : 24362950/24362881, Fax : 011-24360747, E-mail : secy.dbt@nic.in

Message

Dear Participants

We welcome you all to the ISE-SFEC 2023 and wish you a great time in Imphal, Manipur, India!

The International Society for Ethnopharmacology (ISE) promotes local and traditional knowledge on medicinal, food and toxic plants and their past, present and future use. ISE is interested in the perception and the interface of the emic and etic perspective of such knowledge and we encourage and promote the future use of such local and traditional knowledge with the integration of transdisciplinary aspects to strengthen the link between the social and the natural sciences. The Society offers multiple ways to exchange information between scientists and anyone else interested in these topics.

This year, the 22nd International Congress of International Society for Ethnopharmacology and the 10th International Congress of Society for Ethnopharmacology (ISESFEC 2023) on "Reimagine Ethnopharmacology: Globalization of Traditional Medicine", is being organized by the Institute of Bioresources and Sustainable Development in association at the City Convention Centre, Imphal, India during February 24-26, 2023.

This congress will be attended by a large number of participants from all over the globe, scientists from several countries including India will join the congress and enlighten the path of young researchers through their diverse and informative deliberations. There will be several keynote speeches, plenary lectures, panel discussions by eminent scientists as well as paper and poster presentations by researchers. Several panel discussion sessions are being organized during the congress like "the ethnopharmacology conclave" involving traditional healers and editorial meeting about publication ethics, *i*-connect program and business meeting.

The congress will allow young scientists to interact with senior researchers from all over the world, to establish contacts and to start new and fruitful collaborations in this field.

We wish you a pleasant and successful stay at Imphal, India!

Prof. Marco Leonti
Secretary
ISE, Switzerland

Prof. Gunter Vollmer
President
ISE, Switzerland

SOCIETY FOR ETHNOPHARMACOLOGY

Affiliated to International Society for Ethnopharmacology, Switzerland
23/3, Shaktigarh, Kolkata 700 032, India
E-mail: sfeindiase@gmail.com ; sfeindian@gmail.com
www.ethnopharmacology.in

Message

Dear Friends,

Greetings from Society for Ethnopharmacology (SFE), Kolkata, India!

As you are aware that our society has been formed in the year of 2013 with an objective of knowledge sharing among researchers, healthcare practitioners, policy-makers, cultivators, patients and anyone interested in Ethnopharmacology. This organization has started its journey with very modest way and gradually increasing its strength and already created tangible impact in the society. Presently we are having 17 Local chapters operating from different cities across the country and 6 of them started during last one year. The society is organizing conferences, seminars, symposiums, workshops etc. in different parts of India on different issues on cultivation, production, quality evaluation, safety, clinical studies, biological screening and several other issues of natural product research. Our Society is publishing newsletters, periodicals, documents, books, special issues in several journals published by reputed publishers for promotion of knowledge in the field of natural product research.

SFE has expanded its activity by stepping in direct research and presently conducting research project supported by Department of Biotechnology, Govt. of India. Our society is also encouraging researchers in the field of ethnopharmacology by conferring awards for their contribution in different sectors every year.

We are going to celebrate its 10 year celebration i.e. International Congress of Society for Ethnopharmacology jointly with 22nd International Congress of International Society for Ethnopharmacology during February 24-26, 2023 at Imphal, Manipur, India. Besides good number of participants from all over the globe, scientists from more several countries and renowned scientists from India has confirmed their participation to join the congress. There will be several Key note speeches, plenary lectures, Panel discussions by eminent scientists, paper presentations, poster presentation by researchers, professionals and students. Some special sessions are being organized at this congress like- Ethnopharmacology Conclave involving traditional healers, Editorial meet on Publication ethics, i-connect program: Business meet etc.

Hope you will enjoy the scientific sessions, ambience of the city convention centre and warmth of your SFE family!

Shri. Birendra Kumar Sarkar
President
Society for Ethnopharmacology
Kolkata, India

Dr. Subhash C. Mandal
M.Pharm., Ph.D, FIC, FIPA
Secretary
Society for Ethnopharmacology
Kolkata, India

ISE SFEC-2023

International Society for Ethnopharmacology

22nd International Congress
International Society for Ethnopharmacology

&

10th International Congress
Society for Ethnopharmacology, India

"Reimagine Ethnopharmacology - Globalization of Traditional Medicine"

February 24-26, 2023

Venue: City Convention Centre, Imphal, Manipur, India

Message

Dear Friends

Greetings from IBSD, Imphal, India!

I would like to welcome you all for the International Bioresource Conclave and Ethnopharmacology Congress – 22nd International Congress of International Society for Ethnopharmacology and 10th International Congress for Ethnopharmacology, India (ISE SFEC 2023) on the theme, "Reimagine Ethnopharmacology: Globalization of Traditional Medicine" in collaboration with Society for Ethnopharmacology, India during February 24 - 26, 2023 at the City Convention Centre, Imphal, Manipur, India.

This congress will be highlighting on different aspects for the dissemination of knowledge, promotion and development of traditional medicine based on the Ethnopharmacology and medicinal plants by deliberation of experts from forty countries around the globe. I feel this convention will provide an ideal platform for interaction and dissemination of knowledge & ideas between scientists, professionals from Industry and academia in different areas of Ethnopharmacology and medicinal plant research towards exploration of bioresources of North Eastern Region for sustainable development of bioeconomy. For promotion and development of Bioresources and Ethnopharmacology several special panel discussion session including "Publication ethics", "Traditional Healers Conclave", "Reimagine Ethnopharmacology", "Herbs in One Health", "Ashwagandha", "i-Connect program: Business meet" is being organized during this congress.

I would like to thank all the participants for their participation and interest to make this event successful. I wish you all a very effective scientific interaction during this program. I convey my sincere thanks to the Department of Biotechnology, Govt. of India; Council of Scientific & Industrial Research, Govt. of India; National Medicinal Plant Board, Ministry of AYUSH, Govt. of India for their support in organizing this event.

I gratefully acknowledge the service rendered by the organizing committee members from IBSD and SFE, India for their active support in organizing this congress.

Dr. Nanaocha Sharma
Organizing Secretary, ISESFEC 2023 &
Scientist
Institute of Bioresources and Sustainable Development
Takyelpat, Imphal 795001, India

Jointly organized by

Institute of Bioresources and Sustainable Development
Takyelpat, Imphal, Manipur, India

Society for Ethnopharmacology
Shaktigarh, Jadavpur, Kolkata

E-mail: isesfec2023@gmail.com
Web: www.isesfec2023.in

जैवप्रौद्योगिकी विभाग
DEPARTMENT OF
BIOTECHNOLOGY
सत्यमेव जयते

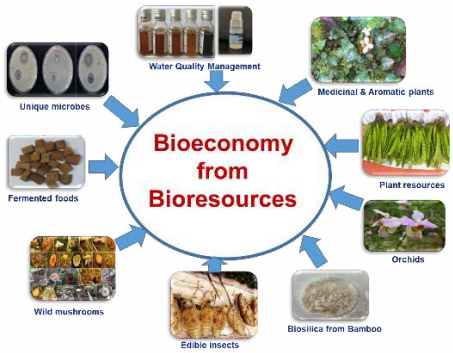
Prof. Pulok Kumar Mukherjee
FRSC, FAScT, FNAAS, FNASc
Director
Institute of Bioresources and Sustainable Development (IBSD),
Imphal, Manipur, India
www.ibsd,gov.in

It is my great pleasure to welcome you all for International Bioresource Conclave along with the 22nd Congress of the International Society for Ethnopharmacology (Switzerland) and the 10th Congress of Society for Ethnopharmacology (India) being organized at Imphal, Manipur, India during February 24-26, 2023 at the City Convention Centre, Imphal, India. This congress will focus on “Reimagine Ethnopharmacology: Globalization of Traditional Medicines”. The event is happening for the first time at Imphal and also in the Northern region India to showcase different initiatives for promotion of bioresourecs of our country with special references to NER. This region of India is very unique in terms of diversity of different people, their traditional knowledge and biodiversity in terms of plants, microbes, animals. This particular region falls under Indo-Burma biodiversity Hotspot which is one of the biodiversity Hotspots of the world.

Institute of Bioresources and Sustainable Development (IBSD), Imphal, an institute of the Department of Biotechnology, Ministry of Science & Technology, Govt. of India is working with the mission on “Bioresources development and their sustainable use through biotechnological interventions for the socio-economic growth of the North Eastern Region”. Main goal of IBSD is “Scientific management of bioresources

in the Indian region falling under Indo-Burma Biodiversity Hotspot". For the development of bioresources and other outreach activities, IBSD has established three other entities in NER including its Regional Centre at Gangtok in Sikkim and Research Nodes at Shillong in Meghalaya and at Aizawl in Mizoram.

For the development of integrated multi-disciplinary research and innovation programs, IBSD is working on different research verticals to identify the unique bio resources of NER and integrated study for their scientific validation, value addition to propel innovations, discoveries and inventions for catalyzing the growth of industry in the region for livelihood generation and boosting bioeconomy from bioresources



IBSD is synergizing all these research activities to boost the bioeconomy from the bio resources of NER with the development of processes/ products/ technologies. In this context, IBSD has initiated a programme on "Bioeconomy from Bioresources with special reference to NER" which was inaugurated by Hon'ble Shri M. Venkaiah Naidu, Former Vice President of India during 2021 and addressed by Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge) for Science and Technology and Earth Sciences during his visit to IBSD, Imphal.

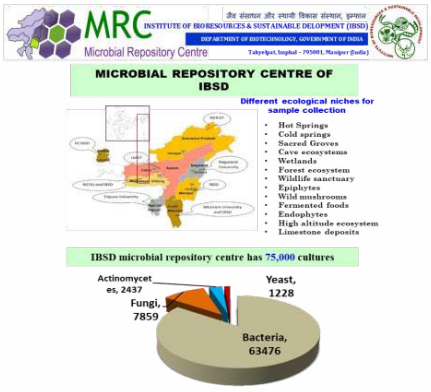
IBSD has established the Phytopharmaceutical Mission to promote the documentation, scientific validation and evaluation of traditional healthcare practices. Under this mission, IBSD is working on documentation, evaluation and validation of traditional healthcare practices of NER to promote the drugs from our ancestors, drugs from nature and to explore the tradition to translation with innovation. IBSD is working for (i) Exploring the traditional healthcare practices and the medicinal and aromatic plants (MAPs)

used in these practices of the NER particularly Manipur, Nagaland, Meghalaya, Sikkim, Mizoram and their scientific validation with translational components (ii) Value-addition to the traditional knowledge can lead to the cause of translational and transformational research through MAPs (iii) Use of MAPs for socio economic development of the region (iv) Encouraging the Start-ups programme under 'Aatmanirbhar Bharat Abhiyaan' (v) Capacity buildings, training, promotion and development of Himalayan bio-resources for therapeutic potentials. In this context, IBSD has established linkages between traditional healers and the scientific communities for benefit sharing and promotion of start-ups with Ethno Entrepreneurships based on development of herbal medicinal based products, fermented foods, edible mushrooms and insects.

IBSD is promoting natural remedies as drugs through AYUSH, Phytopharmaceutical, Nutraceutical mode. In this context, a compendium has been developed for anti-viral plants of North East Region. The seventy plants compiled in this compendium are reported for their anti-viral activities and practiced as well as proven for its medicinal properties. IBSD has performed metabolomics analysis of numerous targeted as well as non-targeted metabolites in medicinal plants of NER using modern Omics approaches. IBSD is working on quality evaluation and therapeutic validation of Cucurbitaceae plants of NER. IBSD is exploring plant bioresources of NER for mass multiplication and production of quality planting material. Under flagship programme, IBSD is working on selected Orchids species for developing biobased entrepreneurship in North East India.

ERU Water Test kit

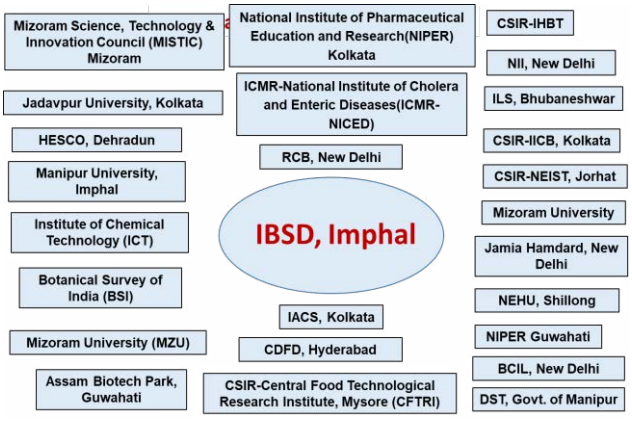
IBSD is working on the development of nutraceutical and dietary supplements from ethnic fermented foods and beverages of NER. In this context, IBSD has focused on microbiology, safety, development of starter culture consortium and development of fermentation processes and products. IBSD has explored the probiotic properties of selected starter culture consortium, chemical profiling and therapeutic values of selected fermented foods. Microbial



repository centre of IBSD has huge collection of Bacteria, Actinomycetes, Yeast and Fungi from different unique ecological niches of NER viz., cave ecosystem, forest ecosystem, fermented food, endophytes, hot-spring, cold spring, lime stone deposits, high altitude ecosystems etc. IBSD is working on Anti-Microbial Resistance (AMR) for the evaluation of antimicrobial activity of the medicinal plants/microbial resources of NER. IBSD is also exploring wild mushroom from NER for nutraceutical and therapeutic potential.

For developing collaboration between industry and institute, IBSD has organized Industry-Connect (i-connect) Events in Manipur, Mizoram, Meghalaya and Sikkim. These events were attended by local entrepreneurs, traditional healers and experts from different industries/ institutes from different parts of India for the development of products/ processes/ technologies with value addition of bioresources and development bioeconomy from bioresources of NER.

IBSD has initiated working on Household Water Quality Management through Testing, Surveillance and Technological Interventions with water testing facility for drinking water, waste water etc to support the local people of NER. In this direction, IBSD has collected samples of drinking water from different localities of Manipur in association with State PHED Department for water quality monitoring, surveillance and developed a water testing kit (ERU Kit) for rapid monitoring of water quality. This year, IBSD has initiated many collaborative projects under 'Himalayan Bioresources Mission' to connect many research institutes from Eastern-Western Himalayas to explore rich bioresources and their sustainable utilization for livelihood generation and future socio-economic development. IBSD



has signed several MoUs with national and international institutes for collaborative translational research on the development of bioresources.

For the promotion of Start-ups in NER, IBSD has setup Bioincubators Nurturing Entrepreneurship for Scaling Technologies (BioNEST) incubator at IBSD, Node Meghalaya to develop women entrepreneurship through orchid floriculture in Meghalaya. Major focus of the programme is capacity building and training of women bio-entrepreneurs and farmers from different parts of Ri-Bhoi District of Meghalaya. In line with phytopharmaceutical mission, IBSD is working on documentation and validation of edible insects of NER for the development of therapeutics for health benefits.

IBSD has set up a ‘Science Museum’ in Chandel District of Manipur which is an Aspirational District of Manipur to develop scientific attitude and to inculcate awareness about the local bio resources among the students and common people of the region. During this period, IBSD has organized many lab visits for the students of Dhanamanjuri University, Imphal, GP Women College, Imphal, Oriental College, Imphal to inculcate scientific temperament among students and scientific interventions for sustainable use of local bioresources.

CM opens INSACOG Sequencing Facility

CHRONICLE NEWS SERVICE/DIPR

IMPHAL: Chief minister N Biren Singh on Saturday inaugurated an 'Indian SARS-CoV-2 Genomics Consortium (INSACOG) Sequencing Facility' established at Institute of Bioresources and Sustainable Development (IBSD) in a function held at Chief Minister's Secretariat here.

With this, samples now can be tested in the INSACOG Sequencing Facility at ISBD, Takyelpat where genome sequencing of SARS-CoV-2 will be carried out not only for Manipur but also for other North Eastern states.

CONTINUE ON PAGE 5

IBSD has established the Indian SARS-CoV-2 Genomics Consortium (INSACOG) facility at IBSD, Imphal, which is the first time such an effort has been made in this part of the country. This sequencing platform/ laboratory within Manipur is a big leap in our collective fight and understanding of the novel coronavirus that has affected all aspects of our lives. Through this INSACOG network, the whole genome sequencing of SARS-CoV-2 virus across the nation, aiding the understanding of how the virus spreads and evolves. Till date, IBSD has sequenced more than 4000 COVID-19 positive samples from NER. In view of the increasing realization of disease spread, IBSD has launched Mobile Diagnostic Laboratory for COVID testing for the State of Mizoram on January 20, 2022. This Mobile I-Lab has facilitated large scale testing and detection of people in remote areas in the state of Mizoram and other states of NER.

To commemorate the 75 years of Independence and to celebrate "Azadi Ka Amrit Mahotsav", IBSD has organized more than 170 outreach activities including webinars, capacity building & training programmes, workshops, lab visits for researchers, scientists, school students, traditional healers, farmers, local entrepreneurs of NER. Since COVID-19 pandemic, IBSD has initiated International Webinar series on "Re-imagine ethnopharmacology" in association with Society for Ethnopharmacology, India (SFE-India) and International Society for Ethnopharmacology (ISE) and organized 75 webinars with deliberation of more than 85 eminent scientists from across the globe to grace the series. Many ideas have been discussed during the series for the development of local bioresources of the region. More than 12,000 participants have attended this international webinar series so far. IBSD has compiled all these outreach activities in the form of a book which may serve a reference material for the scientific awareness about local bioresources among the students, researchers, scientists, entrepreneurs, farmers of this region.

Society for Ethnopharmacology, India (SFE – India), affiliated to the International Society for Ethnopharmacology (ISE), have been working on sharing of knowledge among academics, researchers, students, industries, healthcare - practitioners, decision-makers and others interested in promotion and development of ethnopharmacology and medicinal plant throughout the world and thus to promote the traditional practices for the betterment of healthcare for the society at large. The mission of the society is promotion and development of traditional medicine and medicinal plants with the major highlights on “Globalizing local knowledge and localizing global technologies”. SFE-India bridges the gap between the academia and industry and act as a resource for the researchers, healers, industrialists and those who believe in natural remedies. The society was inaugurated by Dr A.P.J. Abdul Kalam, Former President of India during 12th International congress of International Society for Ethnopharmacology held in Kolkata during 2012.

International Society for Ethnopharmacology, Switzerland (ISE- Switzerland) is a collaborative, interdisciplinary group of scientists – anthropologists, pharmacists, pharmacologists, ethnobotanists, phytochemists, and others – all fascinated by the study of the global use of medicines. ISE is concerned about the understanding on the medicinal uses of plants in traditional societies and seek to understand the cultural and the pharmacological dimensions on the human use of medicinal plant everywhere. The ISE promotes a critical discussion between everyone interested in local and traditional knowledge on medicinal, food and toxic plants and their past, present and

future use. The Society not only organizes regular meetings and promotes research and publication but also offers multiple ways to exchange information between scientists and anyone else interested in such topics.

We are happy to see that international speakers from several countries and renowned scientists from India are joining the congress. There are over 350 scientific abstracts presented by young researchers, which includes 220 poster presentation, Young Ethnopharmacologist Award and 130 oral presentation. In this congress, and 09 keynote lectures along with the 100 plenary lectures will be delivered by renowned scientist throughout the globe. For promotion and development of Bioresources and Ethnopharmacology several special panel discussion session including “Publication ethics”, “Traditional Healers Conclave”, “Reimagine Ethnopharmacology”, “Herbs in One Health”, “Ashwagandha”, “i-Connect program: Business meet” is being organized during this congress. This congress will provide an environment for knowledge sharing among researchers, policymakers, industry persons, healthcare practitioners, and decision-makers interested in the promotion of bioresourecs, Ethno pharmacology, and drug discovery.

I am sure all of you will have a unique opportunity to develop fruitful collaborations and stimulating ideas for bioresource development, ethnopharmacology and medicinal plant research in every aspects capitalizing the very rich heritage and culture of our country, that is so ethnic, so ancient and yet so Indian.

Prof. Pulok K. Mukherjee
Director, IBSD

SOCIETY FOR ETHNOPHARMACOLOGY [SFE -INDIA]
"Globalizing local knowledge and localizing global technologies"
23/3 Shaktigarh, Jadavpur, Kolkata 700032
(Affiliated to the International Society for Ethnopharmacology)
Website: www.ethnopharmacology.in

Activities of Society for Ethnopharmacology, India

The Society for Ethnopharmacology, India (SFE-India) is a registered society under the West Bengal Society Registration act and affiliated to the International Society for Ethnopharmacology (ISE). It is an international scientific organization dedicated to the interdisciplinary study for evaluation of plants, animals, insects, and other organisms used in medicines of indigenous and modern, past and present, cultures. The society is also committed to the preservation and conservation of such practices for future generation.

The Society for Ethnopharmacology, India (SFE-India) was constituted by the eminent academicians, researchers, industrialists and others with the vision of providing an environment for knowledge sharing among industrialists, researchers, students, healthcare-practitioners, decision-makers and others interested in promotion of Ethnopharmacology and medicinal plant. The mission of the society is promotion and development of traditional medicine and medicinal plants through dissemination of knowledge and development of collaboration and cooperation with its vision on

"Globalizing local knowledge and localizing global technologies"

After the grand success of the 12th International Congress of International Society for Ethnopharmacology (ISE) organized by the School of Natural Product Studies, Jadavpur University, Kolkata in February 2012, the Society for Ethnopharmacology was constituted in 2013. The Society is extremely grateful to Late Dr. APJ Abdul Kalam, former President of India, for his inspiration and support since its inception.

The society organizes conferences, seminars, symposiums, workshops etc. in different parts of India and abroad for discussion and sharing knowledge on different issues for cultivation, production, quality evaluation, safety, clinical studies, biological screening and several other issues of natural product research. The Society helps in forming bridge between the academia and industry for developing cost effective natural remedies. Presently the Society has several local chapters with dynamic coordinators for individual local chapters and members across the country.

Society of Ethnopharmacology, India (SFE-India) is dedicated for the dissemination of knowledge and information through different educational programmes throughout India and also to serve as a bridge between industry and academia for development of products, process for value addition and promotion of medicinal plants as well as herbal medicines used in ancient system of medicine and folklore. It also promotes activities for sharing of experience on the scientific evaluation of Ethnopharmacology of Herbal Medicines for betterment of healthcare of the society. The major activities of the society are:

- Dissemination of knowledge for promotion and development of Ethnopharmacology and medicinal plants.
- To carry out the objectives of International Society for Ethnopharmacology.

- ❖ Organizing conferences, seminars, symposiums, workshops etc. in different parts of India.
- ❖ Promotion and development of Ethnopharmacology, Herbal Medicines, medicinal plants and other natural products in India.
- ❖ Promotion of the healthcare of the society.
- ❖ Sharing knowledge on various issues on cultivation, production and validation of traditional medicine, quality & safety evaluation, pre-clinical screening & clinical studies and several other issues of natural products.
- ❖ Act as a resource at local level for individuals including students interested in Ethnopharmacology.
- ❖ Encourage career growth and Knowledge empowerment of its members.
- ❖ Publishing journals, newsletters, documents, books, etc. for promotion of knowledge in the field of natural product research.
- ❖ Conducting research in the area of Ethnopharmacology and traditional healthcare.

For dissemination of knowledge, several local chapters of the society has been made at Belgaum, Bhopal, Delhi, Gujarat, Guwahati, Imphal, Jammu, Jorhat, Mangalore, Mumbai, Mysuru, Nagpur, Pune with active leaderships of the local chapter coordinators from different parts of India as stated below:

Details of the local chapter coordinators of SFE-India

Name of the Chapter	Name of the Coordinator Details
Belgaum Local Chapter	**Dr. Pramod HJ** Coordinator, Belgaum Local Chapter & Head-Pharm. Biotechnology KLE University, Belgaum, Karnataka, India
Bhopal Local Chapter	**Dr. Rajesh Singh Pawar** Coordinator, Bhopal Local Chapter & Professor, Faculty of Pharmacy VNS Group of Institutions, Bhopal, M.P., India
Delhi Local Chapter	**Dr. Sayeed Ahmad** Coordinator, Delhi Local Chapter & Department of Pharmacognosy and Phytochemistry, Faculty of Pharmacy, Jamia Hamdard (Hamdard University), Hamdard Nagar, New Delhi, India
Guwahati Local Chapter	**Dr. Chandana Barua** Coordinator, Guwahati Local Chapter & Professor, Dept. of Pharmacology & Toxicology College of Veterinary Science Khanapara, Guwahati, India
Gujarat Local Chapter	**Dr. Satyanshu Kumar** Coordinator, Gujarat Local Chapter & Principal Scientist (Organic Chemistry) Directorate of Medicinal and Aromatic Plants Research, Boriavi 387310, Anand, Gujarat, INDIA
Mumbai Local Chapter	**Dr. Alka Mukne** Coordinator, Mumbai Local Chapter & Faculty, Bombay College of Pharmacy Kalina, Santacruz (E) Mumbai, MH, India

Mysuru Local Chapter	**Prof. K. Mruthunjaya** Coordinator, Mysuru Local Chapter & Head Dept. of Pharmacognosy JSS College of Pharmacy, JSS Academy of Higher Education and Research [JSSAHER], Mysuru, Karnataka, India
Nagpur Local Chapter	**Dr. Prakash R Itankar** Coordinator, Nagpur Local Chapter & Associate Professor Department of Pharmaceutical Sciences, R. T. M. Nagpur University, Nagpur, MH, India
Pune Local Chapter	**Dr. Sathiyanarayanan L.** Coordinator, Pune Local Chapter & Associate Professor Dept of Pharmaceutical Chemistry Bharati Vidyapeeth University Poona College of Pharmacy, Pune, MH, India
Eastern Himalaya Local Chapter	**Dr. Nanaocha Sharma** Coordinator, Eastern Himalaya Local Chapter & Scientist Institute of Bioresources and Sustainable Development Dept. of Biotechnology, Govt. of India Imphal, Manipur, India
Mangalore Local Chapter	**Prof. Saleemulla Khan** Coordinator, Mangalore Local Chapter & Principal PA College of Pharmacy Kairangala, Mangalore , Karnataka, India
Jorhat Local Chapter	**Dr. Jatin Kalita** Coordinator, Jorhat Local Chapter & Principal Scientist Head, Research Planning and Business Development Division CSIR-North East Institute of Science and Technology Jorhat-785006, Assam, India
Jammu Local Chapter	**Dr. Prosoon Gupta** Coordinator, Jammu Local Chapter & Principal Scientist Natural Product Chemistry Division (Plant and Microbes), CSIR- Indian Institute of Integrative Medicine Canal Road, Jammu-180001, India
Mohali Local Chapter	**Prof. Sanjay Jachak** Professor and Head Department of Natural Products National Institute of Pharmaceutical Education and Research S.A.S. Nagar Mohali, Punjab, India
Bhubaneshwar Local Chapter	**Dr. Sanjeeb K Sahoo** Scientist-F Institute of Life Sciences (ILS) Bhubaneswar, Odisha, India
Bolpur & Howrah Local Chapter	**Mr. Subhamoy Dhar** Executive Director Seacom Group of Institutions Bolpur, WB, India

To recognize the outstanding contribution in the area of medicinal plant research and Ethnopharmacology, the Society has instituted several awards which are conferred during the International congress of the society every year. Details of the award have been mentioned below:

a) SFE - Lifetime Achievement Award - *"Sibeswar Saha Memorial Award"*

b) SFE - Outstanding International Ethnopharmacologist Award - *"Subodh Chandra and Mamata Mukherjee Memorial Award"*

c) SFE - Outstanding National Ethnopharmacologist Award - *"Harihar Mukherjee Memorial Award"*

d) SFE - ZANDU Award for "Best Research on Plant Drugs" – supported by Emami Ltd., Kolkata

e) SFE - Outstanding Service Award – "Dr. Pratim Banerji Memorial Award" – supported by Parkar Robinson Pvt. Ltd., Kolkata

f) SFE- T. Sen Oration Award – "Prof. T. Sen Memorial Award"

g) SFE - Herbal Industry Leader Award – "Dr. Shivaji Rao Kadam Award"

h) SFE – Special Recognition Awards

i) SFE – Outstanding Local Chapter Award

j) SFE-Best publication in Ethnopharmacology and Traditional Medicine research Award – "Dr. Nirmal Kumar and Nirupama Chatterjee Memorial Award"

k) SFE- Young Ethnopharmacologist Award - *"Dr. PK Debnath memorial Award"* (Selection will be made based on the Oral presentation Competition)

The society has organized several seminars, webinars, conference etc. throughout the country since its inception. Some specific activities of the Society for Ethnopharmacology, India and its different local chapters are as follows:

- **National Conference organized by Bhopal Local Chapter of SFE during October 13-14, 2022 at Bhopal, India**

  The National Conference on "High Throughput Screening Methods based on molecular markers for standardization of new drug development process" was organized by Truba Institute of Pharmacy, Bhopal in association with Society for Ethnopharmacology during 13-14 October 2022 at Truba Institute of Pharmacy, Bhopal. This program was attended by more than 250 participants and had several scientific presentations. The Society is very much thankful to Dr. Rajesh Singh Pawar for organizing such event for the promotion and development of SFE-India at large.

- **International Ethnopharmacology and Traditional Healers Conclave during the 9th World Ayurveda Congress & Arogya Expo India during December 8 – 10, 2022 at Panjim, Goa**

  International Ethnopharmacology and Traditional Healers Conclave were organized jointly by Society for Ethnopharmacology and The University of Trans Disciplinary Health Sciences in association with WAC organized during December 8 – 10, 2022 at Institute of Menezes Braganza, Panjim, Goa, India. There was interactive session between traditional health practitioner and the scientists. The program was accomplished with a great success with an overwhelming response of more than 300 participants from different states of the country.

- **9th Convention of Society for Ethnopharmacology and National Seminar on "Translational "Translational Research on Indian Medicinal Plants" September 23-24, 2022:**

  The 9th Convention of Society for Ethnopharmacology and National Seminar on "Translational Research on Indian Medicinal Plants" was held on September 23-24, 2022 at Triguna Sen Auditorium, Jadavpur University, Jadavpur, Kolkata, India. The convention was jointly organized by Society for Ethnopharmacology, School of Natural Product Studies, IBSD-JU Collaborative Research Program, Jadavpur University, Institute of Life Sciences (ILS), Bhubaneswar, CSIR-Indian Institute of Chemical Biology (IICB); in association with Seacom Skills University, Bolpur. The conference was conducted in physical mode, which boasted with 21 lectures in 04 sessions in day 1. Ethnopharmacology conclave session with several traditional healthcare practitioners was organized during this event. A session on Young Ethnopharmacologist Competition was also conducted with twenty young researchers. Three poster sessions were organized, in which more than 150 participants were presented their research work. The event was successful with an attendance of more than 350 participants throughout the country.

- **Research on Indian Medicinal Plants", September 23-24,2022:Capacity Building & Training on Instrumental Techniques - special emphasis on "High Performance Liquid Chromatography (HPLC) and Gas Chromatography Mass Spectroscopy (GC–MS) for metabolite profiling, quality Evaluation and validation of Natural Products", August 08, 2022:**

  The special program on "Capacity Building & Training on Instrumental Techniques"-special emphasis on High Performance Liquid Chromatography (HPLC) and Gas Chromatography Mass Spectroscopy (GC–MS) was organized by the Society for Ethnopharmacology in association with the IBSD-JU Collaborative Research Program on August 08, 2022. This program was attended by more than 200 participants. Scientist and experts from industries and academia from India and abroad has delivered their lecture on several aspects of HPLC and GC–MS analysis of medicinal plant followed by live demonstration on the application of HPLC with the cooperation of Spinco Biotech Pvt. Ltd., Kolkata and GC–MS by ThermoFisher Scientific Pvt. Ltd., Mumbai.

- **9th International Congress of Society for Ethnopharmacology (SFEC–2022), April 22–24, 2022:**

  The 9th International Congress of the Society for Ethnopharmacology (SFEC–2022) was organized by JSS College of Pharmacy, JSS Academy of Higher Education & Research, Mysuru, Karnataka, India during April 22–24, 2022. The theme of the event was on Redefining Ethnopharmacology for the Global Health and Wellbeing. This congress was focused on evidence based validation, drug discovery and development, safety, efficacy, quality, phytochemistry, metabolomics, herb–drug interactions and other aspects for development of ethnopharmacology and medicinal pant research worldwide by several renowned scientists from more than 15 countries throughout the world. This program was attended by more than 600 participants. The program boasted with 10 keynote lectures, 74 plenary talks, more than 170 oral presentations and more than 400 poster presentations. The congress was a bridge in minimizing the gap between industry and institute with reputed industries taking part. Traditional healers meet and ethnopharmacology conclave session was enriched with interactive session with

Traditional Healers. We will express our sincere thanks to Prof. Mruthunjaya K. and other active members of the organizing committee for their efforts to make the event successful.

- **8th Convention of Society for Ethnopharmacology and National Seminar on "Ethnopharmacology for Wellness: Tradition to Translation", December 10,2021:**

  The 8th Convention of Society for Ethnopharmacology and National Seminar on "Ethnopharmacology for Wellness: Tradition to Translation" was held on December 10, 2021 at CSIR-Indian Institute of Chemical Biology (IICB), True Campus, Salt Lake, India. The convention was organized by Society for Ethnopharmacology in association with CSIR-Indian Institute of Chemical Biology (IICB) with the support of Institute of Bioresources and Sustainable Development (IBSD), Imphal; Institute of Life Sciences (ILS), Bhubaneswar; National Institute of Pharmaceutical and Education Research (NIPER), Guwahati; Institute of Advanced Study in Science and Technology (IASST), Assam. The conference was conducted in physical and virtual mode, which boasted with 12 lectures in 02 sessions. An ethnopharmacology conclave session with several traditional healthcare practitioners was organized during this event. A session on Young Ethnopharmacologist Competition was also conducted with fifteen young researchers. One on site poster session along with two online poster sessions was organized, in which more than 100 participants was presented their research work. The event was successful with an attendance of more than 300 participants throughout the country.

- **8th International Congress of the Society for Ethnopharmacology, India (SFEC 2021), August 27-29, 2021:**

  The 8th International Congress of the Society for Ethnopharmacology, India (SFEC 2021) was organized by Poona College of Pharmacy, Bharati Vidyapeeth (Deemed to be University), Pune, MH, India during August 27-29, 2021. The theme of the event was on Ethnopharmacology and Medicinal Plants: Approach towards product development. This congress was focused on several crucial and contemporary issues on the scientific evaluation and validation on Ethnopharmacology and medicinal plants together with the strategies towards drug development by several renowned scientists from more than 20 countries throughout the world. This program was attended by more than 500 participants in both online and in person. An Ethnopharmacology Conclave session followed by interactive session with Traditional Healers for Documentation of Local Health Traditions (LHTs) and Ethno Medicinal Practices (EMPs) was also organized. A special session on product development from Medicinal plants has also been organized during this congress. We will express our sincere thanks to Prof. Sathiyanarayanan L., and other active members of the organizing committee for their efforts to make the event successful.

- **Capacity Building & Training on Instrumental Techniques- special emphasis on "High Performance Thin Layer Chromatography (HPTLC) for Quality Evaluation and Validation of Natural Products", August 05, 2021:**

  The special program on "Capacity Building & Training on Instrumental Techniques"- special emphasis on "High Performance Thin Layer Chromatography (HPTLC) for Quality Evaluation and Validation of Natural Products" was organized by the Society for Ethnopharmacology in association with the IBSD-JU Collaborative Research Program on August 05, 2021. This program was attended by more than 150 participants. Scientist and experts from industries and academia from India and abroad has delivered their lecture on several aspects of HPTLC analysis of medicinal plant followed by live demonstration on the application of HPTLC with the cooperation of Anchrome Enterprise Pvt. Ltd., Mumbai.

- **Capacity Building & Training on Instrumental Techniques- special emphasis on "GC-MS based analysis for Quality Evaluation and Validation of Natural Products", October 08, 2021**

  The special program on "Capacity Building & Training on Instrumental Techniques"- special emphasis on "GC-MS based analysis for Quality Evaluation and Validation of Natural Products" was organized by the Society for Ethnopharmacology in association with the IBSD-JU Collaborative Research Program on October 08, 2021. This program was attended by more than 150 participants. Scientist and experts from industries and academia from India and abroad has delivered their lecture on GC-MS based analysis of medicinal plant followed by the live demonstration on the application of GC-MS with the cooperation of with the cooperation of Thermo Fischer Scientific, India.

- **7th convention and international symposium *"Combating COVID-19 - Ethnopharmacology and Traditional Food & Medicine",* December 17-19, 2020:**

  The 7th convention and international symposium *"Combating COVID-19 - Ethnopharmacology and Traditional Food & Medicine"* was held during December 17-19, 2020 by Institute of Bioresources and Sustainable Development (IBSD) Imphal, Manipur, India in association with Society for Ethnopharmacology, India (SFE-India) and International Society for Ethnopharmacology (ISE). The conference was conducted in virtual mode which boasted with 60 lectures across 10 sessions. An ethnopharmacology conclave session with several traditional healthcare practitioners. One student interactive forum was organized with research scholars from more than 05 different countries. The event was successful with an attendance of more than 600 participants from more than 15 countries and 52 oral presentations across two sessions.

- **International webinar series on "Reimagine ethnopharmacology":**

  The Institute of Bioresources and Sustainable Development (IBSD) in association with Society for Ethnopharmacology, India (SFE-India) and International Society for Ethnopharmacology (ISE) started an International Webinar series on "Reimagine ethnopharmacology" to grow interest and globalize local research during the pandemic period. The series is conducted virtually on Saturdays at 6:00 PM (IST) to cover maximum time zones of the world. So far, 75 sessions have been conducted since May 2020, with the involvement and deliberation of more than 100 eminent scientists and policy makers from India as well as throughout the globe to grace the series with their highly informative talks. Collectively more than 12,000 participants from more than 50 countries have attended the series so far.

- **7th International Congress of Society of Ethnopharmacology, India (SFEC 2020), New Delhi, India, February 15-17,2020:**

  The 7th International Congress of Society of Ethnopharmacology, India (SFEC 2020), New Delhi, India was organized by School of Pharmaceutical Education and Research; Jamia Hamdard, New Delhi, India during February 15-17, 2020. The theme of this event was *"Ethnopharmacology in development of scientifically validated quality products from Medicinal plants and Regulatory aspects"*. World renowned researcher have addressed various sessions on validation of quality products from medicinal plants. The major highlights of the congress were the keynote sessions with three lectures form President-SFE, President American Herbal Pharmacopoeia and Principal Advisor (THISTI), India; 08 plenary sessions with 57 lectures. The program was convened with great success with the participation of speakers from more than 15 countries, more than 500 participants and

52 oral presentations across two sessions were made. A special session on “Food as Medicine – Exploring therapeutic potential” was an effective conglomerate was discussed about the effectiveness of foods as therapeutic agents. The congress also organized an effective Ethnopharmacology conclave session and a Student Interactive Session.

- **PSE-NPS 2020 Summit on “Natural Products for Healthy Living” held in Khulna University, Khulna, Bangladesh, during 16-18 January 2020:**

  It was a great pleasure to invite Natural Products Scientists (NPS) from all over the world to attend the PSE-NPS 2020 Summit on “Natural Products for Healthy Living” held in Khulna University, Khulna, Bangladesh, during 16-18 January 2020. The PSE-NPS 2020 Summit was organized by the Pharmacy Discipline of Khulna University, in association with the Phytochemical Society of Europe (PSE). This program was co badged with International Society for Ethnopharmacology (ISE) and Society for Ethnopharmacology, India (SFE-India). The conference focused on “Natural products for healthy living” to explore the prospects and challenges associated with research in natural products and nutraceuticals. The summit was a huge success with 14 lectures from eminent scientists, 60 oral presentations and poster presentations by various research scholars spanning over three days.

- **Special Issues of reputed Journals published with the help of SFE:**

  - A special issue on “Ethnopharmacology and validation of Traditional Medicine” was developed by Society for Ethnopharmacology, India and published in Indian Journal of Traditional Knowledge; Volume 14 (4), (October 2015). This special issue was edited by Dr. Pulok k Mukherjee; Dr. Tapan K Mukherjee. This issue is available in http://nopr.niscair.res.in/handle/123456789/32961.

  - A special issue on “Ayurveda” was published in Journal of Ethnopharmacology, Elsevier Science, USA; Volume 197, Pages 1-306 (February 2017). This was an initiative by Society for Ethnopharmacology, India to promote Traditional Medicine. This special issue was edited by Dr. Pulok K Mukherjee; Dr. CK Katiyar and Dr. Bhushan Patwardhan. This issue is available in https://www.sciencedirect.com/science/journal/03788741/197/supp/C

  - A special issue on Ashwagandha will be published in Journal of Ethnopharmacology, Elsevier Science, USA. This is an initiative by Society for Ethnopharmacology, India to promote Indian Medicinal Plants at large. This special issue will be edited by Dr. Pulok K Mukherjee; Dr. CK Katiyar and Dr. Bhushan Patwardhan. https://www.elsevier.com/journals/journal-of-ethnopharmacology/0378-8741/guide-for-authors

  - A special issue on “Metabolomics and Ethnopharmacology in the Development of Herbal and Traditional Medicine” has been developed by the Society for Ethnopharmacology, India and published in Frontiers in Pharmacology (Ethnopharmacology). This special issue has been made based on the scientific deliberations made in 7th International Conference of SFE-INDIA (SFEC 2020), New Delhi. Dr. Sayeed Ahmed, Prof. Pulok K. Mukherjee, Dr. C. K. Katiyar and Dr. Gudrun S. Ulrich-Merzenich serving as the Editor of this special issue. https://www.frontiersin.org/research-topics/14729/metabolomics-and-ethnopharmacology-in-the-development-of-herbal-and-traditional-medicine

- The society is publishing the Newsletter regularly in different aspects for development and promotion of medicinal plants and Ethnopharmacology.
- During the last one year we have started a series on “Capacity Building & Training” and have completed two of such programme with wholehearted participation of our members.
- In the last one year four more Local chapters like- Jorhat Local Chapter, Jammu Local Chapter, Mohali Local Chapter and Bhubaneshwar Local Chapter joined with us which has strengthened the society.

We are very much excited by the keen interest of our members of SFE from a diverse number of institutes and industries throughout the country to share the knowledge in this regard.

With our limited strength, esteemed efforts and keen interest of our members we have been working for the promotion and development of medicinal plants and ethnopharmacology in various ways.

We cordially invite you all to join SFE-India in our efforts of “Globalizing local knowledge; localizing global technologies” for a healthier tomorrow, capitalizing the very rich heritage and culture that is so ethnic, so ancient and yet so Indian.

Shri. Birendra Kumar Sarkar
President
Society for Ethnopharmacology
23/3 Shaktigarh, Kolkata, India

Dr. Subhash C Mandal
Secretary
Society for Ethnopharmacology
23/3 Shaktigarh, Kolkata, India

SOCIETY FOR ETHNOPHARMACOLOGY, INDIA
Globalizing Local Knowledge; Localizing Global Technologies
(Affiliated to International Society for Ethnopharmacology)
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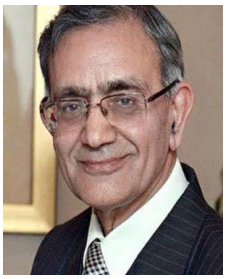
E-mail: sfeindian@gmail.com; sfeindiase@gmail.com
Web: www.ethnopharmacology.in

SOCIETY FOR ETHNOPHARAMCOLOGY, INDIA
ANNUAL AWARDS – 2023

To recognize the outstanding contribution in the area of Ethnopharmacology and medicinal plant research, the Society for Ethnopharmacology, India has instituted several awards. The society received several Nominations for the annual awards 2023. We are happy to confer these awards to those who have made potential contribution in this area.

"SFE - Lifetime Achievement Award – 2023

"Sibeswar Saha Memorial Award 2023" – which has been instituted in the memory of Sri Sibeswar Saha by the society.



Professor Sudhir K. Sopory, an Indian plant physiologist, scientist and former vice chancellor of Jawaharlal Nehru University, New Delhi. Currently he is a SERB Distinguished Fellow of DST, Govt. of India and Senior Emeritus Scientist at International Centre for Genetic Engineering and Biotechnology, New Delhi. In the Year of 2007, he was awarded Padamshree, Govt. of India and in 1987 Shanti Swaroop Bhatnagar Award by CSIR. He served / serving as Chairman / Member of several research Institutes of international repute. More than 250 publications and more than 15 book were contributed by Dr. Sopory in peer reviewed journals and he has edited till date. He is one of the renowned members of Committee on food safety of GM-foods and selection committee for selection of candidates for various awards and schemes (Under Ministry of Health, Govt. of India.

Based on his outstanding contribution for the promotion of ethnopharmacology and medicinal plant research, the Society for Ethnopharamcology, India is honored to confer the "SFE Lifetime Achievement Award - 2023" to Prof. Sopory.

"SFE - Outstanding International Ethnopharamcologist Award-2023

"Pranab Banerji Memorial Award-2023" - instituted by the Society for Ethnopharmacology.

Professor Satyajit D Sarker is working as the Professor and Director School of Pharmacy and Biomolecular Sciences, Liverpool John Moores University, London, UK. His research interest is in the area of Natural Products Discovery including Ethnopharmacology, isolation of phytomolecules, Biosynthesis of plant secondary etc. metabolites etc. He co-authored several books and contributed over 670 publications in peer reviewed journal. He is serving as Editor-in-Chief of Phytochemical Analysis and Journal of Natural Products Discovery; Editor of International Journal of Biochemistry & Physiology; Associate Editor of TANG Journal.

Based on the outstanding contribution of Prof. Professor Satyajit D Sarker, Society for Ethnopharamcology, India is honored to confer him the "SFE - Outstanding International Ethnopharmacologist Award - 2023".

SOCIETY FOR ETHNOPHARMACOLOGY, INDIA
Globalizing Local Knowledge; Localizing Global Technologies
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E-mail: sfeindian@gmail.com; sfeindiase@gmail.com
Web: www.ethnopharmacology.in

"SFE Outstanding International Ethnopharamcologist Award – 2021"

"Pranab Banerji Memorial Award-2023" - instituted by the Society for Ethnopharmacology.

Prof. h. c. mult. Thomas Efferth is working as the chair of the Department of Pharmaceutical Biology and Director, Institute of Pharmaceutical and Biomedical Sciences, Johannes Gutenberg University, Mainz, Germany. He has been awarded with several awards including Prize of the Southwest German Association for Medicine (1991), Willmar-Schwabe-Award of the German Society for Medicinal Plant Research (2006), citizen medal of the City of Heidelberg, Germany (2008), CESAR Award for Translational Oncology (2011), SCENTED drop Award on medicinal and flagrant herbs (2015), Qihuang International Award of the Chinese Association of Chinese Medicine (2017). The focus of Dr. Efferth's research is on pharmacology of cancer and viral infections, network pharmacology, and recently also on COVID-19. Thomas Efferth published more than 700 PubMed-listed papers and in peer-reviewed journals in the field of cancer research, pharmacology, and natural products along with 8 patents. He is editor-in-chief of Phytomedicine and Phytomedicine Plus as well as associate editor of several other scientific journals and scientific advisory board member.

Based on the outstanding contribution of Prof. Thomas Efferth, Society for Ethnopharamcology, India is honored to confer him the "SFE - Outstanding International Ethnopharmacologist Award - 2021".

"SFE Outstanding National Ethnopharamcologist Award -2023

Harihar Mukherjee Memorial Award-2023" – this award has been instituted by the society with the support of Prof. Pulok K. Mukherjee, in memory of his beloved father Sri Harihar Mukherjee.

Dr. Guruaribam Shantibala Devi, Professor (Retd.), Department of Life Sciences, Manipur University, Manipur. She has served as Dean, School of Life Sciences and School of Agricultural Sciences, Manipur University, Canchipur, Manipur, Head, Department of Life Sciences and Department of Biotechnology, Manipur University. She was chairman of several reputed committee and programs. She is member of State Board of Wildlife, Forest and Environment Department, Govt. of Manipur, NITI AAYOG, Govt. of India, Selection Committee for the nomination of Padma Awards (Science and Engineering) etc. She was serving as visiting scientist Bhabha Atomic Research Centre (BARC) Mumbai. She is reviewer of Peer Review journal entitled Natural Product Research and legume Research and other reputed journals. Currently she is the team leader and Member for Inspection of colleges of Manipur University. She contributed several book chapters and several research article in peer reviewed journal.

Considering the expertise and contribution of Dr. Guruaribam Shantibala Devi, Society for Ethnopharamcology, India is honored to confer him the "SFE - Outstanding National Ethnopharmacologist Award - 2023".

"SFE – ZANDU Award – 2023"

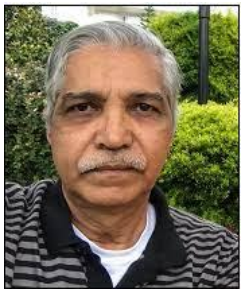
This award has been instituted by Society, supported by Emami Ltd., Kolkata for Best Research on Plant Drugs.

Prof. Alvaro M. Viljoen, National Research Chair in Phytomedicine and Director of the SAMRC Herbal Drugs Research Unit in South Africa completed his M.Sc. on Plant Chemistry from The University of Stellenbosch, South Africa in 1988 and the completed his Ph. D. form the University of Johannesburg in 1999. His commitment to this aspect of phytomedicine research was recently acknowledged through the 2013 TWAS-ROSSA Award from The World Academy of Sciences, for advancing knowledge towards the safe and effective use of herbal medicines. Throughout his career, he has been committed to disseminating scientific knowledge through the publication of peer-reviewed papers. He have contributed to more than 290 peer-reviewed papers, mostly on aspects of medicinal plant research. He has contributed to provide a service to the greater natural products community by acting as an editor for seven journals including inter alia editor-in-chief Journal of Ethnopharmacology (Elsevier) and reviews editor for Phytochemistry Letters (Elsevier). Over the past 4 years he has acted as the guest editor for five special issues for the above-mentioned journals.

For the outstanding contribution of Prof. Alvaro M. Viljoen, in the field of Ethnopharmacology and medicinal plant research, Society for Ethnopharamcology, India is honored to confer the "SFE-ZANDU Award -2023".

"SFE- Outstanding Service Award – 2023"

"Pratim Banerji Memorial Award" – this award has been instituted by Society for Ethnopharmacology supported by Parker Robinson Pvt. Ltd., Kolkata, in memory of beloved president of SFE-India Dr. Pratim Banerji.



Dr. Lal Hingorani, Managing Director of Pharmanza Herbal Pvt. Ltd. (PHPL) and Director of Pharmanza (India) Pvt. Ltd. He has completed his M.Sc. from Bombay University (1979) and Ph.D. from Indian Institute of Technology, Mumbai (1988). Has also served several reputed Pharma company such as Arbitee Chem Pharma Ltd. as CEO, Merind Ltd. (Merck Sharp & Dohme), Walter Bushnell Ltd. and Searle India. His research interest about Phytochemistry, analytical chemistry, Pharmacology of Herbal products and clinical led to tied up with various universities in India and abroad. He has transferred technology from research institute in the market both India and abroad and successfully launched several products in the market through industry-academia collaboration. He contributed several book chapters, 120 research paper in peer reviewed journal and 6 patents.

For his outstanding contribution for Ethnopharmacology and Medicinal Plant Research, the Society for Ethnopharamcology, India is honored to confer Dr. Lal Hingorani, the "SFE-Outstanding Service Award – 2023"

"SFE-T. Sen Oration Award – 2023"

This award is instituted by society in the memory of Prof. Tuhinadri Sen, who was a very active member of the Society for Ethnopharmacology, India.

Dr. Caroline Sonja Weckerle, Head academic affairs Botanical Garden, Institute of Systematic and Evolutionary Botany, University of Zurich, Switzerland. She is working on people and plants in the Shuiluo Valley, Southwest China; Non-timber forest products and related conservation issues in Southwest China; Continuum between ritual and medicinal plant use, She was having experience of one month of ethnobotanical fieldwork in Nepal, Twelve months of ethnobotanical fieldwork in Southwest China, mainly Tibetan areas of the Eastern Himalayas, Eight months of botanical fieldwork in the tropical regions of Peru, collection of Sapindaceae, Paullinieae; herbarium research on Paullinieae (Lima, Iquitos). She has contributed several research article in peer reviewed journal. She is one of the board member of International Society for Ethnopharmacology (ISE), Founding member of Ethnobiology, Member-Swiss Network for Ethnobiology, President of mensa comission UZH, trustees Stiftung Joseph Gnädinger and Board of trustees member ProSpecieRara (PSR).

Based on his contribution Dr. Caroline Sonja Weckerle in the field ethnopharmacology and traditional medicine, Society is honored to confer the "SFE-T Sen Oration Award - 2023".

"SFE - Herbal industry leader award -2023"

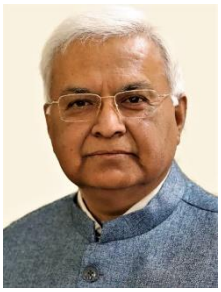
Dr. Shivaji Rao Kadam Award- 2023"- this award has been instituted by Society for Ethnopharmacology supported by the Society for Ethnopharmacology Pune Local Chapter.

Sami-Sabinsa Group Limited - an Indian Multinational Health Science Company headed by Dr. Muhammed Majeed. This company is a pioneer and global leader in health science is a leading producer of nutraceuticals, cosmeceuticals, standardized herbal extracts etc. This company led to helping to establish over 150 small and medium-scale export- oriented nutraceuticals industries in India. Sami-Sabinsa Group influence independent research divisions in the areas of Natural Drugs, Phytochemistry, Synthetic Chemistry, Formulations R&D etc. and hold 400+ US and International patents to date. The company has received over 100 national and international accolades and awarded by 'Thomas Alva Edison Patent Award', 'Best Patent Portfolio Award in SME', 'Best Trademark Portfolio in SME', 'Top 10 Pharma Laboratories in the Year 2022' and the 'Best Manufacturer Export Award'. Dr. Majeed was inducted into the 'Hall of Legends' at the Natural Products Expo California in the year 2016. In 2018, also chosen as the "Nutra Champion" at the Nutra Ingredients Award ceremony in Geneva in recognition of his work on nutrition.

Recognizing the contribution and outstanding business practice on promotion and development of medicinal plants and natural products, Society for Ethnopharmacology, India is honoured to confer the "SFE - Herbal industry leader award "Dr. Shivaji Rao Kadam Award 2023" to Dr. Muhammed Majeed, Chairman & MD Sami-Sabinsa Group Limited.

"SFE-Special Recognition Award-2023"

Dr. Subodh Chandra and Mamata Mukherjee Memorial Award-2023"- this award has been instituted by Society for Ethnopharmacology supported by Dr. Tapan Kumar Mukherjee.



Dr. Sanjay Kumar, Director of CSIR-Institute of Himalayan Bioresource Technology, Palampur, Himachal Pradesh. His main research area is Plants and Microbial Biotechnology and specialized area of research are Bioprospecting Genes, Enzymes, Metabolic Pathways, Societal and Entrepreneurship Development etc. He has more than 160 research papers, contributed in 20 book/proceeding etc. and have several patents. He has post doctoral experiences in several Universities like-Texas Tech University, Lubbock, USA; Rothamsted Research, Harpenden, UK and Kansas State University, Manhattan, (KS), USA. Dr. Kumar has served as Nodal Theme Director of several projects like-Agri, Nutrition and Biotechnology theme of CSIR and Theme director of Nutraceuticals and Nutritionals Theme; Nutraceuticals and Nutritionals mission, coordinating programmes of CSIR.

For his outstanding contribution for development and promotion of Ethnopharamcology, SFE-India is honored to confer the "SFE - Special Recognition Award – Dr. Subodh Chandra and Mamata Mukherjee Memorial Award-2023" to Dr. Sanjoy Kumar.

"SFE - Special Recognition Award- 2023"

- instituted by the Society for Ethnopharmacology, Kolkata, India.

Prof. Nongmaithem Rajmuhon Singh, Professor (Retd.) of Manipur University, Manipur, India, currently working as Vice-chancellor of Dhanamanjuri University, Manipur. He has served as Dean, School of Mathematical and Physical Sciences, Dean of Students' Welfare, Head, Department of Chemistry, Manipur University etc. He received many honorary awards for his excellence in career including Naorem Amuba Singh Teacher Award 2010; Certificate of Appreciation, 2013 for Engendering a Strong Environmental Conscience; State Science communicator Award, 2016 and Best Science Writer, Wangkheirakpam Gautam Memorial Award 2020; Yambem Mani Sahitya Award 2021 (For Marie Curie in Manipuri Version). He is currently hold membership as life member of American Chemical Society, USA, Theoretical Chemical Physics, USA, Indian Association of Chemistry Teachers (IACT), Indian Society for Radiation & Photochemical Science (BARC), Society for Materials Chemistry, c/o Chemistry Division, BARC. He has published more than 120 research papers in National & International Journals, published 8 books and 4 book chapters. He is a prolific writer and contributed several articles in popular journals and daily newspapers.

For his outstanding contribution for development and promotion of the Ethnopharamcology, SFE-India is honored to confer the "SFE - Special Recognition Award – 2023" to Prof. Nongmaithem Rajmuhon Singh.

"SFE- Outstanding Local Chapter Award – 2023"

SFE-India, Eastern Himalaya Local Chapter

SFE-India, Eastern Himalaya Local Chapter, and his active team members has organized the International Bioresource Conclave & Ethnopharmacology Congress – 22nd International Congress of International Society for Ethnopharmacology & 10th International Congress of Society for Ethnopharmacology, India (ISESFEC 2023). Eastern Himalaya Local Chapter has organized several meetings and workshops during the last one and a half year. He also has attended the seminars and conferences organized by SFE-India to interact with the members and coordinators of the society along with his team. Dr. Nanaocha Sharma has been working a lot for the promotion and evelopment of SFE-India through Eastern Himalaya Local Chapter to achieve the mission of the society.

For the outstanding contribution of Eastern Himalaya Local Chapter, Society is honored to confer the "SFE- Outstanding Local Chapter Award – 2023" to Dr. Nanaoch Sharma and his team.

ISE SFEC-2023

International Society for Ethnopharmacology

ORGANIZING COMMITTEE

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CV & ABSTRACT OF SPEAKERS

22nd International Congress of
International Society for Ethnopharmacology (ISE)
&
10th International Congress of
Society for Ethnopharmacology (SFE), India
on
"Reimagine Ethnopharmacology - Globalization of Traditional Medicine"

February 24-26, 2023

Institute of Bioresources and Sustainable Development

IMPHAL, INDIA

Robert Verpoorte

Rob holds a Pharmacists degree (1972) and a PhD (1976) from Leiden. He was lecturer at Leiden University 1976-1987, since 1987 professor and head of the department of Pharmacognosy. Since 2011 he is Emeritus professor at Leiden University. He was guest professor in London (UK), Uppsala (Sweden), Amiens (France), Reims (France), Seoul (Korea), Florence (Italy), Taichung (Taiwan) and Hilo (USA). From 1992-1998 he was Vice-Chairman and Chairman of the committee of the Phytochemical Society of Europe (PSE). He is author/co-author of 810+ scientific papers, 4 books and 7 patent applications. December 2022: H factor 81 (Web of Science), 114 (Google Scholar) and 92 (Scopus). Editor (1996-2002) and Editor-in-chief of Journal of Ethnopharmacology (IF2021 5.090) (2003-2016) and is editor-in-chief of Phytochemistry Reviews (IF2021 7.741) since 2001 and Executive Editor Biotechnology Letters (IF2021 2.716) since 2006. He supervised 70 PhD-theses, and 150+ MSc theses. He received an Honorary Doctorate University of Amiens, France (2004) and of the University of Uppsala, Sweden (2012). In 2007 he received the PSE Medal. He is a honorary professor at the Hong Kong Baptist University 2015. In 2015 he was awarded the Gusi Peace Prize in Manila, The Philippines. September 2017 he was awarded the Egon Stahl Medal in Gold by the International Society of Medicinal Plants and Natural Products Research for his lifetime scientific work. In 2017 recipient of the Qihuang International Prize of China Association of Chinese Medicine (China). He is among the 0.1% Highly Cited Researchers 2018, 2019, 2020, 2021 and 2022 (Cross-Field)(Web of Science, Clarivate Analytics). He is among the 2% top scientists in the world in a recent Stanford study (2017, 2018, 2019, 2020, 2021, 2022), ranking on position 42 worldwide in the field of Chemistry (out of 171,526 authors). His research interests are in biosynthesis and metabolic engineering of plant secondary metabolism; metabolomics; medicinal plants; isolation and identification of biologically active compounds; natural deep eutectic solvents.

Learn from Nature, learn from our ancestors

R Verpoorte, YH Choi, HK Kim

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In ancient times our ancestors explored nature for all kind of products, including medicines. Different medicinal plants were discovered and became part of the trade between regions. Successful herbal medicines spread all over the world, like opium, *Cannabis*, *Cinchona*, and *Atropa belladonna*. The holistic approach of our ancestors resulted in the use of complex medicinal preparations that consists of a number of different ingredients. However, in the Mediterranean region the focus moved to identification of active ingredients. A number of important drugs were isolated in the 19th century, and chemists elucidated their structures. The 20th century became the era of synthesis, creating thousands of new compounds, to cure major ailments. In the 21^{rst} century the synthesis approach is weaning, because for most major ailments there are good drugs. Instead big pharma has gone for biologicals. Their fast response on COVID-19 resulting in the production of novel vaccines, shows their strength. A novel antiviral drug would costs at least 10 years to develop. The question is now where to focus with natural products research for finding new drugs. Should we all go for studies on antivirals, or should we focus on other diseases where in terms of public health a lot could be gained. Should we focus on lifestyle diseases or infectious diseases? Should we screen compounds at random, or should we start from traditional medicines? Should we go for screening on known targets or should we go for a systemic approach with in-vivo test organisms? We need to discuss these questions taking into account both ethical, and economical aspects.

Alvaro Viljoen

Born in 1969, Pretoria South Africa. Completed a BSc, BSc Hons. (*cum laude*) and MSc (*cum laude*) in Botany at Stellenbosch University (SA). In 1994 Alvaro commenced with a PhD at the University of Johannesburg on the chemotaxonomy of the genus *Aloe*. In July 2005, he was appointed as a research fellow in the Department of Pharmaceutical Sciences, Tshwane University of Technology (Pretoria). More than eighty post-graduate students have graduated under his supervision since 2002. His research interest is the phytochemistry and biological activity of medicinal and aromatic plants indigenous to South Africa. He has authored / co-authored >290 peer reviewed papers (*h* index 49) mostly on the phytochemical exploration and pharmacological activity of indigenous medicinal and aromatic plants. He has been elected on to the editorial board of the Journal of Essential Oil Research (Francis & Taylor), Phytochemistry Letters (Elsevier), and the Editor-in-Chief of Journal of Ethnopharmacology (Elsevier) since 2017. In October 2013, Alvaro was awarded the National Research Chair in Phytomedicine a position which he holds concurrently as Director of the SAMRC Herbal Drugs Research Unit in South Africa.

Compiling the first South African Herbal Pharmacopoeia – an important step in the globalisation of South African medicinal plants

Alvaro Viljoen[1,2], Maxleene Sandasi[1,2], Gerda Fouche[3], Sandra Combrinck[1], Ilze Vermaak[1,2]

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Despite the tremendous botanical diversity and widespread use of African Traditional Medicines in South Africa, a compilation of herbal monographs in the form of a Pharmacopoeia acutely focused on the South African flora is lacking. To address this void, we have aimed to collate existing, and generate new data to compile 25 species monographs for botanicals that are currently commercialised or earmarked for commercialisation. In this paper, we discuss the complex workflow required to gain a better understanding of the safety, quality and efficacy of medicinal plants, since these aspects are crucial in monograph development. Several examples will be discussed to illustrate the integration of classic and modern techniques in pharmacognosy to develop detailed monographs. Ongoing research to document pharmacological activity in an evidence-based ethnopharmacology approach will be presented. Through this project, we aim to provide valuable information for academic research institutions, industrial manufacturers of herbal products, as well as national and international policymakers and regulators, to ensure that products of a desired quality reach the consumer.

Pulok K Mukherjee

Professor Pulok K. Mukherjee is working as the Director, Institute of Bioresources and Sustainable Development (IBSD), an autonomous Institute under Department of Biotechnology, Govt. of India consisting of its four centersand nodes in North east India Imphal, Manipur; Aizawl, Mizoram; Gangtok, Sikkim and Shilong, Meghalaya. Prof. Mukherjee is also serving as the Director (Additional charge), Institute of Life Sciences, Bhubaneswar, Odisha, India. Previously, he worked as the Director of the School of Natural Product Studies, and Head of the Department and Professor (on Lien) at the Dept. of Pharmaceutical Technology, Jadavpur University, Kolkata. Prof. Mukherjee has more than 29 years of research and development experience. His research/academic works highlights on development of bioeconomy by exploring the natural bioresources through biotechnological

interventions. He has made several innovative and outstanding contributions on traditional medicine inspired drug discovery from Indian medicinal plants to make them available from 'Farm to Pharma'. Under his guidance, 33 students have completed their PhD degree. Prof. Mukherjee has to his credit more than 240 publications in peer reviewed impact journals, several patents. Prof. Mukherjee has authored/edited 8 books and 20 book chapters; he has been considered among top 2% scientist of the world as reported from the recent study by Stanford University USA. Prof. Mukherjee is a Fellow of the Royal Society of Chemistry (FRSC), Fellow of National Academy of Sciences, India (FNASc), Fellow of National Academy of Agricultural Sciences (FNAAS), Fellow of West Bengal Academy of Science and Technology (FAScT). Prof. Mukherjee is serving as Associate Editor of the Phytomedicine plus, Elsevier Science; Frontiers in pharmacology (Ethnopharmacology) and Consulting editor, Pharmacological Research, Elsevier. He is the member of the editorial board of several International journals including Journal of Ethnopharmacology, Phytomedicine, Pharmaceutical analysis, Synergy; Phytochemical Analysis, India J Traditional Knowledge and many others.

Reimagine ethnopharmacology: globalization of traditional medicine

Pulok K. Mukherjee

Institute of Bioresources and Sustainable Development (IBSD), Takyelpat, Imphal-795001, Manipur, India

Ethnopharmacology is a multidisciplinary area of searching pharmacological rationale for the medicinal use of plants, animals, fungi, microorganisms, and minerals by humans to treat various diseases. The eventual aim of ethnopharmacology is to contribute to evidence-based medicine and speed up to recuperation of the traditional knowledge of indigenous peoples to make it accessible for the development of new drugs. Traditional medicine is used worldwide and is often the only available and reasonable treatment available in developing countries. Traditional medicines must be validated to be of suitable quality, safe, effective, and reliable, based on contemporary evidence. Inadequate research and challenge to explain the traditional theory, poor national integrated policies and insufficient coordination and communication are some key issues responsible for impeding the modernization and globalization of any traditional system of medicine. Traditional medicines will only be considered and recognized by primary healthcare systems when experimental and clinical data establish evidence-based. So, there is a need for high-standard studies including integrated approaches to assure the safety and effectiveness of traditional medicines. Involvement of government, industry and academia should be established to work together in a joint manner to increase the communication and collaboration among the local and international parties to globalize the traditional medicines.

Geoffrey A. Cordell

Professor Emeritus Geoffrey Cordell obtained his Ph.D. in 1970 at the University of Manchester, and after two years at M.I.T. joined the College of Pharmacy, University of Illinois Chicago, from where he retired in 2007. He is the author of over 600 publications, two books on alkaloids, and the editor of 37 books. He is an Honorary Professor at Universities in China, India and the Philippines, and a Visiting Professor in Malaysia (4 universities), Japan, Thailand, Mexico, Brazil, Peru, and Colombia, a former advisor to WHO on traditional medicine, and has received several international awards for his research achievements, and is presently writing two books on natural products research. His research interests include alkaloids and their biosynthesis, ecopharmacognosy, medicines security, cyber ecoethnopharmacolomics, natural products in the 4IR, and C.A.R.E. in natural product research.

L.O.V.E., R.E.S.P.E.C.T., and theFuture of Natural Products in Society

Geoffrey A. Cordell

Natural Products Inc., Evanston. IL, USA and University of Florida, Gainesville, FL, USA

Sustainability is both a wisdom and the ongoing journey for humanity. In the past, it was viewed solely in terms of the continuing availability of a particular natural resource in a certain location to respond to the human need for a nutritional or biological agent. However, it is currently a broader and more profound personal ethical issue in response to the contemporary question “What is my responsibility as a human and a natural product scientist for the quality of the lives of those who will follow?” L.O.V.E. has been a core ethos for humanity for millennia. Through a preliminary exploration of this acronym, and of R.E.S.P.E.C.T., this presentation will illuminate how vital it is to optimize sustainably the interconnected resources (materials and knowledge) for biologically active natural products, and how their depletion has diverse, interwoven implications for society, now, and more pertinently for future generations. The discussion will focus on the fundamental need for humanity to achieve an equitable balance to assure a healthy planet while enhancing global health care, consolidating and integrating aspects of environmental change, the 4IR, the Quintuple Helix, cyber ecoethnopharmacolomics, and assuring medicines security for the long-term provision of safe, effective, and consistent health-beneficent products.

Günter Vollmer

Günter Vollmer is a retired Professor for Molecular Cell Physiology & Endocrinology at the Faculty of Biology, School of Science, Technische Universität Dresden, Dresden, Germany. In addition to his ongoing association with the Faculty of Biology of the Technische Universität Dresden, he is appointed as adjunct professor in the Institute for Pharmacognosy, College of Pharmacy, University of Illinois at Chicago, USA. Since April 2021 Günter Vollmer serves as president of the International Society for Ethnopharmacology. From 2015-2018 he was member of the CONTAM (Contaminations in the Food Chain) panel of EFSA and served on EFSA working groups until 2020. His research is/was dedicated to the elucidation of the molecular and cellular mechanisms of action of natural compounds, of synthetic chemicals with receptor dependent hormone-like activities, as well as of some potentially hazardous chemicals. Overall, his research outcomes contributed to:

- basic research on reproductive organs by the elucidation of biological consequences of the simultaneous activation of hormonal and detoxifying signaling cascades by botanicals.
- consumer protection by evaluating the efficacy and safety of plant derived alternatives for the treatment of menopausal complaints.
- breast cancer prevention by investigating the impact of chemical exposure during fetal, neonatal and pubertal development on tumorigenesis of the mammary gland.

Reflections on metabolism if taking research from cell based *in vitro* models into *in vivo* experimental animal models

Günter Vollmer

Technische Universität Dresden, Faculty of Biology, 01062 Dresden, Germany

Cell based *in vitro* and *in vivo* experimental animal models play a key role in pharmacological investigations during the development of a product from plant material with established ethnopharmacological use. An extract or an individual compound derived from the respective plant material is usually first tested in cell based *in vitro* models. With promising results *in vitro,* the test material is taken to the next step of pharmacological characterization, namely into *in vivo* animal testing. Whether or not a biological response is seen in these experimental animal models, the knowledge of several factors is crucial for the interpretation of the results obtained. One of the most important factors is the metabolic fate

of the compound(s) of interest *in vivo*. Over the years we participated in several *in vivo* studies using extracts or single compounds derived from soy (*Glycine max*) or hops (*Humulus lupulus*). In the case of soy, we were able to show a species and sex specific metabolization of genistein and daidzein as the major bioactive compounds in the soy extract used. For the hops extract we could demonstrate a considerable metabolic conversion of a major constituent of the extract. This hormonally inactive compound is metabolically converted into a highly hormonally active compound. This hormonally active compound is also contained in the original extract, however in minor amounts. In conclusion, these two examples of compound metabolism *in vivo* illustrate the importance of the knowledge of the metabolic fate of the test compound(s) in experiments *in vivo*. The knowledge of the metabolic fate in turn is crucial for the evaluation of the efficacy and safety of the test compound(s), particularly if the research is aimed towards a product intended to be used in human applications.

Thomas Efferth

Professor Dr. Prof. h. c. mult. Thomas Efferth is chair of the Director of the Institute of Pharmaceutical and Biomedical Sciences and chair of the Department of Pharmaceutical Biology, Johannes Gutenberg University, Mainz, Germany. He is biologist by training (Technical University of Darmstadt, Germany). Ph.D.thesis: German Cancer Research Center (DKFZ), Heidelberg, Germany (1990). Awards: Prize of the Southwest German Association for Medicine (1991), Willmar-Schwabe-Award of the German Society for Medicinal Plant Research (2006), citizen medal of the City of Heidelberg, Germany (2008), CESAR Award for Translational Oncology (2011), SCENTEDdrop Award on medicinal and fragrant herbs (2015), *Qihuang* International Award of the Chinese Association of Chinese Medicine (2017), SFE Outstanding International Ethnopharmacologist Award (2021). Since 2018, he is a full member of the World Academy of Sciences. In 2020 (and update in 2022), he was ranked in the Stanford University Citation Ranking among the top 2% of all scientists and scientific disciplines (https://data.mendeley.com/datasets/btchxktzyw/2). High Impact Paper Award of the journal *Engineering* (Chinese Academy of Engineering; 2021). He headed a research group for Pharmaceutical Biology at DKFZ (2005-2009) and was Adjunct Professor (apl.) at the University of Heidelberg (2007-2009). In 2009, he took over the Chair of Pharmaceutical Biology (full professorship) at the Johannes Gutenberg University, Mainz. In 2021, he was appointed as director of the Institute of Pharmaceutical and Biomedical Sciences, Johannes Gutenberg University, Mainz. Furthermore, he holds honorary professorships at the Northeast Forestry University, Harbin, at the Zhejiang Chinese Medical University, Hangzhou, at the Chinese University of Hong Kong, as well as a visiting professorship at the Zhejiang University of Science and Technology, Hangzhou. Furthermore, he is visiting professor (“professional visitor”) .at the McLean Hospital, Harvard Medical School, Boston, MA, USA. Thomas Efferth published 780 PubMed-listed papers and in peer-reviewed journals in the field of cancer research, pharmacology, and natural products (Hirsch-factor: 100; citation rate: 53,000; acc. to Google Scholar) and a textbook on ‘Molecular Pharmacology and Toxicology’ (Springer Publisher; 2006). He holds 8 patents. The scientific results were communicated in 320 oral presentations and invited lectures and 200+ poster presentations at national and international conferences and meetings. He is editor-in-chief of Phytomedicine (impact factor 6.6) and Phytomedicine Plus as well as associate editor of several other pharmaceutical journals and scientific advisory board member (*e.g.,* German Pharmaceutical Society, Hong Kong Research Grant Council, etc.). Eighteen of his former lab members were promoted to leading academic positions (1 president, 1 dean, 2 full professors, and 14 associate/assistant professors). The focus of Dr. Efferth's research is on the pharmacology of cancer and viral infections, network pharmacology, and recently also COVID-19. A major topic is research on chemical entities from natural sources: 1. Systems biology and bioinformatical approaches to unravel modes of actions of synthetic and natural

compounds with activity against otherwise drug-resistant tumors and infectious agents (basic research). 2. Predictive and prognostic markers for personalized medicine (translational research)

Individualized natural product-based treatment of multidrug-resistant tumors based on RNA sequencing

Thomas Efferth

Johannes Gutenberg University, Mainz, Germany

To combat complex systemic diseases such as cancer, single target intervention is proved to be ineffective. Pleiotropic natural products are one of the promising strategies due to their multi-targeting and due to lower side effects. In this presentation, we discuss the application of transcriptomic sequencing and expression analyses of tumor biopsies from cancer patients for natural product-based drug discovery. The efficiency of chemotherapy drugs can be affected by ATP-binding cassette (ABC) transporter expression or by their mutation status. Multidrug resistance is linked with ABC transporter overexpression. We performed RNA-sequencing-based mutation analyses in 18 biopsies of cancer patients for 12 ABC transporters related to drug resistance (ABCA2, -A3, -B1, -B2, -B5, -C1, -C2, -C3, -C4, -C5, -C6, -G2). The mutation rate varied from 27,507 to 300885. In ABCB1, three hotspots with novel mutations were in transmembrane domains 3, 8, and 9. Novel mutations were also found in ABCA2, ABCA3, ABCB2, ABCB5, ABCC1-6, and ABCG2. Diverse nonsense mutations causing premature stop codons were found and compared with the wild-type protein in terms of their protein structure. Nonsense mutations lead to truncated protein structures. Molecular docking and heat map analyses of ABCC1/MRP1 pointed out that Lys498* appeared in a separate cluster branch due to the large deletion, leading to a massive disruption in the protein conformation. The resulting proteins, which are nonfunctional due to nonsense mutations in tumors, offer a promising chemotherapy strategy since tumors with nonsense mutations may be more sensitive to anticancer drugs than wild-type ABCC1-expressing tumors. This could provide a novel tumor-specific toxicity strategy and a way to overcome drug resistance. The ABCB1 nonsense mutation Q856* led to a truncated P-glycoprotein, which may sensitize tumors to anticancer drugs. We also mined the cBioPortal database with 11,814 patients from 23 different tumor entities. We performed Kaplan-Meier survival analyses to investigate the effect of ABC transporter expression on survival rates of cancer patients. 3D-homology modeling allowed virtual drug screening of natural products that are selectively active against wildtype and mutated of ABC transporters. Finally, we present future perspectives on the plausible applications for individualized diagnosis and natural product-based therapy options for cancer.

Arun Bandyopadhyay

Dr. Bandyopadhyay is currently working as Director CSIR-Indian Institute of Chemical Biology, Jadavpur, Kolkata. His areas of research are biomarker for risk assessment of cardiovascular diseases, inflammation in atherosclerosis, mitochondrial dynamics and biogenesis in cardiac hypertrophy and therapeutics for the management of respiratory diseases. He is member of several academic bodies including society of Biological Chemists (I) and proteomic Society of India. He has publisehed many research articles, 03 patents. He has supervized many Post doctoral, Ph. D. and 32 master students.

Pharmacological inhibition of human neutrophil elastase by standardised *Sonneretia apetala* Buch.-Ham. fruit extract

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Chronic Obstructive Pulmonary Disease (COPD), the third highest cause of death worldwide, is a growing global health issue. COPD causes emphysema and mucus hypersecretion, which is predominantly produced by elastase generated by neutrophils at the site of inflammation. *Sonneretia apetala* Buch. -Ham. is a mangrove plant found in the Sunderban districts of West Bengal, India, as well as the coastal regions of Bangladesh and China. Its fruits and leaf extracts have long been used to treat asthma, cough and other metabolic diseases.. The purpose of this study is to see if fruit extracts of *Sonneretia apetala* can inhibit human neutrophil elastase and so slow the course of neutrophil-driven lung emphysema. Fresh fruits were used for the hydro alcoholic extract, which was then lyophilized. Profiling of the extract was done using LC-MS/MS and HPLC. The IC_{50} and mode of action of the extract were determined using an enzyme kinetic assay. Human lung epithelial cell lines were used for *in vitro* research, and cell adhesion molecules were monitored using immunocytochemistry and ELISA. The viability was evaluated using the MTT test. The effect of extracts on lung parameters was predicted using animal models of elastase-induced emphysema. The fruit extract stopped the release of ICAM-1 *in vitro* and competitively inhibited elastase with a low IC_{50}, reversing the elastase-induced rounding of human epithelial cells. In addition, 1-100mg/kg of the fruit extract of Sonneretia apetala lowered the levels of inflammatory markers in bronchoalveolar lavage, sera, and total lung protein and reduced emphysematous features in lungs.

Gudrun Ulrich-Merzenich

Dr. Gudrun Ulrich-Merzenich graduated 1990 in Biology. From 1990 to 1995 she held scholarships of the DAAD (German Academic Exchange Service) and the ICCR (Indian Council of Cultural Relations) in India (Varanasi and Pune) to carry out research on Ayurvedic herbal treatment for rheumatoid arthritis. She obtained her PhD in 1998 at Bonn University, Germany. In 2008 she habilitated in Experimental Medicine at the Medical Faculty of Bonn University. From 2009 to 2013 she was Co-Editor of the Scientific Journal "*Phytomedicine*". From 2014 to 2020 she was Editor-in-Chief of the Scientific Journal "*Synergy"*. Since 2017 she coordinates the international *"Synergy Forum"*. Gudrun Ulrich-Merzenich works at the University Hospital Bonn (U KB) / Medical Clinic III with a focus on research related to molecular and cell biology as well as to applications of the "omic" technologies to elucidate effects and mechanisms of synergistic interactions of compounds. Since 2013 she heads the work group on Synergy Research and Experimental Medicine to develop and examine combinatory applications of natural and allopathic drugs as well as biologicals in various disease entities. She is inventor of novel diagnostic biomarker panels in combination with dedicated bioinformatics and develops innovative compound screening and liquid handling technology.

The neurotrophic activity of *Ballota nigra L.*, *Crataegus oxycantha L.*, *Passiflora incarnata* L., *Valeriana officinalis* L. and its combination *in vitro* and *in vivo*

Gudrun Ulrich-Merzenich[1], A Shcherbakova[1], O Kelber[2], C Kolb [2]

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Extract preparations of the plants *Ballota nigra L.(Bal), Crataegus oxycantha L. (Crae), Passiflora incarnata L. (Pa) and Valeriana officinalis L. (Val)* and their combination (combo) modulate the neurothrophic activity as well as neurotransmitters and hormones involved in the sleep-wake cycle, but not pro-inflammatory cytokines (IL1ß, TNF-α)[1], in the neuroblastoma cell line SH-SY5Y. Gene expression (GE-) profiles from the SH-SY5Y cells - treated or untreated with Bal, Crae, Pa, Val, their combo or Lorezepam - were compared with the GE-profiles of patients suffering from sleep disorders obtained from the GEO-database[2]. GE-profiles of the parietal lobe (PL) and of the thalamus (T) of patients suffering from fatal insomnia (FFI) (n=8) as well as GE-profiles from peripheral blood leukocytes of monozygotic twins with short sleep (n=11 pairs) were identified. Differential gene expressions (patient's vs healthy donors) were compared to the GE-profiles obtained from treated SH-SY5Y cells. Expressions of 4.794 genes in the PL and of 5.106 genes in T were significantly regulated. Of those 459 (PL) and 497 (T) genes were common to all groups. Differential GE-profiles of twins and of treated SH-SY5Y cells had 166 genes in common. These related to the nervous system, to the extracellular matrix as well as to cell proliferation and differentiation. In the context of short sleep most of the identified genes were conversely regulated by the plant extracts compared to the ones of monozygotic twins. Based on GE-profile comparison an effect of the plant extracts towards insomnia and short sleep can be expected, provided bioavailability in the CNS is given.

Ashis K. Mukherjee

Prof. Ashis K. Mukherjee is currently serving as the Director, Institute of Advanced Study in Science and Technology (IASST), Guwahati. He did his M.Sc. in Biochemistry from Banaras Hindu University in 1992 and Ph.D. in 1998 on Indian cobra and Russell's viper venoms from the Dept. of Biochemistry, Burdwan Medical College, Burdwan University, and D.Sc. in Biotechnology from Calcutta University in 2017. His current research interest includes proteomic analysis of snake venom, pharmacological re-assessment of medicinal plants used against snakebite treatment, quality assessment of commercial antivenom, and cardiovascular and anticancer drug discovery from natural resources, including snake venom. He has received several awards and medals for his academic and research achievements; the most notable is the Visitor's Award for Research in Basic and Applied Sciences from the honorable President of India in 2018. He is a fellow of the Royal Society of Biology, UK, West Bengal Academy of Science and Technology, Kolkata, India, and Indian Academy of Science, Bangalore. Dr. Mukherjee has guided 15 research scholars for Ph.D. degrees and 40 M.Sc. dissertations and has published more than 150 research papers in peer-reviewed International and National journals, book chapters, and review articles. He has received 7600 citations for his work with an h-index of 51. He is also a task force member of DBT, ICMR, and WHO on preventing and treating snake bite envenoming.

Envisioning the therapeutic application of plant-derived natural products as antithrombotic drugs: key issues and challenges

Ashis K. Mukherjee

Institute of Advanced Study in Science and Technology (an AI of DST, Ministry of Science and Technology, Govt. of India), Vigyan Path, PaschimBoragaon, Garchuk, Guwahati- 781035, Assam

Many cardiovascular pathology, including COVID-19, are associated with thrombotic complications, characterized by the accumulation of unwanted clots in the blood vessels. Anticoagulants, antiplatelet, and clot-busting drugs are used to treat thrombotic complications. However, commercial antithrombotic drugs show several adverse reactions, and sometimes patients receiving anticoagulant therapy do not demonstrate significant benefits. From ancient times natural products have been documented as a foundation of medicines for the prevention and/or treatment of several diseases. Consequently, searching for safe, potent, and effective antithrombotic drugs by exploring natural bioactive molecules from plant resources is worthwhile. In the past few decades, several attempts have been made to understand traditional herbal drug prototypes' in vitro and pre-clinical antithrombotic potential. These lead us to visualize their future clinical use as potent antithrombotic drugs. However, more in-depth studies, for example, identification and mechanism of action, pharmacokinetics, and pharmacodynamics of active components, should be explored before undertaking a clinical study to establish the efficacy of such herbal products and validate traditional knowledge. In addition, holistic approaches and rigorous studies are needed for the international acceptance of herbal products. The studies should also compare the potency of herbal drugs with currently available commercial antithrombotic drugs and the interactions of herbal drugs with Western antithrombotic medicines. There should be universal guidelines, which are acceptable to all, for the quality assurance of herbal products. Moreover, conserving and cultivating traditional medicinal plants are essential for augmenting the sustainable use and commercialization of antithrombotic herbal drugs.

JN (Kobus) Eloff

JN (Kobus) Eloff is the founder of the interdisciplinary Phytomedicine Programme, Faculty of Veterinary Science, University of Pretoria. Previously he was the Executive Director National Botanic Gardens and Research Director National Botanical Institute. Professor Universities Free State, Cape Town, Pretoria. Supervised 50 MSc and 53 PhD students completed. He is also Editor of several journals. He has reviewed >320 manuscripts of different scientific journals and join Editorial Board of 74 different scientific journals. He has given more than 220 (>100 invited/plenary/keynote) international presentations >350 peer evaluated scientific publications > 19600 citations, h factor 67, 251 publications cited at least 10 times. He has managed project leading to African Herbal Pharmacopoeia. He has several patents registered and products licensed to Industrial Companies based on group's research. Leadership role several national and international professional societies Received highest awards of SA Association Botanists, SA Akademie vir Wetenskap en Kuns, National Science and Technology Forum, Academy for Science of South Africa (ASSAf) and Society for Ethnopharmacology India.

The interaction between activity of plant extractants against animal pathogens/pests; a dilemma and a possible solution

JN Eloff

We have consistently shown that the active compounds against animal pathogens and pests are relatively non-polar and water extracts generally have very low activity. In the case of microorganisms, nematodes, blowflies and ticks we could show that acetone extracts frequently have very good activity. Acetone extracts intermediate polarity compounds and

has an even lower toxicity to humans than ethanol and is not toxic to some pathogens and pests at a concentration of 25% it is a very useful extractant. Examples of some applications both *in vitro* and *in vivo* will be presented. Because water is the only extractant widely available to rural farmers many of the highly active compounds cannot be extracted and used. Acetone is not available to rural farmers. Surfactants has the ability to solubilise non-polar compounds in water. We recently asked which compounds were available to rural farmers and tested the use of an emulsion of cooking oil water and a widely available soap. In a field trial with colleagues in Zimbabwe we could show that the plant mixture was effective in protecting ticks as a commercial acaricide. This opens possibilities for using plant extracts by rural farmers.

Marco Leonti

Marco Leonti graduated in Biology at the University of Basel (CH) in 1996. From 1999 to 2000 he conducted ethnomedical and anthropological field research in Mexico and got his PhD degree in pharmacognosy from the ETH (CH) in 2003, with a study focusing on the ethnopharmacological, phytochemical and biological evaluation of indigenous medicinal plants. After post-doc positions at the London School of Pharmacy and the University of Cagliari (Italy), he was made Associate Professor at the Department of Biomedical Sciences of the University of Cagliari, where he teaches pharmacognosy. He is currently engaged in the isolation and structure elucidation of cannabimimetic, antibacterial, and cytotoxic secondary metabolites from plants and traditional medicines. His research follows evolutionary approaches and focuses mainly on the cultural history of human plant use and the rationale of human plant selection for medicine and nutrition.

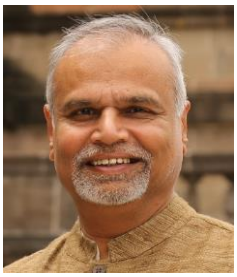
Medicines and foods - tastes and uses

Marco Leonti

Department of Biomedical Sciences, University of Cagliari, Cittadella Universitaria, 09042, Monserrato, Italy

Taste properties of botanical drugs are important in Ayurvedic, Chinese and European medicine. Whether a botanical item is perceived and used as both food and medicine or only as either food or medicine depends on culture, taste and flavour preferences, personal health context and overall epidemiology. Material and methods: We subjected 540 botanical drugs recorded in De Materia Medica with at least one systemic medical application to a tasting panel. For the analysis of associations, we considered 22 experimentally assessed taste, flavour and chemesthetic sensations (‘tastes’) and 39 categories of therapeutic uses. We wanted to know: 1) which tastes increase the probability that a drug is indicated also for food and vice versa, and 2) which are the differences in the therapeutic indications between orally applied plant drugs also used for food and those applied exclusively as medicine. ‘Taste’ properties augmenting the probability of an orally applied plant drug to be used also for food were sweet, starchy, salty, burning/hot, fruity, nutty and cooling. Medicines for diarrhoea, used as libido modulators, purgatives, laxatives, for expelling parasites, breast and lactation and increasing diuresis, were preferentially sourced from drugs also used as food. Food drugs offer the possibility for associating ‘taste’ properties with observed post-prandial physiologic and pharmacologic effects and constitute a fundamental part of herbal medicines.

Bhushan Patwardhan



National Research Professor-Ayush and India Lead for the Global Center for Traditional Medicine, World Health Organization Geneva. Fellow, National Academy of Sciences and National Academy of Medical Sciences (India). Chairman, NAAC, Former Vice Chairman, UGC. Member of several academic research and policy committees such as NITI Aayog, Planning Commission, Lancet Citizen's Commission. Chairman of the Interdisciplinary R&D Taskforce on Covid-19, and member, and Founder Editor-in-Chief, Journal of Ayurveda and Integrative Medicine published by Elsevier. He is the Recipient of several orations, awards and holds 8 Indian, 2 US Patents. He has 175+ scientific publications, with over 11,600+ citations**.**

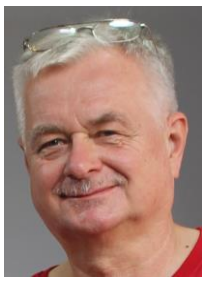
Ethnopharmacology approach: Opportunities in biomedical research

Bhushan Patwardhan

Interdisciplinary School of Health Science, Savitribai Phule Pune University

Drug discovery and development have undergone several transitions during the last century. The advances in biomedical sciences, biotechnology, genomics and molecular technologies have brought more powerful, broad-spectrum chemical and biological drugs for many diseases. The high throughput chemical or genomic technologies have seldom expedited the discovery of newer and safer drugs. Industry leaders, and pharmaceutical and biomedical scientists are desperately looking for novel approaches, new ideas and innovations to disrupt the discovery bottleneck. In addition, inter-individual variation, drug-drug interactions and safety have emerged as major concerns. As a result, recalled drugs have overtaken the number of approved drugs. Under these circumstances, the ethnopharmacology approach is reemerging as a new opportunity in biomedical research. This lecture will highlight the current situation and future trends leading to rationale formulation discovery, therapeutic adjuvants, nutraceuticals and personalized medicine.

Michael Heinrich



Prof Heinrich is Pharmaceutical biologist (Dr. rer nat.habil, Univ. Freiburg 1989, 1997, Dipl. Biol, 1985) / pharmacognosist, and anthropologist (M.A., Wayne State Univ, 1982), with a many years of research experience in a multitude of generally transdisciplinary aspects of medicinal and food plant research (esp. bioactive natural products), as well as at the interface of cultural and natural sciences especially on the traditional use of food and medicinal plants for example in Mexico and the Mediterranea. His area of reserch is bioactive natural products / pharmacognosy / and ethnobotany): metabolomic approaches in medicinal plant research , anti-inflammatory and anti-oxidant natural products focusing on the transcription factor NF-kB and its pathway as molecular targets of natural product research, quality and safety of herbal medical products, intervention studies with herbal medicines.

Why bother about 'best practice'? Or, why we need a consensus on good methodological approaches

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In all areas of science including research on herbal medicines and natural products, it is essential to remind us of some core aspects of science needed to r-e-a-f-f-i-r-m that the approach is valid and this needs to be based on a consensus within the research communities:

- Reproducible [i.e. transparent reporting of a sound methodology and approach]
- Endorsed [scientifically, i.e. are we using valid approaches]
- Acceptable [by all stakeholders / Is there any potential bias in the approach?]
- Feasible [can we answer the questions we are posing?]
- Factual [Is it based on validated methodologies and does it results in well-defined evidence]
- Interdisciplinary [while not mandatory, research now more and more requires complex co-operations
- Responsible [following ethical and legal guidelines and adhering to the principle of transparency]
- Meaningful [Does it make a meaningful contribution to science?]

Research on medicinal plants and bioactive natural products differs from studies performed with single compounds. Therefore, there is a need for a consensus on best practice in the characterisation of extracts used in pharmacological, toxicological and clinical research. The consensus statement on the Phytochemical characterisation of Medicinal Plant extracts (ConPhyMP) was developed using a Delphi process, based on an initial stakeholder survey. This document defines what needs to be reported in order to allow for reproducibility and accurate interpretations of studies using medicinal plant extracts. Specifically, the consensus-based statement focuses on explaining the requirements needed for: (1) Defining the plant material/herbal substances, herbal extracts and herbal medicinal products used in these studies, and (2) Conducting and reporting the phytochemical analysis of the plant extracts used in these studies in a reproducible and transparent way.

Anastasia Karioti

Anastasia Karioti is Associate Professor at the Dept. of Pharmaceutical Sciences, Aristotle University of Thessaloniki, Greece, has a M.Sc. in Pharmacognosy of bioactive natural products from the University of Athens (UOA), Greece and a Ph.D. in the same sector from UOA, Greece. She has served for eight years as Teaching and Research Assistant in Univ. of Florence, Italy (2007-2014), during which she obtained her habilitation at the level of Associate Professor in two scientific fields: Botany and Pharmacology-Pharmacognosy. During her stay (2011-2014) she was engaged with the development of analytical protocols for the preparation of European Pharmacopoeia Monographs of TCM herbal drugs (Working Party on Traditional Chinese Medicine by the PhEur Commission - EDQM). She is author of 88 publications, h-index 27 (Scopus database). She has experience in isolation and structural elucidation of a variety of phenolics, flavonoids and terpenes from plants belonging to the Asteraceae, Lamiaceae families. She is currently working in fingerprint analysis of Greek medicinal plants and in the development of validated analytical methods for the quality control of herbal medicinal products.

Origanum dictamnus: HPLC-PDA-MS profile of the infusion, its relaxing effect on rabbit intestine and electrospun nanofibers

Anastasia Karioti

Laboratory of Pharmacognosy, School of Pharmacy, Aristotle University of Thessaloniki, Greece

*Origanum dictamnu s*L. (Lamiaceae) is a Greek species endemic of the island of Crete, used since antiquity for its wound healing properties and in gynecological disorders. Since 2014, *O. dictamnus* herb is authorized by EMA under the category of Traditional Use Herbal Medicinal Products for the treatment of skin inflammations and bruises, as a wound healing agent, in mild gastrointestinal disorders and relief of cough associated with cold. In the present work, dittany infusion was prepared according to EMA and characterized by HPLC-PDA-MS. Rosmarinic acid and other depsides were the main constituents, whereas flavonoids were also present. To confirm the ethnopharmacological use in gastrointestinal disorders, the infusion was tested on rabbit intestine and produced a dose-dependent

relaxing effect in both the jejunum and the colon. Dittany's relaxing effect was tetrodotoxin-sensitive, implying the involvement of a neurogenic inhibitory pathway.Based on the above results, electrospunnanofibers containing dittany infusion, PVA and chitosan were prepared. The fibers were characterized both for their physical and chemical propertiesand tested for their toxicity in CaCO3 cells.

Ancuta-Cristina Manolica (Raclariu)

Dr. Ancuta-Cristina Manolica (Raclariu) is an Associate Researcher at the Natural History Museum, University of Oslo (Norway) since 2018, and a Scientific Researcher at the National Institute of Research and Development for Biological Sciences (Romania) since 2010. Dr. Manolica has a Ph.D. in Natural Sciences from the University of Oslo in Norway and she was a researcher within the European Food Risk Assessment Fellowship Programme organized by the European Food Safety Authority (EFSA). She is currently leading a postgraduate research project. Dr. Manolica's research is related to the molecular identification of plants and the authentication of a wide range of plant-based products. Applying DNA barcoding and metabarcoding she studies plant ingredients in processed products, including herbal food supplements and medicines, spices, and novel foods. Her research includes also studies of local traditional medicine and risk assessment of botanical preparations.

DNA barcoding and metabarcoding of herbal medicines

Ancuta-Cristina Raclariu-Manolica[1,2] Hugo De Boer[2]

[1]Stejarul Research Centre for Biological Sciences, National Institute of Research and Development for Biological Sciences, Piatra Neamt, Romania, [2]Natural History Museum, University of Oslo, Norway

Medicinal plants have been long used in meeting primary healthcare worldwide. Their therapeutic properties, high popularity among consumers, and folk traditions increased the global market demand for herbal medicines. However, open questions remain regarding their quality and safety in light of numerous reports showing their susceptibility to adulteration and substitution. Economically motivated adulteration or incongruences in the vernacular names, pharmaceutical names, and scientific synonyms are only a few of the suspected drivers behind the reported irregularities that raise serious quality and public health safety concerns. Our research is using DNA barcoding to establish the identity of the raw botanical material, and DNA metabarcoding to elucidate the species diversityin a wide range of commercial botanical preparations. Our data provide strong evidence that DNA barcoding and metabarcoding are reliable candidates for integration into the toolbox of analytical methods for quality control of fresh and/or processed botanical-based preparations, post-marketing control, and pharmacovigilance / nutrivigilance. Our results offer solid indications that by integrating DNA barcoding and metabarcoding with standardized phytochemical methods a complete picture of the quality of botanical preparation is obtained.

Dipendra Kumar Mitra

Professor Dipendra Kumar Mitra works in AIIMS since 2004. He is an MD, Ph.D, trained in Stanford in the laboratory where flow cytometry was invented by Professor L.A. Herzenberg. Currently he chairs the Department of Transplant Immunology &Immunogenetics, AIIMS. He runs several projects funded by various national and international agencies. agencies. Since 2004, he guided 25 PhD. students and several DM students to complete their thesis. His area of research interest is to understand the role of various lymphocyte subsets, particularly at local pathological site in disease pathogenesis. His current research focuses on local immune response among patients with chronic intracellular infections (TB, Leishmaniasis, Sarcodiosis, Leprosy, HIV-TB), Rheumatoid Arthritis and transplant patients. He is also working on different TB Vaccine trials like DBT Horizon 20-20, DBT- PD1 clinical

trial etc. His laboratory also offers diagnosis services for patient with leukaemia and immune deficiency disorders.

Enhancing host immunity through inhibition of Immune checkpoint inhibitors: Scope of plant derived molecules

DK Mitra

Department of Transplant Immunology & Immunogenetics, All India Institute of Medical Sciences, New Delhi, India

Previously, we have shown the critical involvement of regulatory T (Treg) cells and PD-1 pathway in causing suppressed state of T cell response against *Mycobacterium tuberculosis* (*M.tb*) among TB patients. In this study, we attempted to understand the status of host immune response among the Multi Drug Resistant (MDR) and Drug Sensitive (DS) TB patients. Also, we checked the contribution of PD-1 pathway on poly-functional T cells (PFTs), critical for protective immunity in TB. Additionally, we tested the immunomodulatory potential of some natural compounds and investigated their mode of action. For immune response profile and *in vitro* experiments for investigating the effect of natural products, polychromatic flowcytometry based immunological assays were performed. PD-1 blocking experiments were performed in mice infected with *M.tb* and *invitro* model where monocyte derived macrophages (MDM) were infected with virulent *M.tb* DS strains. Among MDR patients, we observed an increase in the frequency of Treg cells and decrease in frequency of *M.tb* specific T cells (IFN-γ+ /TNF-α+) compared to DS TB patients, suggesting a tight correlation of Treg mediated suppression with MDR status. In TB patients, we observed marked reduction of PFTs, which is critical for effective immune response against TB. PFTs could be significantly rescued by blocking PD-1 pathway, which resulted in effective clearance of *M.tb* in MDM *in vitro* model. Blocking PD-1 pathway in mice infected with *M.tb*, demonstrated decrease in Treg cells and restoration of PFTs with enhanced reduction of bacillary load in the lung & spleen relative to chemotherapy alone. Similar restoration of PFTs and reduction in Treg cell's function was observed with one natural compound. Structural investigations (docking and simulation) revealed that the compound was blocking the interaction of PD-1 with its ligand PD-L1, indicating the plausible mechanism for its immunomodulation. Our findings suggest the critical role of PD-1 in suppressing the protective immune response in TB. Rescuing PFTs by blocking PD-1 pathway using antibody or natural compound may offer a novel strategy for adjunct immunotherapy in TB.

Charles S Vairappan

Prof Dr. Charles S Vairappan, began his career with Universiti Malaysia Sabah (UMS) in April 2001, upon graduation with a PhD degree in Chemical Ecology (Natural Products Chemistry) from Hokkaido University (Japan). He then pursued his Post-Doctoral attachment from 2006 to 2007 at the University of Tokyo under the JSPS Fellowship. He has authored close to 125 papers and holds 6 patents. Produced close to 50 postgraduate students, both PhDs and MSc graduates. He is also an accomplished Natural Products Chemist and has elucidated close to 500 compounds and 30% of that are new chemical entity to science. He is also actively contributing to establish a network for Sustainable Utilization of Natural Resources by training conservationist and ecological chemist. He has also successfully incorporated analytical tools to describe the chemical ecology in the tropical rainforest of Borneo. He has special interest in drug discovery, particularly in Marine Natural Products Chemistry. Professor Vairappan is also a Visiting Professor at The University of Tokyo, Rakuno Gakuen University (Sapporo, Japan), Top Research Scientist Malaysia (2020), and a Fellow of Academic Science Malaysia.

Metabolomic profiling and bio-medical potentials of essential oils of *Bornean curcuma*

Charles Santhanaraju Vairappan

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Members o fthe genus *Curcuma* (Zingiberacae), known as a rich source of essential oils are widely utilized in Asian traditional medicine. Eight *Curcuma* species were collected and their essential oils extracted *via* hydrodistillation, and chemical compositions analyzed *via* Gas Chrmatography Mass Spectroscopy (GCMS). A total of 127 types of compounds were identified; 48 in *Curcuma aeruginosa* Roxb (0.17 %), 46 in *Curcuma caesia* Roxb. (0.16 %), 60 in *Curcuma heyneana* Valeton & van Zijp (0.23 %), 25 in *Curcuma longa* L.(0.33 %), 12 in *Curcuma mangga* Valeton & van Zijp (0.19 %), 15 in *Curcuma rotunda* L.(0.16 %), 27 in *Curcuma xanthorrhiza* Roxb. (0.36 %) and 19 in *Curcuma zedoaria* (Christin) Rosc (0.31 %). Chemosystematic significance of these essential oil chemicals were establised using multivariate statistics, Heatmap-Hierarchical ClusteringAnalysis (HCA) endrogram cluster analysis and non-metric multidimensional scaling (NMDS). Four distinct clusters were identified to consist of; I – *C. aeruginosa*, *C. caesia*, and*C. zedoaria*, II – *C. Longa* and *C. heyneana*, III – *C. Rotunda* and *C. xanthorhiza*, and IV - *C. mangga*. In addition, essential oils of all *Curcuma* showed anti-inflammation, anti-cancer and antibacterial activities against clinical microbes. Anti-inflammation and anti-cancer results paved the path to better understand their importance in local traditional communities in Borneo.

Rajib Bandyopadhyay

Rajib Bandyopadhyay is a Professor at Department of Instrumentation and Electronics Engineering, Jadavpur University, India. He did his Ph.D. at Jadavpur University ans joined the Department of Instrumentation & amp; Electronics Engg, Jadavpur University in the year 1990. He has guided 24 Ph.D. students and 5 students are at present working under him. At present, he is involved in research in the areas of NIR and Raman spectroscopy, machine olfaction, electronic tongue. The research group at Jadavpur University under his leadership has developed electronic nose and tongue systems for quality evaluation of tea, and the technology transfer of these instruments have been done. He has published more than 100 papers in reputed international journals and presented more than 100 papers in national and international conferences. He has authored chapters in 10 books published by international publishers. He was invited to Linkoping University, Sweden for an invited talk and travelled to USA, UK, France, Canada, Japan and China for deliberating in international conferences. He was the President of the Kolkata Section of International Society for Automation (ISA) during 2015-16 and the faculty advisor for the Students Chapter of ISA at Jadavpur University. He was a Research Professor at ITMO University, Russia during 2015-2019 and an adjunct Professor at Manipal Academy of Higher Education since 2021. He is a Fellow of Institution of Electronics and Telecommunication Engineers and West Bengal Academy of Science and Technology. At present, he is the President of Institute Innovation Cell (IIC) of Jadavpur University.

NIR and Raman spectroscopy for rapid and non-invasive quality assessment of medicinal plants

Rajib Bandyopadhyay

Department of Instrumentation & Electronics Engg., Jadavpur University

Quality assessment of medicinal plants is of utmost importance as the quality varies due to many reasons like producing region, cultivar, season etc. Till date, the quality assessment is based on human expertise and in few cases involved chemical analysis methods are employed. These methods are invasive, and employ reagents and expensive analytical instruments and are confined in the laboratories only. On the other hand, during the last few decades, spectroscopic methods, especially the Near Infrared (NIR) and Raman techniques have become powerful analytical tool for gathering quantitative and qualitative information from a wide variety of products in the agricultural, nutritional, petrochemical, textile and pharmaceutical industries. The techniques are non-destructive, rapid and simple to operate, require small samples, and are applicable for use with solid samples and can determine in situ the concentration of various phytochemicals at the same time. In this talk, a few applications of NIR and Raman spectroscopy will be discussed. This will be followed by the calibration methods and some variants like surface enhanced Raman spectroscopy. The calibration methods and the recent development in the low-cost hardware components of these instruments will also be dealt with. Finally, a few case studies on estimation of polyphenols and caffeine in tea, andrographalides in *Andrographis paniculata* and a few other medicinal plants will be discussed.

Dilip Ghosh

Dr. Dilip Ghosh has received his PhD in biomedical science from India & post-doc from USDA-ARS, HNRCA at Tufts University, Boston. He is an international speaker, facilitator and author and professionally associated with Nutriconnect, Australia; Adjunct-Industry Fellow, NICM Health Research Institute, Western Sydney University & Adjunct Professor, KASTURBA HEALTH SOCIETY, Medical Research Center, Mumbai, India. He is a fellow of American College of Nutrition (ACN), professional member of Australian Institute of Food Science & Technology (AIFST), an advisor and executive board member of Health Foods and Dietary Supplements Association (HADSA), & The Society for Ethnopharmacology, India (SFE-India) and also in editorial board of several journals. Dr. Ghosh has published more than 100 papers in peer reviewed journals, numerous articles in food and nutrition magazines and books.

Obesity and lifestyle-related disorders beyond the stethoscope: Role of evidence-based botanicals

Dilip Ghosh

Nutriconnect, Sydney, NSW, Australia

Obesity has become a threat to the health and economy of society worldwide and, if not contained, will be responsible for a dramatic increase in cardiorespiratory diseases and certain cancers. While the fundamental cause of obesity is straight-forward, i.e., an energy intake that exceeds expenditure over a prolonged period of time, many other factors, particularly genetic, make some individuals at greater risk for obesity than others, and also make it more difficult for some to lose weight than others. Because of the multi-faceted nature of the biological and societal factors associated with obesity makes it exceedingly difficult to prevent and treat. Current obesity treatment strategies include diet, exercise, bariatric surgery, and a relatively small list of medications. Current prescription drugs have been developed to ameliorate or prevent obesity, but there are the costs, efficacy, and side

effects to consider. Several clinical investigations of herbal medicine have been shown to be effective in the treatment of obesity, but the “cause and effect” relationships are still not properly elucidated. The microbiota is certainly deeply involved in this situation. Many herbs in the Ayurvedic and Chinese Pharmacopeia enriched in fibers and botanicals and therefore, the exploration of herbal foods regulating the microflora may aid the development of hypoglycemic dietary supplements and medications.

Sib Sankar Roy

Dr. Roy is currently working as Chief Scientist at CSIR-IICB, Kolkata and Professor, Academy of Scientific and Innovative Research. He has completed his bachelor and Master in Life Science from Visva Bharati Santiniketan, India. He has obtained his PhD degree from Bose Institute (Jadavpur University) and completed his postdoctoral training at Harvard University, USA. His research focuses on Cancer Biology. He has 51 research publications in peer review SCI journal with h-index 25, 3 book chapters and 3 patents. He has honored ICMR Novartis Oration Award (Gold Medal) for outstanding contribution in the Field of Cancer”-2016 and recipient of Platinum Jubilee Award (New Biology Section) awarded in Indian Science Congress, January 2019. He served as expert committee member of DST (SERB) in the PAC for young scientist’s project and NPDF Scheme. 22 fellows have been awarded PhD degree under his supervision; 8 students are presently pursuing and 60 Master students have done short term project and mentored 3 Post-Doc. He has received 12 numbers of R &D projects funded by various research grant agency such as CSIR, National Tea Research Foundation (NTRF), DST, DBT. He is also Life member of Society of the Biological Chemist (SBC), India, The Indian Science Congress Association (ISCA), Indian Association for Cancer Research (IACR), Life Member, Chemical Biology Society (India).

Metabolic reprogramming in tumor cell: modulation of metabolic pathway as a romising therapeutic strategy

Sib Sankar Roy

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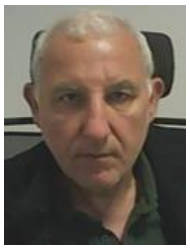
Tumor cells undergo adaptive changes that favours their survival and propagation. The most important alteration is the metabolic reprogramming, where several pathways of metabolism and cellular bioenergetics are significantly changed in the tumor cells. In the present study, we will discuss two aspects of metabolic alterations, which are therapeutically important. a) We established the role of TME-derived cues in determining the altered bioenergetics in cancer cells. The role of highly enriched onco-metabolite (Lysophosphatidic acid) in the ascites/serum of patients have been shown. The link between increased invasiveness and metabolic plasticity further re-establishes the critical role of metabolic adaptation of tumor cells as a driver of tumor progression (*Mol Oncology-2017; FEBS J-2018*). LPA could be an effective biomarker for ovarian cancer detection and LPA-receptors could be potential drug targets. b) To demonstrate another example of metabolic rewiring in tumour cells, we studied glutamine metabolic alteration in tumour cells. Glutamine is an essential nutrient for cancer cells yet they undergo glutamine starvation in the core of tumors. Cancer stem cells (CSCs), responsible for tumor recurrence as well as chemoresistance, are often found in the nutrient limiting cores. We showed that glutamine is not essential for the survival of cancer cells, while it is required for their proliferation. Glutamine starvation leads to the metabolic reprogramming in tumor cells with enhanced glycolysis and OXPHOS. ROS production induces phosphorylation of dynamin-related protein-1 (DRP1) through MAPK-ERK1/2 pathways. Moreover, p-DRP1 promotes mitochondrial fragmentation and enhances numbers of CSCs. Glutaminase inhibitor treatment or Glutamine deprivation induces perinuclear localization of fragmented mitochondria and reduction in proliferation rate, which are usually

observed in CSCs. Co-treatment with both inhibitors, like glutaminase by L-DON and DRP1 by MDiVi-1 significantly reduced the tumor growth as well as stemness-induction. Our data suggest although glutamine deficiency reduces cell proliferation, however, it increases the CSC population and hence the co-treatment of MDiVi-1/L-DON could be a useful approach for proper management of the disease (*Cell Mol Life Sc, 2021*).

Domenico V. Delfino



Prof. Domenico Delfino, M.D., Ph.D., was born in Reggio di Calabria (Italy) on January 1, 1959. He is currently Professor at Pharmaceutical Biology University of Perugia, Italy. He got a medical doctor degree at the University of Perugia, a Ph.D. in Experimental Medicine at the University "Sapienza" in Rome and was Research Associate at the University of Pittsburgh Cancer Center, Pittsburgh, USA, from 1991 to 1994. He is associate professor of pharmaceutical biology and member of the bioethical committee of the University of Perugia, Italy. He was the President of the Nursing School from 2012 to 2019. He is member of the Italian Society of Pharmacology and of International Society of Ethnopharmacology. His research activity has been focused on the study of the generation of NK cells from bone marrow progenitors, pharmacological modulation of thymus apoptosis by glucocorticoids and on ethnopharmacology of arthritis and cancer. He has published more than 85 papers in peer-reviewed international journals.

Ethnopharmacology of Endophytic Fungi

Domenico V. Delfino

Pharmaceutical Biology, University of Perugia, Italy

Endophytic fungi are microorganisms that exist almost ubiquitously within various tissues of living plants where they act as an important reservoir of bioactive compounds. Recently, endophytic fungi have attracted the attention of researchers since revealed the presence of about 200 different important compounds including anticancer agents, antibiotics, antifungals, antivirals, immunosuppressants. Many anti-cancer compounds, such as paclitaxel, camptothecin, vinblastine, vincristine, podophyllotoxin and their derivatives, are currently used clinically for the treatment of various forms of cancer. By increasing the yield of specific compounds through genetic engineering and other biotechnology, endophytic fungi could increase the availability of treatments and their cost-effectiveness. Endophytic fungi and their products can grow within medicinal plants belonging to the world ethnopharmacological culture. Prof. Mazid at the University of Dhaka isolated the compound fusarubine from *Cladosporium* endophytic fungi grown within *Rauwolfia serpentina* (Apocynaceae), known as Indian snake root, used in ethnomedicine to treat hypotension, as an anticancer, central nervous system depressant, hypnotic, antidote against the bite of poisonous reptiles, anti-dysenteric. We have reported that fusarubin inhibits proliferation and increases apoptosis in leukemia and other hematological tumor cell lines in different manners through the p53/p21-dependent pathway, showing very promising putative anti-cancer properties.

Gertrud Morlock

Gertrud Morlock holds the Chair of Food Science at the Justus Liebig University Giessen in Germany. She is also the Director of the associated TransMITCenter of Effect-Directed Analysis. She was awarded the Kurt Täufel Prize of the German Society for Food Chemistry, the Father of Stevia Award of the World Stevia Organization, and the CsabaHorváth Memorial Award of the Hungarian Society for Separation Sciences and Connecticut Separation Science Council. She has authored more than 220 peer-reviewed original research papers (since 2006), 76 further scientific papers, 17 book chapters, 250 poster and 300 oral presentations, conducted 70 workshops, and is active in scientific committees.

Healthy oils are not necessarily healthy

Gertrud Morlock

Justus Liebig University Giessen, Chair of Food Science, Giessen, Germany

Genotoxins were found in healthy oils. The question arises why this has been overlooked so far, and the validity of current analytical tools is being questioned. The power of the planar screening strategy is highlighted, which first discovered the genotoxins. Will planar bioassay, which provides meaningful effect profiles, replace previous toxicological, hormonal and other *in vitro* assays? Combining two different disciplines (chemistry, *i.e.* planar chromatographic separation, and biology for toxicological detection) on the same surface yields more meaningful results compared to the status quo. The differentiation of opposing effects/responses is possible. In contrast, the scientist may be misled in the interpretation of test results obtained with commonly used *in vitro* microtiter plate assays, as only a sum parameter value is reported. Examples illustrate the benefit of the effect differentiation via planar bioassays. It is explained why genotoxins in healthy oils were overlooked by current analysis tools. The combination of two disciplines allows for a novel analytical strategy on compound prioritization (instead of separating everything), which is able to provide understanding and solve pressing questions concerning harms or benefits arising from samples. This urgently calls for an analytical paradigm shift towards non-target planar profiling that can detect genotoxins and does not overlook these. To spread the powerful sustainable hyphenated technique, an open-source 2LabsToGo system was recently developed.

Madhu Dikshit

Dr Madhu Dikshit has been a former Director at CSIR Central Drug Research Institute, Lucknow, a former Visiting Professor & Head at Department of Bioscience & Bioengineering, Indian Institute of Technology, Jodhpur and *former* THSTI National Chair, Translational Health Science and Technology Institute, Faridabad-Gurgaon Expressway, Faridabad, Haryana. Dr Dikshit, a leading scientist of the country, has made significant contributions to the general area of Molecular Pharmacology with special emphasis on redox/NO biology and metabolism. Dr. Dikshit has impacted the area of neutrophil biology by enhancing our understanding that how nitric oxide modulates neutrophil differentiation, survival, free radical generation, NETosis, chemotaxis, and microbicidal activity. She has systematically investigated the role of iNOS in metabolic regulations and insulin sensitivity. She also initiated and led the team for anti-thrombotic drug discovery at CDRI from which one of the NCEs has received DCGI permission for a Phase I clinical trial. At THSTI, she initiated a program on drug and biomarker discovery in the area of fatty liver disease and has made significant contributions. During the Covid-19 pandemic under a DBT-AYUSH project, she undertook the preclinical and pharmacokinetic evaluations of select AYUSH herbal extracts/formulations for mitigating SARS- CoV2 and associated pathologies. Dr. Dikshit has published more than 200 well-cited papers, 23 reviews in peer-reviewed journals, edited three books, has eight patents, and has supervised 37 Ph.D., 10 MD theses, and a good number of graduate students.

Efficacy of the root extract of *Withania Somnifera* in the experimental models of SARS-CoV2, inflammation, and innate immune response

Madhu Dikshit

JC Bose National Fellow, CSIR-Central Drug Research Institute, Lucknow

Severe acute respiratory coronavirus-2 (SARS-CoV-2), the causative agent of the coronavirus pandemic (COVID-19), manifested unprecedented morbidity and mortality. In the severely sick patients it was characterized by cytokine release syndrome (CRS), pneumonia, respiratory distress, prothrombotic state. Local immune response following infection leads to the recruitment of macrophages and neutrophils that release cytokines and also priming of the adaptive T and B cell immune responses. However, in some cases, a dysfunctional immune response triggered a cytokine storm mediating widespread lung pathology. As there was no specific treatment available, several therapeutic options, including Ayurvedic drugs were tried to prevent and alleviate the symptoms in moderate to severe disease patients. Moreover, efficacy of available therapeutic options was also established by using *in vitro* as well as *in vivo*experimental models. *Withania Somnifera* root extract(WS) has been in human use to prevent and treat several infectious as well as non-communicable diseases. We used several *in vitro*assays and animal models to assess the anti-viral, anti-inflammatory and immunomodulatory efficacyof the aqueous extract of *Withania somnifera*, a potent immunomodulatory herbal drug. WS exhibited appreciable anti-viral efficacy, anti-inflammatory potential and was also efficacious against innate immune cell responses. Together, we provide evidence of considerable protection by WS against SARS-CoV2 infection and associated pathologies through its broader immunomodulatory activity.

Alexander N. Shikov

Alexander N. Shikov Ph.D., Dr. pharm.Sci. is the Professor at the Department of the Technology of Pharmaceutical Formulations at the St. Petersburg State Chemical Pharmaceutical University since 2016. He completed his PhD at the Saint-Petersburg State Chemical Pharmaceutical Academy in 1995 and obtained his Dr. Pharm.sci. degree (habilitation) from Saint-Petersburg State Chemical Pharmaceutical Academy in 2006. Dr. Shikov began his career with the St-Petersburg State Chemical Pharmaceutical Academy in 1992 as a professor assistant at the department of drugs technology and phytopreparations. He became a Deputy of the general director at the St-Petersburg institute of Pharmacy in 2008, and was promoted to Professor at the Department of Pharmacology of the North West State Medical University named after I.I. Mechnikov, St-Petersburg, Russia in Sept. 2009. He serve as associate editor of Journal of Ethnopharmacology, Frontiers in Pharmacology Ethnopharmacology and as member of editorial board Phytomedicine, Chinese Journal of Natural Medicine and 6 other prestigeous international journals.He has authored or co-authored about 200 articles in Russian and international peer-reviewed journals. His main research interest is focused on plant adaptogens, standardization of natural products (herbal and marine), pharmacokinetic of natural compounds and approaches to improvement of bioavailability of natural molecules.

Medicinal plants used in Russian medicine to cure diseases of respiratory tract

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Being located in Europe and Asia and having diverse climatic conditions from Arctic in the north to subtropical to the south of country, Russia has a very rich flora. For centuries, Russian population has been regarded a “herbophilious” society in which plants have been

used for the treatment of different diseases). It is estimated that about 60% of the population of Russia relies on herbal medicines for the prophylaxis or treatment of different diseases. Herbal medicine in Russia is part of officinal medicine. The Russian Pharmacopoeia of the 14th edition includes 107 individual monographs for plants. Given the harsh climatic conditions in a significant part of the territory of Russia, respiratory diseases are seasonal and recur regularly. It is not surprising, that the most larger group of medicinal plants described in Russian Pharmacopoeia is belongs to the plants which alleviate symptoms of patients in certain stages of bronchitis or tracheitis (expectorants). This group represebted by 14 plants including *Althaea officinalis* L., *Glycyrrhiza* spp., *Inula helenium* L., etc. The other plants used for the treatment of respiratory diseases are anti-inflammatory (6 plants). The plants with diaphoretic properties induce involuntary perspiration and thus reduce fever, promote circulation, relieve muscle tension, aching joints, and inflammation. These plants are represented by *Sambucus nigra* L., *Tilia cordata* Mill. and *Viburnum opulus* L. Polyvitamin plant (such as *Aronia melanocarpa (Michx.) Elliott*.L, Rosa spp., *Sorbus aucuparia* L)s has been used as supplementary in the treatment of respiratory diseases. A specific aspect of Russian herbal medicine is the use of adaptogens, which are natural compounds, or plant extracts that increase adaptability, resilience, and survival of organisms to stress. The most famous adaptogens are *Aralia elata* var. *mandshurica* (Rupr. & Maxim.) J.Wenб *Oplopanax elatus* (Nakai). Nakaiб *Eleutherococcus senticosus* (Rupr. & Maxim.) Maxim and *Panax ginseng* C. A. Mey. Notable, several medical species (polyherbal compositions) are approved for the treatment of respiratory diseases as well.For the conclusion we may underline the high importance of medicinal plants for the treatment of respiratory diseases in Russia.

Sanjay Kumar

Dr. Sanjay Kumar is currently the Director CSIR-IHBT, Palampur. He obtained his Master's and Ph.D. degrees from G.B. Pant University of Agriculture and Technology, Pantnagar and Indian Agricultural Research Institute, New Delhi, respectively. He Joined CSIR-IHBT as "Scientist B" in 1990 and received post-doctoral training at Texas Tech University (USA), Rothamsted Research (UK), and Kansas State University (USA). His major contributions include discovery of a novel carbon fixation pathway and its transplantation in a heterologus system to reduce photorespiratory losses leading to photosynthetic gain and yield enhancement, discovery of autoclavable superoxide dismutase from high altitude plant, plant adaption mechanism at high altitude, deciphering the mechanisms of thorn formation in rose, winter dormancy and drought stress in tea. Contributed significantly on development of nutraceuticals using traditional knowledge. He has guided 28 MSc/PhD students and holds several international patents and has 207 research/review articles, book chapters, edited book etc. Some of his key contributions have percolated to book and major reviews also. He has been awarded as Fellow of the Indian National Science Academy, National Academy of Sciences, National Academy of Agricultural Sciences and Crop Improvement Society of India. Bestowed with prestigious VASVIK IndustrialResearch Award; R.D. Asana Endowment Lecture Award; Professor G.V. Joshi Memorial Lecture Award; Prof.Shri Ranjan Memorial Lecture Award, Ultra International Team Award for contribution in Essential Oil Industry; Outstanding Alumnus Award of College of Basic Sciences and Humanities, Certificate of Merit in CSIR Leadership Programme; and Young Scientist Award by INSA. He has been chairman/member of several Professional Committees and Task Forces, and has served Editorial Board of several international journals. As Director of CSIR-IHBT he has vitalised several initiatives for empowering society/farmers.

Rawiwan Charoensup

Asst.Prof.Dr. Rawiwan Charoensub, Director of Medicinal Plants Innovation Center of Mae Fah Luang University has been working on herbal medicine, ethnopharmacology and natural products inspired quality, safety and efficacy of herbal drugs leading to development of therapeutic leads from medicinal plants. Her work highlights on standardization of herbal drugs, bioassay-guided fractionation, chemical analysis, pharmacological activities both *in vitro* and *in vivo* and clinical trials study. She had set up the Medicinal Plants Innovation Center of Mae Fah Luang University which focused on research and product development from medicinal plants. She is the organizing committee of several national and international conferences,workshops, and seminars related to herbal medicine, ethnopharmacology and natural products.

Herbal Technology to sustain climate change and Circular Bio-economy

Rawiwan Charoensup

Herbal products have provided humankind with curative treatments for millennia. it has been traditionally used in several industrial sectors including pharmaceutical science, food, cosmetics, chemical engineering, and agroindustry. Natural products gained a notable reputation in recent years due to the current trend in society, which seeks natural, healthier, and more sustainable products. The promotion and integration of herbal medicines into primary healthcare can help us prevent climate change while enabling new drug discoveries, wider access to healthcare, conservation of forest resources, and support in narrowing socio-economic gaps, The economic pressure of the industry is threatening traditional knowledge and cultural practices increasing the risk of biodiversity loss considering the new economic interests and unsustainable competitive utilization of the standing forests, such as mining, logging, real estate, agro-economy. Therefore, the integration of sustainable development goals with the fundamental and technological concepts involved in the manufacturing of high-quality herbal products is important towards a circular economy. The conservation and sustainable use of medicinal plant resources provide a reliable reference for the conservation and sustainable use of medicinal plants. Developing a sustainable herbal technology is a multidisciplinary process of phytopharmaceutical technology used to create herbal remedies. Herbal technology should embrace AI, machine learning, IoT and blockchain technology for conservation, cultivation, traceability and supply chain transparency. Technologies should be developed to actualize good agricultural practices and sustainable use of medicinal plant resources. The need for biotechnical approaches like tissue culture, micropropagation, synthetic seed technology, and molecular marker-based approaches should be applied to improve yield and modify the potency of medicinal plants while supporting the farmers for sustainable community development. Reuse and repurposing of traditionally used herbs and formulations to find novel pharmacological insights based on metabolomics, network pharmacology, proteomics and genomics can further expand the horizon of herbal technology which can sustain climate change and promote a circular bio economy.

Milen I. Georgiev

Milen I. Georgiev has 20 years of experience in natural products fields and has published in excess of 180 papers (Nature Reviews Drug Discovery, Genome Biology, Trends in Biotechnology and Plant Biotechnology Journal, among others). He has delivered 60+ invited lectures in 25 different countries. Milen holds several grants from the NSF of Bulgaria, Romania and framework programmes of the European Union (incl. H2020 – PlantsSYST project, well-funded with

30 million Euro). In 2020 and 2021, he was listed among top 2% in the Stanford University worldwide citation ranking of all scientists and scientific disciplines. Milen is a recipient of Pythagoras award for outstanding scientist by the Bulgarian Ministry of Education and Science (2011, 2015 and 2020), as at present the only scientist in Bulgaria to have won three times. Milen serves as an Editor, Associate Editor and Editorial Board member of dozen journals in biotechnology and natural products fields, incl. Phytomedicine, Food and Chemical Toxicology, Phytochemistry, Biotechnology Letters, Chinese Medicine, eFood, Food Frontiers, International Journal of Molecular Sciences, Frontiers in Pharmacology, among others. Serving as a chairman he has established the International Conference on Natural Products Utilization: from Plants to Pharmacy Shelf (ICNPU), which has four issues so far. The latest ICNPU edition attracted attention of 330+ participants from 50 different countries (www.icnpu.com/2019). His current research focuses on 1) biosynthesis of fine molecules and development of biotech tools for their sustainable mass production, 2) metabolomics and comprehensive metabolite profiling and 3) molecular pharmacology (with particular focus on obesity, photoaging and longevity).

Obesity management potential of natural compounds

Milen I. Georgiev[1,2]

[1]Laboratory of Metabolomics, Institute of Microbiology, Bulgarian Academy of Sciences, 4000 Plovdiv, Bulgaria, [2]Center of Plant Systems Biology and Biotechnology, 4000 Plovdiv, Bulgaria

Obesity has outreached the dimensions of a health problem and has established as a global epidemic (named GI obesity) over the past decades. Obesity is complex, chronic disease and global public health challenge. Being characterized by excessive fat accumulation in the body, obesity sharply increases the risk of metabolic syndrome. Excessive body weight appears among the top five risk factors in terms of attributable deaths and metabolic complications development. Consequently, management of obesity (*i.e.*, prevention and treatment) is subject of undergoing intense research. Natural compounds attracted profound interest as candidates for obesity management. We have examined the potential of plant extracts and their bioactive principles to affect adipogenic differentiation in human adipocytes. Their mechanism of action was studied in-depth by using transcriptional analysis through real-time quantitative PCR and protein abundance evaluation by Western blotting. The key adipogenic transcription factors – peroxisome proliferator-activated receptor gamma (PPARγ) and CCAAT-enhancer-binding protein alpha (C/EBPα) – appeared strongly decreased at a protein level by treatments with plant extracts and pure compounds. Moreover, the phosphoinositide 3-kinase (PI3K)/protein kinase B (AKT) signaling pathway was found to be involved in the anti-adipogenic effect of the plant extracts and pure molecules. Collectively, our findings indicate that selected plant extracts (and their active principles) hampered adipocyte differentiation through PI3K/AKT inhibition. Among selected compounds, betulinic acid and maackiainexhibit the most promising anti-adipogenic activity. Furthermore, the research has been translated from human adipocytes to the organism model of *Caenorhabditis elegans*.

Motlalepula G. Matsabisa

Prof Matsabisa has a PhD in Pharmacology. He is currently the Director of the Indigenous Knowledge Systems (Health) Lead Programme (IKS) within the Department of Pharmacology, School of Clinical Medicine, and Faculty of Health Sciences at the University of the Free State. Prof Matsabisa is a Guest Professor at the Beijing University of Chinese Medicines (BUCM). He is the Director of the DSI-TIA-UFS IKS platform known as African Medicines Innovations and Technology Development (AMITD). He is member of the University of the University of Free State Senate. He is a current member of the Complementary Medicines Committee (CMC) of South African Health Products Regulatory Authority (SAHPRA) and a reviewer of

Complimentary medicines product dossiers. He is the vice-chair of the CMC - Pharmaceutical and Analytical committee. Prof Matsabisa has experience and knowledge in medicine regulation and understands the South African Medicines Act (Act 101 of 1965). He is currently a member and chairperson of an expert Group set up by SAHPRA to advice on the establishment of a regulatory and registration framework for African Traditional Medicines proprietary commercial products and chairs the working group. I am a member of the Ministerial Advisory Committee on cannabis. Prof Matsabisa served on the DOH Traditional Health Practitioners Council and Chairs the Research and Health Committee of the same council. Prof Matsabisa is a member of the WHO Afro Regional Expert Committee on Traditional Medicines for COVID-19.

The Challenges of Traditional Medicine Development for COVID-19 into Clinical Use – Case Study of PHELA, an African Traditional Medicine based Product

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A traditional preparation, now called PHELA, meaning “live”, has been used for decades in Africa for a syndrome of diseases, including an age old disease called Muyaga. PHELA has now found useful as an African traditional medicine for treating HIV and immune compromised persons. With the advent of COVID-19, PHELA has been repurposed for COVID-19 exploiting its immune reconstitution properties. The current use of PHELA has now been systematically studied and this research adds scientific value to this traditional preparation in order to first, give the African traditional medicines an international scientific perspective. Secondly, the systematic and controlled scientific clinical validation of PHELA will help show its safety and potential use by patients with immune compromised system. Thirdly is now to indicate PHELA for long COVID-19 patients presenting with comorbidities of tuberculosis and diabetes. PHELA has been developed as proprietary standardized herbal medicine for wider commercial exploitation to benefit the knowledge holders through royalty payments and more importantly to benefit patients with immune compromised conditions. The scientific development of PHELA and challenges encountered throughout to clinical trials and commercialization will be highlighted as a means to help similar products to avoid such pitfalls.

Mrinal Kanti Bhattacharyya

Professor Bhattacharyya performed his Ph. D. work (Molecular Biology: 1993-1998) at Tata Institute of Fundamental Research (Mumbai). He worked as a Post-Doctoral Research Fellow at Johns Hopkins University, USA (1999-2004). He started his career as a Research Scientist in Tulane University School of Medicine, USA (2004-2007), where he worked on DNA repair and telomere maintenance. He joined University of Hyderabad in 2007 as a Reader. Currently he is a Professor of Biochemistry and formerly he has served as the chair of the department. **His** long-term research interest is to identify the druggable targets from the biology of the malaria parasites with an ultimate goal of discovering new anti-malarial drugs. He has published close to forty research articles and review articles on this subject, including JBC, Molecular Microbiology, Antimicrobial Agents and Chemotherapy, Molecular Biology of

the Cell, etc. He is the recipient of the prestigious Indo-US Professorship in Microbiology form the American Society for Microbiologist. He has also received the coveted Chancellor Award from the University of Hyderabad for his excellent contributions in teaching and research.

Anti-malarial drug discovery: top-down or bottom-up approach or a combination of both?

Mrinal Kanti Bhattacharyya

Department of Biochemistry, School of Life Sciences, University of Hyderabad, Hyderabad.

Half of the world's population is under the threat of malaria, and it continues to be not only one of the greatest killers of mankind, but also a public health nuisance that imposes enormous economic burden due the huge loss of man-hours. Owing to the insecticides resistant mosquitoes, the lack of an effective vaccine and the emergence of multi-drug resistance parasite strains there is aconstant need for discovering novel targets and new drug molecules. Malaria drug discovery initiatives have been guided by both top-down and bottom-up approaches. Screening of plant-based natural products using top-down approaches have yielded two of the most effective malaria drugs: Artemisinin and Chloroquine. On the other hand target-based rational drug design- a classical example of bottom-up approach have also yielded several potent anti-malarials. We propose that any synergistic action between small-molecule–inhibitors discovered through these approaches could be explored as novel combination therapies. To this end the discovery of the DNA-double strand break repair mechanism as an essential pathway of the malaria parasite and hence its establishment as a lucrative druggable target will be discussed. Drug combinations and their synergism will be elucidated.

Patrícia Rijo

Patrícia Rijo has a degree in Chemistry from the Faculty of Sciences of the University of Lisbon (FCUL), and a Master and Ph.D. in Pharmaceutical and Therapeutic Chemistry from the Faculty of Pharmacy of the University of Lisbon (FFUL). She is currently an Associate Professor at the School of Health Sciences and Technologies (ECTS) at Universidade Lusófona (ULHT, Lisbon, Portugal) where she is responsible for Organic Medicinal Chemistry and Pharmacognosy and the international coordinator. The main area of research is medicinal chemistry, phytochemistry, and pharmacognosy, with an emphasis on the Chemistry of Natural Products. She is the director of Communication and External Relations at CBIOS (Research Center for Biosciences and Health Technologies at Universidade Lusófona), where she leads the Laboratory of Natural Bioactives (Bio.Natural). Patrícia has published more than one hundred articles in international journals, has more than two hundred communications (oral and panel) presented at national and international meetings and conferences, and has three registered patents.

Plectranthus: from traditional medicine to building blocks for drug delivery platforms

Patrícia Rijo

Universidade Lusófona, Lisboa, Portugal

Natural products obtained from medicinal plants are widely recognized as an important source of new therapeutic molecules with potential use in several serious diseases, including cancer. The *Plectranthus*genus is used in traditional medicine due to its potential to treat several illnesses. Diterpenoids are bioactive molecules widely found in *Plectranthus* spp., and have a broad spectrum of biological activity, namely anticancer properties. Cytotoxic diterpenoids are frequently very low water-soluble compounds and Drug Delivery Platform

based on Self-assembled Nanoparticles can be a promising delivery system to enhance drug solubility and targeted delivery. In this study, we describe Bioactive Natural Products as building blocks for a Drug Delivery Platform based on Self-assembled Nanoparticles. According, three molecules derived from *Plectranthus* spp. were employed as lead molecules for the synthesis of self-assembled nanoparticles. In recent years, the use of drug-conjugates, usually obtained by covalent coupling of the drug with biocompatible lipid moieties to form nanoparticles, has gained considerable attention. Different approaches have been reported to enhance penetration of small drugs through physiological barriers, among them is the self-assembly drug conjugates preparation shown to be a promising approach to improve activity and penetration, as well as to reduce any side effects. The royleanones were conjugated with squalene, oleic acid, and/or 1-bromododecane self-assembly inducers, and conjugates were successfully synthesized and characterized. Bioactivity was assessed suggesting these nano assemblies can act as prodrugs for the release of cytotoxic lead molecules.

Rainer W. Bussmann

Prof. Dr. Rainer W Bussmann earned his M.Sc. (Diploma) in Biology at Universität Tübingen, in 1993 and his doctorate at Universität Bayreuth in 1994. He is an ethnobotanist and vegetation ecologist, and currently Head and Full Professor at the Department of Ethnobotany, Institute of Botany, Ilia State University, both of which he co-founded. Before moving to Georgia, Dr. Bussmann was director of William L. Brown Center at Missouri Botanical Garden, William L. Brown Curator of Economic Botany, and Senior Curator. Before accepting the directorship of WLBC, he held academic appointments as Research Fellow in Geography and the Environment at University of Texas at Austin from 2006 to 2007, as Associate Professor of Botany and Scientific Director of Harold Lyon Arboretum at University of Hawaii from 2003 to 2006, and as Assistant Professor at University of Bayreuth from 1997 to 2003, following a postdoc at the same institution from 1994 to 1997. He holds affiliate appointments and serves as external thesis advisor at universities worldwide. His work focuses on ethnobotanical research, and the preservation of traditional knowledge, in the Andes, Caucasus, and the Himalayas. Dr. Bussmann has authored over 330 peer reviewed papers, over 1200 peer reviewed book chapters, and authored or edited 38 books. According to Stanford University, he is one of the most cited ethnobotanists and recognized among the 2% most influential scientists worldwide. He is past President of the Society for Economic Botany and has served as board/council member of the International Society for Ethnopharmacology, Society of Ethnobiology, Botanical Society of America, and International Society of Ethnobiology.

Quo vadis Ethnopharmacology?

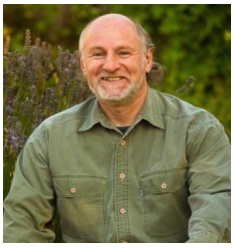
Rainer W. Bussmann

Staatliches Museum für Naturkunde, Erbprinzenstrasse 13, 76133 Karlsruhe, Germany
AND, Ilia State University, Institute of Botany and Bakuriani Alpine Botanical Garden, Department of Ethnobotany, Botanical Str, 0105 Tbilisi, Georgia

Ethnopharmacological has changed greatly over the last few decades. On the scientific side, research has moved from simple inventories of mostly medicinal plants, to detailed quantitative studies, and the elucidation of active compounds. Both developments are highly important but have also led to some disadvantages. On one hand, the focus on compounds and efficacy has led to a decline of publications on field studies, e.g., in the Journal of Ethnopharmacology. On the other hand, the very widespread use of statistical indices in ethnopharmacological field research has led to a virtual inflation of index use, with the other often applying only one index and wrongly extrapolating on plant importance from this, or

applying multiple indices, but coming to wrong conclusions, especially with regard to the "usefulness of plants for further drug development." This lecture will focus on both problems and give an outline on where Ethnopharmacology might go.

Roy Upton



Roy Upton is the founder and president of the American Herbal Pharmacopoeia (AHP) and also serves as its chief editor. He has been working professionally as an herbalist for more than 40 years and is trained in Ayurvedic, Chinese, and Western herbal medicine traditions. In recent decades, Roy has focused on promoting quality control standards for botanical ingredients by integrating the most authoritative of traditional knowledge with the most up to date scientific information available. Roy was the recipient of the Outstanding International Ethnopharmacologist award by the Society for Ethnopharmacology in 2020 and the Excellence in Botanical Research award from the American Society of Pharmacognosy in 2012.

Development of an Ashwagandha Monograph and Therapeutic Compendium for the American herbal Pharmacopoeia

Roy Upton

Founder and Executive Director, American Herbal Pharmacopoeia, Scotts Valley, USA

In recent years, interest in ashwagandha has grown exponentially and was the fourth best-selling botanical supplement in 2021. A primary driver of this increased popularity is the desire for consumers to be well and take proactive measures to stay healthy. Increased demand for botanicals often brings with it challenges in maintaining a consistent supply and limited supplies encourages the inclusion of adulterations. Ensuring the proper identity, quality, purity, and potency of ashwagandha requires a variety of standards that go beyond standard pharmacopoeial monographs but also includes an intimate knowledge of traditional Ayurvedic medicine and plant assessment. This is especially challenging due to the presence of at least six chemotypes of *Withania somnifera*. In 1999, the American Herbal Pharmacopoeia produced a *Monograph and Therapeutic Compendium* for ashwagandha. Since then the market has changed dramatically, while the science has continued to evolve. In collaboration with researchers at the Institute of Bioresources and Sustainable Development, Imphal, AHP has begun a revision of this earlier work to foster a greater degree and quality assurance in North American ashwagandha products.

Rudolf Bauer

Rudolf Bauer studied pharmacy and got his PhD at University of Munich, Germany; 1993 he became Associate Professor at University of Düsseldorf, Germany; since 2002 he is full professor of pharmacognosy at University of Graz, Austria. He has acted as Head of the Institute of Pharmaceutical Sciences from 2004–2020. Since 2007 he is director of the TCM Research Center Graz (Medicinal Plant Research). He is expert in natural product chemistry, analysis, and activity-guided isolation of plant constituents. His current research focuses on phytochemical and pharmacological investigations of traditionally used medicinal herbs, identification of the active constituents, plant metabolomics and interactions with gut microbiota. He acted as president of the International Society of Ethnopharmacology from 2015-2017, of the Society for Medicinal Plant and Natural Product Research (GA) 2002-2007, and as founding president of GP-TCM Research Association during 2012-2014. He has published more than 400 research papers and has edited several books. He is chairman of the expert groups 13A and TCM of the European Pharmacopoeia Commission. He received several awards, like

the Qihuang International Prize of China Association of Chinese Medicine, the Outstanding International Scientist Award (Pranab Banerji Memorial Award) of Society for Ethnopharmacology India (SFE), the Varro Tyler Prize of the American Society of Pharmacognosy, the Government Friendship Award of the Peoples Republic of China, and the honorary doctorates of the universities of Helsinki/Finland and Szeged/Hungary.

Metabolic and pharmacological profiling of the TCM formula Hanshiyi used for the treatment of COVID-19

Stefanie Tiefenbacher[1], Yanyan Zhou[2], Weihao Wang[2], Min Li[3], Chensi Yao[3], Xiaowen Gou[3], Yan Zhang[2], Mengxiao Wang[2], Xiaolin Tong[3], Rudolf Bauer[1]

[1] University of Graz, Institute of Pharmaceutical Sciences, Department of Pharmacognosy, Beethovenstrasse 8, 8010 Graz, Austria

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During the Covid-19 pandemic, TCM has been an important support of the Chinese health care system. Besides others, the National Health Commission of China has recommended the use of Hanshiyi formula (HSYF) for Covid-19, which consists of 20 ingredients (*Arecae semen*, Armeniacae semen, *Atractylodis macrocephalae rhizoma*, Atractylodis rhizoma, *Crataegi* fructus, *Cynanchi paniculati radix et rhizoma*, *Dryopteridis crassirhizomatis* rhizoma, *Ephedrae herba, Eupatorii herba*, *Gypsum fibrosum,* Hordei Fructus Germinatus, Lepidii semen, Massa medicate fermentata, Magnoliae cortex, Notopterygii rhizoma, Pheretima, Pogostemonis herba, Poria, Tsaoko fructus, and *Zingiber isrhizomarecens*). In a retrospective cohort study, it has exhibited a significant reduction of severe cases in the treated group. In a joint project between China Academy of Chinese Medical Sciences and TCM Research Center Graz, the pharmacological effects of HSYF shall be investigated, and quality control methods shall be developed. We are now presenting the results of HPTLC, LC-MS and GC-MS analyses. HPTLC was able to produce a typical fingerprint for every individual herb of HSYF and can be used for initial quality control of the ingredients. In the mixture, 8 herbs could be identified on the basis of typical marker compounds by HPTLC. By UHPLC MS analysis, so far 10 of 19 herbs could be identified in the methanol extract of HSYF based on marker compounds. 27 main compounds of HSYF were quantified by LC-MS. In addition, we identified 52 volatile constituents of HSYF by GC-MS analyses.

Satyajit D Sarker

Prof Satyajit D Sarker, Professor of Pharmacy & Director (Executive Head) of School of Pharmacy and Biomolecular Sciences, is the Founding Head of Centre for Natural Products Discovery at Liverpool John Moores University. He is a Visiting Professor at East Anglia University and has served at Taylor's University and Wuhan Botanical Garden - the Chinese Academy of Sciences in the same capacity. He obtained BPharm and MPharm in Pharmacy from Dhaka University, and PhD in Phytochemistry from Strathclyde University, Glasgow. Previously, he held academic posts at Wolverhampton University, Ulster University, The Robert Gordon University and Exeter University. He is the author of over 670 publications, and one of the most cited authors (*h*-index 63 & *i*-10 index 340) in phytochemistry. He is the Editor-in-Chief of *Phytochemical Analysis* and *Journal of Natural Products Discovery*, and former President of *Phytochemical Society of Europe.* He is in the Editorial Board of *ca.* 40 international journals including *Biochemical Systematics and Ecology, Current Medicinal Chemistry*, *DARU, Diversity, Journal of Pharmacy and Pharmacology, Molecules, Pharmaceutical Sciences*, and *Phytomedicine Plus,* and has served as a reviewer for about 100 different journals. He co-authored *Chemistry for Pharmacy Students* (Wiley & Sons) and Steorid Dimers (Wiley & Sons) and co-edited both

the 2nd and 3rdeditions of *Natural Products Isolation* (Humana Press-Springer-Verlag), published in 2005 and 2012. Some of his publications are *Computational Phytochemistry* (Elsevier, 2018), *Medicinal Natural Products – A Disease-focused Approach* (Elsevier, 2020), *Handbook of Dietary Phytochemicals* (Springer-Nature, 2021). *Recent Advances in Nanotechnology-based Drug Delivery Systems* (Elsevier, 2022) and *Biomolecules from Natural Sources: Advances and Applications* (Wiley and Sons, 2022). His scientific profile has been published in every edition of the *Marquis Who's Who in the World* since 2010.

ChemopreventiveNatural Products: One of the Key Research Areas at the Centre for Natural Products Discovery

Satyajit D. Sarker[1], Lutfun Nahar[1,2] and Kenneth J. Ritchie[1]

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The old saying 'prevention is better than cure' is still relevant when it comes to prevention of cancer. Globally, cancer is one of the major causes of mortality and morbidity in humans. Worldwide, an estimated 19.3 million new cancer cases and approximately 10 million cancer deaths occurred in 2020, and the number of cancer sufferers is set to increase in the coming years because of adverse changes in environmental conditions and lifestyle arising from increasing urbanisation and socio-economic changes. The currently available treatment modalities for cancers are expensive and time-consuming; they suffer from serious side-effects and have limited effectiveness. Therefore, while the search for new cancer chemotherapeutical agents continues, various initiatives for finding ways to prevent cancers from happening in the first place have also started. One of those initiatives is to find natural products that can help prevent cancers. It has been demonstrated that certain dietary phytochemicals can potentially prevent the occurrence of cancers. Numerous attempts have been made to identify natural products that have cancer chemopreventive potential; cancer chemoprevention being the generic term used to describe the process of using a chemical to prevent cancer. However, the main emphasis has mainly been given to food plants; non-food plants have mostly been overlooked in relation to chemoprevention. Whilst the search for new and more effective anticancer drugs from natural origins will still remain one of the major areas of modern drug discovery operations, the importance of finding effective cancer chemopreventive agents from natural sources cannot be overstated, especially considering the huge spending in healthcare for the treatment of cancers. This talk will present an overview on available chemopreventive natural products, their possible mechanisms of actions, and most importantly, a summary of research carried out at the Centre for Natural Products Discovery, involving chemopreventive agents from higher plants, utilising the mechanistic approach of induction of Nrf2 activation as an indicator for cancer chemoprevention.

Sitesh C Bachar

Dr. Sitesh C Bachar is serving as Dean, of the Faculty of Pharmacy, and a Professor in the Department of Pharmacy, University of Dhaka, Bangladesh. He joined Department of Pharmacy, Faculty of Pharmacy as a Lecturer in 1997. Before joining Department of Pharmacy, he received his B.Pharm and M.Pharm degrees from the University of Dhaka. He was awarded Ph.D. in Pharmacy from Jadavpur University, West Bengal, India in 1996. He is a well-recognized medicinal chemist, with particular expertise in the synthesis of Indian-based anti-inflammatory, analgesic, plant growth regulatory compounds, and structure-activity studies. He also possesses special expertise in isolation, purification, and pharmacological evaluation of

Bangladeshi traditional and herbal medicines and their quality. He is an innovative researcher as well as an accomplished teacher in the higher education sector. As an academician and experienced in hospital and clinical pharmacy management, Prof. Bachar has implemented clinical and hospital pharmacy training in Bangladesh for his students at Dhaka Medical College Hospital. Dr. Bachar has published several publications in high-impact international journals in the area of medicinal and natural product chemistry. Over the years, Prof Bachar has shown his ability to sustain high-quality research activities, excellent academic profile, and a lot of collaborative skills. His teamwork and motivating ability are evident in his research, engaging a number of collaborators from various research groups from home and abroad. He is a member of various professional and volunteer organizations. He has also journal editorial advisory memberships, grant reviewing, and journal article reviewing expertise.

Export Potentiality of Bangladeshi Medicinal Plants: The Present Status

Sitesh C Bachar

Department of Pharmacy, Faculty of Pharmacy, University of Dhaka, Dhaka-1000, Bangladesh

The demand for treatment using traditional and complementary medicine (T&CM) is growing. As there has not yet been a study to identify key challenges in this sector in Bangladesh to examine the prospects of the herbal items and discuss the opportunities in new export arenas in order to diversify medicinal products, a baseline study was conducted to picture the overall scenario and gave appropriate recommendations on how to develop this sector. Participants in this survey study activity included 115 manufacturers and 15 wholesalers. A systematic questionnaire designed specifically for data collection via direct interviews, phone calls, and emails was employed. After compiling replies based on the questionnaire, the data was loaded into SPSS program and results were represented using frequencies, means, and percentages. Among 115 manufaturers 40.9% was Unani, 25.2% was Homeopathic, 24.3% was Ayurvedic and 8.7% was Herbal manufacturer companies. Results revealed that among 115 companies 35.7% (41) use 61-90 raw materials among the 158 raw materials provided in the data sheet. The 28.7% (33) and 25.2% (29) companies use 0-30 and 31-60 ranges raw herbs respectively. Only 4 companies use more than 150 plant raw materials. From the studied companies, it was found that only 1.7% and 3.5% of manufacturing companies export raw materials/ingredients and finished products respectively from Bangladesh. Among the wholesalers, it was observed that 93.3 percent of them who took part in the study import raw materials from other countries. The importation of any type of finished or semi-processed goods, however, are prohibited. Bangladesh imports a sizable quantity of medicinal plants every year, despite the fact that domestic products can satisfy the majority of local demand. The mostly used locally grown raw plant materials are basak (*Justicia adhatoda*), amloki (*Phyllanthus emblica*), ginger (*Zingiber officinale*), neem (*Azadirachta indica*), ashwagandha (*Withania somnifera*), and tulsi (*Ocimum sanctum*) and are the potential components for export from Bangladesh.

Sri Fatmawati

Sri Fatmawati has completed her M.Sc. and PhD from Graduate school of Bioresources and Bioenvironmental Sciences, Kyushu University, Japan. She recieved her Postdoctoral training from Kyushu University, Japan and Lemar, Iuem, Brest France. She is currently serving as an Assistant Professor at Department of Chemistry, Faculty of Science and Analytical Data, at Kampus ITS Sukolilo, Jalan Arif Rahman Hakim – Surabaya, East Java, Indonesia. She is also Chair of Organization for Women in Science for The Developing World (OWSD) – Indonesia National Chapter, President of Indonesian Young Academy of Sciences, Head Deputy of Agrifood and Biotechnology Research Center, Head of Policy and Community Service for Its Covid-19

Task Force and Executive Committee of Global Young Academy in Indonesia. She has been awarded with a series of National and International Awards like the APEC SLP Best Creative Award 2022, The FP UGM - Timmerman award 2021, The Most Favorite Speaker on Virtual Summer School "Indonesian Natural Product Chemistry" Indonesia University of Education (UPI) , 2020-2021, Anugerah Wira Adhiacarya Award 2018, Special Award for LNest Grant 2018, Award International Scientific Publication Reward in 2016, The Elsevier Foundation Award for Early-Career Women Scientist in the Developing World in the field of Biological Sciences in East and South-East Asia and The Pacific 2016, Washington DC USA, Early Career Chemist Award in 2015, Kartini Award "The Most Inspiring Woman in 2015, Inspiring Female Scientist from Indonesia Euraxess Links ASEAN E-newsletter in 2015 and International L'Oreal-UNESCO for Women in Science (FWIS) 2013, L'Oreal-UNESCO in 2013. She has published in 58 national and international journals, has published 7 books and 10 patents.

Jamu: Indonesian Traditional Medicines

Sri Fatmawati

Laboratory of Natural Products and Synthesis Chemistry Department of Chemistry, Faculty of Science and Analytical Data Kampus ITS Sukolilo, Jalan Arif Rahman Hakim – Surabaya, East Java – Indonesia 60111

Indonesia's natural wealth has provided abundant resources to maintain the existence of herbal medicine. From generation to generation, herbal medicine is known as Indonesian Traditional Medicine which has recently been in great demand even to all corners of the world. This traditional herbal medicine comes from medicinal plants that are believed to be efficacious by the surrounding community. This is both an opportunity and a challenge for us. Research on the bioactivity of various medicinal plants as raw materials for herbal medicine has been widely studied in Indonesia, such as antioxidants, antidiabetic, antibacterial, and antifungal. It has even become the focus of our research, the Natural Product and Synthetic Chemistry Laboratory, Department of Chemistry – ITS. Research on the bioactivity of medicinal plants that is the focus of research is plants used as traditional herbal medicines including temulawak (*Curcuma xanthorrhiza*), meniran (*Phyllantus niruri*), medicinal mushrooms (*Ganoderma lucidum*), mangosteen (*Garcinia mangostana*), ginseng (*Panax ginseng*), Moringa leaves (*Moringa oleifera*), bay leaf (*Syzygium polyanthum*) and others. This shows that the raw materials of medicinal plants in herbal medicine are very useful in increasing immunity, preventing several diseases, and increasing stamina.

Yuan Shiun Chang

Dr. Chang is a Professor of Pharmacognosy at College of Chinese Medicine, China Medical University, Taichung, Taiwan. Professor Chang engage in the quality control studies of TCM herbs for many years. Heis the PI for the compilation of the 2nd,3rdand 4theditions of both Chinese and English version of Taiwan Herbal Pharmacopeia (THP) which were promulgated and published by ministry of Health and Welfare from 2012 to 2022. He has also been invited since 2011 to join Hong Kong Chinese Materia Medica Standard Project, Department of Health, Hong Kong. Professor Chang is nominated as USP HMC East Asia Expert Panel member (EP) (2015-2025) and USP Botanical Dietary Supplements and Herbal Medicine Expert Committee (EC), (2020-2025). He is also anEuropean Pharmacopeia EDQM TCM Working Party Member, 2017-2022. Professor Chang is also appointed as Honorary Professor of Hong Kong Baptist University (2019-2025). To date, he has published 160 scientific papers and 27 books in TCM related fields.

Taiwan Herbal Pharmacopeia and Quality Control of TCM Herbs and Herbal

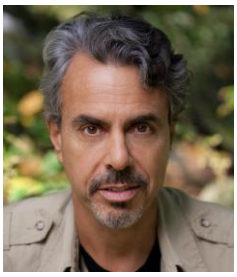
Preparations in Taiwan

Yu Ling Ho[1], Yuan Shiun Chang[2]

[1]Department of Nursing, Hungkuang University, Taichung 433, Taiwan
[2]Department of Chinese Pharmaceutical Sciences and Chinese Medicine Resources, College of Chinese Medicine, China Medical University, Taichung 404, Taiwan

Traditional Chinese Medicine has been very popular in Taiwan in the past. TCM was incorporated in the National Insurance since 1995. Currently, TCM only accounts for less than 4% of total National Health Insurance annual budget. By September 2006, all herbal pharmaceutical companies in Taiwan were upgraded to GMP standard. Currently there are 82 GMP herbal pharmaceutical companies in Taiwan and are moving toward CGMP standard. Taiwan Herbal Pharmacopeia IV (THP) sets the quality standard of TCM herbs and herbal preparations in Taiwan. In this paper, the compilation of Taiwan Herbal Pharmacopeia (THP) (II, III, IV), English version of THP (II, III, IV), Color illustrations of THP, Illustrations of Commonly Misused Chinese Crude Drug Species in Taiwan, etc., will be covered. The method development of microscopic identification, TLC and HPLC will be introduced.The safety limit of sulfur dioxide residue, heavy metal contents, organochlorine pesticides and aflatoxins in the herbs and herbal preparations will also be discussed. The regulations and quality control practice of Chinese medicine in Taiwan will also be introduced including the application of herbal preparation licenses. The authors also like to share some of the works they did in the Hong Kong Chinese Materia Medica Standard Project since 2011. The work in USP Herbal Medicine Compendium, East Asia Expert Panel, USP Botanical Dietary Supplements and Herbal Medicine Expert Committee and EDQM TCM Working Party, European Pharmacopeia will also be shared.

Chris Kilham



Chris Kilham is a medicine hunter, author, educator and TV personality who promotes natural, plant-based medicines, sustainable botanical trade and indigenous cultures. He has conducted ethnobotanical plant research in 45 countries and lectures worldwide about holistic wellness and botanical medicines. Chris helps to develop and popularize traditional medicinal plants, including kava, maca, rhodiola, ashwagandha, ayahuasca, tamanu oil and dozens of others. He has been featured in The New York Times, Outside Magazine, Forbes, Psychology Today, The Wall Street Journal, Newsweek, CNN, NBC Nightly News, The Dr. Oz Show, Fox News Health, ABC Good Morning America, ABC Nightline, and many other top-tier media venues. He has written 15 books, and speaks on medicinal plants all over the world. The New York Times calls Chris “Part David Attenborough, part Indiana Jones.”

Plants, People and Places

Chris Kilham
Medicine Hunter
Ethnobotany and Botanical Trade

In the world of medicinal plants, the plants themselves, people and places form a constant triune. Anywhere on earth that plants are utilized, whether in arid deserts or lush rainforests, people do the work. In many venues plants and their natural origins are well represented. Yet there is greater opportunity to share more of the ethnobotanical dimensions, the relationships between people and plants and cultures. Since the 1980’s medicine hunter Chris Kilham has traveled extensively around the globe conducting ethnobotanical work with medicinal plants, herbs and spices, fruits and oils. Most of this work has been conducted on behalf of commercial entities in natural health, pharma and cosmetics, with the intentionof bringing these botanicals to market via sustainable chains of trade. Drawing on botanicalexplorations in over forty-five countries and relying heavily on an insider’s

photographs from the fieldwe'll examine people of various cultures working with plants in many ways, from wild collection and harvesting, to cultivation, drying, cleaning, shipping, and making formulas and remedies.

Hung-Rong Yen

Professor Hung-Rong Yen is a physician scientist. He currently serves as the Dean of College of Chinese Medicine at China Medical University, and the Director of Integration of Chinese and Western medicine in China Medical University Hospital, Taiwan. He earned his M.D. degree with double majors in Western and Chinese medicine at China Medical University, Taiwan. Afterward, he completed clinical training both in Western medicine (pediatrics) and Chinese medicine in Chang Gung Children Hospital and Chang Gung Memorial Hospital, respectively. He also earned his Ph.D. degree in Chang Gung University, including a 3-year research fellowship in immunology at Johns Hopkins University School of Medicine, U.S.A. His research interest involves Chinese medicine and immunology. As a physician scientist with dual clinical training in Western medicine and Chinese medicine, he has become a leading advocate of the integration of Chinese medicine into conventional care and builds bridges between doctors of all backgrounds. Professor Yen is ranked as the "World's Top 2% Scientists" through Scopus's paper influence data. His clinical practice with integrative medicine has received 2 Symbol of National Quality (SNQ) Awards in Taiwan. His research output in Chinese herbal medicine has also received 1 National Innovation Award in Taiwan.

Immunological modulation and epigenetic modification by chinese herbal medicine for the treatment of asthma in taiwan

Chuan-Teng Liu[1], **Hung-Rong Yen**[1,2]

[1]School of Chinese Medicine, College of Chinese Medicine, and Chinese Medicine Research Center, China Medical University, Taichung, Taiwan
[1,2]Division of Integration of Chinese and Western Medicine, Department of Chinese Medicine, China Medical University Hospital, Taichung, Taiwan

Traditional Chinese medicine (TCM) has been practiced in Taiwan for hundreds of years. Our previous big-data analysis showed many asthmatic patients seek complementary TCM treatment. Herein, we took Chinese herbal compound, pterostilbene, as an example to investigate its effects and mechanism for the treatment of asthma. Airway hyperresponsiveness (AHR), interleukin (IL)-4 and IL-13 levels, IgE, IgG, pulmonary infiltrated monocytes and eosinophils, and mucosubstances were measured in house dust mite (HDM)-induced asthmatic mice under pterostilbene treatment. Bioenergetic metabolism, PI3K-mTOR signaling, GATA3 expression, and histone acetylation in pterostilbene-treated Th2 cells were as well as the immune response in the pterostilbene-treated PBMCs of patients with asthma was investigated. Pterostilbene improved HDM-induced pulmonary allergic airway inflammation by inhibiting Th2 cell and eosinophil accumulation in HDM asthmatic mice. Targeting glycolysis resulted in IL-4 inhibition via the downregulation of mTOR, GATA3, and histone acetylation in pterostilbene-treated Th2 cells. Glucose supplementation rescued Th2 activation and eosinophilic maturation. Pterostilbene reduced CD4+IL-4+ cells in the PBMCs of patients with asthma. Pterostilbene attenuates HDM-induced asthma via inhibition of the Glut1/mTOR/GATA3 axis in Th2 cells. In conclusion, our study provides the first evidence for the translational potential of pterostilbene in the treatment of allergic airway diseases.

Caroline Sonja Weckerle

Dr Weckerle is currently working as head of academic affairs Botanical Garden, Institute of Systematic and Evolutionary, Botany, University of Zurich. Prior to her current position she performed as Oberassistenz" (Lecturer), Institute of Systematic and Evolutionary Botany, University of Zurich, Postdoctoral researcher at the Institute of Systematic and Evolutionary Botany, University of Zurich. She worked as a Ph.D. student at the Institute of Plant Biology and at the Institute of Systematic Botany, University of Zürich (1998 - 2003) and a diploma student at the Institute of Systematic Botany, University of Zürich (1996 - 1998). She is a member of several professional bodies as the board of trustees member ProSpecieRara (PSR), President board of trustees Stiftung Joseph Gnädinger, President of mensa commission UZH, Board member of the International Society for Ethnopharmacology (ISE), Founding member of Ethnobiology.ch, the Swiss Network for Ethnobiology. She has published many research papers in reputed journals and guided many PhD and master's students.

Trends of medicinal plant use over the last 2000 years in Central Europe

Weckerle C.S.

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Medicinal plant knowledge in Central Europe can be traced back from the present to antiquity, through written sources. Approximately 100 medicinal plant taxa have a history of continuous use. Here we focus on use patterns over time and the link between historical and traditional uses with the current scientific evidence. We discuss our findings against the backdrop of changing eras and medicinal concepts. Based on use-records from totally 16 historical, popular and scientific herbals, we analyze how use categories of 102 medicinal plant taxa developed over time. Overall, 56 of the 102 taxa maintained continuous use throughout all time periods. For approximately 30% of the continuous uses, scientific evidence supporting their use exists, compared to 11% for recently added uses and 6% for discontinuous uses. Dermatology and gastroenterology are use categories that are relevant across all time periods. They are associated with a high diversity of medicinal taxa and continuously used medicinal species with scientific evidence. Antidotes, apotropaic magic, and humoral detoxification were important use categories in the past. New applications reflecting biomedical progress and epidemiological challenges are cardiovascular and tonic uses. Changes in medicinal concepts are mirrored in plant use and specifically in changes in the importance of use categories. Our finding supports the concept of social validation of plant uses, i.e., the assumption that longstanding use practice and tradition may suggest efficacy and safety.

Roodabeh Bahramsoltani

Roodabeh Bahramsoltani has been graduated with Pharm.D. degree and then, Ph.D. of traditional pharmacy from Tehran University of Medical Sciences, Tehran, Iran. She is now an Assistant Professor of Traditional Pharmacy, as well as the Vice Dean of International Affairs at school of Persian Medicine, Tehran University of Medical Sciences. She has authored more than 50 international papers and five book chapters. She is interested in the development of natural medicinal preparations based on Persian medicine text books and evaluation of their pharmacological activities in animal/ cellular models.

Evidence-based Persian Medicine

Roodabeh Bahramsoltani

Department of Traditional Pharmacy, School of Persian Medicine, Tehran University of Medical Sciences, Tehran, Iran

Persian Medicine (PM) is one of the oldest medical doctrines all over the world which turns back to thousands of years ago and is mostly known with the pioneer physicians such as Avicenna and Rhazes. In line with WHO policy to integrate traditional medicines into national health systems, schools of PM were established in 2007. Since then, a growing body of evidence is provided by PM scientists as publications in international journals, so that several of the PM treatments are now supported by clinical evidence. Accordingly, Iran was announced to be the fifth most productive country in the ethnopharmacological literature between 2011-2018, as reported by *Journal of Ethnopharmacology*. Also, Scimago has ranked Iran as the forth country with the highest number of publications in the field of Complementary and Alternative Medicine in 2021. Taken together, schools of PM could successfully provide evidence for the integration of PM into health system; however, a long path still lies ahead of evaluating PM hypotheses, as well as demonstrating the clinical safety/efficacy and mechanisms of action of PM treatments. International collaborations with experts in the field of natural products would be a great opportunity for further development of research in this regard.

Diamanto Lazari

Professor Diamanto Lazari has worked since 30 years in the isolation, the structure elucidation and the biological activities (antioxidant, anti-inflammatory, antimicrobial, anticancer) of secondary metabolites from natural sources. Her research activity is directed toward the study of bioactive molecules found in endemic plants of Greek flora which are of interest in biological and/or alimentary fields, as well as the study of Essential Oils. Her experience includes diverse phytochemical groups (polyphenolic compounds, terpenes, sesquiterpene lactones, iridoids, volatile compounds and essential oils, polysaccharides, alkaloids, etc.) from many plant species, while she has special knowledge of the laboratory methods used for the analyses of plant extracts. She is or has been supervisor or member of the advisory committee of several MSc theses and doctoral theses. She has numerous publications in international peer-reviewed scientific journals and announcements in International and Greek Congresses. She served as a member of the Scientific and/or Organizing Committee of several Congresses. She has participated in successfully executed research proposals either as Principal Investigator or as Group Leader.

Exploring the medicinal potential of plants of the genus *Achillea* L. (Asteraceae)

Diamanto Lazari

Aristotle University of Thessaloniki, Faculty of Health Sciences, School of Pharmacy, Laboratory of Pharmacognosy, Thessaloniki, 54124

The genus *Achillea* is one of the most important in Asteraceae family comprising more than 130 species growing wild worldwide but are mainly distributed in the northern hemisphere. The genus *Achillea* in Greece comprises about 25% of the genus' diversity, namely 32 species and subspecies including seven Greek endemic ones. Today, many of *Achillea* species have been traditionally used by local people as folk or traditional herbal medicines in wound healing, for abdominal pain, against diarrhea and flatulence, for symptomatic relief of colds and ulcer, and as diuretic or emmenagogue, appetizer, carminative, and as insecticidal

agents. Moreover, they are used as additives in food products, in gardening as ornamentals or for cut flowers while their essential oils and extracts are also used in cosmetology. This work focuses on the study of the following species collected from various places of Greece, where the species growing wild: *A. abrotanoides* (Vis.) Vis., *A. ageratifolia* subsp. *aizoon* (Griseb.) Heimerl, *A. chrysocoma* Friv., *A. clypeolata* Sm., *A. coarctata* Poir., *A. collina* (Rchb. f.) Heimerl, *A. crithmifolia* Waldst. and Kit., *A. fraasii* Sch. Bip., *A. grandifolia* Friv., *A. holosericea* Sm., *A. millefolium* L., *A. nobilis* L. and *A. setacea* Waldst. & Kit.

Min Ye

Min Ye is a Professor in Pharmacognosy at the School of Pharmaceutical Sciences, Peking University, China. He obtained his Ph.D. degree in 2003 at Peking University, and then completed his postdoctoral researches at Peking University, Louisiana State University, and Yale University School of Medicine (2003-2007). He joined the faculty of Peking University as an Associate Professor in December 2007, and was promoted to Full Professor in 2012. He is currently Vice Dean of the School of Pharmaceutical Sciences, Peking University, and Deputy Director of State Key Laboratory of Natural and Biomimetic Drugs. His research interests are focused on (1) elucidation of the effective components of traditional Chinese medicines, and (2) biosynthesis and biocatalysis of natural products. He has published >250 peer-reviewed research articles in SCI-indexed journals including *PNAS*, *J Am Chem Soc*, *Angew Chem Int Ed*, and *J Nat Prod*. These articles have been cited by >8000 times. Currently, he serves as an associate editor for *J Ethnopharmacol* and *Pharm Biol*. He is a member of the Chinese Pharmacopoeia Commission.

The effective components of Chinese herbal medicines and their biosynthesis

Min Ye

It is critical to elucidate the effective components of Chinese herbal medicines. However, this is challenged by the complicated chemical composition and various pharmacological activities of herbal medicines. On the other hand, the bioactive compounds of herbal medicines are mainly obtained by conventional extraction and purification, which is time and resource-consuming. This work mainly focuses on licorice, a popular Chinese herbal medicine. We established a series of new methods, systematically analyzed its chemical constituents, and discovered a series of bioactive compounds. Moreover, we discovered a number of novel biosynthetic enzymes from licorice and other herbal medicines, particularly *C*-glycosyltransferases, and interpreted their catalytic mechanisms by crystal structure analysis. These enzymes could be used as biocatalysts to synthesize target natural products with high efficiency and selectively

Ashiho A. Mao

Dr Ashiho A. Mao is the Director at Botanical Survey of India, HQ. Salt Lake City, Kolkata. He did his M.Sc. Bot. from Poona University (1988), M.Phil. Delhi University (1990) and joined as Scientist-B (1990) in the Botanical Survey of India. He obtained his Ph.D. from the University of Reading, U.K. (1996), specializing in plant tissue culture and allied techniques. He has over 30 years of research experiences in micropropagation of RET, Orchids, Rhododendrons, Medicinal plants, ethnobotany & floristic study especially of north east India. He has published over 170 Research papers both in national and international journals, co-authored 10 Books. He and his co-workers have described over 20 new taxa and 30 new records for India. He has guided 8 Ph.D. students under his guidance. He had also directed and produced four educational documentary video films. He is also a recipient of many National and International awards. He has visited many countries for attending conferences, meetings

and trainings. He is currently the President of Society of Indian Ethnobotanists and the President of Association of Plant Taxonomist. He is also life member of many National and International Societies. He is also member of various committees at National level.

Plant Wealth of North East India and its bio-economy prospects

Ashiho A. Mao

Botanical Survey of India, Kolkata

India is one of the 17th mega-diverse countries of the world with 4 Hotspot regions viz. Himalaya, Indo-Burma, Western Ghats & Sri Lanka and Sunda Land. The country occupies 2% of world's geography and contributes about 12% of world's known flora. North east India with its unique geographical location is home to about 50% of the total floristic wealth of the country.The region is considered as centre of origin as many primitive families are well represented for which Takhtajan (1969) had termed this region as the "cradle of flowering plants. The region also holds great significance from ecological and evolutionary point of view. It is home to many wild relative of cultivated plants such as Orchids, Musa, Bamboos, Citrus, Gingibers, Palms, etc. Vavilov (1926) considered the region as 'Hindustan Centre of Origin of Cultivated plants'. Crop Wild Relatives (CWR) have enormous genetic reservoir of genetic variation which is more or less closely related to a particular crop and to which it may contribute genetic material. This can provide food security enhancing agricultural production and sustaining productivity in the context of climate change. The region is rich in many important medicinal, wild edible vegetables and fruits and wild horticultural potential plants, such as orchids, balsams, rhododendrons, primulas, gingibers, ferns, bamboos, etc. The paper is intended to highlight the rich floristic wealth of north east India and bio-economic potential for the region's economy growth and well-being of the people.

Debprasad Chattopadhyay

Dr. Debprasad Chattopadhyay completed his M.Sc. in Plant Sciences in 1983, and PhD (Microbiology) in 1989 from Jadavpur University. He received Postdoctoral training at Royal-Hospital London and Staten-Serum-Institute Copenhagen on *Clinical trial of Fosfomycin*. He joined the CSIR-Indian Institute of Chemical Biology as Senior Research Associate in 1992. He started his scientific journey at ICMR-RMRC Port Blair in 1993, and then in ICMR-Virus Unit Kolkata in 1997. After serving 19 years as Scientist, Dr. Chattopadhyay was selected as the First Director of RMRC-Belgaum in 2016; which was upgraded to ICMR-National Institute of Traditional Medicine in February 2017. He has served as the Founder-Director & Scientist G till September 2021, and ranked 4th among top five ICMR-Scientists. Presently, he is associated with the School of Health Sciences, NSHM-Knowledge Campus Kolkata as Research Advisor. Dr Chattopadhyay is exceedingly contributed in discovering Ethnomedicinal leads against difficult-to-treat infections through documentation and validation of purity, safety and potency of healthcare practices of Indian tribes with animal efficacy and molecular mechanism. He has established personal contact with diverse ethnic-communities to validate age-old practices to translate traditional information(s) into medical innovation. Dr. Chattopadhyay is credited with 04 leads, 08 patents, 57 popular-science articles, 27 Review and Chapters, and 134 original research articles in peer-reviewed Journals of repute with 5 Books *Citations*-4711, *h*-index-38; *i*-Index-94.

Breaking the Barrier:**Antimicrobial Resistanceand Phytoantimicrobials**

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Globally antimicrobial resistance is a huge challenge. Although 'resistance' is a natural phenomenon its explosion is manmade, which is progressively going out of control. Traditional health-care system relies on age-old medicaments not only for primary care but also to counter infectious diseases. Traditional and contemporary literature revealed antimicrobial potentials of diverse plant extracts and phytomolecules. Studies indicated that scientific validation of traditional medicine and their integration with modern therapeutics may counter difficult-to-treat infection having narrow therapeutic window. Today almost all common antibiotics are ineffective; while several emerging and re-emerging diseases have no proper drug. To face this global threat scientific community is desperately looking into the natural products. Decades of scientific studies showed that secondary phytometabolites like Conessine, Berteroin, geranium, lysergol, tomatidine, *Trans*-cinnamaldehyde etc can eradicate biofilm, prevent/inhibit microbial entry-to-replication, modulate host-immunity to cell-signaling, fight invading microbes to reverse drug-resistance and so on. This presentation will display selected *in-vitro, in-vivo* and *ex-vivo* studies and trials of selected well-documented multi-targeted phyto-antimicrobials that alter microbial virulence-to-pathogenicity, to growth, damage cellular integrity to lysis, denature/inactivate proteins to enzymes.

Jyoti Prakash Tamang

Professor Dr. Jyoti Prakash Tamang is the Senior Professor in Department of Microbiology, Sikkim University and is the pioneer researcher in microbiology, meta-analysis and health benefits of the Himalayan and South East Asian ethnic fermented foods and beverages. He is a Fellow of Indian National Science Academy (FNA), Fellow of National Academy of Sciences, India (FNASc), Fellow of National Academy of Agricultural Sciences, Fellow of Indian Academy of Microbiological Sciences and Fellow of Biotech Research Society of India and recipient of Bio-Science Award of Ministry of Science and Technology. He has published more than 184 research publications including 8 books, 28 Book-chapters with more than 7700 citations and *h*-index of 50.

Indian Fermented Foods as Medicine: Metagenomics, Metabolomics and Metagenome Assembled Genomes

Jyoti Prakash Tamang

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Ancestors have innovated the ethno-microbiological knowledge of utilization of beneficial microorganisms present in eco-systems for production of perishable bio-resources to obtain the organoleptically and culturally acceptable ethnic fermented food. The novelty of application of metagenomics and metabolomics is the validation of science-based evidences on domestication of beneficial microbial communities, their functionalities, health-promoting benefits and disease-combating mechanisms. Sequence-based metataxonomic studies using shotgun sequences have revealed a huge microbial community structures in some Indian fermented soybean foods. The integrative metagenomes and metabolomics studies of some Indian fermented soybean foods have detected many untargeted metabolites including bio-peptides, immunomodulators, vitamins, etc, which are considered as the primary health-promoters to the consumers. Application of metagenome assembled genomes (MAGs) tool in some Indian fermented foods enabled to identify novel species and predicted their potential functionalities in a dynamic food ecosystem.

K. Thangaraj

Dr. K Thangaraj is presently Director of the Centre for DNA Fingerprinting and Diagnostics (CDFD) at Hyderabad. Prior to this, he was Chief Scientist and Group Leader at the Centre for Cellular and Molecular Biology (CCMB), Hyderabad. His main research interests are; origin of modern human, cardiovascular diseases, mitochondrial disorders, and male infertility. He has published more than 280 research articles, some of which are in *Cell, Lancet, Science, Nature, Nature Genetics*, etc. He is an elected Fellow of - Indian National Science Academy, Indian Academy of Sciences, and National Academy of Sciences. He is a recipient of several awards, including J C Bose Fellowship, Sun Pharma Research Award in Medical Sciences, Raman Research Fellowship, Life-time achievement Award, Excellence in Science Award, Distinguished Scientist Award, Sir CV Raman Memorial Lecture Award, Sir Dr. UN Brahmachari Award, and delivered several Orations. He is a Board Editor of *Mitochondrion*; Associate Editor of *BMC Medical Genetics*; *BMC Genetics; Tropical Medicine and International Health,* and member of the Editorial Board of the journals – *Scientific Reports, Human Genetics,* and *Clinical Genetics*. He was the President of the Indian Society of Human Genetics (2011 – 2015) and the founder of the Society for Mitochondrial Research and Medicine.

Population genomics and public health

K. Thangaraj

Centre for Cellular and Molecular Biology, Hyderabad, India; Centre for DNA Fingerprinting and Diagnostics, Hyderabad

India is a region of remarkable cultural, linguistic, and genetic diversity with over 4,500 anthropologically well-defined groups. Our genetic studies provided evidence that the enigmatic tribal populations of Andaman Islands are the first modern humans who migrated out of Africa. Subsequently, we demonstrated that the contemporary Indian populations have descend from two divergent groups: (1) Ancestral South Indians (ASI), (2) Ancestral North Indians (ANI); and these founding groups have admixed during the past 2000 – 4000 years. Since then, almost all the populations of Indian subcontinent have been practicing endogamy. To assess the impact of endogamy, we have analysed the DNA of more than 2,800 individuals from over 275 distinct South Asian groups from India, Pakistan, Nepal, Sri Lanka, and Bangladesh using about 600,000 genome-wide markers. We found that 81 out of 263 unique South Asian groups have a strong founder event than the one that occurred in both Finns and Ashkenazi Jews in the West – these are founder groups known to have large numbers of recessive diseases. We identified multiple examples of recessive diseases in Indian subcontinent that are the result of such founder events. Our study provides opportunity for discovering population-specific disease causing genes in communities known to have strong founder events. Mapping of mutations that are responsible for population-specific disease would help in developing strategies for diagnosis, counseling, management and modifying the clinical course of these disorders and to reduce the disease burden among South Asians.

K. Suresh Babu

Dr. K.Suresh Babu was born in Guntur District of Andhra Pradesh, India. Dr. K. S.Babu obtained his Masters in 1999 and Doctorate in Natural Product Chemistry in 2005 from Indian Institute of Chemical Technology (Degree awarded by Kakatiya University, Warangal). Later on, he moved to pursue his postdoctoral research at National Center for Natural Product Research, University of Mississippi, USA for three years. He returned to India and joined in CSIR service in 2007 at Indian Institute of Chemical Technology (IICT), Hyderabad.

Dr. Babu's research group has successfully isolated several new bioactive molecules from natural resources and He has published 180 papers in SCI journals and filed 12 patents of India, PCT & US. He is leading many projects of national importance in New Drug Discovery, Standardization of Herbal Drugs of commercial importance. His research interests are New Drug Discovery from Natural Products, Herbal Drugs and their standardization, botanical pesticides, chemical modification of lead compounds, and SAR studies. Dr. Babu is a recognized research guide for doctoral and post-doctoral programs and 9 scholars are pursuing under his able guidance and 21 scholars got the PhD Degree.

Recent approaches in natural products research for drug discovery

K. Suresh Babu

Natural Products & Traditional Knowledge, CSIR-Indian Institute of Chemical Technology, Hyderabad-500 007, INDIA

Concurrent with human civilization, plants have been their true companions as source of food and medicine. These plants have contributed significantly in discovery, design and development of several modern medicines. Recent move of society towards nature for the treatment of various diseases where there is no satisfactory cure in modern medicine has diverted the attention of natural/medicinal chemists and biologists to unravel their chemical characteristics and biological activities together in order to define their therapeutic potential in the light of modern pathobiological understandings. This move has led collectively to rediscover, design and refine the therapeutic application of medicinal plants. During last eight years, we have studied several medicinal plants guided by in vitro based bioassays to delineate the chemistry of medicinal plants responsible for biological activities. This effort has led to identify several potent multiple active medicinal plants, their active fractions and synergistic molecular compositions. We have identified particularly, several free radical scavengers, cytotoxic and α-glucosidase inhibitory principles present in substantial yield in Indian Medicinal Plants. Presence of multiple active phytochemicals in rich concentrations in some of the medicinal plants therefore offers exciting opportunity for development of novel therapeutics and also provides scientific justification for their use in traditional medicines. I will be talking about the various approaches for the discovery of novel potent molecules from various natural sources (terrestrial plants, marine and lichens).

Snehasikta Swarnakar

Dr Swarnakar is currently working as chief scientist at infectious diseases & immunology division, CSIR-Indian Institute of Chemical Biology, Kolkata - 700 032. Her area of resech is protease biochemistry, inflammation and redox biology, medicinal biology, gastric cancer and gastric inflammatory disorders. She has 110 research publication, 19 book chapter, 01 review, 03, patents with 3805 citations, 35 h-index. She has delivered 146 invited lectures. She has supervized 15 PhD, 07 post-doctoral and 36 master students. She has received many prestigious honours & awards. She is member of many professional bodies and received several fellowships of national & international academies and professional Societies.

Protection against gastric inflammation by herbal treatment via metalloprotease inhibition

Snehasikta Swarnakar

Chief Scientist & HOD, Infectious Diseases and Immunology Division, CSIR-Indian Institute of Chemical Biology, Jadavpur, Kolkata-700032

The major contributing factors for gastric inflammation are *Helicobacter pylori* infection, overuse of nonsteroidal anti-inflammatory drugs (NSAIDs) and stress. In addition, matrix metalloproteases (MMPs) activities have also been reported in gastric cancers and gastric diseases. We have identified a few MMPs (MMP-9, -3, -2 & -7) that play a crucial role in

loss of tissue integrity and remodeling of connective tissues during gastric inflammation. A few synthetic inhibitors such as hydroxamic acid-based MMP inhibitors have been developed. However, they proved to be disappointing as they lacked specificity along with toxicity issues in the physiological system. Natural products that inhibit specific MMP activity have always been of strong interest in drug discovery. Our laboratory has shown potent inhibition of MMP-9 expression and activity both in vitro and in vivo animal model by natural products such as tamarixetin 3-O-β-d-glucopyranoside (isolated from *Azadirachta indica)*, curcumin, quercetin, and shatavarin iv. These natural products inhibit MMP-9 activity either by directly binding to their active sites or through signaling cascades mediated primarily through transcription factors NFκB and AP-1. However, the need for clinical trials of these natural products remains crucial for the remedy of gastropathy.

Subarna Roy

A molecular epidemiologist by training, Dr. Subarna Roy is the Director of ICMR-National Institute of Traditional Medicine, Belagavi, Karnataka. He has worked extensively amongst vulnerable communities during outbreaks of infectious diseases and natural disasters. He established the Model Rural Health Research Unit of the Dept of Health Research in Raichur, an aspirational district in Karnataka. Dr. Subarna has been working at the interfaces of community & laboratory, modern medicine & AYUSH, Codified & Non-Codified systems, and research & policy. He has more than 100 publications, 3 patents and has operated more than 30 research projects funded by National and international agencies. Awarded with the University Gold Medal topping the University of Burdwan in West Bengal in 2007, Dr. Roy went on to receive KSTA Fellowship of Karnataka Govt, Major-General Sahaeb Singh Sokhey Award, the highest award of ICMR for work on infectious diseases and the SSMisra Memorial Award from the National Academy of Medical Sciences, New Delhi. Dr. Roy has guided 12 PhD scholars. His present focus is on integrating traditional and modern medicines for public health outcomes. At 49 years, Dr. Roy is the youngest among all Directors of ICMR Institutes across the country.

ICMR-National Institute of Traditional Medicine's contributions to TM research

Subarna Roy

ICMR-National Institute of Traditional Medicine, Belagavi, Karnataka, India

The National Health Policy of 2017 stresses upon making medical pluralism a reality in India. It promotes increasing access to AYUSH care based on documented & validated local home, and community practices. It has targeted meeting National health goals and objectives through integrative medicine, wherever applicable/feasible. Medical pluralism is achieved through practice of traditional/alternative/complementary healthcare alongside modern-day health systems. A strategy towards meet in medical pluralism goal is to integrate AYUSH practices, particularly for preventive and promotive health. The Indian Council of Medical Research (ICMR) is the premier health research body in the country that often provides crucial inputs for such program implementation. Although focused largely on modern medicine, leveraging Traditional Medicine is one of ICMR's five-pronged approaches to meeting its national priorities. The National Institute of Traditional Medicine (ICMR-NITM), located in Belagavi, is the ICMR's dedicated institute for such activities. ICMR-NITM attempts to influence public health outcomes by facilitating the integration of traditional medicinal practices with the modern health system through research, human resource development, and outreach. It researches both, traditional and modern medicine and works on aspects of traditional medicine that can be integrated into the current health system. NITM works at the interfaces of Traditional Medicine [Codified (AYUSH) and Non-Codified (Folklore/Ethnomedicine)] and Modern Medicine, Community/Hospital and Laboratory,

Research, and Practice at the Health Systems level. The domain of activities in Traditional Medicine includes documentation of ethnomedicinal practices, pharmaco epidemiology, pharmaco vigilance, laboratory validation of apparently safe/ useful practices (*in silico, in vitro*), pre-clinical studies (on toxicity/safety as well as efficacy), and clinical evaluation. It also works on the development of cost-effective traditional medicine-based healthcare products and technologies. NITM is presently in its 5th year of existence as a National institute. It has documented the use of over 500 medicinal plants for various conditions by folklore practitioners covering 5 states in the Western Ghats. It has made the data publicly available as a web portal. It has made a directory of traditional healers in the Belagavi district of Karnataka. It has validated a handful of traditional medicines for the management of osteoarthritis, cholera, hepatitis, and diabetes. NITM has proposed several traditional medicinal formulations for managing COVID-19, one of which has been patented for further development. It has also been working on improving the quality of life of cancer patients through the development of add-on herbal therapies and remedies. NITM has developed several methods and technologies for research and industry. It has also carried out clinical trials of two AYUSH drugs on Dengue and Non-Alcoholic Fatty Liver Disease. NITM has also been creating a cadre of integrative health researchers through its training and academic programs. The various contributions of ICMR-NITM in leveraging traditional knowledge for public health outcomes are discussed in the talk.

Sunanda Bhattacharyya

Dr. Sunanda Bhattacharyya is Associate Professor in Department of Biotechnology and Bioinformatics in School of Life Sciences, University of Hyderabad. She has received her PhD in Biophysics from Bose Institute, Calcutta and Master degree from Calcutta University. She has completed several Post-Doctoral training from 2004-2007 at School of Public Health and Tropical Medicine, Tulane University, New Orleans, LA, USA; 2002-2003 at Medical Biotechnology Center, University of Maryland Biotechnology Institute, Baltimore, MD, USA; 2000-2002 at Department of Biochemistry and Molecular Biology, Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD, USA. She has published about 30 research articles, and under her guidance, 29 students have completed their master's theses, 6 are now pursuing their PhD, and 13 project students have been mentored. She holds various research grants (as Principal Investigator) from Institute of Eminence, University of Hyderabad (IoE-UoH) (2022-2024); ICMR (2022-2025); DST (2018-2021); CSIR (2016-2019); DBT (2014-2018); CSIR (2012-2015); UPE (2012-2013).

Development of a high-throughput assay system for screening phytochemicals against plasmodium topoisomerase vi: a novel anti-malarial target

Sunanda Bhattacharyya
University of Hyderabad, Department of Biotechnology and Bioinformatics, University of Hyderabad, India

Topoisomerases are essential enzymes that are required for facilitating reversible conformation of DNA during various processes of DNA metabolism. *Plasmodium falciparum*, the causative agent of malaria, harbours a unique type II topoisomerase, namely topoisomerase VI, that is absent in human. Our study reveals that PfTopoVI is essential for decatenation of replicated chromosomes during endoreduplication. Endoreduplication is a non-canonical cell division, in which the parasite undergoes several rounds of nuclear, mitochondrial and apicoplast genome replication without cytokinesis. We found that inhibition of PfTopoVI causes the parasite-arrest at the schizont stage and thereby it delays endoreduplication. Subsequently, the parasites are unable to complete their life-cycle and fail to reach to the next developmental stages. Thus, PfTopoVI poses an attractive anti-malaria target. We have developed a yeast-based assay system in our laboratory to

screenfor small molecule inhibitors against PfTopoVI. We identified Radicicol, a compound of fungal origin, that inhibits PfTopoVIdecatenation activity and shows promising results when tested in parasite culture. However, Radicicol also displays off-target activity within the parasite. Hence it is important to find out specific inhibitors of PfTopoVI. Our system holds promises for high-throughput screening of various phytochemicals as potential inhibitors of PfTopoVI.

Pallab Kanti Haldar

Dr Haldar is working as Professor at Division of Pharmacology & Toxicology, Department of Pharmaceutical Technology, Jadavpur University, Kolkata 700032, India & serving as Director, School of Natural Product Studies, Jadavpur University, Kolkata 700032, India. His Current area of research are Bioassay guided isolation, purification and characterization of phytoconstituents, Preclinical Screening of medicinal plants against metabolic disorder., Preclinical screening of natural products against diabetes induced microalbuminurea, Standardization of Pharmacological screening on Zebrafish and Metabolomic studies and toxicity profile. He is member of several academic bodies including Association of Pharmaceutical Teachers of India (APTI), Association of Indian Pharmacological Society (IPS), Fellow of Indian Institute of Chemists (FIC), Executive secretary of Society for Ethnopharmacology, (SFE) India. He has publisehed 149 research articles, 01 book, 10 book chapters, 01 patent. His scopus h-index is 24. He has supervized 22 Ph. D. and 32 M. Pharm students.

Roll of medicinal plants to combat metabolic disorder with special emphasis on diabetes and related pathological complications

Pallab Kanti Haldar

Division of Pharmacology & Toxicology, Department of Pharmaceutical Technology, Jadavpur University, Kolkata 700032, India & Director, School of Natural Product Studies, Jadavpur University, Kolkata 700032, India

Diabetes is the largest metabolic disorder involving improper metabolism of carbohydrate, protein and fats. The disease is characterized by hyperglycemia, glycosuria, hyperlipidaemia and gradual loss of body weight. Due to change in food habit and life style in modern days the number of diabetes patients is increasing rapidly. Chronic hyperglycemic condition leads to development of diabetic related pathological conditions such as diabetic nephropathy, retinopathy, cardiomyopathy. Approximately 35% of type 1 diabetic patients develops diabetic nephropathy (DN), which is one of the major microvascular complication. It is the leading end stage renal disease of chronic diabetes which is characterized by interminable albuminuria, rise in arterial blood pressure, decreased glomerular filtration rate (GFR), and a high risk of cardiovascular morbidity and mortality. Therefore, the new approaches for the prevention and treatment of diabetes and diabetic related pathological conditions are needed to establish. Governments worldwide are struggling to meet the cost of diabetes care. Costs to employers and national economies are escalating and every day low-income families are being driven into poverty by loss of earnings due to diabetes and the life-long costs of healthcare. Already, 366 million people have diabetes and another 280 million are at identifiably high risk of developing diabetes. If nothing is done, by 2030 this number is expected to rise to 552 million with diabetes and an additional 398 million people at high risk. Natural compounds may be feasible alternatives for the treatment of diabetes or reinforcements to currently used medicines. They my even reduce the risk of disease. Large amounts can be consumed in everyday diet, which is a positive aspect. There is enormous source of medicinal plants in India especially in the Coastal region of Sunderban and North East Region due to its climatic variation. So the researchers have a huge scope to explore medicinal plants from NER for diabetes and related pathological complications.

Mukhlesur Rahman

Dr Mukhlesur Rahman is an Associate Professor in Pharmaceutical and Natural Products Chemistry and also Subject Area Head of Drug and Chemical Sciences at the University of East London (UEL). He leads the Medicines Research Group at UEL. He developed both BSc (Hons) Pharmaceutical Science and MSc Pharmaceutical Science courses at the University of East London. He is a Senior Fellow of the Higher Education Academy (SFHEA), Fellow of both the Royal Society of Chemistry (FRSC) and the Royal Society of Biology (FRSB). With PhD in Natural Products Chemistry from the University of Strathclyde and over 3 years postdoctoral research experience from the University of London (The School of Pharmacy; currently known as UCL School of Pharmacy), Dr Rahman's research focuses on anti-infective drug discovery from natural sources. His research interests include bioassay directed isolation, purification and identification of antibacterial metabolites from medicinal plants and microbes as well as the synthesis of their analogues. He has been working on numerous medicinal plants from different parts of the world for the isolation and characterization of bioactive metabolites from a variety of structural classes including anti-MRSA compounds and efflux pump inhibitors. In order to confirm the structures of the compounds of natural products, Dr Rahman exploits high field NMR spectroscopy and mass spectrometry. He has also carried out ethnopharmacological surveys to explore the traditional plants that are being used to treat infections. He has published 88 research articles in peer review journals and attended several international conferences in UK, USA, Switzerland, Austria, Greece, Bangladesh and India. He supervised PhD and MRes students, postdoctoral research fellows and professional fellows at the University of East London. His current postdoctoral fellows and PhD and MRes students are focusing on the characterization of anti-infective and anticancer compounds from medicinal plants. At the University of East London, he leads Medicines Research Group and coordinates Schoolwide research seminar series. Previously at Liverpool John Moores University he was Phytochemistry and Phytotherapy section lead of the Centre for Natural Products Discovery. In 2022, he received the Society for Ethnopharmacology (Affiliated to the International Society of Ethnopharma-cology) SFE-Annual Award: T. Sen Oration Award 2021 in recognition of international research profile with significant research contribution to Ethnopharmacology and Natural Products Chemistry. The award was conferred during the 8th International Congress of the Society for Ethnopharmacology, India (SFEC 2021) held at Pune, India during August 27-29, 2021.

How natural products could contribute to tackle the global challenges of antimicrobial resistance (AMR)

Mukhlesur Rahman

Antimicrobial resistance (AMR) is a vital problem of today's healthcare. Following the accidental discovery of the first antibiotic, Penicillin, from a mould *Penicillium notatum*, enormous number of antibiotics (natural, semi-synthetic and synthetic) have been discovered which transformed healthcare system contributing towards the successful treatment of various infections. However, microorganisms having the capability to mutate can resist the. Such antibiotic/ antimicrobial resistance has increasingly become a global challenge. Self-medication and irrational uses of antibiotics in some developing countries have made the situation even worse in the developing countries. During the COVID pandemic, the clinical uses of antibiotics to treat secondary infections could have also contributed to AMR. If no appropriate action is taken into consideration to tackle antimicrobial resistance, it has been predicted that AMR will be number one killer by 2050 with approximately 70 million deaths per year. Therefore, scientists are carrying out research to search for novel and safer antimicrobial agents from natural sources (plants, microorganisms and marine sponges) to tackle the terrible issue of AMR. The lecture will outline the causes of AMR, role of traditional medicine and microbes in drug discovery using bioassay directed isolation and identification approaches. Compounds to be highlighted

during the lecturer represent diverse chemical classes such as alkaloids, phenolics, flavonoids and isoflavnoids, lignans and terpenoids. Some compounds mainly acylphloroglucinols exhibited strong antibacterial activities against a panel of clinical isolates of Methicillin resistant Staphylococcus aureus (MRSA). The lecture will also cover total synthesis of a natural acylphloroglucinol and a series of its analogues.

Robindra Teron

Dr Teron is currently working as Director of the North Eastern Institute of Ayurveda & Folk Medicine Research (NEIAFMR), Arunachal Pradesh. Prior to joining his current position, he has been worked as an assistant professor at Assam University, Silchar (Diphu Campus). His major area of research is ethnobotany & folk medicine. He has guided 14 Ph.D. and 04 M. Phil students. He has published 82 research articles in reputed journals and edited 04 books. He has received many well-known awards and fellowships.

Folk Medicine: Underexplored healing traditions of national importance

Robindra Teron

North Eastern Institute of Ayurveda & Folk Medicine Research (NEIAFMR), (An Autonomous Institute under Ministry of Ayush, Govt. of India) High Region, Pasighat, East Siang, Arunachal Pradesh - 791102

Folk medicine is a form of traditional system of medicine consisting of healing practices and ideas of body physiology and health preservation known to some in a culture, transmitted orally, and practiced or applied by anyone in the culture having prior experience. With strong influence of religious beliefs and culture, folk medicine involves herbal medicine, spirituality charms, and manual therapies or exercises in order to diagnose, treat or prevent an ailment. Folk medicine is prevalent in many countries as source of primary healthcare needs for the reasons that indigenous people find the system more accessible, more affordable, and more acceptable. Being oral in nature (non-codified) and compounded by anthropogenic driven degradation of biodiversity and acculturation, traditional knowledge of folk medicine faces the risk of extinction if proper actions are not initiated in time. Folk medicine has served human society since history, yet it has remained underexplored and undervalued. This medical intellectual resource provides enormous opportunities for national development by addressing pertinent issues such as bioprospecting medicinal plant resource, drug development, affordable healthcare, protection of traditional knowledge and intellectual property rights (IPR), commercial cultivation of high value medicinal plants, livelihood enhancement, biodiversity conservation, etc. Academic and research organizations and industry can come together and work on the validation, development and integration of folk medicine to mainstream healthcare systems for human well-being. Folk medicine therefore, is an asset to the nation.

Chandana Choudhury Barua

Dr Barua is working as a Professor, Department of Pharmacology & Toxicology, college of Veterinary Science, Khanapara since 1985. She is the recipient of Assam Agricultural University's gold medal in BVSc & AH in 1983 and incidentally first lady to complete post-graduation in Assam in Veterinary Pharmacology from Haryana Agricultural University, Hisar in 1985. She completed her PhD from Banaras Hindu University in 1997, received DBT- CREST Fellowship in the year 2011 for Post-Doctoral Training in the University of Illinois, Chicago under renowned Scientist, Late Prof Ghanashyam Pandey. Dr Barua has completed 6 externally funded projects from various funding agencies like DRDO, NMPB, DBT and Indian Council of Agriculture Research (ICAR) and at present supervising 3 numbers of externally funded projects from ICAR, DRDO and DBT as Principal Investigator.

Dr Barua has attended atleast 40 national and International (IUPHAR, Beijing, 2006, CoVET, Prague, 2014), was awarded Best Scientist of Assam Agricultural University (2016-17), Fellow of Indian Society of Veterinary Pharmacology & Toxicology (ISVPT), in 2016, Fellow of National Academy of Veterinary Science (NAVS) and also Best local Coordinator of Society for Ethno pharmacology, India (2017) for her active contribution in the field of ethnopharmacology. As a freelance writer she has more than 200 publications of popular science articles in local English dailies of Assam. A patent has been granted for her work on a wound healing formulation, incidentally the first patent of AAU and CVSc, Khanapara.

Traditional herbal medicinal sources for clinical purpose: importance, challenges and future

Chandana Choudhury Barua

Department of Pharmacology & Toxicology, CVSc, Khanapara

India is known for its valuable heritage of herbal medicinal knowledge. Its ethnic people and tribal living in the remote forest areas still depend to a great extent on the indigenous systems of medicine. Though the North East reflects ecological and cultural contrasts between the hills and the plains, there are also significant elements of continuity. Though some of the tribal medicines have been already incorporated in the organized systems of medicine, much larger number of folk medicines has remained endemic to certain tribal pockets in North East India. Some knowledge on wonderful and effective medicines by the tribal acquired through the experience, are usually passed on by oral traditions as a guarded secret of certain families. Thus, the potentialities of ethnomedicinal studies in North East should be given the importance as it can provide us a very effective strategy for the discovery of more and potential useful chemical compounds. A detailed and systematic ethnobotanical study in the North East region is required as this may provide a meaningful way for the promotion of the traditional knowledge of the herbal medicinal plants/land races of crop plants. It is amazing to note that about 130 major tribal groups are settled in North East. So far, the different authors from the North East region have reported 1350 ethnomedicinal uses, 665 uses as food plants and 899 miscellaneous uses. It is known that the tribal people are not only familiar with the knowledge of plant species in their ecosystems, but also understand the ecological interactions of the various components of their resources. Once unearthed and conserved, this information can be utilized for the benefit of mankind at large. In Assam Agricultural University, various research workers have undertaken substantial amount work on validation of plants of ethno botanical importance. Govt funded projects have also helped to conduct such research work. A DRDO sponsored project on wound healing efficacy of few plants resulted the University's first patent, on a polyherbal formulation on wound healing. Few other plants like *Zanthoxyllum armatum, Gnetum gnemon, Elsholtzia communis, Homalomena aromatic, Clerodendron indicum, Potentilla fulgans, Ficus racemosus*, *Ficus hispida*, *Entada phaseoloides* etc were evaluated for analgesic, anti-inflammatory, anti-arthritic, cancer, diabetic neuropathy, anthelmintic activity to name a few besides antidepressant, anxiolytic, cognitive studies. Detailed study will be presented in the conference.

Mruthunjaya Kenganora

Prof. K. Mruthunjaya completed M. Pharm, in Pharmacognosy in the year 1999 from Govt. College of Pharmacy, Bangalore and PhD in 2009 from Rajiv Gandhi University of Health Sciences, Karnataka. Presently, Dr. Mruthunjaya is working as a Professor in the Dept. of Pharmacognosy at JSS College of Pharmacy, JSS Academy of Higher Education and Research, Mysuru, India. He has 22 years of teaching and research experience in the said college. His area of research is identifying, screening and validation of antioxidant herbs for their various biological properties especially for their hepatoprotective, anticancer, anti-

inflammatory activities. He has guided and Co-guided 24 M.Pharm students and around 20 PG Scholars of Medical, Dental and Life Sciences discipline. He has guided and co-guided 10 PhD Scholars. He is also visiting faculty of Govt. Ayurveda Medical College and Hospital, Mysuru. He is an External member of Board of Studies (BoS) for B.Pharm of RGUHS, Karnataka since September 2021. Presented several papers in national and international conferences and published 87 research and review articles in peer reviewed journals, 1 patent and 2 book chapters.

Traditional plants as memory enhancing agents: An attempt to relate phospholipids and memory

K. Mruthunjaya, R. Roopa, S. N. Manjula

JSS College of Pharmacy, JSS Academy of Higher Education & Research, Mysuru-570015

Worldwide, more than 55 million individuals live with dementia, with 10 million new cases every year. Alzheimer's disease is the most common form of dementia which contributes to 70% of cases. These diseases have been challenging since no potential drug is available to treat dementia with proven efficacy. Hence, it is worthwhile to explore the utility of traditional medicines in the various neurodegenerative diseases. Many traditional herbs and foods which contribute to good brain health, are found to contain phospholipids. Hence, we selected a few plants which contain phospholipids and carried out an evaluation of neuroprotective and memory-enhancing activity *in vivo* in scopolamine induced animal model. Behavioural Parameters viz Novel object recognition model and Morris Water Maze model were carried out. Biochemical parameters viz Lipid peroxidation, reduced glutathione, Nitric acid, Superoxide Dismutase activity, Catalase activity, Acetyl Cholinesterase (AChE) activity and Protein estimations were assessed in brain homogenate. Phospholipids were estimated by Bligh and Dyer method and also by HPLC methods. The correlation between phospholipids and neuroprotective activity was correlated and was found in varying degrees in different herbs.

Pramod J. Hurkadale

Dr . Pramod J. Hurkadale is Professor at Department of Pharmacognosy, KLES College of Pharmacy, Belagavi, Karnataka, India. He has completed his B. Pharm degree from Kuvempu University, Shivamogga and obtained his M. Pharm degree with distinction from Rajiv Gandhi University of Health Sciences. Bangalore. He has been awarded Ph.D. in Pharmaceutical Sciences from Rajiv Gandhi University of Health Sciences, Bengaluru under AICTE sponsored quality improvement program and also Diploma in Clinical Research from Catalyst Clinical Services Ltd, New Delhi. Dr. Pramod has put-up Twenty-Two years of teaching and research experience in UG, PG and guided 10 scholars for their Ph. D programs under KLE University. He has published and presented research papers in national and international journals/conferences and authored a book in Elsevier publishers, CBS publishers and book chapter in Studium Press, USA. He also been invited as speaker for international conferences at Malaysia, South Africa, Dubai, Brunei, Singapore, Thailand, Srilanka, Nepal, Egypt, Saudi Arabia, Bangladesh and Japan He has been awarded Best of the Batch Award from Zydus-Indon Cadila Health Care Ltd, Ahmedabad, Best Paper in International & National Conferences and Best Teacher Award. He is also the Member for various professional bodies APTI, ISP, SFE, KSPC etc. He has also worked as Secretary to organize several workshops/ conferences National and International which was sponsored by ICMR, AICTE, UGC, IPA, etc. and currently EC Member & Coordinator, Society of Pharmacognosy, India and Co-ordinator for society for Ethnopharmacology for Belagavi Chapter. His areas of research interest are, herbal formulations /excipients, biosurfactants, traditional medicines, ethnomedicinal plants and

their screening for various pharmacological activities and jointly collaborated with National Institute of Traditional Medicine, ICMR, Belagavi on tissue culture studies of Medicinal Plants from Western Ghats region.

Utilization Indian Traditional Medicinal Plants for Globalization

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The wealth of India is stored with enormous amount of flora and fauna that has been gifted to her and has been blessed with varied agroclimatic conditions and known as the botanical garden of the World. Ayurveda- Traditional system of medicine is practiced in India since time immemorial. For its acceptance across the globe as an effective healthcare system, emphasis is required to be placed on developing quality control parameters for the herbal constituents with the aid of convincing analytical tools. Authenticity of crude drugs, quality assurance of bioactive fractions, microbial load on herbal raw material, metallic impurities of finished herbal formulations, as well as, clinical and toxicity data of herbal ingredients are the major concerns required to be addressed by the Indian herbal drug industry for global acceptance of indigenous medicines. The Indian herbal medicines manufactured in accordance with the provisions of GMP have tremendous potential for global exploitation.

Sanjay Jachak

Dr Sanjay Jachak is Professor and Head, Department of Natural Product, National Institute of Pharmaceutical Education and Research (NIPER), Mohali–Punjab. He has completed his Ph.D. in the Institute of Pharmaceutical Sciences, Karl Franzens University, Graz, Austria-Europe in 1997. He received his M. Pharm. Degree from Pune University, Pune, India. He has 105 Peer reviewed publications in International Journals with h-Index: 33 as per Google Scholar Citations, Total citations: 4332. He has been granted 4 patents. He also developed product 'Immunebooster Herbal Tea' in 2021 during COVID-19 pandemic. He is recently featured in World's Top 2% Indian Scientists rankings-2022 in the area of Medicinal and Biomolecular Chemistry. He was honored as most cited paper award, Bioorganic Medicinal Chemistry Letters, 2005-2008. He has received Research Fellowship, Austrian Academic Exchange Service, Vienna, Austria from 1995-1998. He has research extramural grants (worth Rs. 5 crores) from CSIR, Deptt. of AYUSH and DBT, Govt. of India. Under his supervision, 14 students completed their Ph.D and 09 are currently working in his laboratory 105 students completed Master degree. He has served as an Associate Dean, NIPER-SAS Nagar from 2011-2012 and also currently serving the same for the session 2022-2023. He has been an In-charge, Small & Medium Pharmaceutical Industry Centre (SMPIC) at NIPER-SAS Nagar (2010-2011). He is still serving as a Course Coordinator for Indian Technical and Economic Cooperation (ITEC), Ministry of External Affairs, Govt. of India; sponsored training programs at NIPER-SAS Nagar from 2014.

Natural Products as source of Anti-Diabesity Agents

Sanjay M Jachak

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Obesity is a primary predisposing factor for metabolic syndrome encompasses abnormalities such as glucose intolerance, dyslipidemia, insulin resistance, abdominal obesity, and hypertension. Adipose tissue dysfunction, oxidative stress, β cell dysfunction are a few main causes of obesity. Present treatments available for diabesity include lifestyle changes, surgical treatments, and therapeutics for weight loss. The non-conventional approaches like

utilizingplant extracts and natural products can be considered for suppressing obesity. Our quest to search the leads for diabesity led us to a few promising medicinal foodplants like *Glycirrhiza glabra, Oroxylum indicum, Murraya koenigii, Senna siamea* etc. Isoliquiritigenin isolated from the dried roots and stolons of *G. glabra* showed antiobesity activity via pancreatic lipase inhibition and has with IC_{50} value of 7.3 µM. Barakol, cassiachrome and cassiarin B were isolated as anti-obesity phytomolecules from *Senna siamea* leaves. Cassiachrome (10mg/kg of body weight) dose supplementation prevented HFD-induced weight gain and reduced serum TC and TG in HFD group. Chrysin isolated from *Oroxylum indicum* prevented HFD weight gain relative to HFD fed animals at 15 and 30mg/kg of body weight. It further prevented visceral adiposity, reduce content of triglycerides and total cholesterol in serum, liver and muscle tissues significantly at both dose. Mahanimbine extracted from *Murraya koenigii* prevented HFD induced hyperlpidemia and fat accumulation in adipose tissue and liver along with restricted progression of systemic inflammation and oxidative stress in Swiss albino mice at 4mg/kg of body weight. These results from our lab revealed that natural products can be used as effective remedy against lifestyle diorders like obesity and diabetes.

Dr Sanjeeb K Sahoo

Dr Sahoo is a scientist at the Institute of Life Sciences, Bhubaneswar, India since 2005. He received his M.Sc. degree in 1994 and Ph. D in 1999 from the University of Delhi, Delhi. He served as a JSPS Postdoctoral fellow at the Department of Microbiology, School of Medicine, Kumamoto University, Kumamoto. He also finished his postdoctoral training from Nebraska Medical Centre, Omaha, USA including a 2 years' fellowship from American Heart Association. His Scientific Contributions include over more than 100 peer reviewed research papers including review articles and book chapters in leading scientific journals of the utmost quality in this field, such as Biomaterials, Future Nanomedicine, Molecular Pharmaceutics, Cancer Research, International Journal of Cancer, Journal of Controlled Release and many more. Dr Sahoo has been granted 4 US patents; one EU patent on Nanotechnology based targeted drug and gene delivery. He is one of the experts in the field of Nanotechnology based drug delivery system mainly in the field of Cancer. Recently, one of the patented technology have been transferred to a Pharmaceutical company in India for commercialization. Dr Sahoo is having h-index 57 and i10-index 112. Dr Sahoo's name has figured in the list of influential researchers of the world released by a US-based firm Clarivate Analytics on the basis of Citations in 2018. Dr Sahoo has also been featured as one of the top 2% scientists in the world in the field of Pharmacology and Toxicology in a study by Prestigious Stanford University, USA. Scientific and Professional Activities includes, Editorial board member of Current Nanomedicine, Clinical & Experimental Pharmacology, Nanomedicine (future medicine), Serving Section Editor (cancer section) of Current Pharmaceutical Biotechnology and members of different scientific organizations.

Ethnopharmacology and anticancer drug discovery: A journey with Nano-formulations

Sanjeeb Kumar Sahoo

Institute of Life Sciences, Bhubaneswar, Odisha-23, India

Cancer is the world's second-leading cause of death, and mortality rates remain high despite advances in diagnosis and treatment. Opportunistically, primitive ethnomedicines and mostly plant-derived forskolin, curcumin, catechin, nimbolide, and piperlongumine like many constituents, showed potential anticancer properties against various cancer cells. Therefore, scientific validation of primitive ethnomedicine is a focused area in anticancer drug discovery. However, phytochemicals have potent multimodal antiproliferative activity and cancer self-renewability potency, but low aqueous solubility and poor bioavailability reduce

target-based drug delivery in a biological system resulting in an obstacle to translational success and mainstream use. Thus, nano-formulation is the most alternative and cutting-age technology to utilize those active phytoconstituents by improving their solubility and bioavailability.Several nanoformulations were developed to improve the solubility, bioavailability, and target drug delivery of those active phytochemicals (forskolin, nimbolide, and piperlongumine), and their drug-ability profiles were investigated using various *in vitro* and *in vivo* models. Overall, the findings provide proof of concept that co-delivery of forskolin and paclitaxel achieves better tumour control, with forskolin efficiently reprograming cancer stem cells (CSCs) and paclitaxel simultaneously inducing cytotoxicity in both CSCs and bulk tumour cells. Similarly, nimbolide and piperlongumine-loaded PLGA-NPs inhibit breast CSCs by epigenetic and metabolic reprogramming, *in vitro*. Furthermore, *in vivo* results indicated that nano-formulation improved phytochemical pharmacokinetics, therapeutic, and anti-metastatic effects over their native form. The results showed that phytochemicals have greater anti-cancer potency, targeting multiple pathways, with nano-formulation being the main driver for success. Therefore, scientific validation of various ethnomedicines, herbal formulations, and derived phytochemicals is essential to fill the gap of anticancer drug unavailability and save our future generations by creating a sustainable and disease-free nation.

Sumeet Gairola

Dr. Sumeet Gairola is a plant scientist with over 15 years of research experience in the taxonomy and ecology of Western Himalayan flora. His work is focused on understanding the effects of altitude, slope aspects, and anthropogenic disturbances on the flora, species composition, regeneration, biomass, and carbon stocks of different forest types of Western Himalayas. He has extensively worked on the region's RET medicinal and aromatic plants and ethnomedicinal plants used by various indigenous communities of the Western Himalayas. He has published more than 80 research papers in various national and international journals. He has handled two industry projects and six research projects received from various funding agencies viz., UGC, CSIR, and DST. He is a nodal scientist of CSIR-Aroma Mission and co-nodal scientist of CSIR-Phytopharmaceutical Mission from CSIR-IIIM, Jammu. Under CSIR-Aroma Mission, as a nodal scientist from CSIR-IIIM, Jammu, he has managed the extension of some high-value aromatic crops in 10,000 ha area, benefiting more than 3500 farmers at various locations throughout the country. He received the National Environmental Sciences Academy (NESA) "Scientist of the Year Award 2016". As a Nodal Scientist of CSIR-Aroma Mission, he received the "Ultra International Team Award" for the innovative and meaningful efforts towards promoting the cultivation and processing of aromatic crops for improving the production of essential oils in India and enhancing the income of large numbers of farmers under CSIR-Aroma Mission. Recently he, along with his team, received the CSIR award for S&T innovations for rural development (CAIRD- 2020) for Purple Revolution in Jammu & Kashmir: Rural Development Through Lavender Cultivation in J&K.

Ethnomedicinal plants used by the indigenous communities of Ladakh, India

Sumeet Gairola

Plant Sciences & Agrotechnology Division, CSIR- Indian Institute of Integrative Medicine, Canal Road, Jammu-180001, Jammu & Kashmir, India

Ladakh, “the land of high-rising passes,” is a cold arid desert located in the northernmost part of the Trans-Himalayan region. Ladakh has a wide variety of habitats and plant species, and the inhabitants are knowledgeable about herbal

medicines. The present study aimed to document the traditional knowledge and current therapeutic practices of the indigenous communities of Ladakh. The ethnomedicinal information was gathered using semi-structured questionnaires from 350 individuals (221 males and 129 females) in 35 villages of 8 regions located between the altitude range of 2865 to 5035 m asl. An extensive literature review on ethnomedicinal field studies conducted in Ladakh was searched in scientific journals. The primary data was statistically analyzed using Use reports (UR) and Informant consensus Factor (ICF). The present study reported 176 medicinal plant species used to treat 115 diseases. A comparative analysis between the present and other local and regional studies showed a total of 517 plant species (502 earlier reported plus 15 novel species) presently used by the indigenous people of the Union Territory of Ladakh. An overlap of 146 species was found between the literature and the fieldwork data on medicinal usage. Out of 176 species, new medicinal uses were recorded for 30 species, and 15 species were recorded for the first time. Seventeen plant species were common and reported in all 8 study regions, and these plants also had high values of FC. The highest ICF values were reported for Pregnancy, Childbearing, and Family Planning (1), followed by respiratory problems (0.91), digestive (0.90), musculoskeletal (0.87), and skin (0.86). The highest similarity of plant uses for medicinal purposes based on the Jaccard index (JI) was reported between the region of Kargil, and Shargole. Species such as *Allardia nivea, Anaphalis nepalensis* var. *monocephala, Androsace mucronifolia, Cichorium intybus, Eriophyton tibeticum* would be interesting targets for drug discovery and needs further investigations. The study showed that the region has a rich medicinal wealth and that more research with an emphasis on pharmacological studies is needed to uncover useful bioactive compounds.

Saleemulla Khan

Dr. Saleemulla Khan obtained B. Pharm from Mysore University; M. Pharm and PhD. From Manipal Academy of Higher Education, Manipal, India. He started his career as pharmacist in Abu-Dhabi, UAE, and later turned to education as Lecturer in JSS College of Pharmacy, Ooty. He worked for Technology Information Forecasting Assessment Council's Centre of excellence in herbal drug research at Ooty. Later he joined Manipal College of Pharmaceutical Sciences, Manipal as Senior lecturer and went on to become Assistant professor Selection grade before he joined as principal. In 2018 July, Dr. Khan joined as Principal in P.A. College of Pharmacy, Mangalore. Dr Saleemulla Khan has more than 50 publications, 75 conference presentations, 5 book chapters to his credit. He has delivered 15 guest lectures. Dr Saleemulla Khan has received research grant from AICTE. He has guided 25 M. Pharm dissertations and a Ph.D scholar. He is recipient of "Best Audio-visual teaching material" award from MAHE, Young investigator from International Research Society of India, Best poster award at Euro-India International Conference on Holistic Medicine, Kerala. He has been an organizing secretary for the 6th International Congress of Society for Ethnopharmacology; local organizing committee member for APTICON held in Manipal and in the 62nd IPC which was also held in Manipal. Dr. Khan is a coordinator for the local chapter of Society for ethnopharmacology, Mangalore. He is member of Faculty of Pharmacy, Yenepoya University. Dr. Khan has visited several countries and presented his research work. He has been actively involved in anthropological work through his association with an NGO, Khurshid Foundation.

Lifestyle diseases; Herbal approaches

Saleemulla Khan

Professor and principal, P.A. College of Pharmacy,Mangalore

Non communicable diseases (NCD) kill about 40 million people globally each year making it to about 70% of all deaths. A Harvard study estimates about $6.3 trillion loss between 2012 and 2030 due to NCDs in India. With its rapid development and increasing urbanization, a large population is at risk of NCDs which can be directly articulated to Lifestyle. In 2016 about 63% of total deaths in India were attributed to NCDs. India is considered a young country at present but projected to double its aging population by 2050 (19.6%) that may shoot up the risk of Lifestyle diseases. Some of the common NCDs that can directly be related to lifestyle are diabetes, cancer, cardiovascular diseases, blood pressure/hypertension etc. A number of these diseases, either can be prevented or can be delayed in their onset by healthy lifestyle practices. Many of these diseases can be controlled or effectively managed by natural products. Our researched focused on some of these lifestyle diseases: Diabetes, antihyperlipedemic and antioxidant studies. The leading cause could be food habits and increasingly urbanized lifestyle. We investigated many commonly used kitchen herbs and tried to develop a herbal tea for the management diabetes. Antidiabetic, antihyperlipidemic and antioxidant activities of methanolic extract of whole plant of *Amaranthus viridis* (MEAV) in alloxan (ALX) induced diabetic rats was investigated MEAV at doses of 200 and 400 mg/kg showed significant reduction is blood glucose, lipid profiles and significant improvement in MDA, GSH, CAT and TT when compared to diabetic control group. *In vitro* α-amylase inhibition activity of MEAV was also studied. We concluded that MEAV possess antidiabetic, antihyperlipidemic and antioxidant activities. Methanol and Aqueous extracts of bark of *Cinnamomum tamala* and species of Cinnamon were screened by using α-amylase inhibition assay for antidiabetic activity. *Cinnamomum cassia* and *Cinnamomum zeylanicum* showed potent antidiabetic activity. Furthermore, *Cinnamomum zeylanicum* Blume bark, a spice commonly used in the Indian household has been shown to have insulin-like biological activity therefore oligomeric procyanidins (OPCs) rich polyphenol fraction from *C. zeylanicum* bark was isolated and an *in vitro* anti-diabetic activity was carried out. Osteoporosis. Bones and joints diseases especially brittle bones are common conditions in geriatric people moreso in women. We have investigated a number of herbal agents and developed dietary supplement for the management of osteoporosis. Ethanol extract of *Cissus quadrangularis* Linn. on ovariectomized rat showed significant improvement on bone formation and reduction in bone loss. Methanol extract of the fruits of *Morinda citrifolia* linn., restored bone loss in ovariectomized rats while Methanol extract of dried exudate of *Commiphora mukul* prevents bone resorption in ovariectomized rats significantly ($p<0.001$).

Dinesh Kumar

Dr Kumar is currentlt working as Sr. Scientist-NMR, Test Facility Manager, Nodal scientist for technical services & Asst. Professor (AcSIR), at Chemical Technology Division, CSIR-Institute of Himalayan Bioresource Technology, Palampur Himachal Pradesh-176061, India. His area of interest is NMR, Metabolomics, analytical chemistry, Natural product chemistry and value added product development from bioresources. Dr Kumar is member of many professional bodies as Member of Italo-Latin American Society of Ethnomedicine, Vigyan Bharti (Vijnana Bharti), Nagpur, Society of ethnopharmacology. He has been received many prestigious awards. He has published more than 100 resecrh articles in reputed journals. Dr Kumar has guided 03 PhD, 06 M. Pharma and 10 MSc students. He has H index: 24, I10 Index: 56 Total citations: 2108.

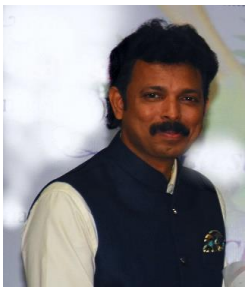
Metabolomics: A way towards metabolic information and quality control of Traditional medicine

Dinesh Kumar

Chemical Technology Division, CSIR-Institute of Himalayan Bioresource Technology, Palampur, Himachal Pradesh 176 061, India

Traditional medicines, a remarkable collection of herbal drugs made by ethnic communities that have been used from primitive age for health benefits. Therefore, peoples have shown great curiosity in medicinal plants and their derived products for lead discovery. Large utilization of these drugs affects the quality of desired product throughout the world. Hence, metabolomics is a tool that provides the comprehensive information (qualitative and quantitative) of chemical entities and quality controls. In the current studies, high throughput screening and multivariate statistical analysis-based metabolomics strategies were employed for comprehensive chemical information and quality control of *Crataegus oxyacantha* and *Mycrotyloma unifloram*. Finding revealed a chemical diversity and alterations in metabolites at different conditions. These insights were useful towards quality control and bio-prospection of ethnic traditional plant-based drugs.

L. Sathiyanarayanan



Dr. Sathiyanarayanan is Vice Principal and Associate professor in Pharmaceutical Chemistry, at Bharati Vidyapeeth Deemed to be University, Poona College of Pharmacy, Pune, Maharashtra, India. He graduated from The Tamilnadu Dr MGR Medical University Chennai, Tamilnadu, and completed PhD from Bharati Vidyapeeth Deemed University, Pune, India. He has published over 85 research papers in peer reviewed international journals and national journals and presented more than 80 papers in various conferences. He has delivered more than 70 invited lectures in various programmes including international and national conferences and Faculty Improvement Programmes for teachers. His area of research interest is natural product research specifically exploring role of natural products in neuroprotection particularly in Alzheimer's disease. He also has expertise in herb-drug interaction and herbal drug standardization techniques. He is the recipient of various research projects from various funding agencies including UGC, DST, National Medicinal Plant Board-Department of Ayush, AICTE and Industrial projects. He received several awards and recognitions including AICTE-'Career award for young teacher', The Best Researcher Award 2013 from Bharati Vidyapeeth Deemed University, IASTAM Baityanath award 2019, Dr. P.D sethi award of merit three times in the year 2011, 2012 and 2017, Best local chapter award from SFE India in 2020 and Special recognition award by SFE India 2021. His international visits include Switzerland, UK, Germany, Greece, Australia and Bangladesh. He is chairman Board of study, Bharati Vidyapeeth Deemed to be University, Co-ordinator for Society of Ethnopharmacology-Pune Local Chapter, Life member - Association of Pharmacy Teachers of India, Indian Pharmaceutical Association (IPA), IASTAM India, Secretary, IPA Pune branch, and approved research guide for PhD and PG students of Bharati Vidyapeeth Deemed University. He is serving as an Associate editor for the Pharm. Methods journal, and editorial board member of some journals and reviewer for several international journals.

Research potential of indian bee products

L. Sathiyanarayanan

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India is an agrarian nation with beekeeping still being traditionally and parallelly practiced, for increasing productivity and yield. Additionally, huge revenues are generated with the sale and export of good quality honey and beeswax. However,

there are other honey-bee-derived products of equal commercial value that are neglected and these are bee propolis, royal jelly, pollen, and bee venom. Propolis - a resinous matter composed of different plant resins collected by the bees during foraging mixed with its own salivary secretion deposited to seal cracks in the hive, whereas Royal jelly - a white, viscous superfood consumed by the queen bee is responsible for its prolonged longevity. Like honey, Propolis and Royal jelly are highly rich in bioactive compounds having distinct efficacies with significant nutritional properties and function values. Our research on standardized propolis and royal jelly extracts have resulted in ameliorating $A\beta_{25\text{-}35}$ as well as okadaic acid-induced memory deficits respectively, with improved anti-oxidant defense system and nutraceutical effects. In the case of Propolis, it's the synergistic effects of flavonoids and polyphenols present, whereas, in the case of Royal jelly, 10-hydroxy-2-decenoic acid (10-HDA) is the key bioactive compound. In another investigation, it was proven that the standardized propolis extract administered as a whole possessed much higher anti-tumor activity *in-vivo* than a single biomarker i.e. Caffeic acid phenethyl ester (CAPE). Therefore, from a commercial standpoint, comparative studies combining chemical and biological evaluation of standardized extracts still remain the key challenge for these bee products. So, with increased awareness and scientific evidence of its medicinal and nutritional value, the demand for other bee products would also increase thereby helping beekeepers to generate additional revenue.

Prasoon Gupta

Dr. Gupta has over 20 years of research experience in the field of Traditional Indian Medicines, and terrestrial, microbial and marine natural products chemistry. Dr. Gupta obtained his BS and MS degree in pharmaceutical chemistry from Devi Ahilya Vishva Vidhyalaya, Indore, India. He has started his carrier as a research scholar with Dr. K. K. Bhutani, one of the pioneers in the field of Natural Products chemistry, at NIPER, Mohali, India where he was associated with many projects of national importance, one to discuss is "Development of Herbal Pharmacopia for ISM Drugs" for quality standards of traditional medicines in India. Further, he obtained his Ph.D. degree in Natural Product Chemistry in 2007 under supervision of Dr. Rakesh Maurya, at Central Drug Research Institute, India. Due to his interest and outstanding research career he has been offered Senior Scientist position at NPMC Division, IIIM, Jammu, where he is currently working on "high-throughput identification of natural products from traditional medicinal plants,". Currently he is dealing with Phytochemical standardization of Ashtavarga Plants.

Discovery of novel steroidal saponins from rhizomes of *Trillium govanianum* and their potential anticancer activity

Prasoon Gupta[1,2]

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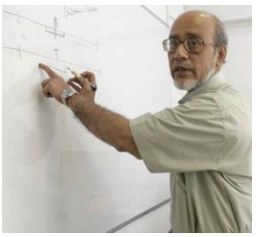
Trillium govanianum Wall. ex D. Don (Family Trilliaceae) is a threatened medicinal plant of the Himalayan region that has much therapeutic value. It is also known as Himalayan *trillium* or Nagchhatri with important phytoconstituents named as steroid saponins which are extensively used in the pharmaceutical industry. In our efforts, bio-activity-guided investigation of the rhizomes of *Trillium govanianum,* led to the discovery of two new steroidal saponins, trilliumosides A (**1**) and B (**2**), along with eight previously known compounds. The structures of the isolated compounds were elucidated based on the 1D, 2D NMR and mass spectrometry data. All the isolated compounds **1-10** were evaluated for their cytotoxicity against a panel of human cancer cell lines. Among the tested compounds, trilliumosides A (**1**) and B (**2**) showed the most promising activity against A-549 (Lung) and SW-620 (Colon) cell lines with IC_{50} values of 1.83 and 1.79 µM respectively. None of the tested known compounds (**2-10)** showed cytotoxicity below 10 µM. Further mechanistic studies indicated that trilliumosides B (**2**) inhibit the colony forming potential as well as *in-vitro* migration of A-549 cell line. Moreover, trilliumosides B (**2**) revealed nuclear morphological changes, increased generation of ROS, reduced MMP and induced apoptosis through upregulation of apoptotic proteins BAX and cleaved (active) Caspase-3 followed by down-regulation of anti-apoptotic protein BCL-2.

Partha P. Majumder

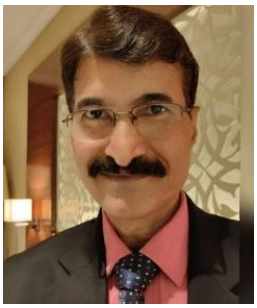


Partha Majumder is a National Science Chair of the Government of India, attached to National Institute of Biomedical Genomics in Kalyani, West Bengal, of which he is the founder. He is also an Emeritus Professor of the Indian Statistical Institute, and an Honorary Professor of Indian Institute of Science Education & Research, Kolkata and Mohali. Professor Majumder has made profound contributions to understanding ancestries and structures of ethnic populations of Asia, particularly of India, using anthropological, molecular genetic and statistical methods. He has also contributed to deciphering the genetic basis of many diseases, including cancers of high prevalence in India. He is an elected Fellow of all national science academies of India, of The World Academy of Sciences (TWAS) and of the International Statistical Institute. He has served as the President of the Indian Academy of Sciences and of the West Bengal Academy of Science & Technology. He serves on the Organizing Committees of the Human Cell Atlas and the International Common Disease Alliance. He is a member of the Executive Committee of the Human Genome Organisation (HUGO). He is a co-Chair of the Equity Working Group of the Human Cell Atlas. He is a recipient of many awards and medals, including the Biology Prize of The World Academy of Sciences, G.N. Ramachandran Medal of the Council of Scientific & Industrial Research, Govt. of India, Sir Prafulla Chandra Ray Memorial Medal of the University of Calcutta, the Golden Jubilee Commemoration Medal of the Indian National Science Academy and the New Millennium Science Medal of the Government of India.

Diversities, relationships and ancestries of population groups of India captured by genomic studies

Partha P. Majumder
National Science Chair (Scientific Excellence), Science & Engineering Board, Govt. of India
National Institute of Biomedical Genomics

Arvind Saklani



Dr. Arvind Saklani is working as the Vice President, Agri Biotechnology with Sami Labs, Bangalore. He has over 36 years of experience in identifying novel and potent plants for developing nutraceuticals and phyto-pharmaceuticals and in bioresources development and cultivation of medicinal plants. He did his post-graduation in Botany from Garhwal University in 1986 and Ph.D. from CSIR-National Botanical Research Institute, Lucknow in 1992. He has served as Assistant Professor, Natural Products at National Institute of Pharmaceutical Education and Research (NIPER), Mohali and Assistant Director at Piramal Life Sciences, Mumbai. Dr. Saklani is a biodiversity specialist and well-known ethnobotanist in India and has spent over 1200 days in Indian forests and among tribals for ethnobotanical and botanical explorations. In 1994, he worked in Amazonian forests, Brazil to study the tribal usage of medicinal plants common in India and Brazil through UNDP program. Dr. Saklani established a plant extract library of about 8500 extracts from 2900 plant species and was actively involved in identification of leads from strategically selected plants/ traditional/ ethnomedical knowledge and preclinical development of novel therapeutic leads. His focus is now on development of promising bioresources, commercial cultivation of medicinal plants and conservation of RET tree species. He has ensured plantation of over 50,000 trees of *Pterocarpus marsupium* in Madhya Pradesh and sign MoU for plantation of *Garcinia indica* in Maharashtra. Dr Saklani has worked on the Biological Diversity ACT and its Amendment related issues impacting the research and growth of Industry and submitted his inputs to the authorities. He has published quality papers. Two of his publications have crossed 400 google scholar citations. Dr Saklani has guided M. Pharm., M. Tech., M.Sc. and Co-guided 1 Ph.D. students. He has delivered several invited lectures. Dr Saklani is a fellow of many learned Societies and reviewer for several journals. Dr Arvind Saklani has been awarded with “Merit of Excellence Award” at Johns Hopkins University, Rockville, MD, USA in 2012; “Academic Excellence Award” by Indian Botanical Society, Mumbai Chapter in 2011, “B.N. Mehrotra Medal” by ‘Society of Ethnobotanists’, Lucknow, India, 2009, “Talented Scientist Award” in ‘International Seminar on Medicinal Plants & Herbal Products’ at S.V. University, Tirupati, 2008, ‘S. K. Jain Medal’ for young Ethnobotanist awarded by ‘Society of Ethnobotanists’, Lucknow, India, 2003 and “Young Scientist Award and Medal” at `35th World Congress on Natural Medicines’ at S.V. Univ., Tirupati, 1997. He is a Fellow of Society of Ethnobotanists, India Association of Angiosperm Taxonomy, and Association for Plant Taxonomy.

Contribution of Sami-Sabinsa Group in Establishing and Growth of Nutraceutical Industry in India

Arvind Saklani

Agri-Biotechnology, Sami-Sabinsa Group Limited, Bangalore

ABSTRACT FOR ORAL PRESENTATION

22nd International Congress of
International Society for Ethnopharmacology (ISE)
&
10th International Congress of
Society for Ethnopharmacology (SFE), India
on
"Reimagine Ethnopharmacology - Globalization of Traditional Medicine"

February 24-26, 2023

Institute of Bioresources and Sustainable Development

IMPHAL, INDIA

Oral Presentation

SESFEC/23/O-001

Phytochemical, computational and Biological Studies on the roots of *Leea macrophylla* (Family: Vitaceae)

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Tribal communities used plant parts of *Leea macrophylla* as remedy for a number of ailments as well as nutritional products. Powdered roots of the plant were extracted with methanol at RT and crude methanolic extract(CME) was further extracted with 50% Methanol in Ethyl Acetate (50%ME) which was subjected to vacuum liquid chromatography (VLC). Successive chromatographic separation and purification of selected VLC fractions provided five compounds. Structures of isolated compounds were elucidated as stigmast-4-en-3-one (1), arachidic acid (2), a methyl ester of fatty acid(3), stigmasterol(4) and *β*-sitosterol(5) by extensive analyses of their spectroscopic data as well as comparison with published values. Among these, compound 1 was isolated first time from this plant. For computational evaluation, isolated compounds 1 and 2 were docked with receptors responsible for diabetes mellitus and binding affinities of these dockings were measured and both the compounds were found to be potential antidiabetic candidates. For biological investigation, CME and its Kupchan fractions (hexane, HF; dichloromethane, DCMF; ethyl acetate, EAF and aqueous, AF soluble fractions) were subjected to assays for cytotoxicity, thrombolytic, antioxidant and antimicrobial activities. During brine shrimp lethality bioassay, HF demonstrated activity with LC_{50} value of 8.71 µg/mL but other fractions did not show any significant activity compared to vincristine sulphate (11.64 µg/mL). In thrombolytic assay, DCMF and CME showed highest activity (31.50% and 29.78% respectively) compared to standard streptokinase (33.6%), while other fractions exhibited mild activity. In antioxidant activity evaluation, EAF displayed significant free radical scavenging activity with IC_{50} value of 0.187 µg/mL as compared to standard *tert*-butyl-1-hydroxytoluene (BHT) (14.57 µg/mL). Finally, antimicrobial activity was assessed by disc diffusion method and EAF was found slightly active against *Bacillus cereus* and *Bacillus subtilis.* This plant can be studied extensively to find out its uninvestigated active constituents and to rationalize its traditional uses, especially as anti-diabetic herbal medicine.

ISESFEC/23/O-002

Taxus wallichiana needle extracts alleviates high-fat diet-induced insulin resistance in C57BL/6 mice; A Chemico-Pharmacological study

Monika Binwal[1,2], Sumati Sen[1,2], Monazza Israr[1,2], Anant Kumar[1], Dnyaneshwar U. Bawankule[1,2]

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Taxus wallichiana has an incredible history of use in traditional medicine for the management of various ailments. Traditionally the stem and needle powder has been used by local communities as a safe remedy in treating diabetes *and inflammation.*The main aim of the study is to investigate the pharmacological mechanism of taxoids of *Taxus wallichiana* against inflammation induced-insulin resistance in high-fat diet-fed C57BL/6 mice*.* All extracts were prepared from needle of *Taxus wallichiana* for *in-vitro* screening against inflammation-induced insulin resistance in Skeletal muscle cell line (L6) using glucose uptake assay. *Tw-Ethyl acetate (Tw-EA), a* most potent extract was chemically defined using standard HPLC method and further validated in physiological condition against high fat diet (HFD)- induced insulin resistance in C57BL/6 mice. *In-Vitro* screening demonstrated that *Tw-EA* is the most potent extract of *Taxus wallichiana* needles to reverse insulin resistance

condition in skeletal muscle cells. Oral treatment of *Tw-EA* exhibited reduction levels of circulating glucose, insulin, and pro-inflammatory cytokine production. Histopathological investigation showed that *Tw-EA* treatment is able to attenuate the adipocyte hypertrophy and inflammatory cell infiltration in skeletal muscles. The mRNA expression of insulin signaling pathway in skeletal muscle and adipose tissue of High Fat Diet-induced insulin resistance mice was significantly upregulated in treatment group when compared with vehicle treatment.These results suggested the suitability of taxoids rich extract for the management of inflammation linked insulin resistance in metabolic disorders.

ISESFEC/23/O-003

Prooxidant potential of *Citrus macroptera*: a folklore plant of Northeast India

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Prooxidative agents are currently becoming a favourable candidate to selectively target tumour cells. They are able to initiate a cascade of oxidative reactions leading to protein unfolding and DNA damages. Citrus macroptera commonly known as “Satkara”, is a semi-wild species of Citrus native to Southeast Asia and is an important herbal and medicinal plant. Its fruit is used as an ingredient in different types of meat and chicken dishes and pickle preparation and in folk medicine. In this study, the pro-oxidant potential of the fruit peel was studied in human non-small cell lung cancer cells, A549 cells. Prooxidant activity was determined by oxidation of Trolox and NADH. Cytotoxicity and flow cytometry analysis confirmed inhibition of A549 cell proliferation in a concentration-dependent manner with early apoptosis. qRT-PCR studies showed CPEA significantly upregulated p53, Bax, FasL, FADD and Bid mRNA expression levels and lowered Cdk1 and Bcl-2 compared to control. Caspase -9, -8 and -3 were also activated in cells treated by the peel extract. Phytochemical characterization of the extract through rigorous spectroscopic (UV, ^{1}H and ^{13}C NMR) and spectrometric (GC-MS, LC- ESI-HRMS) studies led to identification of fatty acids, coumarins, and triterpenoid. These results indicate that *C. macroptera* fruit peel extract acts as prooxidant and induces apoptosis in A549 cells.

ISESFEC/23/O-004

Integrating network pharmacology, molecular docking and MD simulation approach to elucidate the underlying pharmacological mechanisms of *Drynaria quercifolia* in the treatment of rheumatoid arthritis

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GC-MS based screening identified 41 bioactive compounds from the methanolic extract of *Drynaria quercifolia* (DME) with drug-like potentiality. Swiss Target Prediction (STP), Similarity Ensemble Approach, OMIM and DisGeNet databases were mined for information arelevant to the prediction of DME targets and rheumatoid arthritis (RA) related targets. Herb-compound-target-pathway network was built using Cytoscape.Protein-protein interaction network was also constructed and core target proteins were identified. Key targets and enriched pathways were examined by Gene Ontology and KEGG pathway analysis. Interaction between core target proteins and bioactive compounds was investigated utilizing molecular docking and MD simulation. Carrageenan-induced acute inflammatory model employed for further validation of therapeutic properties of DME. Network analysis revealed 117 potential targets of DME of which 11 have been identified as core targets. GO and KEGG analysis indicated that target genes were mostly enriched in the inflammatory response with multiple signalling pathways like PI3K-Akt, TNF, HIF-1, and

VEGF signaling playing a crucial role. Docking and molecular dynamics studies revealed that key target proteins like AKT1, PPARA, and PPARG, may have stable interaction with multiple components present in the DME and thus can be modulated by them. The animal-based study further validated that DME significantly ameliorated carrageenan-induced acute inflammation in wistar rat model.The results suggest that phytocompounds present in DME probably act in a synergistic way to modulate key targets of inflammatory pathways associated with RA and could provide an immunomodulatory therapy for RA and associated chronic inflammations.

ISESFEC/23/O-005

Ethnobotanical insulin plant *Costusigneus* as a novel herbal transdermal patch

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Costusigneus (Family: Costaceae) is being used by the aboriginal humans since long through oral route. In our laboratory, we used various biodegradable polymers, such as HPMC, for release control of this transdermal patch. Backing, Reservoir, Adhesive Layer, Porous Membrane and a temporary liner were used to give the formation of a patch. The leaves of the herbal perennial plant were made into smaller particle size. Water was used as a solvent and 1% Ethanol was added as preservative. Now, Chlorophyll was removed. Lyophilisation was performed to convert gel into a solid mass. Polymer-Controlled release was calculated to be >80% in 12 hours, in Franz Diffusion Cell. The Release Patterns were studied for Zero-Order, First-Order, Higuchi, Korsmeyer-Peppas, Hixson-Crowell pathways of equation for the determination of Release Kinetics, at progressive time intervals. We had received different Release and Unreleased patterns in a percent release mode; with different rate constant. We are opting for the release-kinetics to be matched with the release required at such intervals. This transdermal patch could be affixed in the lower abdominal region which releases intraperitoneally after principal meals, twice a day; which could be terminated instantly by removing the patch externally. Now, search is going on for the moiety which gives anti-diabetic activity and the scientists impact FLAVO-ALKALOID to be the prime medicament in diabetes. *Costus igneous* was phytochemically analysed to contain Alkaloid, Flavonoid, Triterpenoid, Saponin, Tannins and Glycoside. Whether an enzyme is present is under experimentation, by electrophoresis. Total Flavo-alkaloid was calculated after assay and the release pattern was also calculated with this. Total Quercetin content was used as the reference standard in the analysis using RP-HPLC. A complete Qualitative and Quantitative Microscopical visualization were performed in a target to determine the cell inclusions of this Organised Drug.

ISESFEC/23/O-006

Targeting dihydrolipoyl dehydrogenase, DLD suppressed *in vivo* melanoma tumor growth and proliferation

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Dihydrolipoyl dehydrogenase (DLD) is a mitochondrial flavoprotein with diaphorase activity. Cancer being a metabolic disease targeting the metabolic pathway is considered a promising approach in cancer therapeutics. Melanoma, the most severe form of skin cancer, has poor prognosis and is resistant to chemotherapy. Here we report that targeting DLD inhibits melanoma tumor growth and proliferation. Expression of DLD in HEMa, normal human melanocytes and A375 melanoma cells were determined by western blot analysis. A375 cells were transfected with a small hairpin RNA (shRNA) targeting human DLD to

obtain two stable clones with significantly downregulated DLD expression. Athymic Balb Nu/Nu mice were divided into 3 groups and subcutaneously injected with A375 cells (A375-C) and the two stable clones with downregulated DLD expression (A375-DLD1 and A375-DLD2) respectively.Tumor volume was estimated every other day with a digital caliper. The mice were sacrificed, and the tumors were collected. Formalin-fixed, paraffin-embedded tumor tissue sections were used for IHC, while snap-frozen tissues were used for western blot analysis. DLD is highly expressed in normal human melanocytes when compared to melanoma cells. H&E (hematoxylin-eosin) staining of the tumor xenografts indicated a significant inhibition of tumor growth in the DLD knockdown groups compared with that in the control groups. Moreover, IHC analysis of the tumor xenografts also revealed reduced proliferation as Ki67 expression was markedly reduced in the DLD knockdown groups compared with that in control groups. IHC and western blot analysis of tumor xenograft indicate that DLD protein expression was inhibited in the DLD knockdown group while LC3B protein expression was significantly increased in DLD knockdown group suggesting that DLD knockdown induced autophagy and inhibits melanoma tumor growth and proliferation. Thus, downregulation of DLD significantly inhibits *in vivo* tumor growth and proliferation.

ISESFEC/23/O-007

Scientific validation of an ethnoveterinary formulation used for wound healing

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From time immemorial ethnic communities use their indigenous knowledge as a way of life rather than knowledge to register or record. The need of the hour is to document the traditional healing practices, validate scientifically and promote the use and development of ethno-therapeutic products. It helps to develop new, safe and effective therapeutics and to preserve the cultural and biological diversities of the ethnic societies. A wound healing oil used traditionally by the Urali tribes, in Idukki District, Kerala, for treating their livestock was documented. The scientific validation of the wound healing property of the oil was done by incorporating phytochemical screening, *in vivo*, and *in silico* studies. The hydro-alcoholic extract (3:2 v/v ethanol and water) of the plant materials was used for the preliminary phytochemical screening. The oil prepared as prescribed by the traditional healers was evaluated in rat *in vivo* excision wound model. Acute dermal toxicity was also evaluated. The *in silico* study was also performed to analyse the phytoconstituents present in the polyherbal formulation to bind and act as positive regulators of two signaling proteins; casein kinase-1 (CK1) and glycogen synthase kinase-3β (GSK3B) of Wnt/β catenin pathway of wound healing. The botanical sources of the polyherbal wound healing oil was identified as *Allium sativum* L., *Curcuma longa* L., *Acalypha indica* L., *Azadirachta indica* A. Juss., *Lawsonia inermis* L., *Ocimum tenuiflorum* L., *Centella asiatica* L. Urb. in Coconut oil. In the excision wound healing study, topical application of the oil showed a significant reduction in wound area as shown by the percentage of wound contraction on 7th, 14th and 21st day, when compared to the control animals. The histopathological evaluation of skin samples also proved the wound-healing potential of the oil. In the molecular docking studies, out of 429 compounds screened 9 compounds showed better affinity to CK1 and 20 compounds showed better affinity to GSK3B with docking scores less than -10 Kcal/mol.The study reveals the efficacy of the wound-healing oil used by the Urali tribal community. The shelf-life study of the oil is in progress. The scientifically refined wound healing oil will facilitate the commercialization of the traditional practice with an assured benefit-sharing mechanism.

ISESFEC/23/O-008

Supplementation of standardized Kashmiri Saffron extract attenuates chronic scopolamine induced cognitive impairment and neurofibrillary tangles (nft) accumulation in rat brain

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Prevalence of brain related disorders like dementia, Alzheimer Disease are increasing at alarming rate due to stressful and modern lifestyle. Cholinergic system modulates memory and hippocampal plasticity, acetylcholine-neuromodulator, plays critical role in learning and memory. Scopolamine produces amnesia by blocking Acetylcholine. Chronic administration of scopolamine leads oxidative stress, and synaptic dysfunction. Kashmiri Saffron is one of the traditional herbs reported for memory enhancement as well antioxidants. The present study investigated the potential of Kashmiri Saffron Extract (KSE) to attenuate scopolamine (2 mg/kg, i.p) induced Cognitive impairment, amyloid plaque and Neurofibrillary Tangles (NFT) accumulation in rat brain.The experimental animals were divided in five groups of six in each, Group 1 control (salinetreated), Group 2 scopolamine (2 mg/kg,i.p), Group 3,4 and 5 rivastigmine tartrate (p.o.1.5 mg/kg), KSE (p.o.10 mg/kg and 20 mg/kg) respectively, and scopolamine (2 mg/kg, i.p) after 20 min. of dosing, till 4 weeks. Learning, acquisition and reversal memory were assessed by a Morris water maze. At the end of four weeks, brains were isolated to study biochemical parameters (AChE, IL-6, antioxidant), histological observation and to assess amyloid plaques and NFT. Scopolamine produce memory impairment and chronic administration of Scopolamine has formed amyloid plaque and NFT in rat hippocampus. Co-administration of 20 mg/kg KSE with scopolamine has shown remarkable effect on behavioral activity, special acquisition and reversal memory. The KSE has shown promising note in level of AChE and antioxidant capacities. Supplementation of KSE significantly attenuates the formation of amyloid plaque and NFT numbers in the hippocampus. In addition, KSE also counters scopolamine produced neuroinflammation. KSE could play protective roles against scopolamine-induced memory dysfunction and AD like pathologic dysfunctions, including amyloid accumulation, neuroinflammation and neuronal loss. Supplementation of KSE might be a promising prophylactic agent for memory and AD related dysfunction.

ISESFEC/23/O-009

Piperine attenuates cigarette smoke-induced oxidative stress, lung inflammation and epithelial-mesenchymal transition by modulating SIRT1/Nrf2 axis

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Piperine (PIP) is an alkaloid obtained from Black pepper, is a widely available molecule that exerts various pharmacological actions. Several evidences demonstrated that PIP imparts diverse properties like anti-inflammatory, antioxidant, and antitumor etc. To investigate the effects and the mechanisms of PIP on cigarette smoke (CS) induced oxidative stress,

inflammation, epithelial mesenchymal transition (EMT) related changes using *in-vitro* and *in-vivo* models. BEAS-2B and A549 cells were exposed to cigarette smoke extract (CSE) for 48 hr to induce cellular features of airway disease. Male Balb/c mice were exposed to cigarette smoke (9 cigarettes/day, 4 days) to induce features of airway diseases. PIP at a dose of (0.25, 1.25 and 6.25 µM, *in vitro*; 1 and 10 mg/kg, *in vivo*, *i.n*) and DEX (1 µM, *in-vitro*; 1 mg/kg, *in vivo*, *i.n*) was used to assess cytotoxicity, oxidative stress, EMT, Sirtuin1 (SIRT1), inflammation-related cellular signaling and lung function. PIP treatment protects the cells from CSE-induced lung epithelial cell death. PIP treatment restores the epithelial marker ($p<0.05$) and decreased the mesenchymal, inflammatory markers ($p<0.05$) in both in-vitro and in-vivo models. The PIP treatment improves the altered lung function ($p<0.05$) in mice induced by CS exposure. Mechanistically, PIP treatment modulates SIRT1 thereby reduced the inflammatory markers like, IL-1β, IL-6, and TNF-α ($p<0.05$), enhanced the epigenetic marker, HDAC2 ($p<0.05$) and antioxidant marker, Nrf2 ($p<0.05$) expression. PIP demonstrated protective effects via enhancing the SIRT-1 signaling, resulting in decreased inflammation, EMT-signaling, restored cell antioxidant mechanisms, sensitize corticoids resistance and finally improved lung function.

ISESFEC/23/O-010

Neuroprotective effects of ayurvedic edible crab Rasayana in a rotenone-induced Parkinson's rat model

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Ayurveda is the science of life or the art of living, and it is India's most indigenous system of medicine. Rasayana, or rejuvenating therapy, is a distinct branch of Ayurveda that is thought to be useful in overcoming modern-day diseases. Parkinson's Disease (PD) or Kampavata is the second most common neurodegenerative disease after Alzheimer's. The main hallmark of PD is the loss of dopaminergic neurons in the substantia nigra pars compacta and the subsequent loss of dopamine in the striatum. Dopamine is a neurotransmitter that controls movement. The current study investigated the neuroprotective effect of edible crab Rasayana, a traditional Ayurvedic formulation based on virgin coconut oil that is enriched with the flesh of freshwater edible crab and used to treat PD by local Ayurvedic practitioners in Kerala. Male Wistar rats are injected with rotenone (2.5 mg/kg body weight i.p) once daily for 10 days and Rasayana (400 mg/kg and 200 mg/kg body weight) was administered for another 21 days. Behavioral testing was carried out during the treatment period. Animals are sacrificed on the 21st day for biochemical analysis and compared to the vehicle-treated group. Rasayana treatment significantly reversed the toxic effects of rotenone by increasing dopamine levels, decreasing oxidative stress and neuroinflammation, and improving behavioral performance compared to the vehicle-treated group. The findings suggest that edible crab Rasayana can reduce the toxic effect of the neurotoxin rotenone. PD is caused by a multifactorial etiology, drugs with multiple targets, such as edible crab Rasayana, may have therapeutic potential for these pathologies and as such, it may be a useful molecule for alternative and complementary neuroprotective therapy. This is the first report to show these effects, and it adds to the evidence for the role of edible crab Rasayana in possibly improving quality of life.

ISESFEC/23/O-011

Kashmir Saffronbased enriched carotenoids botanical supplement and its role in women's health

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The prevalence of polycystic ovary syndrome (PCOS) has been gradually increasing among females at their reproductive age. Laparoscopy drilling on the ovary is the only available temporary solution with a high incidence of reoccurrence. Providing sufficient nutrients and energy for growth and reproduction depend on the definition of the optimal nutrient composition. Nutrition-associated signalling pathways play a central role in the regulation of ovarian follicle growth and ovulation rates. Therefore, nutritional supplementation may contribute to overcoming complications of PCOS such as immature oocytes, IR, hyperandrogenism, and oxidative stress. The latest research indicates that *Crocus sativus* extract (CSE) improves ovarian dysfunction, and regulates inflammatory genes, in testosterone-induced PCOS mice. Yet, the therapeutic effects and mechanism of action in humans need to be further explored. With this fact, the present study aims to propose a computational method to identify the therapeutic pathways of standardized stigma-based *Crocus sativus*-based botanical supplements with enriched bioactive carotenoids against PCOS. The information on PCOS-related genes was obtained from the PCOSKB database. A network containing the interaction between the putative targets of bioactive carotenoids and known therapeutic targets of PCOS was established and was used to investigate the pharmacological mechanisms of saffron phytoconstituents against PCOS. The results of protein-protein interaction showed that these carotenoids prominently bind to four targets namely, AKT1, STAT3, MAPK1, and MAPK3. Gene ontology (GO) and KEGG enrichment analysis suggest that these four pathways are involved in apoptosis, ErbB signalling, FoXO signalling, and mTOR signalling pathways in humans. Further, molecular docking and dynamics studies showed that Crocetin, Picrocrocin, and Safranal have shown the best binding affinity with AKT1, STAT3, MAPK1, and MAPK3 proteins. The composite results of the study strongly reveal that the stigma-based botanical extract could provide nutritional benefits to women with PCOS and overall women's health.

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Pharmacological profile of selected flavonoids present in fruit peels against inflammation induced insulin resistance in adipocytes.

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The fruits leave residues in the form of peels, pulp, seeds, and leaves. These residuals consist of various secondary metabolites which impart nutraceutical properties. *Citrus* and other fruits have been prescribed in traditional herbal medicine as the source of diabetic medication for diabetes. Flavonoids are the main bioactive compounds in these fruits/peels, with several biological properties, especially anti-diabetic activity. We evaluated antidiabetic activity of flavonoids present in fruits based on *in vitro* studies to unveil the role of selected flavonoids for treatment of diabetes. Selected flavonoids (Hesperidin, Naringin, Quercetin, Rutin) were evaluated for their anti-adipogenic activity by oil red O staining assay and for anti-diabetic activity by glucose uptake assay. Further, we examined whether flavonoids regulate the level of inflammatory cytokines in C6 glial cells. We have found that flavonoids exert their anti-diabetic effects increasing glucose uptake as well as exhibit significant adipogenic inhibitory activity in 3T3-L1 adipocytes. The images of stained lipid droplets in

different cells were captured with the help of microscope. This proved the consistent adipogenic inhibitory property of flavonoids.TNF-α and IL-6 Excretion from LPS stimulated C6 cells were significantly diminish by flavonoids at the dose of 10 µg/ml. Selected flavonoids demonstrating insulin reducing activity by reversing insulin resistance associated with inflammation. Further validation is needed in *in-vivo* condition to confirm its pharmacological profile in laboratory animals.

ISESFEC/23/O-013

Evaluation of the neuroprotective effect of cannabidiolin Alzheimer's disease

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Cannabis sativa commonly referred to as cannabis or hemp contains a molecule called cannabidiol (CBD) and one specific form of CBD is approved by FDA for its benefits in seizures. In addition, CBD is known to cure a variety of illnesses, including anxiety, pain, Parkinson's disease, Crohn's disease, dystonia, and many others. However, CBD has not been much studied for its effect on neurodegenerative disorders like Alzheimer's disease. This study aims to investigate the neuroprotective role of CBD in a beta-amyloid (Aβ)-induced AD preclinical model. The study was performed on Wistar rats where Aβ was injected through (ICV) on day 1 (5µg/5µl, unilaterally). For 21 days, CBD was given orally at doses of 20, 40, and 60 mg/kg body weight on a daily basis. The Morris water maze test was used to measure learning and memory in rats on the 7th, 14^{th,}and 21stdays after the start of dosing. A number of biomarkers were assessed in brain homogenates, including acetylcholinesterase, dopamine, noradrenaline, oxidative markers, inflammatory indicators, Aβ level, and ROS. Moreover, histo- and immunohistological analyses were carried out to look at cellular-level alterations in brain tissues. In addition to oxidative damage and a cholinergic deficit, the Aβ triggered severe learning and memory impairment in disease control animals, and in contrast to that, CBD treatments at various doses were able to dose-dependently lessen behavioral impairments as well as oxidative stress, and levels of inflammatory markers. CBD at 40 and 60 mg/kg was found to decrease levels of Aβ, and levels of ROS in the brain more significantly. Our finding indicates that observed cognitive improvement in the Aβ-intoxicated rats may be linked to the anti-inflammatory and antioxidant activity and APOe pathway of CBD restoration of cholinergic and lipid dysregulation functioning.

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Exploration of metabolic profiles and antidiabetic potential of the different varieties of cucumber (*Cucumis sativus* L.) fruit

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Cucumber (*Cucumis sativus* L.) in the Cucurbitaceae family is an economically important crop around the world. The cucumber varies significantly among cultivars. The fruits are used in the system of complementary and alternative medicine (CAM) since ancient times.The objective of this study was to explore the metabolic profiles and anti-diabetic potential of different cucumber varieties fruit. The metabolites in individual cucumber fruit extract were identified through a quadripolar liquid chromatography analysis of the time-of-flight mass spectrometer (LC-QTOF-MS). The anti-diabetic activity of the selected fruits was carried out using *in-vitro* carbohydrate metabolizing enzymes (α-amylase and α-glucosidase) assay and *in-vivo* study of biochemical and histopathological screening on streptozocin induced diabetic rats. The LC-QTOF-MS analysis of the fruit extract indicated the presence of 20 metabolites, including phenolic acids, flavonoids, flavones, saponins, tri-terpenes, etc.

in individual cucumber extracts. The *in-vitro* antidiabetic studies revealed the moderate inhibition of the carbohydrate metabolizing enzyme (α-amylase and α-glucosidase) and prevent the postprandial hyperglycemia. The study demonstrated marked antidiabetic activity in albino rats in a dose-dependent manner. The fruit extract found a promising effect in various biochemical parameters linked to diabetes and also improve the functioning of the pancreas and kidneys. Current work may assume that the selected fruits are effective against diabetes, which supports its ethnomedicinal use for treating diabetes.

ISESFEC/23/O-015

Anticancer organosulfides from *Ferulaassa-foetida* gum: isolation, characterization and pre-formulation studies

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Ferula oil enriched with organosulfides displayed significant inhibition of cell growth *in-vitro* against SKOV3 and A549 cancer cells in dose-dependent manner. This prompted us to investigate and delineate compounds responsible for the activity. A pre-formulation study was undertaken to improve water solubility. The present study aim to (i) isolate and characterize the organosulfides and evaluate *in-vitro* anti-cancer potential, (ii)fabrication and characterization of ferula oil-loaded nano-emulsion: effect of lipid phase of stability and oil release. Extraction with ethyl acetate was carried out after grounding Ferula gum. A part of the extract was subjected to silica gel column chromatography. GC/GC-MS analysis of ferula oil resulted in an indecisive outcome. This led to development of an expedient isocratic RP-HPLC method for separation and purification of four major compounds which were further unambiguously characterised as (-)-E-2-butyl propenyldisulfide, (-)-Z-2-butyl propenyldisulfide, (-)-1-(methylthio)propyl(E)-1-propenyl disulfide, and (-)-1-(methylthio)propyl(Z)-1-propenyl disulfide employing ^{1}H, ^{13}C, and 2 D NMR. The isolated compounds were further evaluated for their potential against SKOV3 and A549 cell lines where a trisulfide has displayed better activity. Nano-emulsion strategy has been employed for their solubilization. However, emulsification process required addition of lipid phase due to inability of ferula oil to act as a lipid phase. The compatibility studies suggested that fatty-acid are able to produce nano-emulsions with ~20 nm particle size whereas lipid phase containing fatty esters are not compatible. The stability studies at three different temperature conditions (4^{o}C, RT, 45^{o}C) suggested that the developed nano-emulsions have the ability to retain oil content by ~50 % after 30 days. Amalgamation of stability studies with drug release studies suggested that choice of lipid phase is crucial for stability and ferula oil release studies. The developed nano-emulsion was characterized using TEM, Turbiscan and confocal analysis. ^{1}H-NMR was employed to predict locust of lipid phase within micelles. The nano-emulsion retained *in-vitro* anti-cancer.

ISESFEC/23/O-016

Anti-viral efficacy of selected ethnomedicinal *Allium* Sp. of North East Indiaagainst SARS-CoV-2 infection

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Allium species have been extensively used in traditional medicine for the prevention of various viral infections. The present study was designed to investigate the beneficial effect of selected ethnomedicinal *Allium* sp. (*Allium hookeri, Allium chinense, and Allium odorum*) of North East India against SARS-CoV-2 viral infection. The hydro-alcoholic (80% ethanol) extract was prepared from leaves of selected *Allium sp.* collected from different parts of

North East India. The inhibitory efficacy of extracts against binding between SARS-CoV-2 spike proteins to ACE2 protein was determined by using ELISA. The inhibitory potential of the promising extract was further examined through an immunofluorescence study and flow cytometry analyses by using HEK293T/Spike cell line and recombinant ACE2 protein. Phytochemical analyses of the effective plant extract were also performed using both LCMS and GCMS analyses.Treatment with all extract showed a dose-dependent inhibitory activity against interaction between SARS-CoV-2 spike protein and its cognate receptor ACE2. Among them, *Allium chinense* was showing the highest inhibitory potential and the results were comparable to those seen in N-acetyl cysteine (positive control) treated cell. Both immunofluorescence study and flow cytometry analyses also demonstrated the beneficial effect of *Allium chinense* plant extract in inhibiting the interaction between SARS-CoV-2 spike protein and ACE2. Phytochemical analyses revealed presence of various organosulfur compounds in *Allium chinense* plant extract. The outcome of this study demonstrated a promising anti-viral efficacy of ethnomedicinal "*Allium sp*." against SARS-CoV-2 infection, which may be beneficial for the development of promising herbal formulations to mitigate COVID-19.

ISESFEC/23/O-017

Ethnic fermented soybean food of North East India with promising antidiabetic potential

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Fermented soybean foods have attracted scientific attention due to multiple health benefits. The present study has been undertaken to develop fermented soy protein isolates with anti-diabetic potential based upon indigenous fermented soybean foods of North East India. Different varieties of indigenous fermented soybean foods were collected from North-East India. Protein isolates were prepared using alkaline extraction followed by isoelectric precipitation method. Anti-diabetic efficacy was examined using alpha-glucosidase/ alpha-amylase inhibition assay in cell-free system and glucose utilization assay in cultured myotubes (C2C12) under high glucose (HG) exposure. Protein profiling was examined using SDS-PAGE and immunoblotting studies. Phytochemical analysis was carried out by using HRMS. Bacterial strains were identified through 16S rRNA gene sequencing. Molecular mechanism underlying the anti-diabetic potential was also investigated using immunoblotting studies. Protein isolates (PI) prepared from one of fermented soy food showed promising inhibitory potential against alpha-glucosidase/alpha-amylase enzyme activity and caused a significant increase in glucose utilization in HG-treated cells. SDS PAGE and immunoblotting analysis of PI showed the absence of various allergens. Phytochemical analyses demonstrated higher abundance of various isoflavones in bioactive aglycone form (daidzein, genistein, glycitein) compared to the corresponding glycoside form (daidzin, genistin, glycitin). 16S rRNA gene sequencing analyses revealed presence of two *Bacillus* species. Furthermore, treatment with PI also showed an increase in glucose uptake and intracellular glucose-6-phosphate levels and upregulated the protein expression of phospho-PI3K, phospho-AKT and GLUT4 in HG-treated cells to alleviate impaired glucose metabolism. The present study demonstrated a promising antidiabetic potential of ethnic fermented soy protein isolates prepared from the ethnic fermented soy food of North East India.

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Evaluation of pharmacological activities of ethyl acetate fraction of *Ceraceomyces tessulatus*

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Basidiomycetes-X (BDM-X), a novel edible mushroom known as *Ceraceomyces tessulatus*, is claimed to be effective in Japanese traditional medicine against inflammation associated with immune response. In this study, we aimed to assess the antioxidant, analgesic, and anti-diabetic activities of the ethyl acetate fraction (EAF) of BDM-X, by *in-vitro* and *in-vivo* methods. The dried BDM-X powder was extracted with water, and then partitioned with ethyl acetate to yield the corresponding fraction. The antioxidant activity was assessed by 1, 1 diphenyl-2-hydrazyl (DPPH) free radical scavenging assay. To assess the analgesic activity, acetic acid-induced abdominal writhing test was conducted in Swiss albino mice. The mice were treated orally with several doses of EAF and indomethacin as reference drug prior to the pain induction. Diabetes was induced by a single intraperitoneal injection of streptozotocin (150 mg/kg), and EAF was given orally at different doses (500 µg/kg, 1 mg/kg of BW) for four weeks. The oral glucose tolerance test was conducted before sacrifice. At the end of the experiment, organs and serum were collected for further analysis. Phytochemical screening revealed a large quantity of phenolics and flavonoids in the EAF. The EAF demonstrated strong scavenging activity against DPPH with an IC50 value of 45.94 µg/mL. Significant inhibition of pain sensation ($p<0.0001$) was observed with EAF treatment in a dose-dependent manner. The elevated blood glucose levels in diabetic mice were significantly reduced ($p<0.0001$ vs. DM) and improved glucose tolerance with EAF treatment. The elevated serum glucose, cholesterol, triglyceride, LDL, alanine transaminase, aspartate aminotransferase, alkaline phosphatase, and creatinine levels were significantly reduced in EAF-treated diabetic mice. The histopathological changes were improved in the H&E-stained heart, liver, kidney, and pancreas of EAF-treated mice and a marked reduction of organ index were also observed. Our data suggest that the EAF of BDM-X possesses potent pharmacological activities.

ISESFEC/23/O-019

A ready-to-use galactagogue nutraceutical

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A newborn presents unique obstacles when nursing. One of them is a lack of breast milk supply. Many moms had difficulty nursing their infants because their bodies aren't generating enough milk. The fetus is prevented from thriving for a variety of reasons, including insufficient glandular tissue, hormonal or endocrine issues, utilizing hormonal birth control that is nutritionally deficient, and many more. According to estimates made by the medical community and even baby formula manufacturers, 5 to 15% of women are physically unable to breastfeed. A piping hot soup enhanced with nutritious ingredients taken before breastfeeding increases the vascularity in blood vessels leading to enhanced milk flow. A soup enhanced with nutritious fresh ingredients is needed to build-up and maintain health to every part of the body. A nutritious soup also provides energy for milk production. Soups provide the necessary fluids. Breast milk consists of 87.2% water. Our objectives are: (i) to develop a ready-to-reconstitute instant soup mix using some galactagogue herbs and (ii) to evaluate the developed formulation for its taste, texture and nutritional values. The formulation was developed using different proportion of galactagogue herbs (Shatavari and Ginger) with other ingredients. The prepared formulations were evaluated for its organoleptic

properties such as colour, texture, taste, mouth feel, and aroma by 9 hedonic point methods. The optimized formulation was subjected to various physicochemical parameters such as Ash value, moisture content, fiber content, protein content, antioxidant property etc. The results of organoleptic properties indicated that the prepared instant soup is tasty and having good aroma and mouth feel. It has also sufficiently and reasonably nutritional characteristics to increase the milk production. The developed formulation will be a herbal, cheaper, tasty and safe drink for lactating mothers.

ISESFEC/23/O-020

Metabolite profiling and safety evaluation of semi-aquatic edible herbs as potential inhibitors of cholinesterase and β-secretase

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Enhydra fluctuans Lour. and *Ipomoea aquatica* Forssk were used traditionally to alleviate nervous disorders because of their high nutritional values. The extracts were tested for neuroprotective effect through testing against cholinesterase (AChE, BChE), and β-secretase linked to Alzheimer's disease. To understand the safety aspects the extracts were tested for CYP450 isozymes and HepG2 cell line inhibitory potential. Further, the antioxidant capacities as well as TPC, TFC and heavy metal contents were investigated. UPLC-QTOF-MS/MS analysis was employed to identify phytometabolites present in both the extracts. The results showed that *I. aquatica* having more prominent anti-cholinesterase potential compared to the *E. fluctuans* (AChE, IC_{50} = 239.52±1.46, 389.23±2.65 µg/mL; BChE, IC_{50} = 136.94±1.16, 321.56±2.29 µg/mL). But *E. fluctuans* showed more potent β-secretase (IC_{50} = 133.13 µg/mL) inhibitory potency compared to *I. aquatica* (IC_{50} =174.04 µg/mL). Meanwhile antioxidant capacity, TPC and TFC were significantly correlated with the anti-cholinesterase activity where *I. aquatica* showed a more protuberant potential compared to the *E. fluctuans*. The findings from *in vitro* cytotoxicity assay (*E. fluctuans,* IC_{50} = 475.25 ± 1.42; *I. aquatica* = 1650.45 ± 2.14 µg/mL) along with CYP3A4 (*E. fluctuans,* IC_{50} = 498.03±1.96; *I. aquatica* = 113.19±1.23 µg/mL) and CYP2D6 (*E. fluctuans,* IC_{50} = 180.49±1.77; *I. aquatica* = 99.24±1.19 µg/mL) isozymes inhibitory potentials justify safety aspects. The atomic absorption spectroscopy (AAS) analysis results also suggested that the quantified toxic heavy metals concentrations in both the plant extracts were well within the WHO prescribed limits. The UPLC-QTOF-MS/MS analysis tentatively identified 03 phenylethanoid glycosidesin *E. fluctuans*and three chlorogenic acids derivatives in *I. aquatica* extract. Keeping in mind the multi-targeted drug approach, the present findings suggested that both the plant may have potential source of moieties that could possibly have anti-Alzheimer's potential.

ISESFEC/23/O-021

Integrated network-based analysis, molecular docking, and bioautography methods to decipher the protective role of Indian propolis in Alzheimer's disease

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The conventional one-drug-one-disease theory has lost its sheen in multigenic diseases like Alzheimer's. Propolis, a honeybee-derived product and folk medicine possesses diverse array of phytochemicals acting via multiple mechanisms, offering promise as a treatment alternative. However, in India, propolis production is low as the collection itself is negligible. Therefore, apart from creating awareness, it is essential to establish scientific evidence of its medicinal value. So, the present study was aimed at investigating the nootropic effect of bioactive in Indian propolis by combining network pharmacology with molecular docking and HPTLC-Bioautography methods. A database of constituents present in Indian propolis was compiled in-house and ADME properties were assessed using the SwissADME. The Alzheimer-related targets were identified and filtered using BindingDB and DisGeNET. The constituent-target-gene network was constructed in Cytoscape whereas protein-protein interactions, gene ontology, enrichment, and visualization were done using STRING, KEGG, and DAVID databases. The network pharmacology-based analysis showed that the hit propolis constituents related to Alzheimer's were Luteolin, Chrysin, Kaempferol, Galangin, Acacetin, Quercetin, whereas the main Alzheimer-associated targets were ESR1, ACHE, MAOB, BACE1. A total of 14 pathways were recognized with the most enriched being pathways related to Alzheimer's, Cancer, and the HIF-1 signaling pathway. Molecular docking analysis was carried out for the hit compounds against the top protein targets in AutoDock and the interactions were visualized in Discovery Studio and PyMOL. Further, the protective role of propolis constituents as nootropics was assured by *in-vitro* and TLC-Bioautography assay. The *in-vitro* assays helped in establishing correlation of the bioactives responsible for neuroprotection. So with proof of its scientific evidence, the demand for quality Indian propolis would increase, helping beekeepers with additional revenue source.

ISESFEC/23/O-022

Virus under siege: unraveling novel defense mechanism in plants

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Tomato is an economically important crop and is considered a protective food based upon the significant amount of nutrients it provides which are essential for human health. Increasing evidence suggest that tomatoes have anti-cancerous property and can provide protection to skin against harmful UV rays by helping in reducing DNA damage. As a wide range of pathogens infect tomato, in recent years, it has emerged as a model system to study host-pathogen interactions. Tomato leaf curl disease (ToLCD), caused by strains of Tomato leaf curl virus (ToLCV), is a major constraint to tomato production. In India, *Tomato leaf curl New Delhi virus* (ToLCNDV) infection causes up to 70–100% yield loss. Plants have developed different strategies of defense against viruses. Our study focused on the contribution of small RNAs and resistance genes during geminivirus-plant interactions and the mechanism of plant tolerance against ToLCNDV infection. With a view to providing mechanistic insight into miRNA-mediated defense mechanism, the miRNAome of tomato in response to ToLCNDV infection was studied. The relatively higher abundance of miR159 during infection in tolerant cultivar and the inverse correlation of miR159 abundance with its target, *MYB* suggested their putative involvement in the defense response. Molecular characterization of sly-miR159 and *SlMYB* demonstrated their role in regulating the expression of *Sw5a* gene. Functional characterization showed that SlSw5a interacts with AC4 (viral suppressor of RNA silencing) of ToLCNDV to trigger hypersensitive response (HR) and limit virus spread. Altogether, the study delineates interaction between upstream miR159-Myb33 module and its downstream target Sw5a to activate HR leading to geminivirus tolerance. Overall, the results obtained from our studies could be employed in developing tolerance in susceptible cultivars of tomato through modern breeding or molecular approaches.

ISESFEC/23/O-023

Exploration of traditional fermented beverages of Assam for pharmacological activities

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North-East India is unique in cultural diversity and traditional tribal practices. Traditional beverages are used by majority of the tribal community which is often associated with cultural and religious belief. *Noggin-Apong*, *Poro-Apong* (Missing), *Sujen* (Deori), *Xaj-pani* (Ahom), *Jumai* (Bodo), *Rohi* (Sonowal), *Judima* (Dimasha) are well known beverages from Assam. Traditional beverages are very less explored for their beneficial pharmacological effects. Traditionally prepared *Poro-Apong* and *Noggin-Apong* of *Missing* community were collected for this study. Microbiological isolation and characterization was carried out by morphological identification, colony counting and growth kinetic studies, PCR-RFLP with *HaeIII, HinfI, PstI* digestion, 5.8S rRNA sequencing and bioinformatics analysis. Gross calorific value, alcohol content, protein content etc., were measured using biochemical techniques. Phytochemical profiling was carried out using LCMS, HRMS and GCMS analysis. Phenolic acid content, antioxidant property, cytoxicity (HEK293, HepG2, and THP1 cells) were examined using *in vitro* assays. Total 20 isolates of yeast were identified among which *Saccharomysis* spp. was the dominant one. Alcohols, ester, phenolic acid, inorganic & organic acids, aromatic compounds, amino acid, alkaloids, flavonoids, carbohydrates was identified in raw as well as solvent extracts. Gross calorific value of *Poro-Apong* and *Noggin-Apong* were 3515 Kcal/Kg and 3847.0 Kcal/Kg respectively. Total alcohol was highest in *Noggin-Apong* (15%) whereas higher flavonoid content was highest in *Nogging-Apong*. Radical scavenging activity was observed with methanolic extract of *Poro-Apong* (IC_{50} =2.34 µg/ml). *Poro-Apong* and *Noggin-Apong* were devoid of any toxicity against HEK293, HepG2 and THP1 cells. Traditional beverage *Poro-Apong* and *Noggin-Apong* contains a number of bioactive phytochemical molecules with potential beneficial pharmacological effect. These phytochemical molecules will provide opportunity to develop new preventive and therapeutic compounds against various complex diseases.

ISESFEC/23/O-024

An improved method for separating Asiatic acid and asiaticoside rich fraction from *centella asiatica* and its investigation with amyloidogenic proteins

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In Asian countries, *Centella asiatica* is exploited for several types of pharmacological activities due to presence of opulent phytochemicals. Asiaticoside, madecassoside, and their sapogenin triterpene acids, such as Asiatic acid and madecassic acid, are the most noticeable triterpenes in *C.asiatica*. Numerous techniques/methods are used to extract and isolate different phytoconstituents from *C. asiatica*. Still, most methods require special requirements, and some procedures are laborious and time-consuming. Meanwhile, previously reported pharmacological activities are not validated for amyloidogenic proteins

using a spectroscopical approach. The study's primary goal is to develop an improved methodology for extracting and isolating Asiaticoside and asiatic acid from *C. asiatica* at the minimum time with the highest yield and purity for large-scale production and its application for various diseases associated with amyloidogenic proteins (Hen Egg White lysozyme (HEWL- a model protein)). Asiaticoside and Asiatic acid extraction and isolation involved acid hydrolysis method. Defatted plant material was hydrolysed using hydroalcoholic acid to obtain crude mixture of asiaticoside and Asiatic acid (Rich Fraction). Using RP-HPLC, identification and purity of both compounds were established. Interaction of both compounds with HEWL was studied using molecular docking and simulation, Thermodynamic studies, and fluorescence spectroscopy. The developed method produces good yield (Practical Yield - 0.8 %) and purity of asiaticoside and Asiatic acid. As per the ICH guidelines, RP-UHPLC was developed and validated to quantify both compounds in the isolated material. The interaction studies show strong interactions with HEWL. This interaction was supported by data/results obtained from molecular dynamics and simulation, thermodynamic studies, and fluorescence spectroscopy. Some modification in this method leads to large-scale production of highly pure Asiatic acid and asiaticoside for their versatile application in cosmetics and phytopharmaceuticals. The interaction studies show the potential application of both compounds against diseases associated with amyloidogenic.

ISESFEC/23/O-025

Hypoglycemic and probiotic attributes of *Lactobacillusbrevis*: an *in-vitro* and *in-vivo* study

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The prevalence of insulin resistance (IR) and related metabolic conditions like hyperglycemia is alarmingly rising on a global scale. Altered gut bacteria composition which interferes with the permeability of antigens like lipopolysaccharide (LPS) in the intestine, causing persistent low grade systemic inflammation is a potent contributor to IR and subsequent hyperglycemia. *Lactobacillus brevis* is an obligately heterofermentative lactic acid bacterium (LAB). In our study, we investigated the *in-vitro* probiotics and *in-vivo* ameliorative effects of *Lactobacillus brevis* on metabolic profiles of high fat diet (HFD) fed hyperglycemic *Swiss Albino Mice*. Firstly, the strain was subjected *in-vitro* to extreme hostile conditions of the gastrointestinal tract. This ensured the bile (8.16 ± 0.05 Log CFU/mL), acid (7.25 ± 0.06 Log CFU/mL), and lysosome tolerance (6.13 ± 0.11 Log CFU/mL) also the attachment and safety properties. Then, acute oral toxicity testing was carried out and based on that feeding dosage was determined (1×10^8 CFU/Day/animal). Hyperglycemia in *in-vivo* models was developed using HFD regime, which was composed of 58% Fat, 25.6% Carbohydrate and 16.4% Protein. One of the batches was only given this HFD regime (HFD), another with supplementation of *L. brevis* (HFD + LB) and the 3rd batch received only a regular pellet-based meal and water *ad-libitum* (ND). All groups' metabolic parameters, *viz*., increment of percent body weight, lipid accumulation in perigonadal fat depots, glucose tolerance-based AUC Glucose, fasting blood glucose, Serum insulin, HOMA-IR and serum lipid profile were compared with that of the values of ND group. After fixed regime of administration it was observed that metabolic parameters in the HFD + LB group moved towards normalcy whereas the HFD group showed significant ($p \leq 0.05$) irreversible deterioration of metabolic conditions. These findings indicated potent activity of *L. brevis* as probiotic and normoglycemic dietary supplement.

ISESFEC/23/O-026

Antibiotic-Medicinal Plant Extracts Synergy for Biofilm and Quorum Sensing Inhibition in Pseudomonas aeruginosa

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Bacterial resistance to antibiotics is of great concern for treating infectious diseases. The resistance has resulted in increase in MIC, necessitating use of higher doses in clinical management of infections. The higher doses of antibiotics often lead to multiple organ toxicity with compromised system functions. The antibiotic-medicinal plants extract synergy has been explored for combating multiple drug resistance emergence as well as desired therapeutic activity at much lower doses/MIC compared to monotherpay with antibiotics. As combination therapy plant extracts and antibiotics may open the new ways for treating the infections caused by pathogenic microorganism. Various virulence factors involves in pathogenesis are regulated by quorum sensing mechanism which is a population density dependent and cell to cell communication mechanism of bacteria. So, antiquorum sensing mechanism may be an effective approach for the treatment of bacterial infections as well as reduction in emergence of drug resistance. *Pseudomonas aeruginosa* is a gram negative, opportunistic human pathogenic bacteria and one of the common causative agent of nosocomial infections. The infections caused by *P. aeruginosa* are generally treated with antibiotics which may cause some serious and unavoidable side effects in patients. We evaluated combined growth inhibitory, reduction in swarming motility, pyocyanin pigment formation, EPS formation and biofilm formation as well as antiquorum sensing activity of selected medicinal plants against clinical isolates of *P. aeruginosa*. Our results strongly support that the plants in the combination antibiotics should be focused for the effective treatment of bacterial infection as well as reduction in emergence of drug resistance.

ISESFEC/23/O-027

Effect of upper intestinal tract digestion on *Hypericum perforatum* extract using the infogest protocol

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Hypericum perforatum L. is frequently used for mild to moderate depressive disorders, and oral bioavailability of key constituents is known. Yet, to understand the physiological response and the mechanism of action of extracts of medicinal plants, an important step is the investigation of the complex metabolic processes within the human digestive tract. The effects of digestion in the upper intestinal tract on *H. perforatum* dry extract (prepared from the aerial parts with 80% ethanol) were assessed using the static *in vitro* model Infogest 2.0. The amount equivalent to the daily dose was successively mixed 1:1 with simulated salivary fluid (no amylase, no incubation), simulated gastric fluid (pepsin, gastric lipase, 2h, pH 3, 37 °C) and simulated intestinal fluid (pancreatin, bile, 2h, pH 7, 37 °C). Annotation of the constituents present in the native preparation and after digestion in the gastric and intestinal phases (after lyophilization and protein precipitation) was accomplished by UHPLC-HRMS analysis. Individual compound analysis suggested the presence of flavonoids, hydroxycinammic acids, xanthones, hypericins and phloroglucinols in the native extract, with more than 60 constituents being annotated. Apart from a few exceptions (such as hypericins), the levels of most annotated constituents remained basically unchanged through the three digestive phases, indicating that the majority of the constituents are stable towards

simulated upper intestinal tract digestion. Therefore, these compounds may reach the colon in unchanged form *in vivo*, unless they are absorbed in the upper intestinal tract.

ISESFEC/23/O-028

Novel hydroalcoholic polyherbal formulation development and (HPLC-UPLC) ultra-performance liquid chromatographic separation, estimation of gallic acid in *Terminalia chebula* dried fruits, and a marketed siddha-based polyherbal formulation "Kabusura Kudineer"

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The present study aimed to develop and validate an analytical method for the estimation of gallic acid (GA) and methyl, ethyl acetate fraction of *Terminalia chebula* dried fruits and in polyherbal formulations (Marketed & Developed). One of the active substances of Kabusura Kudineer and developed hydroalcoholic polyherbal formulation is myrobalan (*Terminalia chebula* dried fruit-*Combretaceae*). Myrobalan restrains active principal substances are GA. GA is proven for its Anti-viral and immunomodulatory activity. During the pandemic of *Covid*-19, Ministry of Ayush, Govt of India highly recommended the Immuno-booster Siddha-based polyherbal formulation "Kabusura Kudineer" for immune-boosting and treatment of *Covid*-19. The preliminary identification of GA and the sample was carried out by TLC, and FT-IR. The liquid chromatography method was developed on an Inertsil C_{18} (150*4.6mm & 5µm) column. The mobile phase was enhanced for water: Acetonitrile (50:50). The flow rate was 1mL/min and was GA tracked at 272 nm in a UV detector. The Rf value of GA and sample was found to be 0.27. Validation was carried out according to ICH guidelines. The retention time of GA was 2.2 min, and the Valid parameter of GA is system precision, SD (14247.75), % RSD (0.9), Regression equation y = 25511 x−947505, Correlation coefficient (R^2) 0.9999. The adequate Linearity concentration was found to be 50 to 150 µg/ml, LODs (1.70 µg /ml), LOQs (5.16 µg/ml), Method precision % RSD (0.8), SD (11626.7), Recovery 99.8%, and 101.1%.GA content was found in a formulation ("Kabusura Kudineer"- 1.39 µg/mL, Developed Hydroalcoholic Polyherbal formulation-379.4 µg/ml), and Ethyl, methyl acetate fraction of *Terminalia chebula* dried fruits was 105.59 µg/ml and 29.17 µg/ml. The developed (HPLC) UPLC methods have enabled simple, accurate, rapid, easy, reproducible, rugged, and linear analysis in these two fractions, and Siddha-based formulation "Kabusura kudineer" (Marketed), a developed polyherbal hydroalcoholic formulation.

ISESFEC/23/O-029

Transcriptomic time-series analysis of genes involved in anthocyanin biosynthesis in the rice grain of black scented rice, Chakhao

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Chakhao, the black scented rice of Manipur is well known for its deep purple colour, glutinous, unique aroma and flavour. In the year 2020, Chakhao had bagged the Geographical Indication (GI Reg.no. 602) for its intricate part of culture and heritage of the region, Manipur. Many studies in Chakhao have shown the presence of various secondary metabolites mainly the presence of flavonoids which are of potential health benefits. A class of flavonoids, anthocyanin is responsible for the dark purple colour of the pericarp of the rice

grain. Black rice has many health benefits owing to the presence of the anthocyanin mainly due to its antioxidant property. The first step of anthocyanin biosynthesis pathway is catalysed by the chalcone synthase, and following a series of reactions, the first coloured intermediate anthocynidins is formed which served as the substrate for the final anthocyanin formation step. Transcriptomic time-series analysis for the black scented rice, Chakhao Poireiton was performed to understand the differential expression of genes. Depending on the expression profiles, the different genes are categorized into different clusters that showed similar expression patterns. In case of the key genes involved in anthocyanin biosynthetic pathway, the genes fall into different clusters. For examples, the early biosynthetic genes fall in one cluster e.g., Chalcone synthase are actively expressed during heading and flowering stages but the gene is inhibited at the later stages. While in another cluster, the late biosynthetic genes such as UPD-glucose flavonoid 3-O-glucosyltransferase gene are expressed throughout all the growth stages but its expression level increases sharply at the grain filling stages with highest expression at the grain maturity. These results indicated a consorted expression of the early and late biosynthesis genes in Chakhao Poireiton.

ISESFEC/23/O-030

Bioactivities of insect associated bacteria from beetle species of Manipur

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Bioprospecting insect associated bacteria is a newer promising approach when looking for solutions to modern day challenges like antimicrobial resistance and agricultural stress. Beneficial symbiotic associations of insects with bacteria illustrate the acquisition of a microbe's physiological capacity to confer substantial fitness benefits to the host. The present study aims at isolation, bioactivity screening and partial characterisation of insect associated bacteria from beetle samples of Manipur. A total of 20 insect associated bacterial isolates were obtained from *Thysia wallichii tonkinensis* and *Oryctes rhinoceros*. All the 20 isolates were subjected to antimicrobial assays using *Kirby-Bauer* and *Dual culture* methods. TW 16 showed antibacterial activity against all the 3 bacterial test organisms (*Micrococcus luteus, Bacillus subtilis* and *Escherichia coli.*) and TW 14 showed antifungal activity against all the 3 test fungal pathogens (*Fusarium oxysporum*, *Rhizoctonia solani* and *Curvularia oryzae)* assayed. The bacterial isolates were also screened for plant growth promoting (PGP) activities, of which 4 (OR 0, OR 1, OR 4 and OR 5) were positive for all 3 traits tested-phosphate solubilisation, IAA and siderophore production. OR 1 showed highest phosphate solubilisation (351.31 µg/mL) and OR 5 showed highest IAA production (12.15 µg/mL). Further optimisation studies of these bioactive strains may lead to various biotechnological applications. The present study corroborates that insect-associated bacteria may be promising source of antimicrobial and PGP agents. Detailed findings of these bioactive strains will be incorporated in the paper.

ISESFEC/23/O-031

Species diversity of wasps in tasar ecosystem

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Survey was conducted to study the diversity of wasps in tasar plantation during silkworm rearing period. Study was taken up in major tasar growing regions *viz.,* Kharswan, Kathikund

and Ranchi in Jharkhand, Patelnagar and Bankura in West Bengal, Baripada and Nabarangapur in Odisha and Pali in Chhattisgarh. During the survey activity of both predatory and nectar feeding wasps in the tasar host plantations have been recorded at the time of silkworm rearing in order to understand the predatory and non-predatory wasp complex in tasar ecosystem. Data on species diversity revealed that maximum wasps' diversity was observed in Ranchi with 13 taxa which was followed by Patelnagar (7.00 taxa) and in remaining surveyed locations number of taxa recorded was between 03 to 06. Species diversity analysis revealed that diversity was more in Ranchi with the Shannon diversity index (H index) of 2.27 and it was followed by Kharswan, Kathikund and Patelnagar as they recorded the H index of 1.74, 1.48 and 1.05 respectively. Further, it has been observed that except two locations (Patelnagar and Baripada), observed wasp species were evenly distributed in different study locations. However, in case of Patelnagar and Baripada yellow paper wasp was a dominating species. Though activity of yellow paper wasp was observed in other locations except Pali but in those locations, it was not that dominating species. As an exception in Pali it has been observed that *Polistes stigma tamulus* was dominating species as its activity was more in this region compare to other study areas. Based on these preliminary field observations it has been found different wasps species visits tasar plantation for both predation on tasar silkworm and also for nectar feeding on tasar host plants. Among the recorded species it has been observed that 3 species viz., yellow paper wasp (*Polistes sp.*) *P. stigma tamulus* and *P. strogosusatratus* found to be major predatory wasps of tasar silkworm, whereas others found to be nectar feeders and predatory on other insects and spiders.

ISESFEC/23/O-032

Kaempferia rotunda L: Evaluation of genotypes, phytochemical and pharmacological properties

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Kaempferia rotunda, Indian crocus/Leipaklei, is a fragrant aromatic herb. It is an important medicinal plant in the ancient system of traditional medicine against abdominal pain, wounds, diarrhea, and colic disorder. The plant has been widely used in various Ayurvedic formulations, including the health tonic Chyavanaprash. Understanding the growth and development, phytochemical and pharmacological properties is essential for its domestication, commercial cultivation, and scientific validation of traditional knowledge. The present investigation was carried out at Kerala Agricultural University, Thrissur. The experiment was laid out in CRD with three replications using 13 genotypes. The qualitative and biometric observations are based on the descriptor of NBPGR. Profiling of bioactive compounds of rhizome from ethanol extract and essential oil was performed by GCMS and GCMSMS techniques, respectively. The antioxidant property was studied by DPPH radical scavenging method, antimicrobial by agar well diffusion method, and anticancer property in breast cancer cell lines using MTT assay. An *in vivo* acute toxicity study was carried out in swiss albino mice. Based on growth and yield parameters, Manipur collection MCR-6 performed the best, followed by Kerala collection KCR-5. KCR-3 recorded the highest essential oil and oleoresin significantly. 22 compounds were identified from volatile oil and 18 compounds from ethanol extract. No acute toxicity was noticed in the ethanolic extract. It exhibited antioxidant property with IC_{50} of 131.15±4.83µg/mL and showed cytotoxicity in MCF-7 and MDA MB231 cell lines with IC_{50} of 167.1±5.60 and 194.8±8.97, respectively. The extract exhibited appreciable antimicrobial activity on *E. coli*, *S. enterica*, and *P. aeruginosa* and showed potent activity on *S. aureus* (14.18±0.32).The Manipur collection, MCR-6, performed the best. *Kaempferia rotunda* is rich in secondary metabolites. No acute toxicity

was observed in swiss albino mice. The plant has anticancer, antioxidant, and antimicrobial properties.

ISESFEC/23/O-033

Evaluation of antioxidant, anti-inflammatory, anti-HMG-CoA reductase activity and simultaneous determination of phenolic compounds in hydroalcoholic extract of *Ficus cunia* fruits by RP-HPLC

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Free radicals are responsible for the pathogenesis of chronic diseases. Hypercholesterolemia is supposed to arise from oxidative stress. Medicinal plants comprising phenolic compounds display antioxidant and anti-inflammatory capabilities which may play a vital role in controlling hypercholesterolemia. Phenolic compounds are highly spread and broadly dispersed in medicinal plants and are known for several health maintenance abilities. The purpose of the study was to determine the antioxidant, anti-inflammatory and anti-HMG-CoA reductase potential along with simultaneous determination of phenolic compounds of *Ficus cunia* extract. In the current study, estimation of total phenol and flavonoid content, *in vitro* antioxidant, anti-inflammatory and anti-HMG-CoA reductase screening and RP-HPLC method were established for simultaneous determination of phenolic compounds in the hydroalcoholic extract of *Ficus cunia* fruits (HAFC). Total phenolic and total flavonoid contents in the HAFC were (58.12±3.6) mg gallic acid equivalents/g and (23.01±1.35) mg quercetin equivalents/g, respectively. HAFC showed good antioxidant activity (IC_{50}=34.93±2.34 µg/mL for DPPH; IC_{50}=49.25±2.3 µg/mL for ABTS). Anti-inflammatory activity was significant and increased gradually with concentration. HAFC showed good inhibition of HMG-CoA reductase (IC_{50}=37.50±1.80 µg/mL). The optimized HPLC method was performed for 65 minutes with detection wavelengths of 254, 278 and 300 nm, gradient elution system on a C_{18} column. The developed system was assessed by validation as per ICH guidelines. The results showed that ellagic acid was found in the highest amount (11.34±.01 mg/g) followed by catechin (5.18±.02) and gallic acid (4.23±.05) among the examined phenolic compounds while caffeic acid was not detected. This newly developed HPLC method was ascertained to be specific, sensitive, linear and precise. The established results exhibited good chromatographic separation. The results of the present study suggest that the *Ficus cunia* extract has antioxidant, anti-inflammatory potential and capable of lowering cholesterol levels. The developed RP-HPLC method may be useful for quality control of plant extracts/herbal products.

ISESFEC/23/O-034

Studies on bioavailability of anti-asthamatic orodispersible tablets containing extracts of *Glycyrrhiza glabra* and *Curcuma longa*

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Docking studies on glycyrrhizin and curcumin indicated good binding with tryptase and IL-5 proteins, the targets for asthma receptors. Therefore, extracts containing these constituents were formulated into orodispersible tablets. The aim of the study is to formulate orodispersible tablets containing liquorice extract and curcuma extract and determine bioavailability of the same. Powder of liquorice root and curcuma rhizomes were extracted with alcohol and vacuum dried. Two orodispersible tablet formulations were prepared using superdisintegrants. The absolute bioavailability of glycyrrhetinic acid and curcumin were

determined by administering the pure markers by i.v. (2 mg/kg b.w.) and oral (10 mg/kg b.w.) routes to Wistar rats. The relative bioavailability of tablets containing piperine and devoid of piperine was determined by administering the tablet orally (51 mg/kg b.w. –equivalent to 7.65 mg of glycyrrhizin and 5.1 mg of curcumin) to Wistar rats. The concentration of the marker compounds was determined using validated bio-analytical HPTLC. The orodispersible tablets (Liquorice extract 100 mg and curcumin extract 70 mg) were found to contain glycyrrhizin (75 mg) and curcumin (50 mg). The absolute bioavailability was found to be 28.15 and 23.92 % of Glycyrrhetinic acid and curcumin respectively. The relative bioavailabilities of the formulation without piperine and with piperine were found to be 54 and 75% respectively. Cmax of Glycyrrhetinic acid and curcumin were found to be 10.69 and 8.6 µg/ml, in case of tablets containing piperine which is found to be significantly ($P<0.05$) higher than the formulation without piperine. The significant ($P<0.05$) increase in the bioavailability of tablet formulation, as compared to the absolute bioavailability may be due to the good solubility of glycyrrhizin which is a glycoside and followed by detection of glycyrrhetinic acid in blood. Piperine is found to enhance the bioavailability of the tablet formulation

ISESFEC/23/O-035

Phytochemical analysis and anti-microbial potential of *Ayapana triplinervis* Vahl. Hydroalcoholic leaf extract

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Since the dawn of mankind, medicinal plants has been traditionally used to treat and manage human wealth. Medicinal plants are getting global acceptance for its diverse secondary metabolites content and less side effect. *Ayapana triplinervis* Vahl (Family: Compositae) is an aromatic plant traditionally used for wound healing and anti-infective properties.The present study aimed to identify the metabolite profiling and evaluation of antibacterial and anti-viral inhibitory potential of this medicinal plant. UPLC-QTOF-MS based metabolite analysis of *Ayapana triplinervis* Vahl hydroethanolic leaf *extract* (ATHE) was carried out followed by Agilent 6500. Antiviral potential was evaluated against wild-type and clinical isolates of herpes simplex virus I (HSV I) by cytotoxicity, cytopathic effect and plaque reduction assay. Antibacterial potential of the plant extract was performed as per CLSI guideline against gram positive/negative clinical isolates and ATCC strains. UPLC-QTOF-MS analysis showed the presence of 14 phytomolecules including the major compound ayapanin. Selectivity index (SI) of the plant extract against the wild type and clinical isolates of HSV I was found to be 9.47 and 8.72. ATHE exhibited antimicrobial potential against *Bacillus subtilis* and *S. aureus* with 11.84 ±1.05 mm and 13.48 ±1.33 mm zone of inhibition correspondingly. The MIC value of ATHE against S. aureus was found to be 256 ± 1.01 µg/ml. The results of this study the present study reveals that ATHE possesses moderate antibacterial and anti-HSV activity, which may provide useful lead for the development of effective antinfective agents exploring medicinal plants with proper scientific intervention.

ISESFEC/23/O-036

In *vitro* herb-drug interaction potential of an indigenous South African polyherbal as a possible adjuvant during tuberculosis treatment

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The traditional use of polyherbal mixtures for the treatment of various infectious diseases have long since been acknowledged and reported. Previous work had done on *Lippia javanica*, *Euclea natalensis* and *Salvia aurea* have shown their antimycobacterial, antibiofilm, immunomodulatory and hepatoprotective potential. These biological properties are mostly attributed to plants that have the potential of acting as adjuvants for use during tuberculosis infection. Herb-drug interactions are potential barriers for the final formulation of drug candidates. Initial *in vitro* investigations can be done to indicate potential herb-drug interactions and must be seen as important aspects to consider when formulating adjuvants from medicinal plants. The current study investigated the *in vitro* interaction potential of a polyherbal mixture of traditionally used South African plants and the most important CYP P450 enzymes involved in the metabolism of 70-80% of commonly used drugs on the market. These initial investigations have largely indicated the possibility of interaction potential between the polyherbal mixture and the selected CYP P450 enzymes investigated. Furthermore, this interaction potential was also seen for all three of the medicinal plants tested individually, supporting the activity found for the polyherbal mixture, with *S. aurea* having the most profound effect. Further studies need to be done to identify the mechanisms of these interactions and the possibility of excluding *S. aurea* from the polyherbal mixture based on the *in vitro* results found.

ISESFEC/23/O-037

In Silico screening of phytochemicals having anti-viral properties belonging to family Zingerberaceae against COVID-19

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Coronavirus disease is a viral respiratory disease caused by SARS CoV-2 (COVID-19) which has affected most of the world, thereby resulting into high mortality rate and hence declared as global pandemic by World Health Organisation. Various studies have been carried out by researchers to combat the disease and understand the clinical mechanisms. Apart from the FDA approved drugs and its derivatives few herbs known for their anti-viral properties are also been tried against the virus. To supplement the ongoing efforts, we have carried out *in-silico* studies to assess the affinity between six phytochemical compounds from the family Zingiberaceae namely 1-8 cineol, Beta-pinene, Betulinic acid, Curcumin, Flavones and Niclosamide using binding simulations to check the effectiveness in inhibiting COVID-19 infections. Molecular docking was performed to find the efficiency of those compounds and evaluated based on docking scores using AutoDock Vina software. Earlier studies on some of the potential drugs like Imatinib, Remdesivir and Telaprevir predicted strong ligand-protein interactions; however, our studies with the phytochemical compounds also showed comparable results making them promising candidate drugs. Betulinic acid, Curcumin and Niclosamide from Zingiberaceae showed comparable binding affinity towards SARS-CoV-2 and SARS CoV spike proteins. Curcumin showed more conventional hydrogen bonding followed by Niclosamide and Flavones and 1-8 cineol dominated the Alkyl interactions in the studies. The results indicate that these phytochemical compounds may be useful for treatment against the COVID-19 and leads towards the development of potential drugs as well.

ISESFEC/23/O-038

Antimalarial activity of traditional medicinal plants from Northeast India (Manipur)

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Malaria is a primeval tropical disease caused by *Plasmodium*, transmitted through infected female *Anopheles* mosquitoes and is one of the major health concerns across the globe.

There was around 241 million malaria cases and 0.62 million deaths in 2020 across 85 endemic countries (WHO report, 2021). Northeast India has malaria endemic regions that accounts for ~7.5% of the total malaria cases with a high mortality rate of 22%. The unique habitat of northeast India nourishes a plethora of flora and fauna. Previous studies have emphasized the use of natural plant derived compounds for antimalarial treatment. The vast diversity and unique chemical scaffolds in the natural compounds offer a conducive platform to screen for potential bioactive components and develop effective antimalarial drugs. The *in vitro* antiplasmodial activity of plant extracts against *Plasmodium falciparum* (*Pf*)-3D7 and ART-resistant Cam3.I^{R539T}strains were analyzed using [^{3}H]-hypoxanthine uptake assays and Giemsa-stained smears. *In vitro* cytotoxicity was evaluated against HeLa, HEK293T, MCF7 and HepG2 cell lines using MTT assays. Hemolysis assays were performed using erythrocytes (RBCs). Phytochemicals analysis was done by GC-MS and antioxidant studies by DPPH and ABTS assay. *In vivo* antimalarial studies against *Plasmodium berghei* infected Balb/c mice were done using Rane's test and Peters' 4-day suppression test. *In vitro* antiplasmodial screening of *Toona ciliate* and *Croton caudatus* leaf extracts showed potent activity against *Pf* strains (IC_{50}~ 10-20 µg/ml). Presence of phytochemicals and antioxidant activity of these extracts attributed to their therapeutic values. These extracts were non-hemolytic, non-cytotoxic and exhibited no *in vivo* acute toxicity. They showed prominent *in vivo* antimalarial activity (~70-75% parasite growth inhibition) and significant delay in mortality. Our *in vitro* and *in vivo* findings suggested the therapeutic potential of these extracts as antimalarial. These findings deliver a platform for further studies to identify the active components from the extracts to combat malaria.

ISESFEC/23/O-039

Assessment of *Withania somnifera* based botanical supplement in healthy human aging

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Aging is the main risk factor for several debilitating diseases and contributes to an increase in mortality. According to the projection of the World Population Prospects 2019, the present aged population is 9% in 2019 which could be ~16% by 2050. Further, in the history of the human census, the aged population (≥ 65 years) globally had become more than the number of children (< 5 years) in 2018. Hence, managing the aged population is a challenging task for the healthcare sector. Multiple strategies were explored to prevent aging, including synthetic drugs such as rapamycin, and metformin. However, due to the increased toxicity and adverse effects of pharmaceutical drugs, botanical supplements are preferred as they are safe and effective. This study aims to propose a network pharmacology-based method to identify the therapeutic pathways of standardized *Withania somnifera* extract (WSE) based botanical supplement for anti-aging effects. To achieve this objective, a network pharmacology approach, gene ontology (GO), molecular docking, and dynamics simulation studies were performed. The information on aging-related genes was obtained from the Human Ageing Genomic Resources and the JenAge Ageing factor database. Subsequently, a network containing the interaction between the putative constituents of WSE and known therapeutic targets of aging was established, which was used to investigate the pharmacological mechanism of WSE for anti-aging effects. The results of network analysis showed that BANF1, TMPO, EMD, SYNE2, LMNA, SREBF1, SYNE, SUN2, SUN1, LEMD3, and LMNB1 were found to be significant targets of WSE constituents. Further, molecular docking and dynamics results showed that WSE constituents have the best binding affinity with LMNA and TMPO genes. The combined results revealed that WSE based botanical supplement could act on multiple targets of aging such as LMNA, TMPO, LMNB1, and EMD, for an antiaging effect.

ISESFEC/23/O-040

Partial estrogen-like effects of karanjin: a transcriptomic study using MCF-7 cell lines

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Karanjin is a furanoflavonoid that is abundantly present in pongamia oil. Several *in vitro* and *in vivo* effects of karanjin have been reported in the literature to suggest potential health benefits. Recent data indicate that karanjin has anti-proliferative, cell cycle inhibitory, and pro-apoptotic effects, which have motivated research on its application in anticancer therapy. However, its global impact on gene expression has not been investigated. Using the next generation sequencing technology, we have examined the genome-wide transcriptome alteration in MCF-7 cells treated with 10 μM karanjin. We show that karanjin modulates gene expression that favours G2/M transition, and mimics pro-estrogenic effects. Karanjin modulated genes overlap with those modulated by estrogen, or tamoxifen, suggesting a role of ERα in karanjin mediated effects, which was examined by ERα knockdown and chromatin immunoprecipitation assays. The partial estrogen-like effect of karanjin in breast cancer cells flags a caveat to its anticancer potential, while at the same time raising the possibility of its application in hormone replacement therapy.

ISESFEC/23/O-041

Folklore healthcare system of Eastern Himalaya Bio-region of west Sikkim, North-East India

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The present study aims to the ethnopharmacological survey and documentation of the 'Traditional Healthcare Practices' of Folklore Healers living in the Eastern Himalaya Bio-region of West Sikkim, North-East India (Dentam, Borbotey, Utterey, Jorbotey, Sopakha villages). These villages have rich traditional knowledge of the use and practices of medicinal plants. They still practice the traditional method for curing various ailments even in this time when people depend mainly on modern medicine. All together 9 traditional practitioners belonging to five different Communities of five villages of Eastern Himalaya Bio-region situated in West Sikkim district of Sikkim State, India were interviewed. A predesigned questionnaire was used for the interviews, including details of the type of diseases treated, symptoms, bioresources used for treatment and mode of preparation, dosage forms, formulation details and unit doses of the formulations. The interviews were done entirely in the residences of the traditional practitioners and were recorded in written and audio-visual format. The survey recorded the traditional knowledge of 31 plants and 22 formulations used to treat 18 human ailments. Five plant species, *Achyranthus aspera* Linn. (Local Name – Rato Ankhe), *Viscum articulatum* Burm.f. (Harchur), *Astilbe rivularis* Buch. Ham. (Burokhoti), *Bergenia ciliate* Sternb (Pakhanbeth) and *Euphorbia hirta* Linn. (Bhuichiplay) were found to be used by maximum number of traditional practitioners. Graphical representation of the frequency of citation, especially survey and reference data showed significant correlation indicating common and specific use of plants in treating different diseases. These documentation works will preserve rich traditional healthcare knowledge of the folklore healers for future generations.

ISESFEC/23/O-042

Adiposity and adipocyte inflammation combating potentials of *Alpinia calcarata* leaves: *in-silico* and *in-vivo* approach

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Obesity is now considered a global health burden. Obesity has been recorded to be associated with different lifestyle disorders. Identifying the treatment for the management of obesity and related complications is under warrant. *Alpinia calcarata*, a plant from the Zingiberaceae family, has been reported for several medicinal properties. The present study aimed to investigate the role of the leaves of *A. calcarata* in reducing the risk of adiposity and adipocyte inflammation in high-fat diet-induced obese mice and to explore molecular mechanisms involved in this episode. Five major compounds reported earlier in *A. calcarata* leaf extract were used for molecular docking with adipogenic and adipocyte inflammatory marker proteins. Changes in body weight, organ weight, Lee index, fat accumulation, liver, and lipid functions were monitored. Alteration in the expression of IL-6, COX-2, MCP-1, PPARγ, TNFα, and GLUT-4 at the transcript level was also studied. In-silico results showed that among the five compounds, Carotol has the highest binding affinity with COX-2, MCP-1, PPARγ, and TNFα, whereas β-pinene showed with GLUT4. Moreover, a significant reduction in body weight and fat accumulation was followed by significant attenuation in total cholesterol and triglyceride levels by the extract. In agreement with the biochemical and *in-silico* data, the extract was capable enough to reduce the mRNA expression of IL-6, COX-2, MCP-1, PPARγ, TNFα confirming the ability of the extract to ameliorate adiposity and adipocyte inflammation. Taking it all together, it is noteworthy to report this novel function of *A. calcarata* leaf in reducing the risk of adiposity and adipocyte inflammation.

ISESFEC/23/O-043

Glucose-sensitive delivery of vitamin D by dextran-gated multi-functional *Mesoporous Silica* nanoparticles to mitigate hyperglycemia

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Diabetes mellitus is a complex metabolic disorder characterized by high blood glucose levels. The present treatment strategy cannot control the glycemic level of patients with diabetes. Glucose-sensitive delivery of antidiabetic molecules is one of the promising approaches for maintaining normoglycemia and reducing the risk of drug's overdose. A remarkable advancement has been made in the field of glucose-responsive delivery of insulin which is a water-soluble molecule. However, the study on glucose-sensitive delivery of water-insoluble antidiabetic molecules is still elusive. Present study examined the glucose-responsive delivery of vitamin D (VD), a lipid-soluble vitamin, by using 3-carboxyphenyl boronic acid-functionalized mesoporous silica nanoparticle (MSN-CPBA). VD-loaded nanoparticles were prepared and examined their size, shape, pore diameter, pore volume, hydrodynamic diameter and surface charge following previously reported study. The pores were covered by using dextran via binding with CPBA. Results showed that high glucose exposure (HG, 25 mM) kicked off the dextran leading to VD release in both cell-free and cellular systems. The system not only delivered VD in a glucose-responsive manner but also significantly increased the bioavailability of VD. Moreover, treatment with MSN-CPBA-VD-Dex also reduced hyperglycemia via upregulating GLUT4 protein expression and glucose uptake. MSN-CPBA based dextran-gated delivery system would be a promising therapeutic strategy to increase the bioavailability and stimuli-responsive

delivery of antidiabetic molecules for managing diabetes mellitus over conventional approaches.

ISESFEC/23/O-044

Anti-hyperglycemic and hepatoprotective effects of arjunic acid isolated from *Terminalia arjuna* in Streptozotocin-induced type 1 diabetic mice

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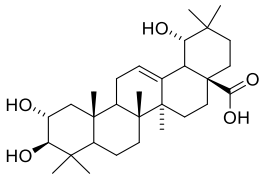
Diabetes mellitus (DM) is a lifelong disease, and its prevalence and complications have risen alarmingly worldwide. The present work was designed to investigate the anti-diabetic and hepato-protective potential of arjunic acid (AA) in type 1 diabetic mice. AA was isolated and purified from the bark of *Terminalia arjuna*. Experimental diabetes was induced among the Swiss albino male mice with a single intraperitoneal injection of streptozotocin (STZ) in a dose of 150 mg/kg of body weight. After one week of STZ induction, blood glucose level was measured, and whose blood glucose levels were ≥16 mmol/L were considered as a type-1 DM. After three weeks of diabetes induction, mice were treated with AA orally at a dose of 50 mg/kg of body weight for 36 days daily. The age-matched mice for the normal and DM group were treated with 0.5% carboxy methyl cellulose. At the end of the experiment, mice were sacrificed, and the serums were collected for biochemical assay and the livers were collected for histological test.



Arjunic acid

After five weeks of treatment, AA significantly normalized the elevated blood glucose level ($p<0.05$ vs. DM). The body weight was significantly reduced ($p<0.05$ vs. Normal), and the organ index were increased in DM mice, but AA tended to alter these changes. The elevated serum total cholesterol and low-density lipoprotein were significantly restored in AA-treated mice ($p<0.01$ vs. DM). The serum biochemical markers for liver damage, such as alanine transaminase ($p<0.01$), aspartate aminotransferase ($p<0.001$), and alkaline phosphatase ($p<0.01$) were significantly elevated among the mice of DM group in comparison to normal mice, whereas significantly restored in AA treated mice ($p<0.05$, $p<0.01$ vs. DM). The histopathological changes were improved in the H&E-stained liver of AA treated. Our findings addressed the anti-diabetic and hepatoprotective properties of arjunic acid for the first time.

ISESFEC/23/O-045

Microencapsulation of essential oils from lavender and anise and study of its anti-epileptic activity

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Epilepsy, a common disorder of the central nervous system, is the result of abnormal synchronical discharges in a group of neurons in cerebral cortex. This research paper focuses on EOs from *Lavandula angustifolia* flowers, Lamiaceae and fruit essential oil of *Pimpinella anisum,* Umbelliferae. Both are reported for use in dementia, neuralgia and seizures in Iranian traditional medicine. The antiepileptic activity was analysed in mice by intraperitoneal route 30 mins prior to the production of convulsion using Maximal Electroshock Seizure model, wherein the convulsions were produced by delivering current of 12mA through ear pinna electrodes for 0.2 sec. The study investigated two concentrations of anise and lavender oil at 1.5 and 3 mL/kg b.w. and their three combination doses. Disappearance of hind limb extensor phase was the positive criteria and both the EOs abolished this phase in individual doses and at combination doses having equivalent concentration of 1.5 and 0.75 ml/kg b.w. One way ANOVA for convulsion phase showed

significance at P<0.05 when compared with control. The combination dose of 0.75ml/kg b.w. showed a mean value of 2.833±0.24sec as compared to Levetiracetam (positive control) which gave 9.667±1.70sec. HPTLC analysis of linalool and anethole in the mobile phase toluene:ethyl acetate 93:07 gave a content of 25% and 76.15% v/v in Lavender and Anise oils respectively. Microencapsulation was done by complex coacervation method with gelatin and acacia as coating material and the essential oil as core material. Batches of microencapsulated granules were prepared by varying the ratio of coating: core material: deionised water and acetic acid. Variation in percentage of Acetic acid led to greater encapsulation efficiency of 68.58% for Anise Oil and 63.88% for Lavender Oil. The microencapsules were characterised for SEM and XRD and formulated into a suitable dosage form.

ISESFEC/23/O-046

Nôti and Tolsi against COVID 19: two Hindou's sacred plants in Reunion Island traditional medicine

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APLAMEDOM Réunion

In Reunion Island, religion and medicinal practice are inextricably linked. Indeed, it is common to see Reunioneses return from their place of prayer with a flower or a leaf take from the rituals. Later, they use this flowers or leaf for therapeutic purposes. This is found regardless of religious obedience but especially in Hinduism. This is precisely the case for two sacred plants: Nôti (*Vitex negundo, Verbenaceae*) and Tolsi (*Ocimum tenuiflorum, Lamiaceae*), currently use both in Hindu's ritual and in Reunion Island traditional medicine. Thanks to the data collected through a qualitative study, based on 40 semi-directional interviews, we can explain the link between the ritual use of nôti and tolsi in the ritual's practices and the use of these same plants in Reunion's traditional medicine in the specific case of the fight against COVID 19. To complete the interviews data, some *participant observation* both with Reunionese and in ritual has done. This was facilitated by a particular *emic* posture. Finally, the study shows that, for Reunionese: Nôti is use in Hindu's ritual for Shri Muruga, Tolsi is use in Hindu's ritual for Shri Vishnu, the two plants are use against COVID 19 as decoction, decoction is take by oral route or use in bath to reduce pain, sometime Tolsi can be used as infusion taken by oral route to calm the respiratory system, one of the main symptom of COVID 19, the sacredness of the two plants is said to increases the efficiency of medicinal use.The next step is to test the efficacity of the plant extract on viral model and identified the active molecule against COVID 19.

ISESFEC/23/O-047

Traditionally used medicinal plants of Manipur protect against rotenone-induced neurotoxicity model of Parkinson's disease in SH-SY5Y cells

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Natural compounds with high antioxidant potential are good candidates for neuroprotective activities as oxidative stress plays a major role in the pathogenesis of many neurodegenerative diseases. The present study aimed at evaluating the neuroprotective properties of four medicinally used plants in Manipur namely, *Alternanthera sessilis*, *Stephania japonica*, *Eryngium foetidum*, and *Plantago asiatica*, on rotenone-induced neurotoxicity model of Parkinson's disease (PD) in human SH-SY5Y neuroblastoma cells. Plant samples were collected and crude methanol extracts were prepared using the Soxhlet apparatus. *In-vitro* free radical scavenging activities of the plant extracts were carried out using DPPH and ABTS assay methods. Neuroprotective activities of the plant extracts were studied in the rotenone- model of Parkinson's disease in SHSY5Y cells using MTT assay

and MAP2 immunocytochemistry. Protection against reactive oxygen species (ROS) generation and destruction of mitochondrial membrane potential were examined by DCFDA and rhodamine 123 assays. The plant extracts showed very good antioxidant properties at 100mg/mL concentration and above. Pre-treatment of the plant extracts protected cell death to up to about 20-30% in SHSY5Y cells insulted with rotenone and also ameliorates the expression of MAP2 in rotenone-treated cells. The extracts were observed to attenuate the increased formation of intracellular ROS and mitochondrial dysfunction induced by rotenone. *A. sessilis* and *S. japonica* extracts showed more effective neuroprotective properties compared to *P. asiatica* and *E. foetidum* extracts. The present study shows that plant extracts protect against neuronal cell death by reducing oxidative stress and maintaining mitochondrial membrane potential. It further validates the use of these plants for the treatment of neuro-muscular diseases in traditional medicines of Manipur. These plants maybe further explored to develop as potential therapeutic agents in future for the treatment of PD and other neurodegenerative diseases.

ISESFEC/23/O-048

Wild edibles used by the tribes in Kerala, their documentation and genetic analysis using ISSR markers

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Each tribal community is unique in their food habits and culture. They are very close to nature and have a traditional knowledge on uses of consuming wild edibles. Documenting their knowledge may help in conservation of the information base for the future generations and investigation of Genetic information on the above edibles may help in understanding their scientific base and phylogeny. The documentation of wild edibles was conducted with extensive field survey among the 9 tribal communities in Wayanad, Idukki and Thiruvananthapuram Districts of Kerala. Participatory rural appraisal approach was adapted to document, protect and promote the wild edibles and the ethnic food culture. Taxonomical identification of the recorded wild edibles was done and the samples were collected for establishing conservation/demonstration plots and nurseries. As tubers of *Dioscorea* species were largely used by the tribal communities in their food culture, a detailed morphological and genetic analysis for distinguishing the varieties have been conducted. Based on availability of tribal inhabitants, 12 Blocks were selected from the 3 targeted Districts and interviewed 105 tribal knowledge holders from 56 tribal settlements. A total of 63 traditional food recipes and its health benefits were documented. The study revealed that diet of tribal people was largely dependent upon the locally available grains, leafy vegetables, fruits and tubers. Wild tubers play a major role in the ethnic cuisine. Nine *Dioscorea* species such as *D. alata*, *D. wallichi*, *D. bulbifera*, *D. tomentosa*, *D. hispida*, *D. pentaphylla*, *D. oppositifolia*, *D. esculenta* and *D.hamiltonii* were identified. All these wild edibles were introduced in the conservation plot and established 3 demonstration plots along with nurseries for the propagation and domestication of wild edibles with the participation of tribal communities in the 3 targeted Districts. The cultivars grown by the communities are mainly from *D. alata* (20 varieties), *D. esculenta* and *D. bulbifera*. The use of other species has declined in recent decades and these wild tubers are not in cultivation as well. The Genetic diversity of the *Dioscorea* samples was also assessed using ISSR markers. The traditional food recipes are good candidates for the development of nutraceuticals to tackle the lifestyle diseases. With the participation of tribal communities, it is possible to conserve the wild edibles and in return, the communities are not only revamping their food culture but also getting economic benefits through the promotion and sale of wild edibles.

ISESFEC/23/O-049

The plants of Indian's indenture in Reunion Island: an ethnopharmacological approach

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APLAMEDOM Réunion

Indian diaspora is present all over the world and especially in Reunion Island where Hinduism is well known and practice. This implements a circulation of sacred plants - and others - between India and Reunion Island because plants are used both in religious practices and in traditional medicine. This observation is the result of the history of the settlement of the island where slavery and indenture followed before the departmental in 1848. Before this date, biomedicine was not present in La Réunion and the people who came to work there - including the Indians - each brought their knowledge related to care to lead to a traditional Reunionese medicine. As the Indian indentured had obtained the right to practice their worship, they brought with them this traditional knowledge and found by arriving with a number of plants known in India and used in rituals. In this communication, we will present some plants which circulate between India and La Reunion. Thanks to the data of our association, APLAMEDOM Reunion, collected by 20 years of experience on medicinal plants use on the island, we have identified the plants which linked to the Indian indenture, specified their mode of use in Reunionese traditional medicine, make links with the traditional use of the plants and the molecule synthesized by it. Finally, we can list the plants link to Indian indenture in reunion island traditional medicine and see that the therapeutic use is comfort by chemistry.

ISESFEC/23/O-050

Promising anti-inflammatory potential of ethnomedicinal hill pepper from North East India

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The present study has been undertaken to examine the anti-inflammatory potential of *Piper mullesua* Buch. -Ham. ex D. Don, also known as "Hill Pepper", an important ethnomedicinal plant commonly used to treat cold and cough among various ethnic groups in Arunachal Pradesh and Manipur, India. Hydro-alcoholic (70% ethanol) extract was prepared using leaves of "Hill Pepper" collected from hill areas of Arunachal Pradesh. Anti-inflammatory assays, production of intracellular reactive oxygen species (ROS), and phagocytosis activities were performed using murine macrophage cells (Raw264.7) treated with or without various concentrations (5, 10, or 20 mg/mL) of the plant extract against LPS (50 ng/mL) exposure. Both phytochemical and micronutrient analyses of the plant sample were also performed by using LC-MS/MS and AAS methods, respectively. Treatment with LPS caused a significant increase in ROS production, secretion of pro-inflammatory cytokines (TNF-α, MCP-1, IL-6) and decrease in anti-inflammatory cytokines (IL-4, IL-10) and phagocytosis potential compared to untreated group. Supplementation with the plant extract dose-dependently reduced the ROS production, prevented the alternation in the secretion of pro-inflammatory and anti-inflammatory cytokines, and upregulated the phagocytosis potential in LPS-treated cells. The anti-inflammatory potential of the plant extract was also found to be similar compared to those seen in diclofenac-treated cells against LPS exposure. Furthermore, micronutrients namely, Zn, Fe, Cu, Cr, Mg, Mn, and Se were present in significant amount compared to recommended daily allowance (FSSAI guideline). Phytochemical analyses (LC-MS/MS) revealed the presence of various compounds, like

methyl eugenol, eucalyptol, linalool, gamma-lactone, alpha-pinene, limonene, myrcene, which may play an important role underlying the anti-inflammatory potential of “Hill Pepper”. The outcome of this study suggested the promising anti-inflammatory potential of ethnomedicinal “Hill Pepper”, which may be beneficial for the development of potential herbal formulationsto mitigateinflammatory pathophysiology.

ISESFEC/23/O-051

Bioactive secondary metabolites from Rwandese medicinal plants

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Plants have served as the principal source of medicines in all parts of the world through the ages. Herbal medicines have been used as decoctions, infusions, tinctures or single substance drugs. Due to their impressive ability of diversification, plants have also served as sources of inspiration for synthetic chemists in the urge of preparing new molecules for diverse applications. In our search for bioactive compounds, we identified the secondary metabolites of *Eucalyptus melliodora*, *Eucalyptus anceps, Eriosema montanum*, *Clerodendrum myricoide*s, *a*nd *Senecio mannii*, a selection of Rwandese medicinal plants, and assayed them for their antifungal, antibacterial, antiviral, and cytotoxic activities. We used chromatographic, spectroscopic and spectrometric methods including GC, HPLC, UV, IR, XRD, NMR, and HRMS for the separation, purification, and structure elucidation of the plant constituents. The essential oils of *E. melliodora* and *E. anceps* were shown to contain mono- and diterpenes, and their alcohol derivatives, which were evaluated for antifungal activity. The investigation of *E. montanum* afforded 20 compounds including two new prenylated dihydrochalcones. Three new and two known iridoid glycosides were isolated from *C. myricoides*. The phytochemical investigation of *S. mannii* afforded one new silphiperfolanol angelate ester, two new macrocyclic pyrrolizidine alkaloids, and five known secondary metabolites. The structural modification of 2-angeloyloxy-5,8-dihydroxypresilphiperfolane, yielded two new derivatives with rearranged ring system. The relative stereochemistry of senaetnine was determined by NAMFIS (combined NMR and computational) analysis. The isolated new compounds were showed to possess useful biological activities, and may provide hits for drugs discovery.

ISESFEC/23/O-052

A comprehensive investigation of hemp (*Cannabis sativa* L.) for identification of CBD-rich genotype

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Cannabis sativa L. (Cannabaceae), also known as Indian hemp, is originated from central Asia to southern Asia and has been cultivated mainly in Central Asia since ancient times.*C. sativa* has long been used for healing and recreation in several parts of the world due to its potent bioactive compounds. Over 400 chemical constituents, including more than 100 phytocannabinoids, the non-psychoactive cannabidiol (CBD) and the psychoactive Δ9-tetrahydrocannabinol (Δ9-THC) are the major and widely studied constituents of this plant. CBD is the main chemical constituent that possess broad ranges of therapeutic potential against various illnesses like nerve disorders, Tourette's syndrome, pain, inflammation, multiple sclerosis, epilepsy, sleep disorders, schizophrenia, Alzheimer's and Parkinson's disease. THC is mainly used for recreational purposes and substantially impacts the human body, therefore, many countries banned the cultivation of *C. sativa*. In recent years, many countries allowed the cultivation of *C. sativa* cultivars with less THC content (0.2% in Europe and 0.3% in some Asian countries). The present study focus on the variability of *C. sativa*

germplasms in North Indian states and their quality attributes. The study could help to find out the CBD-rich genotypes from India.

ISESFEC/23/O-053

Evaluating the chemotherapeutic potential of helicase and chaperone axis as novel antimalarial target

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In spite of its ancient origin, malaria remains a global health problem as half of the world's population lives in areas that are at risk of malaria. A major impediment to combating the deadly disease malaria, caused by the protozoa *Plasmodium* is the emergence of drug resistance in the parasite to most of the known drugs. Thus, this scenario impels us to identify new drug targets for the development of antimalarial drugs. RecQ helicase family members are essential in homologous recombination-based error-free DNA repair processes in all domains of life. RecQ helicases are a family of proteins, several homologs of which have been identified in multicellular organisms. The members of this family play a vital role in homologous-recombination based DNA repair. The Bloom (Blm) homolog from *P. falciparum* 3D7 strain, *PfBLM* belongs to RecQ helicase family. It has been implicated in replication, double strand break (DSB) repair and in the maintenance of genome integrity in the parasite. In human, Blm has been reported as a client of heat shock protein 90 (Hsp90) and Hsp90 inhibition results in loss of Blm function. In this study, we aim to explore whether PfBlm is a client of PfHsp90 with a view of targeting the helicase and chaperone axis to curb malaria, using various plant extracts to evaluate their anti-malarial effect. To this end, the physical interaction between PfBlm and PfHsp90 is currently being investigated by yeast-two-hybrid assay and co-immunoprecipitation. Results from these experiments and the effect of Hsp90 inhibition on stability and function of PfBlm will be presented.

ISESFEC/23/O-054

Pharmacological evaluation of hesperidin on olanzapine-induced weight gain, dyslipidemia and insulin resistance in rats

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To evaluate the effect of hesperidin treatment on olanzapine-induced weight gain, dyslipidemia and insulin resistance in female Sprague-Dawley rats, Olanzapine (2mg/kg bid i.p.) was administered for 28 days to induce weight gain, dyslipidemia and insulin resistance in female Sprague-Dawley rats. Hesperidin was administered at doses of 50, 100, and 200 mg/kg p.o. over the course of 28 days. Body weight, food intake, and water intake was recorded daily. Locomotor activity was recorded weekly. NOR test and OGTT was performed after the 28th treatment. At the end of the experiment, Leptin, insulin, adiponectin, and anti-oxidant biomarkers were evaluated followed by histopathological examination.Treatment with hesperidin significantly reduced the weight increase, and increased appetite caused by olanzapine administration. Significant improvement in locomotor activity was observed upon hesperidin administration. Further, hesperidin showed a significant improvement in discrimination ratio in the NOR test. Hesperidin was found to significantly improve the glucose level in OGTT. There was significant improvement in lipid profile i.e. total cholesterol, triglyceride, HDL, LDL and VLDL which was deregulated by olanzapine administration in rats. Furthermore, leptin, insulin, and adiponectin levels were significantly improved upon hesperidin administration. Additionally, there was a significant improvement in anti-oxidant biomarkers followed by amelioration of histological examination. In conclusion, it was found that hesperidin reduced the weight increase, lipid, and glucose dysregulation caused by olanzapine administration. Additionally, it restores olanzapine-induced changes in plasma levels of leptin, adiponectin, and insulin. Hesperidin also

improved cognitive behavior, which was seen in an increase in discrimination ratio in novel object recognition test.

ISESFEC/23/O-055

Investigation of anti-hypercholesterolemic medicinal plants

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Hypercholesterolemia or hyperlipidemia or atherosclerosis is a major health problem in Bangladesh as well as the world and the number of patients is increasing day-by-day. There are some modern medicines for the treatment of such diseases but these medicines have high cost along with calamitous side effects. But herbal drugs are traditionally used from long ago because of their perceived effectiveness. Most of the herbal drugs have fewer side effects and safe to use, and relatively affordable costs. Therefore, the objective of the research was to find out herbs/plants grown in Bangladesh for the treatment of hypercholesterolemia, hyperlipidemia and atherosclerosis. Since, Bangladesh has a great natural resource of medicinal plants and plant-based health remedies. A large number of people in Bangladesh as well as in the world mainly depend on the easily affordable herbal drugs. Successful implementation of the research work, a good number of herbs/plants was found which showed potential activity to reduce the hyper-cholesterol and hyper-lipid levels in mice model. These findings will help us to use these herbs/plants for the treatment of hypercholesterolemia or hyperlipidemia, atherosclerosis and obesity. This research will also provide scientific knowledge to the manufacturer and patients to use safe and effective herbal drugs.

ISESFEC/23/O-056

Study of biofumigant property of enriched fraction of *Dilleniaindica* L. leaves along with its mode of action against stored grain insect pests

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Synthetic insecticides though effective and reliable, cause several hazardous effects on humans and environment which has led to ban several of them. Hence, the focus is now shifted to other alternatives such as plant based potent insecticide with biodegradable and eco-friendly nature. In this study, the fumigant property, and antioxidant effects of *Dillenia indica* L. (Dilleniaceae) were studied against three coleopteran stored-products insects. The bioactive enriched fraction isolated from ethyl acetate extracts of *D. indica* leaves was found toxic to rice weevil, *Sitophilus oryzae* (L.) (Coleoptera); lesser grain borer *Rhyzoperthadominica*(L.) (Coleoptera) and red flour beetle, *Tribolium castaneum* (Herbst.) (Coleoptera) with the LC_{50} values of 101.887, 189.908 and 115.1 µg/L respectively after 24 h exposure. The enriched fraction caused significant oxidative imbalance in the antioxidative enzyme system such a superoxide dismutase, catalase, DPPH (2,2-diphenyl-1-picrylhydrazyl), and glutathione-S-transferase (GST). The *in vitro* acetylcholinesterase (AChE) enzyme inhibition assay revealed that the enriched fraction affects the insect's nervous system when tested against *S. oryzae, T. castaneum* and *R. dominica* with LC_{50} value of 88.57 µg/ml, 97.07 µg/ml and 66.31 µg/ml respectively. GCMS analysis of the enriched fraction indicates three major compounds namely, 6-Hydroxy-4,4,7a-trimethyl-5,6,7,7a-tetrahydrobenzofuran-2(4H)-one, 1,2-Benzisothiazol-3(2H)-one, and Benzothiazole, 2-(2-hydroxyethylthio)-. Finally, we concluded that the enriched fraction of *D. indica* has insecticidal properties and the toxicity may be due to the inhibition of AChE enzyme in association with oxidative imbalance created on the insect's antioxidant enzyme systems.

ISESFEC/23/O-057

Anti-microbial activity of medicinal plant *Zanthoxylum armatum* against gastric pathogen *Helicobacter pylori*

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Helicobacter pylori, a prevalent gastric pathogen, cause peptic ulcers and gastric cancer. It infects more than 50% of the world's population each year. There is an increasing demand for novel plant-based therapeutics to treat chronic infections. It has been found in previous research that traditionally used plants have medicinal properties against gastric diseases. Thus, our aim of the study was to evaluate herbal plant extracts which could be utilized as an alternative for the treatment of *H. pylori*. In this study, ten plant extracts were screened against *H. pylori* using the disc diffusion method as well as liquid culture. Among them, *Zanthoxylum armatum* showed the best antimicrobial activity against *H. pylori* with a minimum Inhibitory concentration ~2 mg/ml. However, this plant extract exhibited no antimicrobial activity against *E. coli* at the above concentration suggesting it is specific for *H. pylori*. Further, it also showed an effect on the morphology of the *H. pylori* cells. Additionally, the cytotoxicity of the plant extract was tested by MTT assay on mammalian cell lines and showed no toxicity at MIC value. Thus, these results highlight the significant *in vitro* effect of the *Zanthoxylum armatum* against *H. pylori*, that pave the way for further *in vivo* experiments to confirm its potential for preventing and treating *H. pylori* associated gastric diseases.

ISESFEC/23/O-058

Antibacterial peptides from Bangladeshi plants of solanaceae family

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Antimicrobial peptides (AMPs) from plants have drawn great interest in recent years for developing new antimicrobial agents. The Solanaceae is an important plant family that has been playing an essential role in traditional medicine and human nutrition. According to literature, a variety of natural antibacterial peptides AMPs were isolated from plants of the Solanaceae. The aim of this study was to identify and characterize AMPs from Bangladeshi plants of solanaceae family. With the aim to discover new AMPs from Bangladeshi plants, a total of 26 Bangladeshi plant species of Solanaceae family were collected, dried, ground into coarse powder and extracted for peptide extraction using acetonitrile with formic acid. The peptide extracts were screened for the presence of AMPs by LC-QToF MS analysis and tested for antimicrobial activity against two bacterial strain and one human pathogenic fungi using microdilution assay. The active peptide fractions were further reduced, alkylated and enzymatic digested to MS based quantify the cysteine content and cyclic nature. A total of 25 extracts showed the positive results for the presence of peptide peaks which eluted from 24 – 45 min. The peptide extracts were further fractionated using sepahdex PD10 column and each fraction were tested for antimicrobial and cytotoxic activity against U-937 cell lines. A total 7 peptide fractions showed about more than 95% growth inhibition cells with an IC_{50} value 50 - 12.5 µg/ml and six peptide fraction showed potential antimicrobial activity with MIC 333-62.5 µg/ml. The MS analysis of reduced-alkylated active peptide showed that they were cysteine rich but enzymatic digestion indicated these peptides are not cyclic nature. This is the first time identification of bioactive AMPs from these Bangladeshi Solanaceae plants. Further study need to be done for their characterization and exploration of their mode of action.

ISESFEC/23/O-059

Multifacet utility and phytochemical validation of *Taverniera cuneifolia* as a potential alternative of *Glycyrrhiza glabra*

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Natural substances derived from plants have always been the source of synthetic drugs, resulting in clinically increased efficacy and fewer side effects. The widespread usage of a small number of plants, such as Glycyrrhiza, Rauvolfia, Piccorrhiza, Withania, and Asparagus has prompted the search for new suitable alternatives at the local level. Consequently, the study of unknown genera containing marker compounds and active ingredients with therapeutic value is the need of the hour. One such potential plant is the *Taverniera cuneifolia*, which is found throughout Asia, the Middle East, and African countries. The use of this genus in many traditional and folk remedies for the treatment of illnesses as an anti-inflammatory, antitussive, antiulcer, spasmolytic, gastroprotective, memory-enhancing, blood purifier, spleen tumours, wound healing, etc. is well-known. The sweet taste of the roots has given it widespread recognition, drawing comparisons to *Glycyrrhiza glabra*. Chemical studies have confirmed 117 components identified from Taverniera species, including Anthocyanin, Flavan, Flavonols, Flavones, Isoflavone, Flavanone, Flavonoid glycoside, Retrochalcones, Diterpenoid, Triterpenoids, and Saponins. In the present study, an effort was made to determine the presence of sugars and their seasonal variation in *T. cuneifolia* relative to *Glycyrrhiza glabra*. For analysis, the High-performance thin-layer chromatography (HPTLC) method was developed and validated as per the ICH guidelines to measure three common sugars i.e. glucose, fructose, and sucrose in *Taverniera cuneifolia*. The mixture of Butanol: Propanol: Boric acid in water (5 mg/mL) (30:50:10, V/V/V) was used as the mobile phase for the separation of sugars in plant samples. Further, the developed HPTLC method was validated for selectivity, linearity and range, LOD and LOQ, precision, robustness and accuracy. Subsequently, the method was used to determine the quantities of glucose, fructose, and sucrose in *T. cuneifolia* plant samples taken from three distinct locations with their seasonal variation.

ISESFEC/23/O-060

Flavone enriched extract of *Osbeckia nepalensis* Hook.f. ameliorates elevated hepatic gluconeogenesis *via* AMPK phosphorylation in diabetic models

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Osbeckia nepalensis Hook. f., ICMR documented medicinal plant, was widely used by the folk people of NE India as an anti-diabetic medicine. Extensive study with scientific validation is needed to uphold the therapeutic activity of the plant for the treatment of T2DM. The objective of the present study is to analyse the claimed anti-diabetic potential of *O. nepalensis*, its enriched fractions and compounds isolated thereof through *in vitro* and *in vivo* experiments. The crude methanolic extract was screened for glucose uptake activity in FFA treated CC1 hepatocytes and bioactivity guided fractionation was carried out yielding bioactive enriched fraction and four marker compounds. The antihyperglycemic activity of the fractions and isolated compounds were evaluated in *in vitro* conditions for the uptake of glucose while the most active enriched *n*-butanol sub fraction 1 (BuSFr1) was used for *in vivo* study in STZ induced diabetic Wistar rats. Bioactivity guided fractionation of methanolic extract of *O. nepalensis* yielded enriched fractions from which four marker compounds were

isolated. Among the four compounds, Taxifolin-3-O-glucoside (TG) gave the most significant glucose uptake activity in FFA treated CC1 hepatocytes while BuSFr1 exhibited substantial antihyperglycemic activity and increased glucose tolerance and plasma insulin level in STZ induced diabetic rats in a dose dependent manner. Upregulation of AMPK phosphorylation along with the downregulation of gluconeogenic enzymes G6pase and PEPCK and their transcription factors were also seen in both TG treated CC1 hepatocytes as well as BuSFr1 treated diabetic wistar rat liver tissues. The present study demonstrated the efficacy of *O. nepalensis,* its enriched fractions and the isolated compound TG in *in vitro* and *in vivo* diabetic models. Moreover, the ethnomedicinally claimed efficacy of *O. nepalensis* Hook. f. is supported by the experiments conducted in this study.

ISESFEC/23/O-061

Effect of poly herbal formulation on ethanol induced gastric ulcers in rats

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The increasing interest in the use of plant-based formulations is leading to a fast growing market for Ayurvedic, nutraceutical and Polyherbal formulations. Poly herbal formulation contains *Nigella sativa, Punica granatum, Ficus carica* and *Moringa oleifera.* Aim of present work is to investigate Poly herbal formulation (PHF) on ethanol Induced gastric ulcer in rats. The effects of PHF on ethanol induced ulcer were investigated in volume of gastric secretion, free acidity, total acidity, ulcer index and histopathology of stomach in rats. The ethanol induced ulcer significantly increases in volume of gastric acid secretion, free acidity, total acidity ,ulcer index and histopathology changes with respect to control, treatment with PHF significantly($P < 0.001$) decreases the volume of gastric acid secretion, free acidity, total acidity, ulcer and Histopathology of stomach surface of columnar epithelium and tubular gastric glands are normal with respect to control. From the study we concluded that PHF have large number of varied chemical compounds present in the different medicinal plants, regardless of whether constituents with defined therapeutic activity

ISESFEC/23/O-062

A potential probiotic *Lactobacillus plantarum* isolated from fermented ethnic food of Manipur alleviates tnf-α by regulating adam-17 protein

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Fermented foods are good source of probiotics and studied for their health benefits. With wide varieties of fermented ethnic food and cuisine of Manipur, exploration for potential next-generation probiotics that can mechanistically influence host health was crucial. With emerging concept of live bio-therapeutic products, probiotics have great potential as future novel therapeutics. In this regard, we studied the anti-inflammatory effect of potential probiotic *Lactobacillus plantarum* strains isolated from fermented ethnic food of Manipur in maximizing gut integrity and its potential role in reducing/inhibiting TNF-α post-translation proteolytic cleavage through the regulation of disintegrin and metalloproteinase (ADAM) family members (ADAM-17) activity. TNF-α is released as pro-TNF-α by macrophages/monocytes during inflammation. Pro-TNF-α undergoes proteolytic cleavage through ADAM-17. Regulating TNF-α and its shedding mediator ADAM-17 might be a promising mechanism in reducing gut-associated disorders. To study *in-vitro* anti-inflammatory effect of potential probiotic *Lactobacillus plantarum* strains. Two *Lactobacillus plantarum* strains were isolated from fermented beverage and milk of Leimaram and Thangmeiband. Caco-2, HT-29, and THP-1 cells were used. RT-PCR and ELISA quantify

gene and protein expression whereas Confocal microscopy for visualization. Potential probiotic *Lactobacillus plantarum* strains enhcanced gut integrity by inducing tight junction protein expression in *Salmonella*-induced caco-2 cells. It also reduced the shedding of TNF-α by down-regulating ADAM-17 expression in THP-1 cells. Potential probiotic *Lactobacillus plantarum* strains isolated from ethnic fermented food ameliorate gut integrity as well as alleviate TNF-α by regulating ADAM-17 expression.

ISESFEC/23/O-063

Enrichment of *Glycyrrhiza glabra* root extract for Phytopharmaceutical ingredient development as an anti-diabetic drug candidate

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Herbal drugs are gaining popularity in the present scenario due to the major concerns arising with the synthetic drugs. However, their acceptability in the pharmaceutical industries and medical field is still questionable because of the lack of sufficient scientific evidences. To tackle this problem, CDSCO has defined a separate class of drugs, known as Phytopharmaceutical Ingredients (PPI), which governs purified fractions of medicinal plant part with minimum four bioactive compounds attributing pharmacological and therapeutic activities. Indian Pharmacopoeia Commission has conducted a research study on *Glycyrrhiza glabra* roots, to prepare its PPI monograph to address diabetes. In-vitro and in-silico antidiabetic activity of the plant extract was conducted along with phytochemical profiling via biochemical tests. Extract enrichment was done by using phytoconstituents elution and purification by chromatographic methods. Detection and quantification of four bioactive markers viz., *liquiritin, glycyrrhizin, formononetin,* and *glabridin* was done by various high throughput methodologies viz., HPTLC, DSA, HPLC, FTIR, and NMR. We have successfully enriched the total content in the extract by 12.87% w/w, assayed by HPLC. The enriched extract consisted *liquiritin and glycyrrhizin* in highest content, i.e., 5.95% and 4.33% w/w respectively, followed by *glabridin* and *formononetin* by 2.25% and 0.34% w/w respectively. The prepared extract showed excellent inhibitory effect on α-amylase enzyme and in-silico study showed *liquiritin* and *glycyrrhizin* being potent anti-diabetic compounds. This study is a scaffold for upcoming PPI monograph designing and PPI-IPRS development of *Glycyrrhiza glabra* in forthcoming edition of Indian Pharmacopoeia 2024 (IP-2024).

ISESFEC/23/O-064

Importance of tribal traditional ethnomedicinal knowledge system in addressing contemporary disease burden

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Despite recent scientific advancement and globalization, the system of traditional medicine and complementary/alternative medicine is considered as a primary health care modality in the resource-constrained health care settings. Herbal medicinal system has been postulated and established through empirical observation and trial and error experiments since time immemorial to maintain good health and alleviate ailments and diseases. The collaborative efforts of ethnobotanists, anthropologists, pharmacists, and physicians could be a workable strategy to evaluate and validate the usage of traditional medicinal plants with the modern scientific methods and innovative techniques. Furthermore, conducting clinical trials to assess their efficacy and human safety is imperative and inevitable. Tribal communities and their cultural context of illness and health is a broader known fact. Tribals, across the length and breadth of India, are following certain traditional norm related to their wellbeing and illness irrespective of their regions. The present paper aims to explore the health and health care beliefs of the tribal communities in India, with special reference to Odisha. Tribal healers who are the beholders of traditional medicinal knowledge system are key to medicines meant not only for their own community members but for the whole of society and for the future healthcare needs and in addressing contemporary disease burden.

ISESFEC/23/O-065

LC-QTOFMS-BASED METABOLITE PROFILING AND EVALUATION OF α-GLUCOSIDASE AND α-AMYLASE INHIBITORY POTENTIAL OF COMBINED PLANT EXTRACT-BASED NUTRACEUTICAL FORMULATION FROM NER

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Lifestyle changes have played a more significant role in affecting human health and leading to lifestyle-related diseases. Natural Products are still considered the primary medication source for the masses, and standardised nutraceuticals will provide a broader range of action, lower side effects and cost-effective treatment in the modern world. In this study, nutraceutical development was done using three traditionally active plant extracts, and its anti-hyperglycaemic potential was evaluated using *in-vitro* α-glucosidase and α-amylase inhibitory assay. Three plants, namely *Curcuma caesia* (rhizome), *Houttuynia cordata* (root) and *Allium hookeri* (root), were collected from the local market of Sikkim and developed into a tri-based nutraceutical in the ratio 1:1:1. Metabolite profiling of each of the plant extract was done by UPLC-QTOF-MS analysis and synergy was established based on neighbourhood approach using network pharmacology. α-amylase and α-glucosidase enzyme inhibitory potential was measured for then nutraceutical and compared with the individual extract. Metabolite profiling of the three plant extracts resulted in the identification of polyphenolic compounds. Network pharmacology analysis exhibited synergy between the three extracts. α-amylase and α-glucosidase inhibitory assay suggested significant dose-dependent activation of the nutraceutical. IC50 values for the nutraceutical (13.67±0.68) were found to be significantly lesser when compared to individual extracts. Thus, *Curcuma caesia* (rhizome), *Houttuynia cordata* (root) and *Allium hookeri* (root) based nutraceutical proved to be effective in inhibition of α-amylase and α-glucosidase enzyme in a mixed type of inhibition. Network pharmacology analysis was influential in developing synergy between the Phytomolecule in the three plant extracts. Further studies on in-vivo antidiabetic activity can be done to validate the results and exploration of molecular mechanisms. Thus, the nutraceutical formulation can be an adjunct therapy in inhibiting α-amylase and α-glucosidase.

ISESFEC/23/O-066

Phytochemical investigation of *Pterocarpus marsupium* roxb. For value addition

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Pterocarpus marsupium Roxb. (Fabaceae), generally known as Indian Kino or Bijasal, is a large deciduous tree. It is found in Nepal, Sri Lanka and India. The every part of this plant is traditionally being used for different pharmacological activities such as antioxidant, anti-inflammatory, antidiabetic, anti-cataract, hepatoprotective, antianalgesic, and antimicrobial etc. Importantly, its heartwood is used for the management of diabetes and inflammation. Phytochemical Investigation of *Pterocarpus marsupium* Roxb. for value addition of its phytoconstituents. The methanolic extract of *P. marsupium* was partitioned with different organic solvents using a liquid-liquid extractor. The ethyl acetate fraction was chromatographed over silica gel column which yielded five compounds namely, pterostilbene, liquiritigenin, 2,3-dehydroliquiritigenin, marsupsin, and pterosupin. Pterostilbene and Liquiritigenin were structurally modified to novel anti-cancer molecules. The methanolic extract of powdered heartwood of *P. marsupium* was prepared and partitioned with different organic solvents. During this process, lipophilic compounds were

separated with hexane and phenolic compounds were mostly separated with ethyl acetate. The column chromatography of ethyl acetate fraction yielded pterostilbene, liquiritigenin, 2,3-dehydroliquiritigenin, marsupsin, and pterosupin with 95-99 % purity. The isolated molecules were characterized by spectroscopic tools. In view of their value-addition, the isolated pterostilbene and liquiritigenin were efficiently modified to yield target oriented novel anti-breast cancer molecules which had impressive biological activities against estrogen dependent and independent breast cancer cell lines.In conclusions, five phenolics were isolated from *P. marsupium* in good yield. Amongst other, the isolated pterostilbene and liquiritigenin were efficiently modified to the target oriented novel anti-breast cancer molecules. This study ravelled that phenolics such as pterostilbene and liquiritigenin has great scope to offer structural templates for novel therapeutics.

ISESFEC/23/O-067

A study on the medicinal plants used in Northeast India for curing various cardiovascular disorders

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North-east India is a part of both Himalaya and Indo-Burma biodiversity hotspots resulting in a plethora of medicinal plants used that are used by different tribal communities. This study focuses on discussing the potential application of medicinal plants in developing new therapeutic molecules for the prevention of CVDs. In this perspective, the literature survey and our experimental report have established that numerous plants have been proven to have an excellent and positive effect on different critical diseases or disorders such as diabetes, hypertension, hyperlipidemia, cancer etc. About 80% of the ingredients of the Indian system of medicine are shared by plants. In Assam, there are more than 200 medicinal plants, some of which like Arjuna, Vinca, Tulsi, Surpagandha, Kalmegh etc. have got very good expert value despite their extensive uses in the country itself. But, as the general people are not aware of their uses and potentialities, some are being destroyed willfully by the people for animal feeding, fuel, etc. some are being burnt and cut down to clear the jungle. Such rare or scarce medicinal plants have got a very good demand for the preparation of both modern and Ayurvedic drugs. Since, the mode of imparting education for the standardization of herbal medicine and practices has not developed at a speed consistent with to present time. Therefore, there is a need to create awareness among common people regarding the use of herbs to treat ailments in association with conventional medication. To change the popular public perception of the use of herbal products, a need is being felt for clinical trials and development by researchers, manufacturers and regulatory agencies to ensure the quality and consistency of traditional herbal products. Using modern technologies, the quality and consistency of the wide spectrum of herbal products can be monitored.

ISESFEC/23/O-068

Identification of osteogenic agents from *Spinacia oleracea* leaves and development of therapeutic formulation for osteoarthritis

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Spinacia oleracea L. belongs to family Amaranthaceae commonly known as ‘Palak’ in Hindi. The plant is used as antipyretic, diuretic, laxative, anthelmentic, useful in diseases of blood and brain, asthma, leprosy, inflammation of the lungs and the bowels, pain in joints. It is recommended as the best source of vitamins and minerals. It also possesses several

flavonoids, terpenoids and polyphenols. Osteoarthritis (OA) is a problem of weight bearing joints such as hips and knees due to loss of cartilages which ultimately causes physical disability to move or walk. Extract was prepared in LR grade ethanol and compounds purification was done using different chromatographic techniques. For bio-evaluation, 0.8 mm hole was drilled in the diaphyseal region of femur in adult SD rats. Extract was administered orally and fractured femur was collected after treatment regimen. Micro-CT, transcriptional analysis and measurement of calcein intensity of callus formed at the injured site was performed to study the efficacy of the extract and formulation on bone regeneration. Further, compounds from extract were assessed for *in-vitro* osteoblast activity. Alcoholic extract (SOE) of *Spinacia oleracea* leaves at 250 and 500 $mg.kg^{-1}$ day^{-1} doses was given for 28 days to the rats orally. Treated rats were showed increased bone volume to tissue volume (BV/TV) which resulted in decrease of trabecular pattern factor (Tb. Pf) in micro-CT analysis of sub-chondral bones. It also stimulated chondrogenic marker gene expression with reduction in pro-inflammatory markers. Purified compounds isolated from it which showed increased Sox-9 and Col-II protein expression in articular chondrocytes. The compound 3-O-Methylpatuletin, stimulated the differentiation and mineralization of primary osteoblast and depicted concentration dependent antagonizing effect of H2O2 in osteoblast apparently, minimizing ROS generation thus affectivity in fracture repair. Serum and urine analysis indicated that SOE possess the potential to down-regulate glutathione S-transferase (GST) activity, clinical markers of osteoarthritis like cartilage oligometric matrix protein (COMP) and CTX-II. Overall, this led to a significant improvement in locomotion and balancing activity in rats as assessed by Open-field and Rota rod test. We formulated it with microcrystalline cellulose and the technology was patented as US and Indian patent. The present study showed that bone cartilage regeneration along with all improved parameters which indicates anti-osteoarthritic potential of spinach and the developed formulation as therapeutic agent for osteoarthritis.

ISESFEC/23/O-069

In vitro culture of *Artemisia parviflora* robx. Ex d. Don for artemisinin production

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Artemisia parviflora is an mportant medicinal plant. It has been used in ethno-medicine by local practitioners in hair lotion and for treatment of various diseases. The present study investigated the *in vitro* artemisinin production potential of *A. parviflora*. Callus was induced from leaf explants of *A. parviflora* and cell suspension cultures were established using the friable callus obtained from the leaf explants. Enhancement of artemisinin accumulation in cell suspension culture was also investigated through application of three abiotic elicitors (salicylic acid, methyl jasmonate and jasmonic acid), one biotic elicitor (chitosan), as well as five precursors (phenylalanine, valine, L-aspartic acid, proline and riboflavin) at different concentrations. The effect of different environmental factors like light, pH, carbon source, different concentrations of sucrose and various nutrient stress conditions (nitrogen stress, sulphate stress, vitamin stress, phosphate stress, etc.) on artemisinin production were also investigated. Friable callus with artemisinin content of 0.034% on dry weight basis was induced from the leaf explants cultured on MS (Murashige & Skoog 1962) medium supplemented with 3 mg L^{-1} 2, 4-dichlorophenoxyacetic acid (2,4-D). Cell suspension cultures were successfully established from the friable callus and complete growth kinetics and artemisinin production profile of cell suspension cultures were studied at 5 days intervals for growth cycle of 45 days. An average cell biomass of 2.526 g fresh weight as well as artemisinin content of 0.015% of the cell suspension cultures peaked on the 15^{th} day of the growth cycles. Maximum enhancement in artemisinin content (compared to the untreated cell cultures) was obtained upon elicitation of the cell suspension cultures with 10 mg/l salicylic acid (after 96 hours). The callus and elicited cell cultures of *A. parviflora*

accumulated artemisinin, which may be useful as potential alternative source for artemisinin production.

ISESFEC/23/O-070

Exploring the Social, Ecological and Economic Impact on Conservation of Sacred Groves of the Indigenous Communities of Northeast India

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Sacred groves are tracts of virgin forest with rich biodiversity and are protected by local communities to keep them in a relatively undisturbed state. These are the small patches of remnant forest, protected by local communities on religious ground, which are the traditional Indian way of *in situ* conservation of biodiversity. Various indigenous communities dedicate sacred groves to the local deities or ancestral spirits. Such a grove consists of a multi-species, multi-tier primary forest or a cluster of trees, depending on the history of the vegetation. These groves were protected by local communities, usually through customary taboos and sanctions with cultural and ecological implications. Here in this paper an attempt has been made to understand the social, ecological and economic impact on conservation of sacred groves of the indigenous communities of Northeast India. It further investigates the verbatim of the local healers and the curative healing practices of different ailments those who are living in the vicinity of the sacred groves. The pluralism of the ethno-medicinal practices among the indigenous communities would also be analysed in the context of the changing scenario.

ISESFEC/23/O-071

Development of endophytic fungi as a bio-cell factory for sustainable production of extracellular red pigment with potential pharmaceutical potential

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The growing concern over the harmful effects of synthetic colorants on both the consumer and the environment has raised a strong interest in natural coloring alternatives. Due to global increase in the manufacture of processed foods and continued consumer demands for natural food ingredients, the market for natural colorants for food use is estimated to grow rapidly. Currently, a vast majority of the natural food colorants permitted are derived by extraction of the pigments from raw materials obtained from flowering-plants. Among other non-conventional sources, filamentous fungi, particularly ascomycetous and basidiomycetous fungi (mushrooms) are known to produce an extraordinary range of colors including chemical classes of pigments such as melanins, azaphilones, flavins, phenazines, and quinines. Present project aimed to screen the endophytic fungi isolated from different habitats and to identify the potential producer of colour amongst these organisms. Out of screened fungi, fungal isolate CPE02 was selected based upon the capacity to produce profuse extracellular red pigment and being considered as generally regarded as safe (GRAS) fungi. The isolate was identified as *Monascus purpureus* employing morphological features and phylogenetic characterization by internal transcribed spacer (ITS) sequences. The chemical profiling of the active extract was carried out with UHPLC-DAD-MS in order to identify the pigmented molecules. The isolate possess antioxidant activities against DPPH, ABTS radicals and found to have significant antibacterial activity against both Gram-positive

and Gram-negative anthropogenic bacterial pathogens emphasising its role as potential source of natural red colourant in the food industry.

ISESFEC/23/O-072

Application of AI-based Raman spectrometer for rapid safety and quality assessment of traditional rice beer

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Apong is a rice beer of the Missing people found in the Northeast Indian states of Arunachal Pradesh and Assam. It is prepared by fermenting cooked rice cakes called E'pob. According to FSSAI, it is classified as rice wine which is an alcoholic beverage fermented and distilled from rice and typically has an alcohol content of 18-25% ABV. Presently the quality methods of determination of alcohol are GC, hydrometer, distillation etc. However, these methods suffer from drawbacks such as being lab-based, expensive, high human skill and chemical based which is not accessible to the remote tribal population. This study presents a rapid and non-destructive quality estimation technique for the estimation of ethanol and methanol contents in rice beer using a developed portable Raman spectrometer. The cost-effective and portable Raman spectrometer consists of a laser power supply, an optical head, the detector and a customized graphical user interface (GUI). In this study, twenty-eight Assam Apong samples were considered and the Raman spectral data acquisitions were made in transmission mode. The data sets have been divided into a calibration set and a prediction set. Different pre-processing techniques were applied to the acquired spectral data and a model was developed using the PLS regression algorithm by applying the calibration data set. Then the prediction set was applied to the developed model. The RMSEP, RPD and R^2 for the prediction set were obtained as 0.05, 3.08 and 0.92 respectively, which depicts the model's efficacy. The results indicated that Raman spectroscopy with PLSR model and SNV pre-processing, using a portable spectroscope, could be effectively used for rapid determination of alcohol quality by estimation of ethanol content of Apong. The preliminary results demonstrate the efficacy of the developed portable Raman technique for the estimation of ethanol in Apong.

ISESFEC/23/O-073

Indigo yielding plants in medicine and quindainones chemistry

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Isatis tinctoria and similar Indigo yielding plants contains many complicated condensed aromatic compounds. Some indigoids and indolochinazolins have shown promising anti-cancer and anti-inflammatory properties, also anti-malaria acitiviy is there. In anti-cancer research, not only the cytotoxic activity of a compound is important, much more counts the therapeutic index and resistance breaking properties. Among *Isatis* metabolites,

quingdainones (Indigo brown) have received less attention. These are cross breeds between tryptanthrines being indoloquinazolines and indoxyl. An active dihydroxyquingdainone AC_{50} 7.5 µmole, has been found and further characterized and compared to synthetic derivatives. No other compound of this family including the unsubstituted quingdainone was active. Finding its apoptosis inducing ability (in a caspase 3 dependent manner) it was further characterized using Nalm-6 cells. Reduced mitochondrial membrane potential was determined using JC-1 staining and flow cytometric measurement, 6.3 µmole dihydroxyquingdainone showed 50% cell number with low mitochondrial membrane potential. BeKa cells (Vincristine resistant Nalm 6 cells, show an increased expression of the p-glycoprotein. Substances can be actively secreted from the cell via this protein, whereby they become multidrug resistant (MDR), which has also been demonstrated for BeKa cells. BeKa cells show a co-resistance to anthracyclines (Idarubicine, Daunorubicine, Doxorubicine, Epirubicine), Mitoxanthrone, Fludarabine, Vincristine or Vinblastin and Etoposide *in vitro.* Nalm-6 and BeKa cells had been treated with dihydroxyquingdainone for 72 h. The comparison of the percentage of apoptotic cells in these treated cell lines showed no significant differences. Thus it is no substrate of the p-glycoprotein and explains a prominent effect in vincristine resistant leukaemia cells.

ISESFEC/23/O-074

Identification of plant extracts active against *acaricide-resistant ticks and mosquito larva*

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Mosquitoes and ticks are the primary vectors transmitting pathogens to humans and animals. According to WHO, 7.25 lakh humans die from mosquito-borne diseases, while Tick and Tick-borne diseases (TTBDs) affect 80% of the world's cattle population. Tropical and sub-tropical countries, including India, are most affected by these vectors and vector-borne diseases. *S*ynthetic insecticides and acaricides are t*he most common methods for controlling mosquitoes and ticks,* respectively. However, the indiscriminate application of synthetic insecticides and acaricides is developing resistance in *mosquitoes and ticks.* Hence, there is a need to identify novel natural insecticides and acaricides. Plants possess secondary metabolites like terpenes, phenols, acids, steroids, aldehydes, and essential oils. Some of the metabolites are known to have insecticidal properties. In this study, we attempted to identify plant extracts with anti-tick and mosquitocidal properties and their mode of action. We prepared soxlate using selected polar organic solvents with low to high polarity (hexane, chloroform, and methanol). We selected 20 Indian medicinal plants and prepared extracts using the soxhlation apparatus. We analyzed the acaricidal properties of these plant extracts using Adult Immersion Test (AIT) and Larval Immersion Test (LIT**), while for mosquitoes, we performed LIT. The screening leads to identifying plant extracts that can kill ticks and misquotes. Further, we prepared a formulation with the plant extracts, which show acaricidal properties. The formulation could kill acaricide-resistant ticks also.** The prepared formulation is stable under long-term storage. Our preliminary results show that this formulation effectively kills acaricides under *in vivo* conditions. We are in the process of filing a patent application with this formulation.

ISESFEC/23/O-075

In-silico and in-vivo assessment of diabetes ameliorating potentiality and safety profile of *Gynura procumbens*: a breakthrough approach to combat diabetes mellitus

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Diabetes mellitus is one of the most notable health dilemmas in both developed and developing countries. Safety, affordability, and potency of antidiabetic medicaments have become a fundamental requirement in the disease management system. Nowadays, plants can be potential candidates to combat this deadly disease. Hence, analyzing plants for new antidiabetic remedies has become an impressive territory for life science researchers. Gynura procumbens has long been used to treat diabetes. Thus, We strived to ascertain the hypoglycemic potentiality of extract of leaves of *Gynura procumbens* (G. procumbens). Fresh leaves of G. procumbens were collected and sundried to prepare ethanolic extracts to evaluate pharmacological parameters. Diabetes was induced in rats via injecting alloxan through the intraperitoneal route at a dose of 150 mg/Kg body weight. Humalyzer 3000 was used to perform a biochemical assay of collected samples from rats. Antihyperglycemic activity study along with overdose toxicity test was performed. The pharmacological activity of this plant has also been evaluated through a molecular docking study. This in-silico study investigated the binding affinity of natural ligands from *G. procumbens* against glycoside hydrolase enzymes. We detected a peak plasma concentration of *G. procumbens* at 3:45 hours which is roughly similar to the peak plasma concentration of metformin. Again, In OGTT and antihyperglycemic tests, it has been ascertained that both plant extract and metformin can exert significant ($P<0.05$) hypoglycemic activity in a dose-dependent manner. Here, metformin exhibits better therapeutic efficacy than that of plant extract, but it possesses null statistical significance. Also, our safety profile expressed that, similar to metformin, plant extract can restore the disturbed pathological state in a dose-oriented approach with a wide safety margin. In-silico study also validates the potentialities of natural constituents of G. procumbens. This study suggests that *G. procumbens* can be considered a potential antidiabetic plant. Robust and Meticulous investigation regarding plant chemistry and pharmacology in the future may bring about a new dimension that will aid in discovering antidiabetics in the diabetes management system.

ABSTRACT FOR POSTER PRESENTATION

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IMPHAL, INDIA

ABSTRACT FOR POSTER PRESENTATION

ISESFEC/23/P-001

An ethnobotanical study of medicinal plants in different regions of Thoubal district, Manipur

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Since ancient times, medicinal plants have been used to treat a wide range of illnesses, and despite the enormous advances made in contemporary medicine, man still makes use of this ancient knowledge. The study's objective is to conduct an ethnobotanical investigation of significant ethnomedical plants in various areas of Manipur's Thoubal district. Numerous quantitative indices, including as the Informant Consensus Factor (ICF), Use Value (UV), Relative Frequency of Citation (RFC), were used to quantify the advantages, significance, and coverage of ethnomedicine. By using a predesigned questionnaire that included questions about the diseases being treated, their symptoms, the bioresources used, the formulations used, the method of preparation, the dosage form, and other information, the team conducted an interview with the traditional healers to learn about their traditional medical practices. A total of 132 plant species under 64 families were documented from 44 informants. *Alangium chinese* (Lour.) Harms (0.94), *Zingiber officinale* Roscoe (0.92), *Solanum xanthocarpum* Schrad. & H. Wendl Linn (0.91), *Zanthoxylum acanthopodium* DC (0.89), *Curcuma longa* Linn (0.88), *Passiflora edulis* Sims (0.87), *Polygonum posumbu* Buch.-Ham. ex D. Don (0.85) and *Phlogacanthus thyrsiformis* (Roxb. ex Hardw.) Mabb (0.84) have the highest relative frequency of citation (RFC). The present study enabled us to list the medicinal plant species used in various regions of Thoubal District, Manipur. These species may be a genuine natural source of novel biomolecules with potential therapeutic use.

ISESFEC/23/P-002

Anti inflammatory and antiproliferative activity of *Meyna spinosa* Roxb*.*, an unexplored ethnomedicinal plant

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Inflammation and the presence of pro-inflammatory cytokines are associated with numerous chronic diseases such as type-2 diabetes mellitus, cardiovascular disease, Alzheimer's disease, and cancer (Chen et al., 2017). Over the years, a number of scientific studies have highlighted an inverse association between a diet rich in fruits and vegetables and the onset of chronic diseases (Zhao et al., 2017). In this context, an increasing number of researchers have examined the anti-inflammatory effects of fruit extracts and their derivatives. Meynaspinosa is an ethnomedicinal plant mainly found in north-east part of India. Traditionally it is used for the cure of cold, dysentery, indigestion, skin infection, intestinal worm, etc. It is a rich source of triterpenes, flavonoids, glycosides, saponins, phytosterols, etc. In this study, anti-inflammatory and antiproliferative activities of Meynaspinosa have been studied. Inhibition of Nitric oxide, inhibition of COX-2 and attenuation of pro-

inflammatory cytokines were studied in LPS stimulated Raw 264.7 macrophages and antiproliferative activity was studied in A549 cells. Treatment with ethyl acetate extracts of the fruits at 70 µg/ml and 140 µg/ml led to nitrtite concentration of 11.089 ± 0.568 µM and 11.089 ± 0.778 µM respectively, TNF-α levels as 145.560±3.361 µM and 255.339±19.981 µM respectively with respect to control, NAC (278.321±43.618 µM at 70 µg/ml and 308.883±22.152 µM at 140 µg/ml) and COX-2 level as 18.649±0.232 µM and 12.222±0.490 µM respectively with respect to control, NAC (38.722±2.993 µM and 33.704±0.880 µM respectively at 70 µg/ml and 140 µg/ml). Antiproliferative activity of ethyl acetate extract against A549 lung cancer cells was checked and IC50 was found to be 1188.21 µg/ml, 998.16 µg/ml, and 956.93 µg/ml respectively at 24, 48 and 72 hrs. Based on these results, it can be concluded that Meynaspinosa have anti-inflammatory and anticancer activity.

ISESFEC/23/P-003

Antibacterial and antiproliferative potential of Akhuni/Axone, a fermented food of Northeast India

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Fermented food items provide economic sustainability as it prolongs the availability of food, preserve and enhance the nutritional contents of food items. This study underlines the anti-bacterial, and antiproliferative properties of Akhuni/Axone as a functional food. Akhuni is a traditional fermented soybean from Nagaland. Ethyl acetate extract of Akhuni (AKEA) exhibited potent antibacterial activity against *S. aureus* and *E. coli* with MIC value of 8.09 ± 0.86 and 10.79 ± 0.91 mg/ml respectively whereas MBC values were 10.79 ± 0.63 mg/ml and 13.45 ± 1.12 mg/ml against *S. aureus* and *E. coli* respectively. The time-kill analysis and cellular leakage assay results indicated that AKEA has bactericidal effect with an increase in membrane permeability, membrane destabilization and cell lysis in a concentration and time dependent manner towards both the pathogens. Oxidative stress analysis indicated that AKEA treatment led to excessive ROS production and oxidative stress. The ability of the extract to inhibit the growth of tumorigenic cells was determined using cell cytotoxicity assay. Ethanol extract (AKET) was found to exhibit antiproliferative activity at 24 hrs with an IC_{50} value of 296.87 and 263.34 µg/ml in A549 and B16F10 cells respectively. Results from this study will help in further in-depth and extensive evaluation as well as broaden the scope of this generation-old traditional food.

ISESFEC/23/P-004

GC-MS phytoconstituent analysis of essential oil of *Cinnamomum tamala* from Manipur, India

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Cinnamomum tamala has traditionally been used as an astringent, stimulant, and diuretic, carminative and in the treatment of heart diseases. The leaves are used as flavouring agent in food industry and in pharmaceuticals for its medicinal properties. The essential oil of the leaves of *C. tamala* is used medicinally as a carminative, flatulent, diuretic and in treatment of cardiac disorders. The present work reports on the investigation of the phytoconstituents present in the essential oil of *Cinnamomum tamala* (Buch.-Ham.) T.Nees. The essential oils were extracted by hydro-distillation method by using Clevenger apparatus. Gas chromatography-mass spectrometry(GC-MS) was carried out to determine the phytoconstituents present in the essential oils of the *C. tamala* leaves.GC-MS analysis showed the presence of various components in the essential oil of the *C. tamala* leaves.m-Eugenol (60.98%), β-Thujene (17.48%), 1,3-Benzenediol, O,O'-di(2-methylbenzoyl)-

(4.31%), à-Pinene (2.53%), Cyclohexene, 1,5,5-trimethyl-6-(2-propenylidene)- (1.07%), Terpinolene (0.95%) were found to be the major components present in the *C. tamala* essential oil.The study's findings showed that the essential oil from *C. tamala* leaves contains a number of significant phytoconstituents.

ISESFEC/23/P-005

Evaluation of antioxidants, anti-inflammatory activities and chemical composition of *Coridius chinensis* (Dallas), an edible insect species of North-East India

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Coridius chinensis is an edible insect, known for having both food and traditional medicine value. The crude extract of *C. chinensis* was screened for secondary metabolites, *in vitro* antioxidant activity, and anti-inflammatory activity. Our findings show the presence of important secondary metabolites, nutrients like proteins, carbohydrates, and crude fats, anti-inflammatory which have potential medicinal use. There are significant amounts of secondary metabolites viz., phenol and flavanoids. In comparison to other solvent extracts such as hexane and ethyl acetate, methanolic extract exhibited strong antioxidant property. A total of 61 components were identified from the methanolic extract of *C. chinensis* by GCMS analysis. According to the present findings, *C. chinensis* can be recommended source of healthy food with excellent medicinal qualities which can be used as neutraceuticals, and other applications in human life.

ISESFEC/23/P-006

Phytochemical contents and anti-feedant effects of *Ageratina adenophora* (Spreng.) against three cabbage pests

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Since spraying of synthetic pesticides in an agricultural field does have negative side effects, searching for a safer alternative i.e., botanical insecticides for crucifer pest management is required as they are less harmful to humans and animals. Here, solvent extracts (hexane, ethyl acetate, chloroform, acetone and methanol) of Crofton weed, *Ageratina adenophora* (Spreng.) RM King & H. Rob (Asteraceae), was studied for antifeedant activity against third instar larvae of Large cabbage white butterfly *Pieris brassicae* L. (Pieridae: Lepidotera), Diamondback Moth *Plutella xylostella* L. (Plutellidae: Lepidoptera) and Cabbage cluster caterpillar *Crocidolomia pavonana* F. (Crambidae: Lepidoptera). Among the solvent extracts tested, *A. adenophora* hexane extract at 5% (Weight/volume) concentration exhibited maximum antifeedant activity against *P. xylostella* (92.1%), *C. pavonana* (87.4%) and *P. brassicae* (81.7%) and effective concentration (EC_{50}) values were 1.41%, 2.06 % and 2.77 % (W/V), respectively. The hexane extract was characterized using GC-MS analysis and it was determined that it was comprised of 9, 11-Octadecadiynoic acid, 8-oxo-, methyl ester (27.46%), 2(3H)-Naphthalenone, 4,4a,5,6,7,8-hexahydro-4a, (R) 7,7- trimethyl- (20.40%), Germacrene D (6.11%), 2(1H)-Naphthalenone (5.79%), 5,6-Decadien-3-yne,5,7-diethyl (5%) and á-Bisaboelne (2.09%) . The results suggest that hexane extract of *A. adenophora* could be used for the development of botanical insecticides.

ISESFEC/23/P-007

Nimbolide-based nanomedicine enhances paclitaxel activity against triple-negative breast cancer by targeting cancer stem-like cells

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Triple-Negative Breast Cancer (TNBC) is the most aggressive subtype of breast cancer with high rates of metastasis. Currently available chemotherapeutics for the treatment of TNBC include taxanes (paclitaxel and docetaxel) which reduces bulk tumors by inhibiting highly proliferative cancer cells. Recent evidence suggested that paclitaxel enhanced pro-inflammatory cytokines. Thus, combined treatment of anti-CSCs agents with chemotherapeutic agents can be a promising approach for complete tumor regression in TNBC patients. Recently, phytochemicals have garnered significant attention as potent anti-cancer agents due to their safety profile, scaffold structure and efficacy. In our previous study, we have successfully demonstrated that nimbolide (Nim) is a potent naturally occurring terpenoidthat exhibits anti-CSCs effects, but poor pharmacokinetics and low bio-distribution limit its therapeutic application. To enhance its biological activity, Nim encapsulated PLGA nanoparticles (Nim NPs) were formulated, *in vitro* and *in vivo* studies demonstrated that Nim NPs showed enhanced anti-CSCs effect compared to Nim. In the present study, we have examined the combinational effect of Nim or Nim NPs (anti-CSCs agent) with paclitaxel (chemotherapeutics) *in vitro* and *in vivo* models. *In vitro* studies indicated that a non-toxic dose of paclitaxel-induced stemness and ALDH+ population, however, combinational treatment of paclitaxel with Nim or Nim NPs significantly reduced stemness, ALDH+ population, chemoresistance, EMT and migration in BCSCs as compared to monotherapy of either paclitaxel or Nim/Nim NPs. Further, *in vivo* results demonstrated that a combination of Nim or Nim NPs with paclitaxel significantly showed enhanced anti-tumor efficacy in orthotropic and lung metastatic nude mice xenograft, whereas Nim NPs and paclitaxel combination showed better inhibitory effects. Taken together, it is anticipated that Nim-based phyto nanomedicine with paclitaxel will be a potential therapeutic candidate for inhibiting BCSCs and bulk cancer cells offering an efficient strategy for TNBC therapy.

ISESFEC/23/P-008

Documentation of Indigenous Ethnomedicinal plants in Imphal west district, Manipur, India - an approach for conservation and sustainable use of plant wealth

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Over the years, native population has been using local plants for medicinal purposes and has accumulated significant ethnomedicinal information to deal with health insufficiency. This explorative study provides information about the indigenous traditional knowledge on medicinal plants used by the inhabitants in Imphal West, Manipur, India. The present study was mainly focused on documentation of medicinal plants used by Imphal West to treat different diseases. To get the data on traditional uses of medicinal plants, 16 informants were interviewed using semi structured questionnaire. Documented ethnomedicinal data is translated and statistically analyzed using quantitative indices, used value (UV), relative frequency of citation (RFC), fidelity level (FL), informant consensus factor (Fic), family important value (FIV), Relative popularity level (RPL) to arrive at some important result. A total of 91 medicinal plants belonging to 31 families used in 24 disease categories were documented. Leaves were the frequently used plant parts, and crushed preparation was the

commonly used method for herbal medicine. Plants with high use value were *Curcuma caesia* (4), *Eclipta prostrata* (2), *Blumeopsis flava* (2), *Oreocnide integrifolia* (2). In the present study provides useful information about traditional uses of medicinal plants in different ailments and anticipated that ethnobotany plays a important role in conservation and sustainable use of plant wealth in Imphal West of Manipur, India. Loss of such plant bodies stands for unsustainability. The plants with the highest use values could be employed in pharmacological research and biotechnological approaches in order to achieve adequate revenue.

ISESFEC/23/P-009

Insulin resistance reversible potential of selected phytosteroids in skeletal muscle cell: A preliminary study

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Phytosteroids are plant-derived steroids found in most of the plant foods, unrefined plant oils, and dry-fruits. Phytosteroids are pharmacologically active molecules and well-known worldwide for their traditional use for multiple health benefit applications. Ethnopharmacological validation of selected phytosteroids against insulin resistance reversal potential may play an important role in developing value-added products for the neutraceuticals and pharmaceutical industries. The present study works to validate the Insulin resistance reversible potential of selected phytosteroids against TNF-α induced insulin resistance in skeletal muscle cell line (L6). We have selected the tigogenin, diosgenin and with Aferin-A as phytosteroids based on their traditional use for the management of metabolic disorders and inflammation and it was obtained from the phytochemistry division of the institute (CSIR-CIMAP Lucknow, India).Before performing the pharmacological validation of selected phytosteroids, we performed its safety profile using MTT assay in skeletal muscle cell. Pharmacological potential safe phytosteroids was performed against tumor necrosis factor-α(TNF-α)-induced insulin resistance in skeletal muscle cell line (L6). Results of this study indicated that the selected phytosteroids are not cytotoxic to skeletal muscle cells and are able to reverse the TNF-α-induced insulin resistance in the skeletal muscle cell. Among these phytosteroids, tigogenin is most potent phytosteroid to reverse the insulin resistance condition as an evidence of glucose uptake assay. These results suggest the suitability of tigogenin and tigogenin-rich extracts for *Trigonella foenum-graecum*, reported plant having these phytosteroids with special reference to its analytical chemistry, in-vivo validation in experimental animals and also molecular mechanism using insulin signalling cascade for the management of inflammation-linked metabolic disorders.

ISESFEC/23/P-010

SPME/GC-MS Volatile organic compounds analysis in *Cinnamomum tamala* leaves from Manipur, India

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Cinnamomum tamala is a plant that belongs to the Lauraceae family which has been extensively used for the treatment of a wide array of disorders in various traditional systems of medicine. *C. tamala* has historically been used as an astringent, stimulant, diuretic, carminative, and in the treatment of cardiac disorders. Because of its therapeutic potentials, the leaves are employed in pharmaceuticals and the culinary sector as flavouring agents.in the present study we investigated the volatile organic compounds present in fresh leaves of

Cinnamomum tamala (Buch.-Ham.) T. Nees. The VOC's were collected by using the SPME fiber (Black plain-75µm CAR/PDMS) which was conditioned and cleaned thermally at 250ºC for 30 mins.The SPME fiber was exposed to the sample containing in the 15 mL glass vial for 20 min and was injected into the injector of GC-MS instrument of each sample for 2 min. The aroma or volatile constituents were studied by using GC-MS with Quadrapole detector using Thermo Scientific (Trace 1300 GC & TSQ8000 DUO) having TG-5MS column. The relative VOC's constituents were expressed by its peak area percentage. The most abundant volatiles found were 2-Thujene (24.96%), Eugenol (23.63%), Bicyclo germacrene (10.18%), Germacrene D (7.14%), o-Cymene (6.08%), Caryophyllene (2.94%), Camphene (2.05%), and others. The results suggested that SPME is a very useful tool for the analysis of aromatic compounds.

ISESFEC/23/P-011

Phytochemical analysis of essential oil of E*lsholtzia griffithii* by GC-MS spectroscopy from Manipur, India

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Elsholtzia griffithii plant belongs to Lamiaceae and has been used as domestic folk medicine, herbal tea, food, spices, beverages, perfumeries, cosmetics, aromatherapies, and the source of honey manufacture. They have wide application in the treatment of digestion disorder, rheumatic arthritis, nephritises, colds, headaches, pharyngitis, fever, diarrhea, and nyctalopia in China. In the present study, we analyzed the phytochemical constituents present in the essential oil of *Elsholtzia griffithii.* Hydro-distillation method by using Clevenger apparatus was used to extract essential oils. The phytoconstituents present in the essential oils of the *Elsholtzia griffithii* leaves were determined via. Gas Chromatography-Mass spectrometry (GC-MS). GC-MS analysis showed the presence of various components in the essential oils of the *Elsholtzia griffithii* leaves. α-Citral (46.45%), Photocitral B (39.47%), Geraniol (3.17%), Isocitral (2.6%), Isoneral (1.77%) were found to be the major components present in the *Elsholtzia griffithii* essential oil. The findings showed that the essential oils present in the *Elsholtzia griffithii* leaves contain a number of significant phytoconstituents. Considering the phytoconstituents availability, the plant has the potent of antimicrobial, anti-inflammatory activities.

ISESFEC/23/P-012

Investigation of Phytoconstituents of unexplored *Aganope thyrsiflora* plant of Mizoram: An approach for scientific evidence-based research

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Traditional medicinal knowledge has been extending till today within specific geographical regions and tribes, as rooted adamantly in Indian traditional System of Medicine. As WHO recognized the importance of traditional medicine, scientific evaluation forms the basis of herbal discovery and industry. Mizoram is a state of rich biodiversity, where researchers have been taking an interest in exploring the value of the state for its contribution in medical science. *Aganope thyrsiflora* is a medicinal plant widely distributed in the state of Mizoram, North-east, India. The young leaves of the plant have been used as vegetables since time immemorial. The plant is documented as a medicinal plant by the local practitioner however scientific reports have not yet been documented. Different medicinal plants possess various bioactive compounds, which have a major contribution in estimation of its pharmacological activity. To ensure the safety of the medicinal plant and to encourage its rightful pharmacological property, evidence-based scientific research is highly suggested. The plant

was authenticated and methanolic extract of *Aganope thyrsiflora* was obtained by using Soxhlet apparatus. Phytochemical screening of the methanolic extract is performed for its alkaloid, flavonoids, tannins, etc. GC-MS analysis was also performed to determine the bioactive compounds present in the methanolic extract of *Aganope thyrsiflora.* Phytochemical screening of the plant showed the presence of alkaloids, glycosides, flavonoids, tannins, phenols, carbohydrates, phytosterols, diterpenes, quinines, sugars. GC-MS showed the presence of 95 compounds. Among which, neophytadiene, phytol, 9, 12-Octadieneoic acid, n-hexadecanoic acid, stigmasterol, tocospiro a and b, 4-vinylphenol, guaicol and methyl nicotinateare important compounds for pharmacological activity. By analyzing the data obtained, *Aganope thyrsiflora* is believed to have an important role as a medicinal plant. The information provided by this study shall provide valuable data in further investigation of the plant towards medical research.

ISESFEC/23/P-013

Essential oil compositions from *Artemisia vulgaris* L. with antifungal activities against *Fusarium oxysporum* and *Sclerotium oryzae*

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The main aim of this study is to investigate the essential oils (EO's) from the fresh leaves of *Artemisia vulgaris* available in Manipur and its potential antifungal activities against *Fusarium oxysporum* and *Sclerotium oryzae*. The fresh leaves of *A. vulgaris* were collected in the month of June 2022 from the hillocks of Phayeng, Imphal west district of Manipur (N 24º 16.275, E 093º 52.651**.** The EO's isolated by hydro distillation using the Clevenger apparatus from *A. vulgaris*, were analyzed by GC/MS and SPME-GC/MS to describe their volatile chemical profile. The oil content in the leaves of *A. vulgaris* was 0.7 % (w/v) with eucalyptol as the most prominent compound. The EO's shows antifungal activity against the fungal cultures *Sclerotium oryzae* (ITCC 4107) and *Fusarium oxysporum* (MTCC 9913) in dose dependent manner and compared with the standard voriocanazole.Results revealed the EO's characterized from the hydro distillation and SPME extraction gives the same chemical profile with higher antifungal activity in *S. oryzae* than *F. oxysporum.*

ISESFEC/23/P-014

Phytochemical characterization and evaluation of antioxidant, cytotoxic, antimicrobial and anti-biofilm activities of *Sphaerostephanos unitus* (L.) Holttum

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Pteridophytes are a source of medicine in traditional societies around the world. A lesser-known fern, *Sphaerostephanos unitus* (L.) Holttum has attracted little research interest. The current research aims to identify its phytochemical components and determine whether it has antioxidant, cytotoxicity, or inhibitory potential against clinical microbial isolates. Standard protocols were followed for all phytochemical evaluations.. DPPH and nitric oxide assays were used to measure in-vitro antioxidant activity. The extracts' cytotoxic activity was assessed by brine shrimp lethality assay. The MIC and MBC were determined using a resazurin microtiter assay. All the extracts studied contained phenolic compounds, flavonoids, and tannins. The maximum total phenol (1166.67±0.002 mg GAE/g), flavonoid (657.223±0.002 mg QE/g), and tannin content (763.473±0.007 mg GAE/g) determined in ethanol extract. It also showed the best antioxidant activity in both DPPH free radical scavenging assay (35.743±0.82 µg/ml) and nitric oxide free radical scavenging assay (73.293±0.73 µg/ml). Acetone extract showed the highest activity for the brine shrimp

lethality assay with an LC50 of 468.53 µg/ml. Additionally, fatty acid fraction was extracted for microbial inhibitory studies. All the crude extracts and fatty acid fraction showed significant antimicrobial and anti-biofilm potential, and the lowest MIC and MBC were recorded for the fatty acid fraction (0.125 mg/ml and 0.25 mg/ml, respectively). The fatty acid fraction also showed the highest biofilm inhibition activity (94.8%) compared to the crude extracts. These findings support the use of *S. unitus* (L.) Holttum in traditional medicine.

ISESFEC/23/P-015

Herbalisation of oral matrix tablets using *Abroma augusta* seeds

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Abromaaugusta Linn. (Family:Malvaceae), is commonly called 'Ulatkambal' in Hindi and 'Devil's Cotton' in English. In this plant, there are alkaloids and other secondary metabolites, like flavonoids, steroids, riterpenes, and glycosides. After extraction with successive solvent extraction procedure, extracts were subjected to wet granulation, drying and compression to a definite oral matrix dosage form. Seeds of *Abroma augusta* were processed by removing the seeds' coat by petroleum ether. After first extraction with ethyl acetate, by maceration, for 7 days; the marc was treated similarly with the next solvent with increasing polarity; n-Hexane, and finally water. All these fractions were then subjected to separate wet granulation batches for making herbal oral matrix tablet formulation. The individual fractions were tested for all possible Phytochemical Screening according to all reported reagents and noted. Column chromatography and reverse phase HPLC were performed for quantitative analysis of the different phytochemicals present in *Abroma augusta* seeds. In the column chromatography, different fractions, as per the partition coefficient of individual drug towards the mobile phase, were collected in different conical flasks. Further, after complete separation by column they were undergone RP-HPLC. The retention time were noted and compared with isolated, purified, re-crystallized pure samples available in the commercial market. Research is going on for HPLC-MS and MS-MS quantification of the herbal fraction; in a target to reach at the lead compound(s). Fractions and their oral matrix tablets were analyzed for qualitative and quantitative determinations. All these determinations of the herbal secondary metabolites, present in different extracts, were analyzed, (as the total flavonoid content, in terms of total Quercetin present). The release rate kinetics also, was studied as the total flavonoid content, because, they are different herbal analytes; which are closely related structural phytochemical analogues

ISESFEC/23/P-016

Evaluation of sedative and hypnotic effect of *Paeonia daurica* subsp. *Macrophylla* root extracts in mice

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Paeonia daurica ssp. *Macrophylla* (*Paeoniaceae*) is a perennial plant, growing in Iran. In Persian medicine, *Paeonia officinalis* (Oode-saleeb) roots have been used for treatment of some diseases especially for epilepsy and brain disorders. Sedative and hypnotic effects of aqueous extract, total hydro alcoholic extract and its fractions (hexane, chloroform and methanol) were examined by the righting test method. Plant samples (50, 100 and 200 mg/kg) and vehicle (10 ml/kg) were injected intra peritoneally (ip) 30 minutes before sodium thiopental (40 mg/kg, i.p)in groups of 7 mice. The amount of time taken before losing the righting reflex and the time taken to regain the righting reflex

were recorded as onset of sleep and sleep duration, respectively. According to the results, almost all samples (50, 100 and 200 mg/kg) except chloroform (50 mg/kg) and total hydro alcoholic extract (50 mg/kg) reduced the onset of sleep in mice. Among the different samples chloroform (100 mg/kg), methanol (50 and 100 mg/kg), hexane (200 mg/kg) and aqueous extract (50 mg/kg) had the best effects compared to diazepam (3 mg/kg) ($p<0.001$). Also nearly all samples, except methanol fraction increased the duration of sleep induced in mice. Chloroform (200 mg/kg) was the most effective sample on sleep duration compared to diazepam (3 mg/kg)($p<0.001$).Results of this study demonstrated that the aqueous and hydro alcoholic extracts (and some of its fractions) were shown to reduce the onset of sleep and increase the sleep duration compared to the negative control group and in some cases diazepam. It can be concluded that the extract of *P. daurica* ssp. *Macrophylla* can have sedative and hypnotic effects.

ISESFEC/23/P-017

Pharmacognostical and phytochemical evaluation of *Balanite aegyptiaca*

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Belenites aegyptiaca (Balanitaceae) commonly known as “Ingudi”.It is conventionally used in Ayurvedic system of medicine for the treatment of various pathological conditions but especially for treatment of skin disorders such as psoriasis, leucoderma and leprosy in the form of internal medications as well as external applications. *Belanites aegyptiaca* fruit has not been studied in details for its pharmacognostical characters. Considering this, an attempt has been made to establish preliminary pharmacognostical profile of fruit which may be considered as a reference standard for future studies. The fruit of *Balanites aegyptiaca* was procured from rural area of Mehsana district of Gujarat and it was authentified by the botanist. The pharmacognostical and phytochemical analysis was carried out using the standard procedure as per the WHO guidelines. The microscopical and the morphological evaluation confirmed its identity. The physicochemical evaluation confirmed that fruit has higher water soluble phytoconstituents (36.83 ± 2.72%) and also the inorganic and organic matters were found in considerable range. The powder of fruits of *B. aegyptiaca* shows medium flow property might be due to gummy material present in a plant and it confirmed a good binding property of fruit powder. The preliminary phytochemical screening showed that it contains carbohydrates, steroidal components and saponin glycosides. The methanolic extract was fingerprinted using chloroform: methanol(10:1, v/v) as a solvent system and it shows presence of sixteen phytocomponents. The quantitative analysis confirms that the fruits of *B. aegyptiaca* contain 6.64 ± 0.78% of total carbohydrates and 15.03 ± 0.51 total saponin. The present study confirms that the fruits of *B. aegyptiaca* contain various primary as well as secondary plant metabolites which have promising nutritional as well as medicinal value but detailed study is still required.

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Murraya koenigii (L.) Spreng.: a potential phytotherapy to treat diabesity

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‘Diabesity’ is described as the combined adverse health effects of obesity and Type-2 Diabetes Mellitus. Excessive fat plays a vital role in the pathogenesis of diabesity. Despite impressive advancements in synthetic drugs, natural products still serve as an essential source of new medicines. *Murraya koenigii* (L.) Spreng. (Curry leaves) is a powerhouse of carbazole-alkaloids with an excellent pharmacological profile. Exploring the phytochemical richness of curry leaves methanolic extract; seasonal and geographical variation studies of

curry leaves collected from 12 different Indian locations; investigating the anti-obesogenic potential of *M. koenigii* using 3T3L-1 cell line. Methanolic extract was prepared by refluxing dried curry leaves with methanol. Silica gel column chromatography of MeOH extract using hexane and ethyl acetate gradient was employed for isolation. Seasonal and geographical variations of twelve curry leave samples were studied using HPLC. Four carbazole-alkaloids; Mahanimbine, koenimbine, girinimbine, and koenigicine were isolated. The percentage content of mahanimbine and koenimbine was highest in the Delhi sample while koenigicine was highest in the sample procured from Uttar Pradesh. MeOH extract (≤25 µg/ml) and isolated alkaloids (≤ 15 µM) in 3T3L-1 adipocytes showed no cytotoxicity. The anti-obesogenic activity of extract and carbazole-alkaloids revealed significant inhibition (50-60%) of lipid accumulation in a dose-dependent manner using the Oil-Red '*O*' assay. Moreover, carbazole-alkaloid combinations further showed synergistic effects by providing a significant decrease (60-70%) in fat accumulation. Present study provides pivotal information about the appropriate season and location for procuring curry leaves with sufficiently stable and biologically potent markers. Both curry leaf extract and carbazole-alkaloids uncloaked a plethora of their anti-obesogenic potential. Thus, *M. koenigii* might be the much-required prospective phytotherapy with prodigious applications for the management of diabesity and its related metabolic disorders.

ISESFEC/23/P-019

Anti-Inflammatory activity of *Serpylli herba* on human skin keratinocytes

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In traditional medicine, *Thymus serpyllum* has been used, among others, to heal wounds, treat acne, and relieve inflammation of the skin and mouth. The aim of the study was to investigate the effect of 60% (*v/v*) methanolic extract of *Serpylli herba* of the Kozioł population and its fractions (dichloromethane, diethyl ether, ethyl acetate, n-butanol and water residue) on the secretion of pro-inflammatory cytokines (interleukin 6 – IL6 and interleukin 8 – IL8) by human skin keratinocytes exposed to UVB radiation at a dose of 20 mJ/cm^2. The effect on cell viability was examined by MTT and preliminary chemical analysis was performed by the UHPLC-MS^n method. The extract at a concentration of 50 µg/mL decreased the secretion of IL6 and IL8 by 46 and 49%, respectively. The ethyl acetate fraction, rich in rosmarinic acid and methyl rosmarinate, inhibited the secretion of IL6 the most strongly, by 61% at a concentration of 50 µg/mL. The dichloromethane fraction did not affect the secretion of IL6, and the remaining fractions decreased it by about 20-40%. The secretion of IL-8 was inhibited by all fractions, most strongly by the ethyl acetate fraction, by 51% at a concentration of 50 µg/mL. The extract and fractions did not adversely affect the viability of the cells. The dominant chemical compounds in the extract were flavonoids such as luteolinhexoside, luteolinglucuronide and apigenin glucuronide, and phenolic acids such as rosmarinic acid and its derivatives (salvianolic acids A, K and I). *Thymus serpyllum* herb has strong anti-inflammatory properties, and the compounds responsible for these properties may be rosmarinic acid and its derivatives.

ISESFEC/23/P-020

HPTLC analysis and α-amylase inhibitory potential of *Oreocnide Integrifolia* (Gaudich.) Miq. – an ethnomedicinally relevant plant from Northeastern India

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Oreocnide integrifolia (Urticaceae family) is commonly called as U-khajing and the leaf infusion is used by the people of northeast India as folklore medicine to alleviate diabetic symptoms. The present study aimed to scientifically validate the folklore use of leaf extract against diabetes using *in-vitro* experimental model along with biomarker profiling. The hydro-alcohol leaf extract was subjected to qualitative and quantitative phytochemical screening (total flavonoids and phenolic contents) spectrophotometrically. The extract was standardized for the presence of kaempferol as standard phytomarker through HPTLC analysis. The *in-vitro* antidiabetic potential of the extract was performed using a 96-well micro plate assay based on α-amylase enzyme inhibitory potential using acarbose as standard inhibitor. The phytochemical screening revealed the presence of saponins, alkaloids, tannins, phenols, flavonoids, glycoside and steroids. Estimated contents of total phenolics and flavonoids in the extract were found to be 17 mg of A/g and 9 mg of RU/g respectively. For antioxidant activity the IC_{50} values were found to be 326.47±3.56 µg/ml for DPPH assay and 362.39±4.65 µg/ml for ABTS radical scavenging assay. The amount of standard kaempferol was found to be 0.01%w/w by HPTLC analysis. The IC_{50} value for inhibition of α-amylase enzyme was 384.26±4.28 µg/mL. This study reveals that *O. integrifolia e*xtract showed anti-diabetic potential and can be explored further for the development of nutraceutical product.

ISESFEC/23/P-021

Phytochemical Characterization of siberian ginseng roots using LC-DAD-ESI-MS/MS

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Eleuthercoccus senticosus root is not known for having one dominant compound or group of metabolites, but rather has a mixture of different constituents, of which major ones are sometimes called as ‘eleutherosides’. Among these eleutherosides are carbohydrates or glycosides of phenolic alcohols, lignans, coumarins, triterpenoids, and phytosterols. However, they are not limited to this plant and can be found in many different species, sometimes in bigger quantities than in Siberian ginseng. There is even some debate, whether they can be considered as main active constituents, as many studies have shown that the roots of Siberian ginseng are far richer in hydroxycinnamic acid derivatives than in any of the eleutherosides. Dried and shredded Eleutherococcussenticosus roots were purchased from NatVita (Mirków, Poland) and identified according tothe10th Edition of European Pharmacopoeia.70% (v/v) aqueous methanol extract was prepared and analyzed using the Liquid Chromatography Diode Array Detector Electrospray Ionization Tandem Mass Spectrometry method (LC-DAD-ESI-MS/MS). Through LC-DAD-ESI-MS/MS analysis of *Eleutherococci radix* 36 compounds were identified or partially identified using both positive and negative ion modes. Phenolic acids and their derivatives, coumarins and lignans were found in the plant material. The plant material presents a complex mixture of different specialized metabolites without a single dominant compound. The root was especially rich in hydroxycinnamic acids derivatives and lignans in their aglycone and glycosidic form.

ISESFEC/23/P-022

Eleutherococci radix – quality assessment of herbal products

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Eleutherococcus senticosus (Rupr.& Maxim.) Maxim. Also known as Siberian ginseng, Shigoka or Ciwujia is a shrub belonging to *Araliaceae* family that is native to Russia, China,

Japan, and Korea. A root of *E. senticosus* was found to be an effective treatment of symptoms of asthenia, such as fatigue and weakness and is included in the 10th Edition of European Pharmacopoeia. The quality of 19 commercially available products containing the root of *E. senticosus*or its ethanolic extract in the form of cut root, capsules, tablets, and tinctures was evaluated according to the monograph in the10th Edition of European Pharmacopoeia. Authenticity of the plant material was examined using microscopic anatomical analysis and thin-layer chromatography (TLC). Quantitative analysis of marker compounds syringin (eleutheroside B) and syringaresinol4,4'-di-*O*-β-D-glucoside (eleutheroside E) was performed using high performance liquid chromatography (HPLC). Results were compared with pharmacopoeial requirements and amounts labeled by the manufacturer. Adulterants were found in some of the samples. The samples tested had different qualitative and quantitative profiles. The concentrations of marker compounds varied greatly from product to product. Not all the samples were following the requirements listed in Pharmacopoeia, nor did they contain labeled amounts of eleutherosides. Furthermore, some samples did not contain indicated plant material and were adulterated. These results illustrate the importance of quality control and standardization of plant material.

ISESFEC/23/P-023

Bilateral interactions between gut microbiota and natural products applied in anxiety and mood disorders

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Mental disorders remain one of the main challenges for modern medicine. It is well documented thatthe microbiome-gut-brain axis can strongly influencebehaviour and well-being.In this context, the interactions between gut bacteria and natural products traditionally used in anxiety and mood disorders remain elusive. The presented project aimed to determine whether and to what extent the extracts prepared from: St. John's wort (*Hypericiherba),* valerian root (*Valerianae radix*), hawthorn fruit (*Crataegifructus*), passionflower herb (*Passiflorae herba)*, hawthorn herb (*Crataegi folium cum flore*) kava-kava (*Piperis methysticirhizoma*), hop strobes (*Lupuliflos*) and lingzhi mushroom (*Ganoderma lucidum*) can be the source of potentially active post biotic metabolites. To that end, prepared extracts were incubated with human intestinal microbiota in aerobic conditions for 24 hours. After that time, supernatants were collected and analyzed using UHPLC-DAD-MS/MS. On the other hand, the impact ofprepared extracts on the gut microbiota community structure was examined using 16s rRNA Next-Generation Sequencing (NGS), followed by the analysis of changes usingαand ßindicators of diversity. The analysis of UHPLC-DAD-MS/MS data revealed that the chemical composition of the examined extracts changed after a 24-hours incubation withthe intestinal bacteria. Thanks to gut microbiota activity, 18postbiotic metabolites, absent in the maternal extracts, were obtained. Moreover, NGS uncovered significant changes in the gut microbiome structures exposed to the natural products, suggesting bilateral interaction between extracts and intestinal bacteria. The presented results underline the pivotal role of gut microbiota in the pharmacokinetics of naturally occurring substances. Further research evaluating post biotic metabolites activity may shed light on the previously unknown potential mechanism of action of natural products traditionally used in mental disorders.

ISESFEC/23/P-024

Anti-inflammatory effects of natural raw materials as potential therapeutic enhancers for lipopolysaccharide-induced inflammation

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An adequate inflammatory response isthe body's primary form of defence in the event of injury or infection. Prolonged or excessive inflammation can cause permanent tissue damage. *Lipopolysaccharide* (LPS) infection becomes a trigger for neutrophils to the inflammatory reaction, leading to reactive oxygen species (ROS) and pro inflammatory cytokines production. For many years infusions and tinctures have been a traditional form of natural products used in folk medicine. Additionally, due to the mutual infiltrationof European and Far Eastern medicine, the standardization of traditional recipes appears to be crucial to ensure the quality of the natural formulations.The objective of this study is a detailed phytochemical analysis of *Eucommia ulmoides* Oliv. bark, *Petasites hybridus* root and *Pulmonaria officinalis L.*herbainfusions and ethanolic extracts as well asa comparison of their biological activityby an assessment of their effect on reactive oxygen species (ROS) and cytokines secretion (TNF, IL-8, IL-1β) in a model of human neutrophils (PMNs).Phytochemical analysis was carried out by UHPLC-DAD-ESI-MS/MS method. Neutrophils were isolated from human peripheral blood, obtained from healthy donors, by dextran sedimentation and centrifugation in a density gradient. After 24-h incubation with tested infusions/extracts, supernatants were studied on pro inflammatory cytokines secretion assays.The ROS production by f-MLP-stimulated PMNs was determined using a chemiluminescence assay. Aqueous-alcoholic extracts effectively reduced IL-8 and IL-1βsecretion by neutrophils compared to the LPS-stimulated control. For the inhibition of TNF secretion, *Eucommia* bark and *Petasites hybridus* root infusions proved to be more effective compared to tinctures. This study provides a basis for confirming the usefulness of natural preparations as potential components in the treatment of inflammatory-based diseases. Furthermore, obtained results are a prelude to further phytochemical analysis and biological activity of the tested raw materials on further research models.

ISESFEC/23/P-025

Network pharmacology and molecular docking analysis of active phytochemical constituents of *Pyrus pashia* and its molecular mechanism against liver disease

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Liver disease is a serious health problem worldwide. Despite having advanced therapeutic and development of modern synthetic drugs there is always a need for new and no side effects of therapeutic agents made from traditional medicinal plants. *Pyrus pashia* is a traditionally important plant used by the Monpa people of Tawang and by the people of Arunachal Pradesh, a North-Eastern part of India. However, the exact molecular mechanism remains unclear. Based on UHPLC (Ultra High Performance Liquid Chromatography) analysis 15 compounds were identified from the *Pyrus pashia* leaf. The present work aims to investigate the availability of the hepatoprotective activity of the *Pyrus pashia* plants using network pharmacology analysis against the identified compounds. Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway analysis and Gene Ontology analysis of biological processes and molecular functions were performed. Molecular docking experiments were performed to validate the network pharmacology results. The results showed that there were 15 phytochemical compounds in *Pyrus pashia* and potential targets including CYP2E1 and SIRT1. Network analysis shows that *Pyrus pashia* exerted a promising preventive effect on liver disease. This provides a basis to understand the mechanism of the hepatoprotective activity of *Pyrus pashia.*

ISESFEC/23/P-026

Characterization and bioactivity evaluation of the biosurfactants from the seed pods of *Gymnocladus assamicus* (Leguminosae)

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Herbal medicines are the fulcrum of alternative medicine which is gradually streaming towards integration into the mainstream healthcare system. The land of the rising sun Arunachal Pradesh is a part of the Eastern Himalayan biodiversity hotspot is the ethereal universe of extraordinary floral and faunal endemism greatly influenced by its diverse geography, topography and varied climate pattern. *Gymnocladus assamicus* P.C. Kanjilal is a critically endangered species that belongs to Caesalpiniaceae a legume tree that is popular among the indigenous people of Arunachal Pradesh. The mature seed pod of the plant is used as soap, shampoo and also to treat stomach and skin disorders, especially as lice repellent by the Adi people of the state.The investigation was undertaken with the objectives of the detection and estimation of phytochemical constituents and quantitative analysis of the secondary metabolites for the characterization of biosurfactant extracted from the seed pods, assessment of the larvicidal activity of the seed pod of *Gymnocladus assamicus* and evaluation of antioxidant activities of this plant. Preliminary phytochemical analysis indicated the seed pod of *Gymnocladus assamicus* contains considerable amount of saponin validating their use as a good source of natural soap or detergent. Screening of the efficacy of larvicidal assay against *A.aegypti* and *C.quinquefasciatus* showed susceptibility to the extract of *Gymnocladus assamicus* and the plant extracts showed significant antioxidant activity in DPPH antioxidant assay. Nowadays people are more concerned about herbal healthcare products rather than using artificial one. In conclusion, the plant extract fulfilled all the characteristics to be considered as potential species for the development of natural healthcare products which will become cost-effective and affordable.

ISESFEC/23/P-027

Assessment of bioactive compounds and nutritional profiling of *Etlingera linguiformis* (Roxb.) R.M.Sm.

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Etlingera linguiformis (Roxb) R.M.Sm. (Zingiberaceae) is well-known aromatic ginger mainly distributed in India, Bangladesh, and Myanmar. In Assam, the species locally known as “Karphul” has been used to cure throat pain, and as an anti-diabetic agent. In Nagaland, people use the rhizome in treating sore throats, stomach aches, rheumatism, respiratory ailments, and its oil is used in perfumery, but there no scientific study has been made for analyzing its nutritional composition and chemical composition. The aromatic properties of the species make it special and valuable which are widely used in different prospects. The present study was conducted to investigate the nutritional profiling from the rhizome of *Etlingera linguiformis* as well as the extraction of essential oil from the rhizome, leaf, and stem using the hydro distillation method and analyzed by GC-MS. The percentage yield of volatile constituents of the rhizome, leaves, and stem were 0.0025%, 0.0049%, and 0.008% respectively. The rhizome essential oil contained estragole (60.84%) and anethole (36.93%) as major compounds whereas the leaves essential oil was largely dominated by estragole (23.03%), 3-Carene (12.22%), 1-Methyl-1-ethenyl-2,4- bis (1'- methyl ethenyl) cyclohexane (10.41%) and Cyclohexane, 1-methylene 4-(1-methylethenyl) (9.47%). The essential oils of the stem contained the major compounds estragole (37.59%), anethole (36.10%), and eucalyptol (7.14). The present study widens the detailed understanding of the nutritional

content of the rhizome as well as the chemical composition of three different parts of the plant. Due to its high aroma in the rhizome, the species may be a potential cash crop for the flavor and fragrance industries

ISESFEC/23/P-028

Phytochemical analysis and prediction of Anti-Sars-Cov-2 activity through In-silico approach of Dasamoola Ashtak Kwath

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Dasamoola Ashtak Kwath is an Ayurvedic remedy mostly used for respiratory discomfort. This formulation is comprised of 14 plants, namely *Gmelina arborea*, *Aegle marmelos*, *Stereospermum colais*, *Oroxylum indicum*, *Premna corymbosa*, *Desmodium gangeticum*, *Pseudarthria viscida*, *Solanum xanthocarpum*, *Solanum indicum*, *Tribulus terrestris*, *Zingiber officinale*, *Piper nigrum*, *Piper longum* and *Justicia beddomei*. In-silico molecular docking of phytoconstituents present in medicinal plants of the formulation, have been performed against eight viral target enzymes, such as PLpro, Mpro, replicase, RDRP, etc. TLC and UHPLC profiling of the formulation and its fractions have been performed. UPLC-HRMS analysis of various fractions viz. n-hexane, ethyl acetate and n-butanol prepared from formulation and their correlation with in-silico study revealed that 12 phytoconstituents identified in formulation showed activity against SARS-CoV-2 viral proteins. Tribulusterine showed GScore of -6.256 against viral replicase. 2,4,5,7-tetrahydroxy isoflavanone showed GScore of -8.612 against PLpro. Vasicinolone showed GScore of -7.182 against endoribonuclease. Rutin showed GScore of -7.793 against Mpro. Solasonine showed GScore of -5.543 against RDRP. Rutin showed GScore of -6.414 against helicase. Tribuloside showed GScore of -8.730 against exoribonuclease. Tribuloside showed GScore of -5.953 against membrane protein. It can be concluded that these phytoconstituents may be responsible for anti-viral effect of the formulation against SARS-CoV-2 virus. The safety profiling of this formulation needs to be performed via cell-based assay before taking up further studies on the formulation.

ISESFEC/23/P-029

Ethnobotanical exploration of medicinal plants and promotion of tribal health care practices

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Indigenous knowledge of medicinal plants is critical for both the preservation of traditional medicine and future research. One part of biodiversity protection and exploitation is the documenting of traditional medicine. Field trips were conducted in 32 tribal settlements of Mala Arayan, Mannan, Urali, Muthuvan, Paliya, Ulladan, Kurichya, Kuruma, Paniya, Chetti, and Kattunaikka communities in Idukki and Wayanad districts to collect information from 95 informants about medicinal plants and their use among tribal people. The ethnomedicinal data was gathered through organised questionnaire interviews with traditional healers. The data was examined using Use Value (UV), Informant Consensus Factor (Fic), and Fidelity Level (FL). A total of 99 species of plants distributed in 95 genera belonging to 52 families were identified as commonly used ethnomedicinal plants by tribal healers in the Idukki and Wayanad districts. These plants were used to treat various diseases grouped under 19

disease categories, with the highest number of species (28) being used for dermatological disorders followed by gastrointestinal disorders (15), and respiratory system disorders (11). Leaves are the most frequently used plant part. Herbs (42%) were the primary source of medicine, followed by shrubs (26%). With community engagement, a special focus has been placed on the conservation and promotion of ethnoveterinary practises. Two ethnoveterinary promotion clusters were established in the districts of Idukki and Wayanad, and awareness workshops on traditional animal treatment and its current relevance were held. 10 medicinal plants were sent to 100 homes in the Idukki and Wayanad districts in order to establish a home herbal garden. To safeguard ethnoveterinary practises, a community knowledge register and a mobile application called 'GauMithra' with traditional remedies for 16 major livestock diseases were created and made available on the Play Store. Tribal traditional knowledge has enormous potential to serve national and global needs, providing both societal benefits and economic growth. However, due to rapid cultural changes and modernization, tribal communities' indigenous knowledge is dwindling. The need for scientific validation of traditional health practices and their exploration for potential therapeutics are urgent.

ISESFEC/23/P-030

A study of the genus *Berberis* L. (Berberidaceae) in Arunachal Pradesh

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The genus *Berberis* L. (Berberidaceae) traditionally known as barberry are simple-leaved shrubs or rarely small tree-like bushes characterized by 1–5-armed spines or spiniform structures at the stem nodes occurs widely across the alpine and temperate region of the world.The present study was carried out in the Tawang and West Kameng district to investigate diversity, ethnomedicinal use of *Berberis*.For each species encountered, field notes were taken along with the voucher specimen following standard technique. Systematic recording of data was done using a specially designed questionnaire and the data have been analysed.Several *Berberis* species has been investigated; some of them are really interesting. The ethnic communities such as Monpa, Takpa, and Sherdukpen are use *Berberis* species against various respiratory, gastrointestinal, and endocrine diseases in their healthcare system. This *Berberis* group is totally unexplored in the state has potential medicinal value. Further field study is recommended to explore in taxonomic as well as ethnomedicinal field in the State.

ISESFEC/23/P-031

Beneficial effects of *Urtica pilulifera* seed extract in enhancing folliculogenesis in the Diminished Ovarian Reserve (DOR) model in Balb/c mice

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Diminished Ovarian Reserve (DOR) is one of the most common reasons for women's infertility. *Urtica pilulifera* seed (UPS) extract is a Persian traditional medicine prescription that positively affects female infertility. This study aimed to evaluate the beneficial effects and underlying mechanism of UPS on the DOR model induced by Cyclophosphamide (CTX) in balb/c mice. We used CTX in single dose of 75 mg/kg (i.p) to establish DOR model. 25 mice were randomly divided into 5 groups: a control, a model group (DOR), DOR+50 (DOR and 50 mg/kg UPS, Gavage), DOR+100 (DOR and 100 mg/kg UPS, Gavage), and DOR+200 (DOR and 200 mg/kg UPS, Gavage) groups. The animals in UPS groups received the seed extraction in a volume of 0.2 ml for 14 days and were then sacrificed. Then the levesl of the steroidal hormones (FSH, LH, and estradiol), oxidative stress markers

(superoxide dismutase (SOD) and malondialdehyde (MDA) alterations were analyzed. Our findings showed that UPS extract could dose-dependently alleviate MDA concentration in the DOR model. The UPS extract improves the SOD activity in ovaries and modulates the regulation of steroidal hormones such as FSH, LH, and estradiol. In conclusion, our results revealed the therapeutic potential of UPS extract in the DOR model as an alternative treatment via different mechanisms such as oxidative stress reduction and steroidal hormone regulation.

ISESFEC/23/P-032

Isolation and characterization of therapeutically important furocoumarins from the seeds of traditional medicinal plant *Psoralea corylifolia*

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Psoralea corylifolia (Buguzhi) is used in traditional Chinese medicinal system as well as traditional Indian medicinal system for the treatment various diseases. The whole plant specially fruits have significant medicinal properties and are used internally and externally as Laxative, Anthelmintic, diuretic and mainly in leucoderma, psoriasis, leprosy and other skin diseases due to its antimicrobial properties. Various chemical constituents like, Coumarins, flavonoids, lipids, resins, stigmasteroids, etc. have been isolated identified from *Psoralea corylifolia*, having established bioactivies which include, Antibacterial, antioxidant, antifungal, estrogenic, antitumor etc. *Psoralea corylifolia* (Buguzhi) seeds were collected and authenticated. Coarsely powdered seeds were then extracted by using maceration and soxhlet extraction methods. Obtained extracts were further purified by using column chromatography to separate desired phytoconstituents. Isolated furocoumarinswere characterized by using modern analytical techniques like TLC, HPTLC, etc. by comparison with standard the isolated compounds were found to be Psoralen and Isopsoralen.A novel method was developed for isolation. Isolated compound was characterized by chromatographic and spectroscopic methods. The developed methodis less time consuming and gives higher percentage yield.

ISESFEC/23/P-033

Anticancer activity of *Garcinia xanthochymus* fruit extract against colon cancer through apoptosis

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Garcinia xanthochymus, also known in Manipuri as “heirangoi” is rare plant grown in the state. It belongs to the family clusiaceae. The current study was conducted to investigate the anticancer property of the different extract of the fruit pericarp and to decipher the possible mechanism of its action in colon cancer cell lines,HT-29, HCT-116 and HCT-15. MTT assay, cell counting and colony forming assay have shown that the hexane extract induced cytototoxic and antiproliferative effect against colorectal cancer in a dose dependent manner. Also an increase in the early/late apoptotic rate in AnnexinV/propidium iodide (PI) double staining assay was observed, which also indicates the apoptotic potential of the extract against colorectal cancer in a dose dependent manner. Western blot analysis showed increase in active forms of caspase 3 and decrease in the inactive forms. Also expression of pAKT,pERK, Bcl-2 were found to be decreased. This study thus represents the antiproliferative and apototic potential of the Hexane extract of *G.xanthochymus* fruit against colorectal cancer.

ISESFEC/23/P-034

Comparative antioxidant and anti-cholinesterase potential of ginger varieties of North-East India in respect to variation of 6-gingerol contents

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The North-east region of India known as one of the highest ginger (*Zingiber officinale* Roscoe) productivity areas in the world and is also recognized as India's organic ginger hub. The present study aimed to compare the antioxidant activity, cholinesterase enzyme inhibitory potential and variation of 6-gingerol content estimated by HPTLC analysis among the collected ginger varieties.In-vitro antioxidant activity of the extracts of nine different ginger varieties was measured by the ABTS and nitric oxide (NO) radical scavenging assay. Ellman's method followed for acetylcholinesterase enzyme inhibitory assay spectrophotometrically using galanthamine as standard drug. The variation of 6-gingerol content estimated using a validated HPTLC method.The findings revealed that GV6 exhibited highest 6-gingerol content and antioxidant activity showing potent cholinesterase inhibition followed by GV5, GV4, GV9, GV3, GV2, GV8, GV1, and GV7. For GV6 the IC_{50} values for antioxidant activity were found to be 34.51±3.71 µg/mL for ABTS and 45.19±2.69 µg/mL for NO radical scavenging assay. For acetylcholinesterase enzyme inhibition assay the IC_{50} value was 90.53±2.38 µg/mL for GV6 and 20.15±0.16 µg/mL for galantamine. This work underlines the importance of ginger varieties from North-east India as a source of natural antioxidants in addition to its anticholinesterase potential considering 6-gingerol as phytomarker. All the findings together provide confidence and research prospects to promote ginger in different food, pharmaceutical and supplement industries.

ISESFEC/23/P-035

Formulation and *in-vivo* evaluation of herbal emulgel for wound healing activity

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Mallotus philippinensis Lam. Muell. Arg (Euphorbiaceae) have been reported in traditional Asian medicine for a number treatment, especially wounds and skin disorders. This current vocation was focused on exploitation of *Mallotus philippinensis* (MP) as a topical mediator for chronic wound dealing. Pharmaceutically six MP formulations were formulated and antibacterial activity of all formulations was accessed. The best formulation based on an antibacterial activity was selected for evaluation of wound curative assets. Total flavonoids, and an anti-oxidant activity of the selected formulation was also investigated. Wound healing activity was assessed in Alloxan-induced diabetic rats and control rats. Alloxan injection (50mg/kg) was used to induce marked hyperglycemia, compared with controls. Wound was created on the upper back of each animal. MP Gel and Emulgel formulation was topically applied after wounding to each animal. All wounds were cleaned once a day until wound closure. MP formulation (F6) which exhibited antibacterial and anti-oxidant activities had the ability to enhance the wound healing process in diabetic rats when compared with the control and standard. When gel and emulsion are used in combination the dosage form is referred as Emulgel. This study suggested that MP could be a potential alternative treatment for diabetic wounds.

ISESFEC/23/P-036

Stevia: a review of analytical methods for major bioactive

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Stevia rebaudiana Bertoni, belonging to the Asteraceae family is the sweetest herbalmedicinal plant. Extensive research has proven that most of the stevia activities of the plant are due to Steviol glycosides present chiefly in leaves. The human body cannot metabolize the Steviol glycosides which are responsible for the sweeting property,thus it provides zero calories. Out of many active glycosides, stevioside and Rebaudioside A are the main constituents for sweetness and pharmacological activities like anti-diabetic, anti-hypertensive, anti-fungal, etc. The purpose of this review was to provide a brief summary of the overall knowledge of popular species of stevia, approval for use of stevia in the food industry from USFDA, FSSAI of India. We also present a brief overview of the effects of processing parameters on the content of sweeteners in the drug and extraction processes, along with different analytical techniques,HPLC and HPTLC reported for the separation and estimation of thestevioside and RABAa. A literature survey, indicated RP-HPLC and HPTLC methods are most frequently used for the quantification of major stevia glycosides.Ethyl acetate, ethanol, and water are commonly used mobile phases in different ratios on pre-coated silica plates for achieving good separation of glycosides.Acetonitrile, methanol, and water are generally used as mobile phases in RP-HPLC in different ratios on C18 column for the simultaneous detection and estimation of Stevioside and Rebaudioside A from the extract. The study highlights the benefit of stevia in herbal medicine along with the importance of analytical methods for the determination, separation, and quantification of major bioactive compounds.

ISESFEC/23/P-037

In-vitro antimicrobial activity and HPTLC analysis of hydroalcoholic fruit pod extract of *Parkia speciosa*

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The antimicrobial activity of the 70% hydroalcoholic fruit pod extract was evaluated against human pathogenic microbes by agar diffusion assay. The minimum inhibitory concentration, minimum bactericidal concentration and minimum fungicidal concentration levels of the extract were determined using high through put micro well plate. The assay outlet in simple and reproducible way for assessing the biofilm inhibition and eradication capacities of antibiofilm agents against adherent bacterial biofilms grown in 96-well plates. The assay employed two dyes: crystal violet to stain biofilm biomass and 2, 3, 5-triphenyl tetrazolium chloride to quantify metabolism of the biofilm cells. TLC and HPTLC technique were performed to developed, identified and quantified the compound present in the test extract. The zone inhibition was significantly shown positive results against the specific test pathogenic microbes. The results from the various evaluations showed that the hydroalcoholic extract exhibit sufficient positive results against the pathogenic microbes. Solvent system was developed using TLC and polyphenol compound was identified and quantifies by standard using HPTLC technique. As according to the present evaluations clearly indicates that the fruit pot hydroalcoholic extract from *Parkia speciosa* could be used as potential source of antibacterial and antifungal agent as it has been used for the treatment of infections traditionally.

ISESFEC/23/P-038

Aegle marmelos leaf extract protects against diabetic kidney injury in mice by augmenting gasotransmitters and subjugating oxidative stress

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Increased oxidative stress due to altered levels of gasotransmitters play a major role in the progression of diabetic kidney disease (DKD). *Aegle marmelos,* an Indian herbal plant has several therapeutic potentials which have been used to treat several diseases including diabetes mellitus. But its protective effect and mechanistic role on diabetes induced renal damage is still unclear. Hence, in this study we are investigating the effects of *Aegle marmelos* leaf extract (AMLE) on diabetes induced kidney injury in mice model and trying to dissect the possible underlying mechanism.Diabetes was induced in C57BL/6 J male mice by intraperitoneal injection of streptozotocin (50mg/kg.b.wt) and AMLE (250mg/kg/b.wt & 500 mg/kg/b.wt) was orally administered daily for 22 weeks.At the end of the experiment period, the blood, urine and kidney tissues were obtained for studying the biochemical parameters, protein expression and histological analysis.AMLE treatment significantly diminished the diabetes induced kidney cell injury as observed by the significant decreased levels of serum creatinine, urinary albumin and kidney hypertrophy in AMLE treated mice. Also, the extract markedly reduced the fibrotic markers expression and the histological results revealed that AMLE reduced the collagen deposition in the kidney of STZ mice. Furthermore, AMLE treatment decreased the generation of reactive oxygen species and malondialdehyde accumulation in kidney homogenate by downregulating NADPH oxidase activity and NOX4 protein expression. The gasotransmitters such as nitric oxide and hydrogen sulphide levels were reduced in the kidney tissues of STZ treated mice. But, AMLE treatment significantly increased the gasotransmitters level and also subsequently decreased the ADMA levels in the renal tissue.This study demonstrated that AMLE treatment could protect the diabetes induced renal damage by promoting the gasotransmitters and subsequently attenuating the NOX4 mediated ROS generation and oxidative stress.

ISESFEC/23/P-039

Comparative study on chemical profiling and antimicrobial properties of essential oils of cinnamon bark collected from different location of Manipur

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The study describes the chemical composition and antibacterial activity of essential oils (EOs) from six distinct cinnamon growing areas in Manipur, India. The greatest essential oil production (4.5%) was recorded in samples taken from Chandel (CN) and Kshetrigao (KTG), followed by Churachandpur (MOI) and Pheidinga, PHEI with 3%, Heingang, HNG (2.5%), and Naharup, NHR (1%). The GC-MS study revealed that Chandel and Kshetrigao had the greatest area percentage of Cis-cinnamaldehyde, followed by Churachandpur. According to the HPTLC examination, the maximum Cinnamaldehyde level was found in Chandel, followed by Kshetrigao. Chandel EO also has the greatest levels of Eugenol and Linalool. However, Eucalyptol was not found in the EOs samples from Chandel, Kshetrigao, or Pheidingha. Linalool was not detected in the EOs of Naharup or Heingang. The EOs extract had a broad range antibacterial action, with gram-negative pathogens being more sensitive

than gram-positive infections. The samples Chandel and Kshetrigao, on the other hand, had the most potent bactericidal and fungicidal activity against both bacterial and fungal strains, Candida albicans and Candida tropicalis. The current study provides significant data for resource evaluation, rational utilisation, and selection of the best cinnamon variety for widespread dissemination. Chandel, Kshetrigao, Churachandpur, Pheidinga, Heingang, and Naharup are the locations where the samples were gathered. Six essential oils of Cinnamomum species were analysed using gas chromatography/mass spectrometry (GC/MS) in different locations of Manipur. Cinnamaldehyde, Eugenol, Eucalyptol, and Linalool HPTLC chromatograms were generated for cinnamon essential oils. The minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC), and minimum fungicidal concentration (MFA) of cinnamon essential oils have been determined. According to the GC-MS analysis, Chandel and Kshetrigao had the highest proportion of Cis-cinnamaldehyde, followed by Churachandpur. Chandel has the highest cinnamonaldehyde content, followed by Kshetrigao, according to HPTLC analysis.The EOs extract shown wide antibacterial activity against both gram-negative and gram-positive pathogens. The samples Chandel and Kshetrigao had the most potent bactericidal and fungicidal activity against both bacterial and fungal strains, *Candida albicans* and *Candida tropicalis.*

ISESFEC/23/P-040

Antifungal activity of *Croton tiglium* used by agricultural workers to treat onychomycosis

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Onychomycosis is one of the most common fungal nail infections reported among agricultural workers of Assam. They use young leaves and seeds of *C. tiglium* to get rid of nail infections as a traditional practice without scientific evidence. This study for the first time examined the antifungal activity of *C. tiglium* and its phytochemical compounds as an alternative treatment against onychomycosis. Agricultural workers viz. rice fields, tea gardens, and horticulture workers with nail deformities or discoloration were sampled. The nail scrapping and clipping were collected and processed according to Walshe and English criteria. Primary data on traditional medicinal plants used by agricultural workers were collected through interviews and discussions with traditional healers. To evaluate the antifungal activity of the herbal medicine, methanol extracts of *Croton tiglium* were tested by poison food technique against fungal isolates. The leaf extract was analyzed through GC-MS/MS for the identification of phytochemical compounds. In Silico analysis of compounds against Cyp51 (Sterol 14-alpha Demethylase) was analyzed through Molegro Virtual Docker software. The SwissADME web tool was used for in silico study of the Lipinski rule and drug-likeness property. Of all tested isolates, *C.tiglium* showed promising antifungal activity (>50% mycelial growth inhibition) against *Pestalotiopsis* sp., *Arthrinium* sp., *Neopestalotiopsis* sp., *Lasiodiplodia theobromae, Curvularia lunata, Trichophyton rubrum, Talaromyces* sp. The percentage of mycelial growth inhibition ranged between 31% (6.26 ± 0.145) to 85.50% (1.3 ± 0.115). The highest inhibition was recorded against *T. rubrum* (85.50%, 1.3 ± 0.115), followed by *Neopestalotiopsis* sp. (79%, 1.9 ± 0.133). Fourteen compounds were identified in the extract by GC-MS, of which Azulene, 9-Hexadecenoic acid, Octadecane, and 3-ethyl- 5-(2-ethylbutyl) were the major antifungal compounds with previously reported antifungal activity. The result of molecular docking showed the ligand 9-Hexadecenoic acid was the lead compound of CYP51 inhibitor with MolDock Score -121.166 and Rerank Score -97.744. 9-Hexadecenoic acid further docked in the active site of Sterol 14α-demethylase by forming hydrogen bonds (-0.9167) with Lysine78. These broad-spectrum antifungal activities of *C. tiglium* and 9-Hexadecenoic acid inhibitory effect against the CYP51 could be a possible option for the treatment of onychomycosis.

ISESFEC/23/P-041

A comparative study on morphological and biochemical characters of umorok and sirarakhong chili

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Umorok is a unique chili native to North-East India.It is the 7th hottest chili in the world where the capsaicinoids are the main compounds responsible for its hotness. Conversely, Sirarakhong chili is endemic to a small village called Sirarakhong in the Ukhrul district of Manipur.It is popular for its unique flavour rather than its hotness. In our study, the morphological characters were compared using the International Plant Genetic Resources Institute (IPGRI) descriptor and biochemical characters were analysed using High-performance liquid chromatography (HPLC) and Gas chromatography-mass spectrometry (GC-MS). In our study, we found some distinct characteristics of Sirarakhong chili which usually has a very long fruit (20 cm) and is narrow (1.2 cm) with a sweet, woodsy aroma.Umorok as compared to Sirarakhong has a shorter (6.3 cm), broad (3.2 cm) fruit shape and rough wrinkle skin.We have quantified the capsaicinoid content using HPLC where Umorok showed very high capsaicinoid contents whereas Sirarakhong chili has unique aromas and flavonoids. Our study also takes into account the characteristic change in biochemical profile in two different growth stages of both chilies. The study also shows that Sirarakhong chilis have high economic potential in food industry where low hotness with high flavour is in demand.

ISESFEC/23/P-042

RP-HPLC analysis *and in-vivo* antidiabetic *potential of Bruguiera cylindrica* (L.) BL. - a mangrove of the sundarban region

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Bruguiera cylindrical L. (family: Rhizophoraceae) is mainly found in mangrove swamps in tropical Asia, especially in the Sundarban region. Traditionally fruits, leaves and roots are used to treat various liver disorders. Marketed medicines are reported to have adverse effects on the gastrointestinal system, so development of phytomolecule is very important. In this present study, scientific validation and evaluation of the *in-vivo* Antidiabetic potential of bark extract of *Bruguiera cylindrica* L. were performed. RP-HPLC method has been developed to estimate Ursolic acid in hydroalcoholic bark extract. Methanol and acetonitrile (0.1% formic acid) were used as Mobile phase. Diabetes induced by a single dose of streptozotocin (45 mg/kg i.p.) in Wistar rats. Extract was further screened for antidiabetic activity and administered to the diabetic rats at a concentration of 200 and 400 mg/kg orally once a day for 28 days. The content of ursolic acid was found to be 3.04 ±.04 (% w/w) by the RP-HPLC study. The retention time and coefficient of determinants of ursolic acid was found at 06.52 min and 0.998 respectively. Oral administration of the extracts for 28 days caused a significant reduction in blood glucose levels in diabetic rats. SGOT, SGPT, and ALP levels also prominently reduced toward the normal values after the treatment regimen with extract when compared with diabetic control animals.From that, it can be concluded that *Bruguiera cylindrical* L. have potent antidiabetic activity against streptozotocin-induced diabetic rat model. The bark extracts also showing profound effect on serum hepatic marker and significantly reduced the level as compare to the streptozotocin-induced diabetic Rats. The presence of ursolic acid in the extract may be responsible for the antihyperglycemic effect

and complications related to its. Further study of nutraceutical development and establishment of molecular mechanisms of phytomolecule response will be performed.

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Metabolite profiling and investigation of *in-vitro* α-glucosidase enzyme inhibition assay of *Paris polyphylla* Sm.

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Paris polyphylla (Family: Melanthiaceae) is a perennial medicinal plant, native to North East region of India. It is increasingly used in modern pharmaceuticals and traditional therapies. Due to increasing demand, in order to direct *P. polyphylla* sustainable production in the future, it is crucial to understand the socio-ecological interactions pertaining to its existing distribution, use, trade, and conservation. Various plant parts are characterized by vast number of bioactive compounds such as alkaloids, phenolic acids, flavonoids, steroidal saponin, triterpenoids and glycosides. The potential health benefits of phytochemicals found in *Paris polyphylla* has received ample attention in the recent literature, focusing especially on compounds with high antidiabetic, antitumor and antioxidant properties. This study mainly focuses on the extraction, standardization by HPTLC and inhibitory assay of alpha-glucosidase enzyme activities of *Paris polyphylla* extract. *Paris polyphylla* were selected for this investigation and rhizomes were then harvested, dried, and extracted by using the cold maceration extraction method with hydroalcoholic solvent. Using ferulic acid as a marker compound and HPTLC was used to standardize the hydroalcoholic extracts of this plant. The extract was employed in evaluate of the inhibitory activities of α-glucosidase enzyme with acarbose serving as the reference standard. The results showed IC_{50} values between 1.7 - 3.57 mg/ml of extract, whereas acarbose IC_{50} value was 2.42 ± 0.38 mg/ml. This plant extract's quantitative ferulic acid estimation was calculated to be between 1.79% w/w by HPTLC study. Thus, this present study exhibited potent α-glucosidase inhibitory activity of *Paris polyphylla* Sm. hydroalcoholic extract and presence of ferulic acid in the extract. By inhibiting α-glucosidase enzyme the extract can be useful in the treatment of diabetes-related illnesses. Furthermore, establishment of molecular mechanism related to α-glucosidase enzyme inhibition and *in-vivo* antidiabetic study will be performed.

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Assessment of *in-vivo* adaptogenic activity of *Trichosanthes dioica* Roxb. fruit extract

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Trichosanthes dioica Roxb. commonly known as pointed gourd is native to Indian subcontinent and popular in every south Asian kitchen. It belongs to the Sicyoeae tribe of Cucurbitaceae family. Traditionally, the fruits are hypocholesterolemic, hypoglycemic and used for the treatment of fever, wounds, boils, and carcinogenic tumors. The roots possess potent dose dependent neuropharmacological (anti-nociceptive, locomotor depressant, muscle relaxant) activities. In the present study, hydroalcoholic fruit extract were evaluated for *in-vivo* antistress (in Swiss albino mice) and *in-vitro* antioxidant activity in to correlate with its adaptogenic and antistress activity. Antioxidant activity was carried out by DPPH and NO free radical scavenging assay methods. At a dose of 150 and 300 mg/kg, fruit extract was

evaluated against forced swimming endurance stress test, tail suspension test, anoxia stress tolerance test, chronic cold resistant stress test and elevated plus maze test and assessment of biomarkers (serum glucose, Corticosterone, WBC, RBC count) to evaluate the antistress activity in mice. *Withania somnifera* (100 mg/kg) was selected as reference standard. The fruit extract possesses prominent antioxidant activity in both DPPH and NO free radical scavenging assay. Concomitant treatment with extract at 300 mg/kg exhibited increased in anoxia stress tolerance time as well as Dose dependent significant reduction in serum glucose, corticosterone, and WBC, RBC count as compared to stress induced group. Fruit extract (300 mg/kg) and *Withania somnifera* significantly inhibited the stress and stress-induced changes in these parameters. The present study provides scientific support for the antistress and adaptogenic activities of hydroalcoholic fruit extract of *Trichosanthes dioica* Roxb. in a dose dependent manner. Further research can be done to find the detailed molecular mechanism based on neighborhood approach through network pharmacology and promote the concept of 'food as medicine'.

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Evaluation of *in-vitro* and *in-vivo* anti-diabetic potential of *Gomphogyne cissiformis* fruit from cucurbitaceae family

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Gomphogyne cissiformis is a member of the Cucurbitaceae plant family, which is also known as "Golkakri" in Sikkim. This plant is commonly available in North East India, where it is utilised by several ethnic groups to treat a variety of maladies such as malaria, diabetes, analgesia, sedation, as well as respiratory problems, toothaches, and rheumatism. Investigating the anti-diabetic potential of fruits from *Gomphogyne cissiformis* in an experimental animal model developed by a high-fat diet and low dosages of streptozotocin. In this work, type 2 diabetes models in wistar rats caused by low doses of streptozotocin (STZ) and a high-fat diet are being examined to determine the anti-diabetic benefits of *Gomphogyne cissiformis* hydroalcoholic solvent extract. By reducing fasting blood sugar and HbA1c levels were administered orally to the groups (n=6) for 28 days at doses of 200 and 400 mg/kg p.o. respectively. All of the values were statistically significant ($p < 0.05$) when compared to the diabetes control group. In this study, 150 mg/kg p.o. of metformin was used as a reference standard. *In-vitro* testing revealed that GCME had an inhibitory impact on the enzymes α -amylase and α-glucosidase with IC50 values of 167.0 ± 3.14 g/ml and 84.2 ± 2.51 g/ml, respectively. According to the results of the current study, diabetic rats fed a high-fat diet and low-dose STZ demonstrated promising hypoglycemic effects from *Gomphogyne cissiformis* fruit.

ISESFEC/23/P-046

Seed germination study in *Bixa orellana* (Annatto) a potent medicinal plant from North East India

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Annatto (*Bixa orellana* Linn.) is a small evergreen tree in the *Bixaceae* family, also known as Lipstick tree and Achiote. It is native to tropical America and India. The entire plant is beneficial, especially the seeds containing "Bixin," a resinous orange or red coating known as "Annatto." It is widely used by food processors and cosmetic industries. Annatto ranks second after Saffron with anti-inflammatory, anticancer, antifungal, antibacterial,

neuropharmacological, antioxidant, anticonvulsant, analgesic, and antidiarrheal activities. It has been used for centuries as a treatment for fevers, heartburn, asthma, diabetes, measles, gonorrhea, etc. Annatto is propagated through seeds which remains dormant because of its hard seed coat. Many authors reported dormancy overcoming by different stratification methods. The existing study showed the substrate medium effect on seed germination of *B. orellana*. Dried annatto pods were collected from Imphal, Manipur, India. The seeds were removed, cleaned and air dried. Germination was carried out by imposingthree treatments: seeds above germination paper, between paper and on vermiculite at temperature of 25°C with 80% RH in diurnal conditions. The experiment was performed in three replicates each having 50 seeds in randomized block design.The effect of substrate media showed above 40% germination in all the treatments.The maximum 48% germination observed in vermiculite, followed by 44% in between paper and 43% on the paper surface. The maximum germination on the vermiculite surface may be due to optimum moisture availability and light conditions. The non-availability of optimum light and moisture might be the reasons for lesser germination in between paper and above paper, respectively.

ISESFEC/23/P-047

Investigation of the potential toxicity and therapeutic effects of *Ficus cunia* using Zebrafish model

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Ficus cunia has been attributed with copious therapeutic claims in Indian traditional medicinal systems, especially for its ethno-medicinal and economical uses. It belongs to the family Moraceae and is commonly known as “drooping fruit” and “heirit” locally in Manipur.The scientific validation for its claim of medicinal value is needed. The hydro-alcohlolic extract of *ficus cunia* fruits (FCHE) were prepared and assessed for its antioxidant potential, embryotoxicity and wound healing properties using zebrafish (Danio rerio) model. Biopsy punch injury was induced in adult zebrafish and the dermal wounds were treated with 80µg/mL and 160µg/mL doses of FCHE over 14-days by direct topical application method. The wound healing effects were evaluated from the progression of wound closure, expressions of the wound healing marker genes and histological examination. The extract has promising antioxidant capacity shown by DPPH and ABTS assay. The LC50 of the extract on zebrafish embryos is 230µg/mL and showed a significant reduction in percent hatchability, heartbeat rate, and developmental morphological abnormalities in the embryos treated with extract in dose dependent manner. The percentage of wound closure, gene expression and histological analysis depicted that the zebrafish treated with 160µg/mL exhibited faster and better wound healing activity, compared to 80µg/mL treated and control group. The rapidity of the wound healing, as shown in the zebrafish model, suggested that extract has potential for further development into a botanical-based wound healing agent.

ISESFEC/23/P-048

Black ginger extract promotes caudal fin regeneration in Zebrafish

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Kaempferia parviflora is an herbaceous plant belonging to Zingiberaceae family. The rhizomes are used as traditional medicinal plant for treatment of a wide spectrum of illnesses.Identification of phytochemical compounds of hydroalcoholic extract of *Kaempferia parviflora* was studied using LC-MS analysis. Total phenolic and total flavonoid content was checked using Folin-Ciocalteu and Aluminum Chloride method respectively. Antioxidant

activity was studied using DPPH and ABTS radical cation decolorization assay. For regeneration experiment, caudal fin of adult zebrafish was amputated approximately 5mm proximal to the first branch of lepidotrichia. Different concentrations of the extract 100, 200, 300, 400 µg per gram fish body weight in 5 µL were administered to the fishes by oral gavaging twice daily for consecutive 10 days. Regenerated caudal fin was measured at 0,3,6,8 and 10 dpt. For toxicity study, embryos were incubated in embryo water containing 10-100µg/mL of hydroalcoholic extract. Toxicity was determined by assessing hatching rate, cardiac rate, morphological changes and survivability in zebrafish embryos. Phenol and flavonoid content was found to be 64.724±0.94 mg GAE/g ext.wt. and 243.7±0.173 mg QE/g ext.wt., respectively. The percentage of inhibiton of DPPH and ABTS is shown as 60% at concentration of 400 µg/mL. Survivality, heart rate and hatching rate started to decrease from 60 µg/mL treatment. At 96hpf, malformations like yolk sac edema and pericardial edema can be observed starting from 60µg/mL treatment group. The 400µg/mL treated group showed maximum regeneration of caudal fins with significant regeneration at 6dpt and 8dpt. Regeneration in males was found to be significant only for 400 µg/mL at 6 dpt. In females, regeneration of caudal fin was found to be significant for 400µg/mL at 6dpt, 8dpt and 10 dpt. Our data signified that *K.parviflora* extracts helps in regeneration of caudal fin in zebrafish. Extract concentrations starting from 60 µg/mL showed toxicity for embryo viability.

ISESFEC/23/P-049

Design and development of nanoparticulate drug delivery system for cancer

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Docetaxel (DOC) is a highly potent anticancer agent from the Taxanes family, widely used against various cancers like prostate, breast, neck, and gastric. However, the drug has important matters of concern like its solubility and low bioavailability, non-uniform biodistribution, and high renal clearance. Solid lipid nanoparticles (SLNs) are the most fascinating nanocarrier system for the delivery of anti-cancer drugs. Here, we applied a novel delivery strategy; synthesis of Stearic Acid (SA) and Polyethylene glycol (PEG_{2000}); Polyethylene glycol monostearate (SA- PEG_{2000}) and characterized by DSC, FTIR and 1H-NMR.The SA- PEG_{2000}-DOCSLNs was prepared by Solvent Diffusion method technique and characterized for particle size, zeta potential, entrapment efficiency, drug loading, and polydispersity index (PDI), and *in-vitro* drug release at pH 5.5 and pH 7.4. *In-vitro* cytotoxicity of SA- PEG_{2000}-DOC was assessed on PC-3 cells at different time intervals of 24, and 48 h and compared with DOC-loaded conventional SA nanoparticles and pure DOC. A significant reduction in the IC50 of SA- PEG_{2000} -DOC against PC-3 cells was observed. In vitro cellular uptake in PC-3 cells showed improved uptake of SA- PEG_{2000} -DOC. *In-vivo* studies showed SA- PEG_{2000}-DOC SLNs have improved pharmacokinetics and contributed to the more pronounced blood residence time of DOC;which confirms the role of PEG in the long-circulation properties of SLNs. Additionally, a biodistribution study reveals that PEGylated NPs showed improved plasma concentration by six-folds and reduced uptake by the RES system.The results indicated that PEGylated SLNs as promising nanocarriers for the Docetaxel delivery as well as stable, safe, and convenient for clinical management of cancer.

ISESFEC/23/P-050

Phytochemical properties and free radical scavenging activity of *Kaempferia parviflora* (black ginger)

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Kaempferia parviflora (Black ginger) belongs to the family Zingiberaceae. The rhizome has been used as folk medicine for many centuries. A number of pharmacological activities of Black ginger have claimed benefits for various ailments. This study aimed to evaluate the phytochemical properties and free radical scavenging activity of Kaempferia parviflora (Black ginger).The rhizomes of *Kaempferia parviflora* were collected from Manipur and was identified by the BSI, Kolkata, India. A known amount of powdered rhizome of Black ginger was extracted in hydroalcoholic extraction (Methanol: Distilled Water in the ratio 70:30) using cold maceration method. Phytochemical investigation was carried out to determine the presence of the phytoconstituents was evaluated. The DPPH and ABTS Scavenging Activity of Black ginger was also estimated using the standard protocols.The phytochemical studies of the rhizome of Kaempferia parviflora showed the presence of alkaloids, glycoside, flavonoids, phenol, saponin, tannin, terpene and steroid. The various concentrations of Black ginger scavenged DPPH free radical in a concentration dependent manner up to 1000 µg/ml. The various concentration of Black ginger did inhibit the generation of $ABTS^{\cdot+}$radical in a dose dependent manner. According to the results, phytochemical studies on the rhizome of *Kaemperia parviflora* showed the presence of a wide of secondary metabolites such as alkaloid, glycoside, flavonoid, phenol, saponin, tannin, terpene and steroid. Reducing sugar are absent.The antioxidant activity of hydroalcoholic extract of Black ginger was evaluated by their ability to inhibit the generation of DPPH and ABTS radicals in-vitro.

ISESFEC/23/P-051

Genomics of *Panicum sumatrense* to develop viable genomic resources for a climate resilient crop

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Sustaining and improving crop productivity in response to emerging challenges of climate change is a global concern now-a-days. Hence there is a pressing need of various crop improvement strategies, particularly genomics based ones. These methods are among widely used approaches for identifying desirable traits within crop plants that are naturally climate resilient and have enhanced nutritional value. Being a nutrition rich crop along with its climate resilient ability makes little millet, a crop species for future food security. Generating genomic resources for the species is significant and will have implications in crop improvement. Therefore the current study focuses on identifying the contributing factors towards its novel genetic makeup using whole genome and transcriptome approach. RNA-Seq of the crop plant generated ~230 million reads from control and treated tissues, which were assembled into 86,614 unigenes. *In silico* differential gene expression analysis created an overview of patterns of gene expression during exposure to drought and salt stress. The whole genome assembly identified little millet to be an allotetraploid plant with an estimated genome size of 1.2GB. A total of 139 scaffolds were generated with N50 of 18.5Mb. The genome was annotated to predict protein coding genes and orthologous groups were analysed after comparison with various plant genomes. This high-quality genome assembly can be a valuable resource as future reference for genomic studies in this crop and related crop species. Currently the study focuses on characterization of the selected candidate gene *LM_C2H2* in Rice plant.

ISESFEC/23/P-052

Deciphering the regulation of nutritive value and abiotic stress response in *Moringa oleifera* through genomic approach

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Moringa oleifera (drumstick tree) a tropical multipurpose plant with medicinal and nutritional properties and with an ability to grow in low water conditions. This makes the species an ideal candidate to study the regulatory mechanisms that modulate abiotic stress tolerance and its possible use in agroforestry system. It is a well-recognized member of the Moringaceae family and thought to be originated in the sub-Himalayan forests of the Indian subcontinent. Moringa leaves are an excellent source of protein. It has 13 known species mostly possessing nutritional, phytochemical and pharmacological properties. All parts of the plant have been used for a number of health benefits and play a distinct role in treating several health conditions. However, abiotic stress factors have an adverse impact on the nutritional quality. The present study is therefore, designed to determine the effect of abiotic stress on gene expression in the plant with focus on transcription factors. We generated and assembled a draft genome sequence of *M. oleifera* (var. Bhagya) into 915 contigs with a N50 value of 4.7 Mb and predicted 32,062 putative protein-coding genes using Next Seq platforms. DNA libraries were prepared for sequencing on PacBio Sequel and Illumina HiSeq 2500 platforms to generate long and short reads respectively. RNA Seq was carried out with control and drought stressed samples. We predicted a total of 21 Heat Shock factors (HSFs) in the *M. oleifera* genome and carried out phylogenetic analyses, motif identification, analysis of gene duplication events, and differential expression of the HSF-coding genes in *M. oleifera*. Analyzing the effect of abiotic stress on nutritional value as well as deciphering the genomics of nutrient assimilation will enable us to correlate and study the interaction of the genes responsible for nutrigenetics and the regulation by HSFs in presence or absence of abiotic stress.

ISESFEC/23/P-053

Generating genomic resources for *Coccinia grandis* and identification of genes regulating fruit morphology

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Fruit morphology is a major trait targeted for selection during domestication of fruit-producing crops, which has resulted in dramatic increase of shape variation in cultivated fruits compared to their wild ancestors. The family Cucurbitaceae is characterized by great variations in fruit shapes and sizes and extensive genetic and genomic studies have been carried out for the other members of Cucurbitaceae family like Cucumber, watermelon, melon. *Coccinia grandis* commonly known as Ivy gourd is a popular cucurbit, commonly used as vegetable. Cultivars of *Coccinia grandis* with different fruit sizes can be valuable genetic material for the study of fruit morphology. This study is aimed at examining the molecular regulation of fruit size In Ivy gourd. We performed comparative transcriptomics of two Ivy gourd cultivars namely Arka Neelachal Kunkhi (larger fruit size) and Arka Neelachal Sabuja (smaller fruit size) differing in their average fruit size. Transcriptome sequencing and assembly resulted in 155205 unigenes. We found 2,228 differentially expressed genes between the two cultivars, out of which, 65 showed especially promising results. We also identified 38 transcription factors, 618 potential long noncoding RNAs (Lnc RNAs) out of which 4 Lnc RNAs were found to be differentially expressed, and 112933 simple sequence repeats (SSRs) in the transcriptome of Ivy gourd. The present study will contribute to further understanding of the molecular mechanisms regulating fruit morphology and genes that determines fruit sizes and may lead to the development of molecular marker tools for selecting genotypes with desired morphological traits.

ISESFEC/23/O-054

Trikatu, an Ayurvedic remedy for breast cancer

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In this present study, the effects of an Ayurvedic herbal combination called “Trikatu” on Breast Cancer cells were explored. This traditional Ayurvedic remedy is an herbal blend of dried powdered *Piper nigrum* (Piperaceae), *Piper longum* (Piperaceae), and *Zingiber officinale* Roscoe, (Zingiberaceae). The HPLC quantitative analysis of the active compounds in the extracts was investigated. Total flavonoid, total phenolic contents, and antioxidant assay were performed. Individual component of these combinations has various therapeutic effects; however, the anticancer activity in Brest Cancer of this combination has not yet been identified. *In vitro*, cytotoxic study was determined using MTT assay, to evaluate cytotoxicity in Breast Cancer cell lines exposed to the various extracts. The effect of the extracts on cell migration was investigated using a monolayer wound healing assay, and Cell cycle arrest and apoptosis were evaluated by propidium iodide and annexin V-FITC/PI staining. The apoptotic effects were evaluated using flow cytometry. Trikatu extracts exerted strong antiproliferative and cytotoxic effects against various cell lines. The result showed that Trikatu significantly inhibited the migration of Breast Cancer cells. The extracts reduced wound closure and strongly induced apoptosis. Therefore, Trikatu extract may be developed as a potential therapeutic remedy to treat Breast Cancer in the future.

ISESFEC/23/P-055

Micrografting as tool to rejuvenate the disease crippled citrus industry in Manipur and Northeast India

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Using decapitated two week old citrus rootstock seedlings and apical meristem of new flush having '0.5-0.65' mm size, micrografting in vitro is done inside LAF chamber. Grafted ones culture in liquid MT with 0.5 mg/L BAP and 6% sucrose in dark followed by light conditions. The micrografted ones are double grafted into pencil size seedlings which will act as scion source. Reverse transcription (RT)-PCR has been performed for detection of citrus tristeza virus (Ctv). Disease free status of the plants has been confirmed through indexing using molecular tools as well as by visual observance. The expected amplicon size '672 bp' for Ctv coat protein specific gene is not observed on gel electrophoresis after PCR amplification using specific primers HCP1 and HCP2. The double grafted ones are used as scion source in the production of budded planting material production. Screening of the grafted planting material is also done occasionally. Citrus productivity in the NE India is comparatively low compared to the main land India. Compared to the major citrus producing countries, there are a number of loopholes where the citrus industries of the region need to give emphasis. Raising the phyto-sanitary and hygienic conditions of citrus orchards is of major concerned. The decline of citrus orchards commonly observed in the NE India need to substantiate through plantation of disease-free planting. The regions agro-climate and prevailing sanitary conditions of the orchards give an impetus to endemic plant pathogens for infection of the citrus orchards round the year. So, there is esteem necessity for plantation of disease-free budded planting material production to achieve a sustainable citrus industry.

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Omega-6 fatty acid-rich crosses of Safflower for future health security

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Safflower is an important oilseed crop in world and also in India. The crop possessed good amount of oil packed with good fraction of fatty acid. The crop has rich amount of unsaturated fatty acid which is considered good for health. The main fraction of fatty acid

present is omega-6 fatty acid and oleic acid. Plants having high content of omega-6 fatty acid and oleic acid were selected and crosses were performed. The oil contents of plants GMU- 2830, GMU-1217, GMU-2830 and GMU-6891 were found to have higher content of linoleic acid while the oil content of plants EC 755664 and EC755673 had higher oleic acid content. A total of six crosses were performed viz., EC-755664 × GMU- 2830, EC-755664 × GMU-1217, EC-755673 × GMU 2830, GMU 6854 × GMU 1217, EC 755673 × GMU 6891 and EC 755673 × GMU-1217. Fatty acid profiling of F2 populations in all the crosses were found to be good along with good amount of oil content. Highest linoleic acid was found for cross EC 755673 X GMU 2830 followed by GMU 6854 X GMU 1217 while crosses EC 755664 X GMU 2830 and EC 755664 X GMU 1217 had moderate average content of both linoleic acid and oleic acid. The result obtained will be useful further in breeding work for production of hybrids with high oil and good fatty acid content and in different crop improvement work.

ISESFEC/23/P-057

In vitro screening of selected Indian medicinal plant extracts for potent anti-viral activity

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Since the beginning of human civilization, mankind has been affected by different kinds of infectious diseases. To combat the spread and severity of such infection and evoke an effective host immune response, extensive research is underway in developing drugs against the virus. Several Indian medicinal plant varieties have shown potent antiviral activity against common human viruses. Most of them work by strengthening the host immune system. In this light, treatment with plant extracts could be an efficient anti-viral option worthy of further investigation. This study aims to evaluate the antiviral potential of leaf extracts from traditionally used plants in the cell culture model together with their cytotoxicity and safety-related quality aspects. Methodology: The in vitro safety and anti-viral activity of each extract against CHIKV and SARS-CoV-2 were examined using Vero and A549 cells. Both cells showed remarkable cell viability at 24 hours post-extract treatment. Quantitative RT-PCR, Western Blot, Plaque assay, and confocal analysis revealed the effectiveness of some plant extracts in controlling viral infection with more than 80 percent of reduction of viral load. Additionally, transcriptomic profiling using Next gen-Seq showed differential regulation of different stress response pathways in virus-infected cell lines after exposure to the extracts. These findings provide a rationale for further studies on the isolation of active principles and ethnopharmacological evaluation of plant extracts against viral infection. Since these extracts can evoke host responses, they can also prove to be suitable targets for drug development against viruses.

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Studies on optimization of oslation process for bakuchiol from *Psoralea carylifolia* seeds

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Bakuchiol is a meroterpene and is utilized in many cosmetic preparations in the form of bakuchiol oil as substitute to retinoids. The rich source of bakuchiol is seeds of *Psoralea corylifolia.* The study aimed to optimize a process for isolation of Bakuchiol from the seeds of *Psoralea corylifolia*. The seeds of *Psoralea corylifolia* were extracted with Petroleum ether (60-80 º) using soxhlet extractor. The petroleum ether extract was concentrated under

vacuum and it was treated with sodium bicarbonate (10%w/v) solution followed by sodium hydroxide (3%w/v) solution. The sodium hydroxide layer was treated with concentrated hydrochloric acid and Bakuchiol was partitioned in diethyl ether. Bakuchiol thus obtained was purified on silica column by carrying out isocratic elution with Petroleum Ether: Ethyl acetate (9:4) as mobile phase. Optimization of the isolation process was carried out by applying Design of experiments using Design Expert 12 and the parameters affecting the yield of Bakuchiol were analyzed. The isolated Bakuchiol yielded single spot in TLC analysis [Mobile phase pet. ether: ethyl acetate (9:4)]. FT-IR spectrum of isolated Bakuchiol indicated phenolic OH group stretch and aliphatic C-H stretch at 3650-2500 and for aliphatic C-H stretch (2850-2950). Isolated bakuchiol indicated maximum absorbance at 248nm which is same as that of the λmax value of standard Bakuchiol. The temperature of extraction, Sodium hydroxide and partitioning solvent were found to affect the yield of Bakuchiol. The optimized conditions for isolation of Bakuchiol with maximum yield of 4.71 % w/w were found to be 45^{o}C for initial extraction and 3% w/v aqueous Sodium Hydroxide with diethyl ether as portioning solvent.

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Bioactivity screening of medicinal plants against sepsis-causing multidrug-resistant bacteria

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Antimicrobial resistance is a global menace currently. The rise in multidrug-resistant bacteria has placed a substantial burden of morbidity and mortality from sepsis. Researchers are in full throttle to find the next antibiotic. Many of them have turned to plant-based traditional medicine for their quest. Manipur has its own unique traditional medicine systems. These systems make extensive use of a number of plants. Of these plants, 16 plants were screened for bioactivity against 18 multi-drug resistant clinical strains, 6 each, of *Escherichia coli*, *Klebsiella pneumoniae*, and *Acinetobacter baumanii*. Here, we report the antibacterial activities of langthrei and manahei organic extracts against the strains. The highest activity was shown by the manahei extract against *A. baumanii* strain, followed by *K. Pneumoniae*, and the least against *E. coli*. Upon further studies, the antibacterial activity was found to be confined to the ethyl acetate-methanolic fraction of the manahei extract; MIC values of 250, 400, and 500 µg/ml against *A. baumanii*, *K. pneumoniae*, and *E. coli* respectively. Results of time-kill assay, resistance studies, and anti-biofilm assay are being analyzed. Further experiments for purification, structural elucidation, and determining mode of action of the active compound are also under way.

ISESFEC/23/P-060

Anti-quorum sensing activity potential of lactic acid bacteria isolated from fermented fruit beverages

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Quorum sensing is a mechanism that enables the cell-to-cell communication of microbes by secretion of signaling molecules and its function is to regulate the vital processes in the bacterial cell such as virulence factor production or biofilm formation which leads to growing resistance to antibiotics. Inhibition of quorum sensing is one of the effective approaches to prevent biofilm formation. The present study aims to evaluate the anti-quorum sensing activity potential of Lactic acid bacteria isolated from fermented fruit beverages collected from different parts of Manipur. Six Lactic acid bacteria (LAB) isolated from fermented fruit beverages were identified based on morphological and 16sRNA identification. For anti-quorum sensing activity, the cell free supernatant was extracted from the LAB strains

evaluated by using a biosensor for quorum sensing Chromobacterium violaceum MTCC 2656 and Pseudomonas aeruginosa PAO1 for inhibition of pigment and biofilm formation. All the LAB strains from the fermented fruit beverages showed significant decreases in violacein production in C.violaceum MTCC 2656 and inhibition of biofilm formation and pyocin production in P. aeruginosa PAO1. Among these Lactobacillus sp strains showed a high percentage of anti-quorum sensing activity. Therefore, the LAB strains having significant anti-quorum sensing potential can prevent biofilm formation and could be a promising lead towards alternative antibiotics in tackling the current scenario of antimicrobial resistance.

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Anti-osteoporotic effect of *Pistacia atlantica* Desf. oleo-gum-resin and its nanocapsulated on biomechanical properties and bone density in ovariectomized rats

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Pistacia atlantica Desf. oleo-gum-resin a medicinal herb that is traditionally used to manage bone disorders, especially osteoporosis in traditional Persian medicine. In the present study, the osteoprotective effects of *Pistacia atlantica* oleo-gum-resin were investigated in the ovariectomy-induced osteoporosis rat model. The essential oil of *P. atlantica* gum was standardized by Gas Chromatography. Osteoporosis was induced in rats through ovariectomy. Sixty-three wistar female rats were randomly divided into sham groups (SHAM) and eight ovariectomized subgroups. Three doses of gum and its encapsulated form (50, 100 and 200 mg/kg) were orally administered to OVX rats for eight weeks. Serum biochemistry (alkaline phosphatase, and calcium), weight of body, Hounsfield Unit (HU) of femur, and three point bending of tibia were examined and compared with the positive group (0.1 mg/kg/day alendronate). The GC/MS analysis of the essential oil identified twenty constituents, and alpha-pinene with a concentration of 127.479 mg/ml is the predominant constituent. *P. atlantica* gum and its encapsulated form increased bone strength, significantly improved serum calcium and decreased turnover markers such as alkaline phosphatase compared to the control group. A dose of 200 mg/kg encapsulated form improved the Hounsfield Unit of femur. Current study exhibited osteoprotective effect of *P. atlantica* oleo-gum-resin in OVX induced osteoporosis, high content of Alpha-pinene might be the responsible factor. Also, nanocapsules containing *P. atlantica* oleo-gum-resin showed better results. Clinical trials are needed to confirm its efficacy in the management of postmenopausal osteoporosis.

ISESFEC/23/P-062

Phytochemical screening and indentification of phytochemical constituents of *Piper mullesua* using chromatography-mass spectrometry (GC-MS) analysis

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Piper mullesua are plants used as a cooking spice as a replacement of traditional pepper and also traditionally used in treatment of cold and cough. Various components of bioactive

compounds are known from various parts of this plant, but the activity of the bioactive compounds from the leaves and fruits have never been reported. This aim of the work was designed to analyze the components of bioactive compounds contained in the hydroalcoholic extract of *Piper mullesua* leaves. *Piper mullesua* leaves were dried and grinded then subjected to hydroalcoholic extraction with methanol and distilled water in the ratio 70:30. The crude extract was prepared using rotar evaporator after distillation with 0.2 µm filter paper. Thereafter, the crude extracts were screened for phytochemicals and found positive for flavonoids, terpenoids, tannins as well as saponins. As a result, for further identification the extract was then subjected to phytochemicals component analysis with GC-MS (Trace 1300 Gas Chromatograph and TSQ Duo Mass Spectrometer). GC-MS analysis of the content of the bioactive compounds of hydroalcoholic extract contained various bioactive compounds. The dominant bioactive compounds are Dihydro Ferulic Acid Methyl Ester (21.26%), 10- Pentadecen-5-yn-1-ol (13.02%), Methyl 8-methyl-nonanoate: (9.27%) and Photocitral A (5.61%). The extract shows antioxidant activity at around 50% (DDPH). The results of the work showed that there were various bioactive compounds and the bioactivity score of some of the phytochemicals demonstrates moderate interaction affinity for ion channels, nuclear receptors, and moderate enzyme inhibition activity. The work sought to develop a potential biomarker for the consumption of relatively small amount of coffee.

ISESFEC/23/P-063

Stability indicating assay method development and validation for analysis of lutein by HPTLC

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Objective of the study was to develop an accurate, simple, sensitive, precise, and economic stability-indicating assay method (SIAM) for estimation of Lutein by High-Performance Thin Layer Chromatography (HPTLC) and validate it as per ICH guidelines. Lutein was procured from Panacea Phytoextracts Pvt. Ltd as a gift sample. AR grade of methanol, ethanol and acetonitrile were obtained from Loba Chemical Pvt. Ltd. The work was carried out on CAMAG HPTLC system equipped with Linomat V applicator, TLC Visualizer 2, TLC scanner 3, VisionCATS software along with stationary phase TLC Silica gel 60 F254 aluminium plates and mobile phase methanol: ethanol: acetonitrile in ratio 4:4:2 v/v/v. A sharp, symmetrical and well-defined peak of lutein was obtained with Rf value 0.65± 0.05. The wavelength 453nm was selected for densitometric analysis. The linear range of drug was observed between 1 to 6 µg/spot (r^2 = 0.996). The values of limit of detection and limit of quantification were found to be 0.434 and 1.316 ng/spot that indicate the sensitivity of the method. The results of forced degradation studies indicated that the drug was sensitive to alkali and photolytic conditions. From this study, it can be concluded that the developed method was found to be simple, rapid, accurate, sensitive, precise, and economic. The forced degradation studies indicate that the developed method can be used for routine analysis of Lutein in the presence of its degradation products.

ISESFEC/23/P-064

Antimalarial activity of *Mentha spicata* and *Tithonia diversifolia* leaf extracts against *Plasmodium falciparum* and *Plasmodium berghei*

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Malaria is a global health issue causing substantial mortality and morbidity across the globe. The emergence of drug resistance against artemisinin-based combination therapy necessitates the development of new and effectual antimalarial drugs. Medicinal plants have a great potential to provide new anti-malarial compounds. The North East Region of India is a genetic treasure house of plants with enormous resources (50% of the total flora of the country) in the form of medicinal plants, and traditional knowledge. Screening of traditionally used medicinal plants is considered a key source for the discovery and development of new therapeutic agents to combat multidrug-resistant Plasmodium sp. The present study aims in vitro and in vivo screening of crude plant extracts for their antimalarial property. In vitro antiplasmodial activity against Pf3D7 and PfARTCam3.I R539 were carried out using [3H]-hypoxanthine uptake assays and confirmed through giemsa-stained smears. Cytotoxicity study in HeLa, HEK293T, MCF7 and HepG2 cell lines were done using MTT assays. Hemolysis assays were performed using fresh human RBCs. Phytochemicals present in the plant extracts were identified by GCMS. Antioxidant activity and quantitative phytochemical analysis were also performed. The in vivo anti-malarial study was carried out using Peter's 4-day test and Rane's tests in Plasmodium berghei infected Balb/c mice. The in vitro study showed the significant antiplasmodial activity of Mentha spicata (IC50 value ~ 56 µg/ ml) and *Tithonia diversifolia* (IC_{50} value ~ 10 µg/ ml). Compounds identified by GCMS are also known to have antimalarial activities. The extracts are non-cytotoxic, non-hemolytic, and showed no in vivo overt toxicity. They exhibited promising in vivo antimalarial activity with notable parasite growth suppression 70 -75 % in and delay in mortality. The in vitro and in vivo results provide evidence for traditionally used plants to treat malaria. To identify and characterize the active novel phytochemical components with antimalarial activity, further fractionation of the extract is required.

ISESFEC/23/P-065

Generating genomic resources for an invasive halophyte, *Phragmites karka*

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Phragmites karka belongs to the family Poaceae and is widely distributed in India, Australia, and Europe. In Odisha, this species is widely distributed in the regions of Chilika and has rapidly invaded north and north-western segments of this lake. It occurs mostly in waterlogged, saline areas, along the swamps, or on dry lands. The plant is a perennial reed with long rhizomes. It also accumulates a high amount of soluble sugar and lignocellulosic biomass which helps for ethanol and biofuel production and traditionally used as a remedy for diabetes, heart diseases, and urinary troubles. It also used as a biosorbent for the removal of mercury ions from an aqueous solution and act as an excellent stabilizer of eroding river banks. Given its ability to grow well in conditions of higher salinity, we were interested in finding out the genes responsible for this. Therefore, we assembled the transcriptome of P. karka under conditions of salinity stress using high-throughput RNA sequencing. A total of 161,403 unigenes were assembled with the average length of the transcript being 1354bp. In leaves, 954 unigenes, and in roots, 1097 unigenes were significantly differentially expressed and coded for genes like Heat shock proteins, chaperones, kinases, etc. We have also identified a total of 11,242 transcription factors including members of ARF, BBR-BPC, bHLH, bZIP, ERF, FAR1 in response to salinity. We have also assembled the whole genome to enrich genomic resources for this plant and obtained a total of 12704 scaffolds. The analyses have led to some interesting findings and helped us identify some essential genes that could be crucial to the study of salinity stress response in plants.

ISESFEC/23/P-066

Transcriptomics of *Vigna aconitifolia* for developing a gene expression atlas

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Demand for food legumes as one of the basic nutritional requirements is inflating globally. Due to supply-demand imbalance, conventional pulses are becoming unreachable for a sizable population due to their rising prices, thereby suffering acute malnutrition debilities. The underutilized species *Vigna aconitifolia* (Moth Bean) is an important legume crop and is valued for its seeds for their high protein content that can be recommended for human wellness. Despite its economic potential, genomic resources for this crop are scarce and there is limited knowledge of the developmental process of this plant at a molecular level. Therefore, we have chosen to study the molecular mechanisms that regulate plant development in *V. aconitifolia*, with a special focus on flower and seed development. We have performed a comprehensive de novo transcriptome assembly using six types of tissues of *Vigna aconitifolia* (var. RMO-435), namely, leaves, roots, flowers, pods, and seed tissue in the early and late stages of development, using the Illumina nextseq platform. We obtained 150938 unigenes with an average length of 937.78 bp. Real-time PCR analysis further validated that the unigenes displayed significant differential expression in the late stages of seed development. The *Vigna aconitifolia* transcriptomic resources generated in this study provide foundational resources for gene discovery with respect to various developmental stages. Using the data from this analysis, we will develop a stress-resistant (abiotic/biotic) and high-yielding varieties in enhancing yield as well as nutritional quality through the use of modern genetic engineering approaches.

ISESFEC/23/P-067

Formulation, design, and optimization of chewable tablet from traditional plants for sore throat

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Infectious diseases have limited treatment in modern medicine. However, Indian Traditional Medicine (TM) has a rich history and resource of large variety medicinal plants for various infectious conditions. The purpose of the current research was to develop a formulation design and optimise a ploy-herbal chewable tablet using different medicinal plant extracts against infectious diseases. A total of 8 TM plants were screened and selected namely., Myrica nagi, Clerodendrum serratum, Inula racemosa, Piper nigrum, Terminalia belerica, Pistacia integerrima, Solanum indicum, Acacia catechu. These herbs were subjected for individual extraction. Further, using JMP trial 16.0 software, we developed poly-herbal chewable tablets and looked into the antibacterial activity of the optimized poly-herbal chewable tablet. The pre-formulation and post-formulation parameters studies showed that the CT 07, CT 09, and CT 11 formulations showed the best result from all other prepared formulations. The anti-microbial activity of the optimized batch was studied. The outcomes of the stability study, which was optimised for the poly-herbal chewable tablet, remained relatively stable throughout the study. The outcomes of the formulations indicate that CT 07, CT 09 and CT 11 are the best formulations. All of the above extracts have antimicrobial activity against infectious disease and have a beneficial impact on the treatment of upper respiratory tract infections.

ISESFEC/23/P-068

Analytical method development and validation for simultaneous estimation of myo-inositol and d-chiro inositol in pharmaceutical dosage form

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To develop a simple, rapid, accurate, precise, specific and sensitive method for simultaneous determination of D-chiro inositol and Myo-inositol in pharmaceutical dosage form. The RP-HPLC method was developed on Cosmosil sugar-D column (4.6×250 mm, 5 µm) at 25°C with a mobile phase consist of acetonitrile : water (75:25 v/v), at 1.0 ml/min flow rate with 10 µl injection volume and detection was done by using refractive index detector. The method was validated as per ICH guidelines. The values of retention time of D-chiro inositol and Myo-inositol were found to be 9.8 min and 11.2 min, respectively. This method was found to be linear and the value of co-relation coefficient between drug concentration and peak area were found to be 0.9991 for D-chiro inositol and 0.9998 for Myo-inositol. The accuracy studies indicate that the values of percent recovery for D-chiro inositol were found to be 99.86±0.21 to 99.45±0.63 % and for Myo-inositol 98.44±0.74 to 98.44± 0.12 %. The value for resolution between two peaks was found to be 3.933. Validation parameters of this method indicate that the developed RP-HPLC method is simple, accurate, precise, specific, robust and sensitive. Results suggest that this method can be used for routine analysis of both drugs in pharmaceutical dosage form.

ISESFEC/23/P-069

Development and validation of stability indicating assay method for estimation of lumefantrine in bulk and tablets

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To develop a simple, rapid, accurate, sensitive, economical and precise stability indicating method for routine estimation of Lumefantrine in bulk and tablets. A Hibar C18 (4.6×250 mm, 5µm) column and mobile phase containing Acetonitrile: Methanol (50:50 v/v) was used for this study. The flow rate of mobile phase was maintained at 1.2 ml/min; column temperature was fixed at 40°C and UV detection was carried out at 234 nm. The forced degradation studies were performed and method was validated as per ICH guidelines. The Retention time of Lumefantrine was found to be 8.8 min. The developed method was found to be linear in the concentration range of 10-60 µg/ml. The value of correlation coefficient between peak area and concentration was found to be 0.995.The value of % RSD was found to be within prescribed limits for precision studies which indicate reproducibility of method. The values of LOD and LOQ were found to be 14.54 and 44.07 µg/ml, respectively. The results of forced degradation studies indicate that the drug was found to be stable in acidic, basic, neutral, photolytic and neutral conditions while degraded in oxidation condition. It can be concluded from the results that developed HPLC method is simple, rapid, accurate, precise and sensitive. Results of stress testing indicate that the method is stability indicating. Thus, the method can be used for routine analysis of Lumefantrine in bulk and tablets.

ISESFEC/23/P-070

Chemical analysis of *Dactylorhiza hatagirea's* nutritional and antioxidant potentials

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The objective of the current study was to chemically profile D. hatagirea tuber nutrients and antioxidant capacity. While amino acids, dactylorhins, and polyphenols were measured using UPLC and ion chromatography, the chemical profile of D. hatagirea tubers was carried out using UHPLC-QTOF-IMS. In addition, atomic absorption spectroscopy and assay methods were used to determine the total amounts of phenolics, flavonoids, antioxidants, and micro- and nanoelements. A total of 100 metabolites, including sugars, terpenoids, steroids, amino acids, polyphenols, nucleosides, saponins, organic and fatty acids, had been identified by UHPLC-QTOF-IMS. Of these, 38 molecules were determined based on mass fragmentation, UV, and retention time, and 62 molecules were found through a search of the METLIN database. Threonine, tryptophan, and other essential and non-essential amino acids were discovered in polyphenols, but only vanillic acid (0.05–0.73 mg/g) was detected by UPLC-DAD analysis. Dactylorhin A (0.819 0.02 mg/g) and B (0.886 0.10) are marker compounds. Furthermore, the tubers extract contained 48.59 mg/g of flavonoids and 73.61 mg/g of total phenolics, respectively. In DPPH and ABTS experiments, the extract demonstrated antioxidant potentials with IC_{50} values of 1.58 0.17 and 4.25 0.08 mg/mL. Environmental toxins (Cd, Hg, Pd, As) were not present, however tubers contained micro (Mn, Na, Zn, Cu) and macro (Ca, Fe, Mg, K) components. The recent discovery has made chemical information, including the nutritional and therapeutic benefits of eating orchid, available. Additionally, this research will support biotechnological and agricultural solutions for higher-quality food without overusing the environment.

ISESFEC/23/P-071

Phytochemical screening, antioxidant activity and analysis of chemical composition using SPME/GC-MS spectroscopy of *Ilicium griffithi* fruits

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Illicium is the sole genus in the family Illiciaceae. *Illicium griffithii* is a medicinal tree species of the temperate broad-leaved forests of North-East India. Its fruits are used in the pharmaceutical and spice industries. The fruits are used medicinally to treat cough, sinusitis, toothache, regurgitating, dyspepsia, abdominal pain, and food poisoning and are considered carminative, stomachic, and galactagogic. The aim of the work is to determined antioxidant activity and analysis of chemical compositions using SPME/GC-MS spectroscopy of Ilicium griffithi fruits from Arunachal Pradesh. The fruits were shade dried at room temperature for 15 days. Dried Material were then powdered separately and stored in the airtight container. Powdered fruits 300g were soaked in methanol 70% for 72 hr respectively with intermittent shaking. The solution was filtered and the filtrates were concentrated under reduced pressure using rotary vacuum evaporator. Finally, crude extracts were obtained and store at 4°C.Primary phytochemical and chemical were analyzed using qualitative chemical analysis and SPME/GC-MS spectroscopy and antioxidant activity of methanol extracts were determined using 1,1-diphenyl-2-picrylhdrazyl (DPPH). Phytochemical qualitative analysis revealed the presence of phenols, flavonoids, tannins, triterpenoids, steroids, alkaloids, saponins and carbohydrates and SPME/GC-MS spectroscopy reveals the presence of phenyl propenes (26.20%), phenols (13.21%), and monoterpene alcohols (12.38%), sesquiterpenes (6.52%) fatty acids (6.37%) esters (2.75%). The major components were myristicin (23.0%) and linalool (12.3%) Antioxidant activity of methanol extracts was found

on DPPH is (70.00± 1.88). The findings showed that it contains a number of significant phytoconstituents, potent of antimicrobial, antibacterial, anti-inflammatory activities.

ISESFEC/23/P-072

GC–MS analysis of phytoconstituents present in wild and cultivated zingiberaceae plants extract and their antioxidant activity

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Zingiberaceae plants, commonly known as gingers, have been popular for their medicinal and culinary properties. Despite their extensive health-promoting benefits, many Zingiberaceae plants still receive no scientific attention. The present study was implemented to identify the phyto components of plant extracts of *Zingiber officinale*, *Curcuma angustifolia,* and *Curcuma longa* using preliminary phytochemical screening and GC-MS analysis. Leaves and rhizome collected were shade dry, powdered and mixed with methanol (70%) and water (30%). The prepared extract was utilized for phytochemical and GC-MS analysis. Hydroalchoholic extract of *Z. officinale, C. angustifolia* and *C. longa* was analyzed by gas chromatography-mass spectroscopy and yielded positive results signalling towards identification and characterization of therapeutic claims of this species in the traditional system. The antioxidant activity of *Z. officinale* was determined by the most suitable DPPH method. The most significant constituents found in *Z. officinale* are Butan-2-one, 4-(3-hydroxy-2-methoxyphenyl)- (18.55%), Zingerone, acetate (18.55%), Gingerol (18.73%), 5-Hydroxy-1-(4-hydroxy-3-methoxyphenyl)octan-3-one (18.73%), 4-Pentene-2-ol, 2-methyl (7.88%), *C. angustifolia* are (5R,6R)-3,6-Dimethyl-5-(prop1-en-2-yl)-6-vinyl-6,7-dihydro benzofuran-4(5H)-one (71.45%), Epicurzerenone (71.45%), Zederone (13.69%) and in C. longa are Cyclopropa[3,4]pentaleno[1,2 -d][1,3] dioxole, 2a,2b,2c,5a,5b,5c-hexahydro-4 ,4-dimethyl-, (2aà,2bà,2cà,5aà,5bà,5cà)- (32.81%), Eugenol (4.68%), Phenol, 2-methoxy-3-(2-propenyl)- (4.68%). The antioxidant activity of *Z. officinale*, *C. angustifolia* and *C. longa* showed significant free radical scavenging capacity against DPPH free radicals. The study concluded that *Z. officinale*, *C. angustifolia* leaf extracts contain many biological active compounds which could be exploited for a development of plant based drug.

ISESFEC/23/P-073

Evaluation of antiviral activity of the holy Basil (*Ocimum sanctum*) and the Indian gooseberry (*Phyllanthus emblica*) against Chikungunya virus

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Chikungunya virus (CHIKV) infection has baffled the world at large due to the debilitating arthritis, high rates of morbidity and lack of any specific antiviral against it. *Ocimum sanctum* and *Phyllanthus emblica* have shown to have a broad antibacterial, antiviral and antifungal activity. Although, natural extracts have been found to alleviate many disease conditions still a thorough study regarding its biological actions is farfetched. In the current study, the extracts of *Ocimum sanctum* and *Phyllanthus emblica* have been prepared and their effects have been evaluated individually as well as in combination against CHIKV in vitro. The experiments have been performed before 2 hours of infection, during infection, after infection, pre and during infection, during and post infection and pre during and post infection. It was observed that the extract showed inhibition of the infection when treated pre during and post individually by the extracts as well as when they were in combination. In conclusion, *Ocimum sanctum* and *Phyllanthus emblica* show promising anti-CHIKV property

and ability to reduce infection. Thereby, future thorough studies guarantee a scientific breakthrough in the field of natural therapeutics concerning virology.

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Paris polyphylla Sm. induces ROS and caspase 3 mediated apoptosis in colorectal cancer cells in vitro and potentiates the therapeutic significance of 5FU and Cisplatin

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Paris polyphylla Sm. (Melanthiaceae) is an essential, vulnerable herb with a wide range of traditional applications ranging from fever to cancer in various communities. The use of *P. polyphylla* in India is limited to the traditional healers. *P. polyphylla* rhizome from Manipur, India was investigated for its anti-colorectal cancer activity. *P. polyphylla* extract (PPE) was evaluated for total phenolic content (TPC), total flavonoid content (TFC), total saponin and steroidal saponin content, anti-oxidant activity by DPPH and ABTS, in vitro cytotoxic activity in colorectal cancer cell lines HT-29, HCT-15 and HCT-116 and normal cell line Hek 293 by MTT (3-(4,5-dimethylthiazol-2-yl))-2,5-diphenyltetrazolium-bromide). The cell line showing high cytotoxicity by PPE was further evaluated by colony forming assay, migration assay, measurement of ROS (Reactive oxygen species), apoptosis by Annexiv V/PI, Caspase 3 activity and the combinational effect of PPE with Fluorouracil (5FU) and Cisplatin. PPE showed good TPC, TFC and anti-oxidant activity. PPE showed the lowest IC50 in HCT-116 and it is less cytotoxic to the normal cell line Hek-231. PPE inhibits the metastatic property, increases the production of ROS and induces apoptosis in HCT-116. PPE acts synergistically with 5FU and Cisplatin and decreases the viability of HCT-116. *P. polyphylla* from Manipur is a potent herb showing anti colorectal cancer activity and potentiates the therapeutic significance of 5FU and Cisplatin.

ISESFEC/23/P-075

Documentation of traditional foods of Lunglei, Lawngtlai and Siaha districts of Mizoram

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Traditional foods may be described as those foods item or dish prepared in a daily meal periodically by the native people. The traditional food style of Mizoram includes consumption of rice and a local cuisine called ‘Mizo bai’ as their daily meal. The ‘Mizo bai’ is prepared with the combination of some wild vegetables, wild fruits, tubers, other ingredients for food seasonings like salt, soda, ajinomoto, and some fermented food products like fermented soybean (bekang), fermented pork fat (sa-um), fermented fish (nghaum, nghathu and dangpuithu or sidol). Survey and documentation was conducted at Lunglei, Lawngtlai and Siaha districts of Mizoram followed by collection of local vegetables from fields and local markets. Random sampling survey technique is used for compilation of data, collecting decent information and capturing the photograph of cuisine as well as GPS location of the survey site. From the survey, more than thirty different cuisine prepared were compiled and it was found out that some cuisine or dishes consumed for daily meal were medicinal plants having a property of antidiabetic, anti-hypertension and antioxidant activity which will provide the baseline study for further research. A detail study on characterisation on bioactive compounds and their impact on human health can lead to development of functional food inspired from traditional knowledge associated with traditional food of Mizoram. These studies can help in value addition of local foods, which can open a new avenue for a local farmers leading to socio-economic development of the region.

ISESFEC/23/P-076

Collection of citrus genetic resources of Manipur and its potential uses

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Survey has been undertaken covering interior as well as village areas of the state for collection of citrus genetic resources. Presence of any unique citrus genotypes has been enquired through interaction with villagers, senior persons in locality, market area etc. Using descriptor for Citrus morphological data diversity existing within and among *Citrus sps.* is recorded. Germplasm collection survey has been taken up in different areas of Manipur. A total of 180 accessions were collected till now. Germplasm include *C. maxima, C. reticulata, C. jambhiri, C. medica, Papeda, C. indica, C. macroptera, C. limon* and some unidentified species. Morphological characterization of leaves, fruits and seeds of different citrus species of this region show diverse characters like dentate and crenate leaf margin, elliptic, ovate and lanceolate leaf shape, ellipsoid, spheroid, and ovoid fruit shape, clavate, cuneiform, ovoid, spheroid, semi-deltoid, spheroid, semi-spheroid seed shape, sessile, brevipetiolate and longipetiolate leaf lamina attachment. Manipur and NE India is known as natural home for Citrus and has often been described as Hotspot in respect to *Citrus*. Home gardens where diversity can be observed, is also in the verge of lost due to anthropogenic activities, thus rising necessity for systemic collection of citrus germplasm of Manipur. To breed cultivars and rootstocks with improve traits of horticultural importance, existing citrus resources play a significant role and raise the necessity for its conservation. Rich phytochemical of Citrus has many health beneficial properties. Flavonoids (quercetin, myricitin, rutin, tangeritin, naringin, and hesperidin) present in citrus fruits have inherent ability to modify body's reaction to allergens, viruses and carcinogens. Polymethoxylated flavones of citrus peels (viz. Tangeretin and nobiletin) possess property that can effectively lower cholesterol. Citrus fruits are highly recommended for persons suffering from kidney stones, gout and arthritis as citrates in citrus juice, prevent formation of kidney stones and ease their dissolution.

ISESFEC/23/P-077

Antiviral activity of plant extracts from Cameroon pharmacopeia against Chikungunya virus

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Chikungunya Virus (CHIKV) is a mosquito-borne alphavirus, which is of major concern as it causes severe arthritic conditions. Although it still continues to affect the world population at large, yet there are no specific antiviral drugs or vaccines available against it. Since the reporting of its first incidence, the CHIKV outbreaks were mostly sporadic in countries in Africa, Asia, Europe and the Indian Pacific Oceans. However, this global spread of CHIKV is still going on by reaching new territories and higher numbers of infections. One of the sub-Saharan African countries being affected by the Chikungunya virus (CHIKV) is Cameroon. An ethnobotanical survey conducted in some regions of Cameroon, led to the identification of nine medicinal plants used in traditional medicine for the healing of fever-related diseases

and arthritis. In this study, the antiviral activity against CHIKV (S-27 prototype strain) was observed by preparing a hydro-ethanolic extract of each plant. Four extracts, *Entada africana* (E4), *Entandrophragma cylindricum* (EI), *Khaya grandifoliola* (E2) and *Macaranga hurifolia* (E6) showed antiviral activity with a half maximal inhibitory concentration of 8.29; 8.14; 12.81 and 26.89 µg/mL. *Entandrophragma cylindricum* (EI), *Khaya grandifoliola* (E2) and *Entada africana* (E4) showed strong inhibition on the entry step of viral infection while only *Entandrophragma cylindricum* (EI) inhibited the viral titer significantly in replication as well as intercellular assembly steps. Four plant extracts namely *Entandrophragma cylindricum* (EI), *Macaranga hurifolia* (E6), *Phragmentera capitate* (E12) and Detariummicrocarpum (E13) were effective against the egression step. Results from this study showed *Entandrophragma cylindricum* (EI) is promising sources of anti-CHIKV agents.

ISESFEC/23/P-078

Efficacy of local bioresources for augmenting reproductive efficiency and health in pigs

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Delayed puberty and extended weaning to estrus interval (WEI) are major factors in reducing reproductive efficiency of gilts and sows. Being a food animal, use of antimicrobials in preserving boar semen and therapeutics is a matter of concern, so pig industry in particular has to think about use of phytobiotics in artificial insemination and health programmes. Preliminary work was carried to use local bioresources for reducing age at puberty in gilts, WEI in sows, diarrheal mortality in piglets and augmenting spermatozoa preservation. For the purpose of estrus induction, delayed pubertal gilts and sows with extended WEI were fed with sun dried leaves of *Moringa oleifera* at a standardized regimen. Secondly, gel free ejaculates were collected by double gloved hand method from healthy boars and extended in aqueous extract of *Azadirachta indica* as per standardized procedures to estimate the sperm preservability. Finally, piglets suffering with diarrhea, were fed with luke warm extract of *Musa balbisiana colla* to improve their health. Supplemented feeding of *Moringa oleifera* significantly ($p<0.01$) reduced the age (months) at puberty in gilts (8.2±.0.26 vs 9.38±.0.25) and WEI (days) in sows (17.8±.1.06 vs 22.35±.1.49). Spermatozoa extended in aqueous extract of *Azadirachta indica* showed poor progressive motility in preservation at 24, 48, 72 hours in comparison to control. *Musa balbisiana colla* extract fed piglets (66.66%) recovered in percentage similar to control (70%). Used bioresources were estimated effective for improving production and health. As this study was a preliminary one, further investigation of used bioresources in terms of variable factors involved, hormonal levels, pathogen isolation and cellular targets may offer newer pathways to boost their use in different reproductive and health conditions.

ISESFEC/23/P-079

Digitalisation of medicinal plants data: a computational effort to probe traditional therapeutic practices

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Traditional knowledge (TK) is often difficult to capture, verify and represent accurately in written form. Therefore, documenting the TK properly is very important for researchers and the communities concerned. Traditional knowledge should also be made accessible to community stakeholders to ensure that it is being effectively used. Proper documentation of TK can provide the community with valuable information that can be used for management purposes or research. The current study provides a detail on the documentation and

digitalization of medicinal plants across the states and union territories of India along with their ethnobotanical practices, phytochemicals and geographical availabilities. Two databases North East India Medicinal Plant Database (NEI-MPDB) and Online Structural and Analytics based Database for Herbs of India (OSADHI) have been developed which reports the medicinal plants of North-east India and PAN India. NEI-MPDB is the first database to report 561 medicinal plants found in all eight states of NE India, whereas OSADHI reports the highest number of medicinal plants (6959) across India. These databases provide taxonomic classifications, traditional practices, phytochemicals with their ADMET and physicochemical properties, structures as well as anti-viral potencies. Further, efforts are being made to develop state/tribe/community-based database of the North Eastern states of India, documenting the details of the practices of the traditional healers, various formulations for the long-term integration and connection with modern medicine. These data will be articulated with the knowledge of computer aided drug designs, data science and clubbed with artificial intelligence and machine learning which can help TK and practices so that it can have its own place in modern healthcare.

ISESFEC/23/P-080

HPTLC based standardization and Network analysis of poly herbal formulation used in the management of Rheumatoid Arthritis

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Rheumatoid arthritis (RA) is a major autoimmune disease characterized by chronic arthritis and inflammation of tissue. The conventional treatment includes corticosteroids and NSAID's. However, they result into severe side effects. So, recent trends emphasize on exploiting natural products for treating RA. One such marketed product used is ANTRTH capsule which comprises of potential biomarkers acting synergistically. However, stringent quality control measures need to be implemented for their correct usage in therapy. The objective of the study was to standardize the marketed polyherbal formulation with respect to the selected markers and investigate its mechanism by network pharmacology. HPTLC methods were developed and validated using mobile phase mixture of toluene:ethylacetate:methanol:formic acid (5:3:2:0.5 v/v/v/v) and toluene:ethylactetae:formic acid (5:5:0.5 v/v) for simultaneous estimation of Quercetin, Berberine, Rutin, Curcumin and Gallic acid, Caffeic acid, β-sitosterolrespectively in ANTRTH marketed formulation at wavelength of 294, 326, 366 nm and 426nm. Binding DB was used for determining potential targets for the active constituents, and was filtered as per the targets associated with RA. A network of formulation-extract-phytoconstituents-targets was constructed using Cytoscape 3.9.1. Protein-Protein interactions, gene ontology, enrichment analysis were done using STRING, DAVID AND KEGG databases. The methods were found to be accurate, precise, robust and were standardized for ANTRTH formulation product. Hence, these methods could be used in the quality control of ANTRTH formulation product. The major phytoconstituents identified were Quercetin, Rutin, Caffeic acid, Curcumin and major targets were found to be Dipeptidyl peptidase 4, Matrix metalloproteinase-9 and Polyunsaturated fatty acid 5-lipoxygenase. The findings of the study provide preliminary scientific evidence of potential biomarkers responsible for anti-rheumatic activity.

ISESFEC/23/P-081

Comparative study and α-glucosidase activity in essential oils of *Callistemon citrinus* (Syn. *Melaleuca citrina*) from Indian Himalaya

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Callistemon citrinus (Curtis) Syn. *Melaleuca citrine* also known as crimson bottlebrush, is a plant that is extensively grown in tropical and subtropical areas. According to reports, *C. citrinus* has a wide range of biological activities, including wound healing, hepatoprotective, cardioprotective, anti-inflammatory, anti-diabetic, hypolipidemic, antioxidant, and antithrombotic effects. It also prevents the activity of the enzymes cholinesterase and elastase. The main topic of discussion in our current study is the chemical composition of the essential oils (EOs) extracted by hydro-distillation from the leaves, aerial part, and fruits of the *C. citrinus*, which have been reported to have antifungal, antibacterial, antioxidant, and insecticidal properties. Utilizing GC/MS and GC-FID, extracted metabolites from EOs were examined. According to our research, there was a significant quantitative difference in the EO composition of the samples, and the organ content varied amongst the samples. To our surprise, the aerial component is found to have the highest yield at 0.9%. Seventeen different metabolites were identified in the EO samples, accounting for (97.2–99.5%) of the total amount, with monoterpenes (12.5–34.6%) and oxygenated-monoterpenes (61.8–86.8%) hydrocarbons dominating, in addition to *α*-pinene (11.8–24.7%), *α*-phelleandrene (1.2–3.0%), *p*-cymene (3.3–3.9%), and 1,8-cineole. Strong glucosidase inhibitory activity was evident in the isolated EOs, which was comparable to the positive control, acarbose.

ISESFEC/23/P-082

Identification of Therapeutics for SARS-CoV2: A Polypharmacological and Drug Repurposing Approach

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With the enormous cost of drug development which is a major impediment, and the length of time it takes to develop a drug almost eliminates the possibility of developing an effective therapy. In this regard, targeting multiple targets with a single drug which is known as polypharmacology may be an efficient strategy for the development of effective therapeutics. In addition, emerging approaches such as ethnopharmacology and network pharmacology serves as a promising tactic for identifying potential leads with polypharmacological property for SARS-CoV2. In the current study, a total of 4015 approved drugs were screened against selected SARS-CoV2 targets (3CLpro, PLpro, RdRp (NSP12), NSP13, NSP14, NSP15, and NSP16). On the bases of docking score, drug interacting with multiple targets and those drugs showing significant number of interactions with the residues of targets, four drugs namely venetoclax, tirilazad, acetyldigitoxin, and ledipasvir were selected. These four drugs were further taken for various analysis and it was observed that the protein-drug complexes were comparatively stable in the MD simulations and MM-PBSA study, and the important interactions between the drugs target complexes retained their interaction stability throughout the simulations. The study has resulted in the identification of potential leads with polypharmacological properties that can be repurposed for COVID-19 disease. While drug repurposing reduces the cost and, more importantly, the time required to screen potential leads, and polypharmacology allows the identification of drugs that can bind to multiple targets, thereby increasing the probability of a drug being effective against a disease.

ISESFEC/23/P-083

Orchids of Manipur: a wellspring of bioeconomy

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Orchids with their distinctive floral modifications and colossal diversity pique interests of researchers, floriculturists, collectors and traders. Because of overexploitation and habitat destruction due to anthropogenic activities, their population has been diminishing at an

alarming rate. Taking references from legit compendiums while identifying and assessing the species thriving in the state of Manipur, can help prioritize the conservation of these threatened plants. According to literature survey conducted under this study, a total of 474 species of orchids have been reported in Manipur. To prioritize conservation issue, prevalence study has been conducted at 15 different sites of Manipur, identified, and collected 84 orchid species which are further conserved in IBSD's net-house. Conservation steps are complemented at a broader scale by conducting interaction programmes and workshops to create awareness about the depleting diversity of orchids, its prospects as an additional source of income, employment generation and entrepreneurship development through orchid cultivation. For an effective sustainable utilization of this bioresource to increase bioeconomy, mass multiplication of orchids that holds potential for commercial value can be obtained through tissue culture. Plantlet generation through *in-vitro* propagation from seeds of *Vanda coerulea* and *Dendrobium transparens* has been achieved. Virus indexing performed for ensuring disease free plantlets that can be distributed to potential farmers for cultivation has been performed. Maintaining the population diversity in its natural habitat as well as increasing the population *via* biotechnological method can help promote ecotourism which may act as a catapult for the upliftment of socio-economic condition of the people of the state. Thus, the work showcases the potential of orchids as a wellspring bioresource for bioeconomy generation of the state.

ISESFEC/23/P-084

Comparative studies on the lectins found in *Meizotropis buteiformis* and *Butea monosperma*

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Lectins are proteins or glycoproteins of non-immune origin that recognize and bind reversibly to a specific carbohydrate without modifying them. A novel D-Galactose binding lectin purified from the seeds of *Meizotropis buteiformis* is being compared with the well-studied lectin from *Butea monosperma* seeds and is found to be similar in various characteristics. The native molecular weight of the *M. buteiformis* lectin (MeibuL) was found to be 75kDa with a subunit molecular weight of 36kDa & 38kDa while that of *B. monosperma* lectin (BML) was found to be 67kDa with a subunit molecular weight of 32 and 34kDa. Both of the lectins are found to be heterodimer in structure and the subunits are bounded non-covalently. They belong to the same class of glycoprotein having different percentage of neutral carbohydrate content. At neutral pH (7.4), the thermal stability of MeibuL is found to be at 50^{o}C while that of BML is found to be 80^{o}C. The agglutinating activity of MeibuL is inhibited by D-Galactose and does not require a divalent ion for its activity which agree with that of BML. Studies had shown that BML had anti-cancer property and inhibits cell growth of Hepatocellular carcinoma (HepG2). Moreover, BML act as carrier protein cum drug delivery agent for disposition of anti-bacterial drug, such as cationic lipid N-acylethanolamine (cNAE) and silver nano particle. Our studies had shown that lectin MeibuL have similar characteristics with the well-studied BML, which gave insight for further research to develop MeibuL as a drug delivery agent to a specific target cells, tissues, or organs which might exert an anti-cancer property against different cancer cell lines.

ISESFEC/23/P-085

Design oriented formulation development of nanosponges of tenofovir disoproxil fumarate based hydrogel

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Aim of current study is to formulate and design a nanosponges drug delivery system for Tenofovir disoproxil fumarate. Objectives of the study are to formulate and evaluate the Hydrogel by using Nanosponge drug delivery system for *in-vitro* skin permeation and *in-vitro* release of Tenofovir. Tenofovir Disoproxil Fumarate was obtained as gift sample. Poly Vinyl Alcohol (PVA), Ethyl Cellulose (EC), Glacial Acetic Acid (GAA) and Sodium Acetate were procured from Loba Chemie, India. Dichloromethane (DCM) and Gellan Gum were procured from Merck. Shimadzu 1900i UV-Spectrophotometer, Horiba SZ-100 Particle size and Zeta Analyzer, Labconco Lyophilizer, Systronics pH meter and Jasco FTIR were used in this project. Nanosponge was prepared by Quasi Emulsion solvent evaporation method and optimized using Taguchi L9 orthogonal array and then the hydrogel was prepared. Prepared formulation was evaluated for particle size, zeta potential and entrapment efficiency, Characterization was done by SEM, DSC, IR and followed by Drug release and skin permeation studies. Tenofovir Disoproxil Fumarate nanosponges were optimized appropriately using Taguchi OA L9 method. Particle size study indicate that the nano range of the prepared formulation. 74.7% of drug was entrapped in the formulation. Drug release study indicates that 86% of drug was released from hydrogel in controlled manner within 24 hrs and release pattern follows the 1st order kinetics. Skin permeation study indicates that about 67% of drug was permeated through the skin.

ISESFEC/23/P-086

Phytosome as a novel approach for herbal medicines

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Phytosomes are spherical vesicles which are most used to incorporated with phytocompounds that have been used as novel drug delivery system. The phytosomes are developed to carry the drug and targeted to a specific site of action. The solvent evaporation method is used for the preparation of phytosomes. Phytosomes are prepared by reacting natural or synthetic phospholipids with active compounds like bioflavonoid, alkaloids, and polyphenolic constituent. Phytosomes, also known as herbosomes, advanced and novel forms of botanicals and natural plant that can be absorbed orally, topically, and transdermally. Phytosomes have improved pharmacological properties and have a wide range of applications in cosmetics. Phytosome preparation methods are non-traditional, simple, and reproducible. And apart from that, the phospholipids are using have their own health benefits. Several phytosome-related areas will be reported in the future option of pharmaceutical application. The phytosome technology creates a link between traditional phytoconstituent delivery systems and novel drug delivery systems. Herbal products are always concerned about adsorption and bioavailability; phytosomes are the most suitable novel approaches for herbal drugs to overcome these issues.

ISESFEC/23/P-087

Therapeutic potential of genus cymbidium: a systematic review

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Orchids are one of the extremely evolved angiosperm families, known for their medicinal importance. Orchids under genus Cymbidium distributed throughout Southeast Asia, China, Japan, and Northern Australia and investigated for different biological activities. Aim of this systematic review is to analyze the therapeutic potential of orchid of genus cymbidium. This study was performed according to the guideline of Preferred Reporting Items for Systemic Reviews and Meta- Analysis (PRISMA) 2020. Different scientific database Google Scholar, Scopus, Pub med was critically searched to find out relative literature using specific keyword. Relevant article were selected based on exclusion and inclusion criteria, and information were analyzed. We have identified 407 papers in database search. Based on

exclusion and inclusion irrelevant article were removed and finally 63 articles included in this study. Genus Cymbidium consists of 76 orchid's species. In folk medicinal practices orchids of genus cymbidium used to cure bone fracture, treat boils, to stop bleeding, treat mild paralysis in India, Nepal andBangladesh. Extract, fraction or isolated compounds of genus Cymbidium also investigated preclinically for anti-oxidant, anti-inflammatory, antibacterial, CNS depressant, anti-aging, antifungal and anticancer activities. Some of the important species includes *Cymbidium aloifolium, Cymbidium kanran, Cymbidium elegans, and Cymbidium devonianium*. A number of phytoconstituents such as cymensifins (A, B, and C), 1,4-phenanthrenequinones, 5-hydroxy-2-methoxy-1,4-phenanthrenequinone and ephemeranthoquinone-B, with 5-hydroxy-2-methoxy-1,4-phenanthrenequinone were isolated from genus cymbidium and successfully investigated for anticancer and antitumor activity using *in vivo* and *in vitro* studies. The present systematic review provides comprehensive information ethenomedicinal, pharmacology activity of genus Cymbidium along with biologically potent phytochemicals. Genus cymbidium could be an important source of bioactive molecule or bioextract in management of different disease in future.

ISESFEC/23/P-088

Diabetic wound healing activity of herbal formulation: a systematic review

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Altered wound healing is a major clinical challenge in diabetic patients that results substantial impact on quality of life. Despite of availability of modern therapeutic approaches management of diabetic wound (DW) is a major challenge. This systematic review focused on documenting herbal formulation investigated in preclinical and clinical trials in management of DW. This study was performed according to the guideline of Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020. Different scientific database like Google Scholar, Scopus, PubMed were critically searched to find out relevant literature using specific keyword combination. Irrelevant articles were removed based on exclusion/inclusion criteria, and selected articles were analyzed. We have identified total 215 papers in database search, and after removing irrelevant papers finally 27 articles included in this analysis. Total 35 formulations prepared with extract/fraction/isolated phytoconstituent etc. were investigated successfully in management of diabetic wound in preclinical and clinical studies when applied topically. Among these, 14 are polyherbal formulation. Some of the important plants evaluated for their diabetic wound healing efficacy are *Glycyrrhiza glabra, Musa paradisiaca, Curcuma longa, Pandanus odaratissimus, Aloe vera, Cocos nucifera* etc. Isolated compound like quercetin, curcumin, rutin, kaempferol, narginin, luteolin, apigenin have shown potent effect in management of diabetic wound. Herbal formulations like extract infused oil, ointment, cream; aerosol sprays have shown promising effect in clinical studies. The effectiveness of plants in treating diabetic wounds is associated with an increase in fibroblast cells, fibroplasia, collagen production, promotion of tissue regeneration, angiogenesis, and antibacterial, anti-inflammatory, and antioxidant effects. Present study highlighted the effectiveness and promising future of herbal formulation in management of diabetic wound. Herbal medicine embedded with potent phytoextract/ bioactive phytochemicals can be an alternative or effective adjuvant to manage DW in better way.

ISESFEC/23/P-089

Phytochemical & pharmacological investigation on the fruits of *Ficus racemosa*

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Ficus racemosa Linn. (Moraceae) commonly called Gular is an evergreen deciduous tree; the fruits, traditionally used in Leucorrhoea and blood disorders. This research paper

focusses on its phytochemistry and provides experimental evidence for use of unripe fruits in treatment of bleeding disorders. Phytochemical investigation on the total aqueous extracts showed the presence of carbohydrates, flavonoids, phenolics and saponins. Proximate and heavy metal analysis were within the permissible limits. Spray drying was carried on total aqueous extract microencapsulated with maltodextrin (10% w/v) at temperature 280°C, atomization air flow 1.19 kg/cm^{-1}. HPTLC chromatogram in mobile phase- toluene: ethyl acetate: formic acid detected two major peaks at Rf 0.93 and Rf 0.45; identified as terpenoid derivative. Further the aqueous extract was studied for platelet increasing activity in cyclophosphamide induced thrombocytopenia animal model. Seven groups of six Sprague Dawley rats weighing 130-150gms were studied for 14 days, for both prophylactic and therapeutic treatment at two different dose levels. Thrombocytopenia was induced on first 2 days and from day7 to day 14 the plant extract was administered by oral route in therapeutic group, whereas in prophylactic group both cyclophosphamide and plant extract were given from day1 to day6. The plant extract displayed a significant increase ($p<0.001$) on day7 in comparison with the cyclophosphamide group. In the therapeutic group platelet count increased from day 11 and reached to normal level on day 14. The plant extract group in which thrombocytopenia was not induced also showed significant increase in platelet count. Hence it may be concluded that the total extract of unripe fruits of Gular was efficient in treatment of thrombocytopenia; a condition which acts as a clinical indicator in severity of various diseases.

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Integration of chemoinformatics and machine learning for drug discovery

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The molecular modeling majorly depending on explicit physical equations such as quantum chemistry, molecular dynamics simulations etc. In contrast, the machine learning algorithms uses different pattern recognition algorithms to understand the mathematical relationships between empirical observations of small molecules and infer them to predict the biological, physical and chemical properties of the novel compounds. The available chemical data is skyrocketing and machine learning has become indispensable tool to mine the patterns, chemical information that eventually helps to synthesize a molecule with desired properties. Integration of chemoinformatics and machine learning yield fruitful outcome in the prediction of small molecule properties, designing of novel molecules etc. In our group, the chemoinformatics and machine learning approaches are extensively employed for different biological problems such as *M.tb* permeability, antivirals, clinical trials candidates, VDR agonists and antagonists prediction. Different descriptors were calculated from RDKit, Modred software and various machine learning algorithms were considered for the machine learning models generation. The machine learning calculations not only helped in developing equations to predict the properties, but also helps to rationalize the features that are useful in developing molecules with desired properties. Along with the small molecules properties, incorporation of the target proteins structure information and molecular dynamics properties yields better results which we have demonstrated in our studies.

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Exploring the Himalayan plants with Immunomodulant and galactagogue properties

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The medicinal plants are boon to humans for their livelihood and healthcare. There are several unexplored plants species which are having tremendous benefits to human as well as animal health. In recently role of Immunomodulator has been discussed word wide for serious disease; cancer, infection, neurological disorder, autoimmune disease, metabolic disease, cytokine storm etc. In this context, literature survey was carried out about the plants which possess immunomodulant and galactogue activity. There are some plants reported for their immunomodulatory were selected for the similar purpose. The objective of the overall program is to unravel the mechanism of action of secondary metabolite present in these plants, especially in the fraction which will be found active for the activities which are being carried out. There are also traditional ways of using medicinal plants such as crude plants, herbal teas, decoction, and alcoholic extracts. These plant materials are used in a nonstandardized manner frequently. However, nowadays more and more emphasis is being put on the use of standardized materials and preparations to ensure the efficacy, safety, and composition of the drug or herbal preparations. The botanical drug on galactogogues should study nutritional values (macro- and micronutrients) as wells as therapeutic potentials (secondary metabolites and their activities) through the modern scientific research. *Tinospora cordifolia*, *Withania somnifera*, *Asparagus racemosus* are plants selected to evaluate their potential in animal health with reference to immunomodulant and galactogue properties. Some other plants viz. *Sonchus asper* and *Achyranthes aspera* are also subjected for the same activity and also want to explore secondary metabolite present in the active extract. This information would be helpful to develop a product under phytopharmacautical category. This would be the first report on immunomodulant and galactogue activity together which will deepen our knowledge of understanding, how immunomodulant are helpful to facilitate galactogue activity? Or the galactogue activity has different approach to be dealt with.

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Ageratina adenophora (Spreng.) King & H.Rob leaf extract as antidiabetic agent: *in-vitro* and *in-vivo* evaluation and quantification of chlorogenic and caffeic acid

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Ageratina adenophora is a herbaceous perennial invasive weed, commonly known as crofton weed, possesses several secondary metabolites that are pharmacologically intriguing and use for various therapeutic applications. The leaves and tender parts of the plant have abundant chlorogenic and caffeic acids, which are reported novel insulin sensitizers. The main aim of the present study was to evaluate the antidiabetic capacity of *Ageratina adenophora* hydroalcoholic extract in STZ-NA induced diabetic Wistar albino rats and *quantification of chlorogenic and caffeic acids.* Diabetic rats were treated with AAHY at 200 mg/kg and 400 mg/kg orally for 28 days. Metformin (150 mg/kg b.w.) was used as a reference drug. Fasting blood glucose (FBG) level; serum biochemical parameters; liver and kidney antioxidant parameters were estimated, and pancreatic histopathology was performed after 28 days of treatment. The study concludes that the hydroalcoholic extract of *Ageratina adenophora* has significant blood glucose lowering capacity on nomoglycemic, diabetic and oral glucose loaded Wistar albino rats while maintaining the body weight of diabetic rats. The experimental results verified that the *Ageratina adenophora* hydroalcoholic extract has beneficial effect in inhibiting α- glucosidase and α-amylase activities and restored the altered blood glucose level, Glycated haemoglobin, body weight, serum enzymes (SGOT, SGPT and ALP), total protein, urea and creatinine levels close to normal range in STZ induced diabetic rats. The AAHY significantly enhanced tissue antioxidant parameters

(SOD, GSH and LPO) close to normal level. The presence of high quantity of chlorogenic (6.47 %) and caffeic (3.28 %) acids as some of the major phytoconstituents may contribute to the improvement of glucose tolerance, insulin resistance, cellular oxidative stress, and obesity in STZ induced diabetic rats. The results provide scientific support for the traditional use of the plant to treat diabetes.

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Green synthesis, characterization of nanoscale silver nanoparticles and studies on bioactivity using *Alpinia calcarata*

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The development of green strategy for the synthesis of nanoparticles with plants extracts is critical in nanotechnology because it avoids the use of chemicalss. To synthesize silver nanoparticles (AgNPs) using aquous extracts of Alpinia calcarata (AC) leaves (L) and rhizomes (Rh) were used as a reducing and capping agent. DLS, FT-IR, XRD, TEM and UV-Visible spectophotometre were among the techniques used to identify the compounds and characterise produced nanoparticles. UV-Visible spectrophotometre confirmed the reduction of silver nitrate to silver nanoparticles, with an absorbance peak in the region of 420-424 nm. Both the as prepared AgNPs from leaves (AgNPs L) and rhizomes (AgNPs Rh) had good stability, well crystalline with quasi spherical shape and size ranging from 3-45 nm and 3-50 nm respectively as via Zeta potential, XRD, TEM and DLS measurements. Preliminary phytochemicals studies and FTIR analysis confirmed the presence of secondary metabolites with carbonyl, amine and hydroxyl groups acting as reducing and/or capping agents. Additionally, disc-diffusion studies revealed remarkable and comparable inhibitory effect of the synthesized AgNPs ACL and AgNPs ACRh on all the tested opportunistic MTCC-4878 (TA), MTCC-1811(AF), MTCC-7880(EF) fungal strains. The fungistatic rate also rises with enhancing sample concentration.

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Network pharmacological evaluation of *Centella asiatica* for anti-fibrotic properties

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Centella asiatica Linn has been traditionally used in Ayurvedic medicine in India since thousands of years. It has been listed in Sushruta Samhita as Manduk-Parni. It is widely used for wound healing, depression, epilepsy, gastric ulcer, and blood purification and has been demonstrated to combat over-healing wounds such as liver fibrosis and oral submucous fibrosis. The present study aims to identify the targets responsible for antifibrotic activity of the herb by network pharmacology. Phytochemicals present in *Centella asiatica Linn* were identified using various phytochemical databases and literature to create compound library. The compounds were virtually screened for drug-likeness properties for identification of potential ligands by Swiss ADME web server. Targets for the ligands were

identified by Therapeutic Target database (TTD), Swiss target prediction and Binding database online servers. Using literature, proteins involved in fibrosis were manually curated. String database was utilized to perform gene ontology enrichment studies and common protein targets present between the Compound pathway analysis and Disease pathway analysis were used to draw a conjoint network prediction comprising of both compound and disease based investigative approaches. Five ligands were derived after virtual screening of phytochemicals. A total of 809 potential targets were predicted for the ligands which were analyzed against fibrotic proteins. Network pharmacology analysis predicted that *Centella asiatica* might exert its antifibrotic activity by targeting an array of proteins such as cyclooxygenase-2, matrix metalloproteinases, growth factors, kinases, interleukins and modulating the inflammatory pathways and collagen deposition.

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Impact of post harvesting conditions on the quality of raw herbs

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The quality of raw material is prerequisite for production of high-quality plant-based drugs or products and to enhance benefits of these products on human health. During storage of dried plant material for prolonged period, medicinal plants undergo chemical changes (composition and content) in secondary metabolites which influence the pharmacological and phytochemical activity of the plant. Comprehensive information was searched systematically from electronic databases, namely, Google scholar, PubMed, Sciencedirect, Scopus, Wiley, and Springer to find relevant data regarding the influence of prolonged storage of raw medicinal plant material on phyto constituents and their biological activity. The studies on impact of prolonged storage (post-harvest factor) on the quality of medicinal and aromatic plants were selected and reviewed. The studies suggested that stored plant material do retain most of their pharmacological efficacies, though to a lesser intensity, and therefore can continue being used as medicinal remedies. Also, the changes are plant part and species specific. There is a dearth of scientific data on the stability and efficacy of the bioactive compounds in medicinal plants after prolonged storage as compared to wide application and importance of medicinal plants. It is important to study the impact of long-term storage conditions on the shelf life (in terms of phytochemical constituents content, composition, nutritional activities, biological activities) of medicinal plants after post-harvest.

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Analytical method development for simultaneous estimation of herbal drugs

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Docking studies on glycyrrhizin and curcumin indicated good binding with tryptase and IL-5 proteins, the targets for asthma receptors. Very little information is available on the bioavailability of herbal formulations due to several challenges. One of the major challenges is development of bioanalytical method for simultaneous estimation of marker compounds from serum. The aim of our study is to develop simple, sensitive analytical method for simultaneous estimation of glycyrrhizin, curcumin and piperine and its application for standardization of extracts and formulation. Standard glycyrrhizin was procured from Sigma Aldrich, and curcumin and piperine were isolated in laboratory. Analytical method was developed for simultaneous estimation of curcumin, piperine and glycyrrhizin. The optimized HPTLC method includes, mobile phase (n-butanol: glacial acetic acid: water 4:1:5) and stationary phase as Silica gel 60 GF 254. The detection was carried out at 343nm. The validation of analytical method was carried out for all parameters as per ICH guidelines. The validated HPTLC analytical method was applied to a standardization of extracts and analysis

of Oro dispersible tablet formulations containing glycyrrhizin, curcumin and piperine. Curcumin, piperine and glycyrrhizin could be resolved with the Rf values of 0.58 for glycyrrhizin, 0.67 for curcumin and 0.72 for piperine. The method was validated for linearity 300-800ng/spot for glycyrrhizin and 30-80ng/spot for curcumin and piperinewith R^2 value > 0.995. The method was found to be reproducible with % RSD value < 2%. The developed analytical method was found to be cost effective, rapid, reproducible, selective, and accurate which can be used for standardization of extract and routine analysis of formulations.

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Ethnobotanical uses and commercial perspectives of some important high-altitude spices and condiments in Western Himalaya, Uttarakhand

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The aromatic spices and condiments are extensively used as food adjuncts to add aroma, flavour and taste to a variety of cuisines, as preservatives, in different parts of Uttarakhand Himalaya and may play pivotal role in the development of trade and commerce across the region. These species are often much more than merely as spice or condiments as these are also valued for their medicinal and biological properties. Thus, the present study focused on the documentation of ethnobotanical practices of *Allium humile* (Ladum), *Allium stracheyi* (Faran), *Allium rubellum* (Doodhu), *Angelica glauca* (Choru), *Carum carvi* (Kala Jeera) and *Origanum vulgare* (Oregano) by the local inhabitants of district Chamoli, Pauri and Tehri Garhwal in Uttarakhand and indigenous uses of *Rosmarinus officinalis* (Rosemary) in different parts of the world. Although, some of these species may not be well known to main-stream societies, but are in good demand by the tribal and ethnic communities for the taste and associated healing properties particularly in cold climate of high Himalayan regions. Further, *Allium sp.*, *Choru* and *Kala Jeera* have also occupied an important place in the traditional system of medicine for many decades in the mountain regions of Uttarakhand. Especially, *Ladum* is used for culinary purpose, leaves are used as the best quality condiments, and medicinally, it is used to cure jaundice, cough and cold. Likewise, the use of *Faran* and *Doodhu* as a green vegetable, spice and condiments and to cure cold, cough and nasal infection have been documented from the region. Use of *Kala Jeera* seeds as spice and condiments and to cure stomach disorder and gastric problems are still in practice even by the modern societies. Being essential oil yielding crops, leaves of *Rosemary* and *Oregano* are used as a flavoring ingredient for variety of Italian and continental foods especially soup and salad dressings. *Oregano* also produces a yellow-green colored dye and is used in aromatherapy. All these species also possess anti-bacterial, anti-viral, anti-septic, anti-helminthic, anti-microbial, antioxidant, anti-fungal, anti-coagulant, etc. properties. Essential oil extracted from these species is prominently used in aroma therapy and also, as insecticidal and preservative agent. The annual domestic demand of *Allium* Sp. is around 10 MT and for *Kala Jeera* is around 50-100 MT. Along with the demand, distinctive taste, flavour, odours and curative properties, these species have the immense potential to improve the local economy, if large scale cultivation followed by primary post-harvest processing, product development and market linkages are standardized and organized properly. Moreover, scientific innovation in post-harvest processing and product development from these species along with entrepreneurship and employment generation will also encourage the startup programme under "*Aatma Nirbhar Bharat Abhiyaan*".

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Propagation & Cultivation: A promising way to conservation of rare, endangered & threatened medicinal plants as well as the economic empowerment of local inhabitants

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The Indian Himalayan Region (IHR) is a genetic treasure house of plant, animal and microbial resources. The plant bioresources of the region includes not only tropical and sub-tropical species but also the species of temperate and alpine regions. The different ethnic groups with distinct cultural entities inhabit in the region are custodians of rich indigenous traditional knowledge systems on the uses of components of biodiversity of the Himalayan region for their daily sustenance like food, fodder, shelter and healthcare. Among the various bioresources, the IHR has an enormous form of medicinal and aromatic plants and the sustainable use of these invaluable plant genetic resources helps in economic growth of the region in particular and to the nation in general. In recent years, due to the increased renewed interest in herbal products globally, inclusion of Indian medicinal plants, innovations and development of new drugs from the botanicals in a scientific way, particularly using conventional as well as biotechnological interventions will help in the global acceptance of the use of herbal products by modern medical profession. However, to accelerate the research, drug formulation and product development from the important medicinal and aromatic plants, the availability of pure raw botanicals is a major hurdle. In the case of raw materials of medicinal plants of the higher Himalayan region, yet now most of the materials is being collected or extracted from the wild through illegal and unscientific collection measures. Besides this, there is still shortage of availability of pure raw botanicals for the trajectory of phytopharmaceutical drugs in India as well as in other concerned countries. Therefore, keeping in view to fulfilling the industrial as well as local demand of pure raw botanicals for research, drug development and product formulation purposes, the propagation and cultivation of medicinal and aromatic plants in farmers' fields has been initiated/promoted in higher Himalayan region of Uttarakhand with some selected medicinal and aromatic plant species i.e., *Aconitum heterophyllum, Nardostachys grandiflora* and *Swertia chirayita* under Himalayan Bioresource Mission programme of Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India, because the propagation and cultivation is only a promising way to conserve the species in natural habitat and the raw materials obtained from the cultivation can fulfil the demand of industries and simultaneously help in economic empowerment of the local inhabitants through business of the cultivated materials.

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Top 20 of inflammation-related molecular targets of bitter tastants

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Previous studies revealed that bitter tastants have a higher probability to have an anti-inflammatory activity than other tastants. The aim of the present work is to predict the most important 20 inflammation-related molecular targets of bitter tastants and to analyze their potential regulatory mechanisms focused on inflammation. 390 bitter phytochemicals (each having at least 40 hits on PubMed searches) selected from Plant Molecular Taste Database (www.plantmoleculartastedb.org) were included in our analysis. 363 potential molecular targets of these phytochemicals (obtained using a bioinformatic tool www.swisstargetprediction.ch/) were identified as inflammation-related targets by interrogation of 4 international databases www.uniprot.org, www.proteinatlas.org, www.pubchem.ncbi.nlm.nih.gov, www.ncbi.nlm.nih.gov/protein. In the present study, we sorted the targets by the descending number of bitter tastants predicted as ligands. Afterwards, we have performed a systematic search in PubMed using the phrase: target name AND (inflammation OR anti-inflammatory OR pro-inflammatory). Top 20 inflammation-related molecular targets of bitter tastants includesreceptors (adenosine A1, A2a, A2b,A3 receptors, EGFR erbB1, estrogen receptor alpha and beta),enzymes (arachidonate 5-lipoxygenase, COX2, COX1; iNOS; metalloproteinases 8 and 9; thrombin; tyrosine protein kinase SRC, p38 alpha MAPK; dehydrogenase-11-beta-hydroxysteroid dehydrogenase 1; cytochrome P450 19A1), HSP90alpha andP-glycoprotein 1. We estimate that antiinflammatory activity of bitter tastants may be associated either with activation of certain targets (e.g. HSP90alpha, estrogen receptor alpha and beta,adenosine receptors a1, a2a, a3) or inhibition of others (e.g. COX1, COX2, arachidonate 5-lipoxygenase). Potential mechanisms involved by bitter tastants mediated by these 20 top targets may be: modulation of the mRNA levels of proinflammatory cytokines (TNF-alpha, IFN-gamma, IL 1beta, IL-6, IL-8, MCP-1, ICAM-1, and PG), chemoattraction of immune cells (neutrophils, macrophages, and eosinofils), regulation of cell proliferation. Bitter phytochemicals may exhibit antiinflammatory activity by targeting important enzymes, receptors or other proteins involved in inflammation.

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Production and characterization of bioactive and multifunctional peptides in *Chhurpi* cheese produced using *Lactobacillus delbrueckii* WS4

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Functional characterization of *chhurpi* cheese produced using proteolytic *Lactobacillus delbrueckii* strains and its simulated *in vitro* gastrointestinal (GI) digests was done. *Chhurpi* protein hydrolysis was visualized by SDS-PAGE analysis and quantified by o-phthalaldehyde (OPA) assay. Simulated *in vitro* gastrointestinal (GI) digestion of the *chhurpi* cheese was done using the enzymes pepsin and pancreatin. Antioxidant activity was assessed by estimating HOCl radical scavenging activity and myeloperoxidase (MPO)-inhibitory activity of the undigested and GI digested *chhurpi. In vitro* angiotensin-I converting enzyme (ACE)-inhibitory activity analysis of *chhurpi* and its GI digests was performed. Peptidomics of the *chhurpi* showing highest *in vitro* activity was performed by LC-MS/MS analysis for identification of bioactive peptides. *In silico* analyses including molecular docking and quantitative structure activity relationship (QSAR) was performed to identify novel potential antihypertensive peptides. Undigested and GI digested *chhurpi* produced using *L. delbrueckii* WS4 demonstrated the highest HOCl radical scavenging, MPO-inhibitory, and ACE-inhibitory activity. Peptidomics analysis of *chhurpi* produced using *L. delbrueckii* WS4 and its GI digest resulted in the identification of several bioactive peptides with functional properties including antioxidant, ACE-inhibitory, and immunomodulatory activity. Multifunctional peptides were identified in both undigested and GI digested fractions of

chhurpi with YQEPVLGPVR and YQEPVLGPVRGPFPIIV escaping simulated *in vitro* GI digestion. *In silico* anti-hypertensive property prediction followed by molecular docking demonstrated a strong binding affinity of selected peptides with ACE catalytic residues. QSAR quantification of selected *chhurpi* hepta-, octa-, nona-, and deca-peptides resulted in prediction of potent ACE-inhibitory peptides. The nona-peptides HPHPHLSFM and LKPTPEGDL, identified in *chhurpi* GI digest, were predicted to express ACE-inhibitory IC_{50} values of 9.18 µM and 0.059 µM, respectively. This is the first report on the identification of bioactive and multifunctional peptides in undigested and GI digested *chhurpi* cheese produced using defined proteolytic starter strain.

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Characterization of bioactive peptides in traditional fermented soft *chhurpi* consumed in different season of the Sikkim Himalayan region

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Soft *chhurpi*, a traditional fermented milk product consumed in the Sikkim Himalayan region was collected during the different season. The LC-MS/MS based peptidomics analysis approach was adopted to identify novel bioactive peptides and antimicrobial peptides in the seasonal soft *chhurpi*, having potential health benefits using different webserver. Further, *in silico* molecular docking analysis was used to predict antihypertensive, antioxidant, and antimicrobial peptides, exhibiting strong non-bond interactions between soft *chhurpi* peptides and the catalytic residues. A total of 1803 peptides were identified in the seasonal samples of soft *chhurpi* originated from different milk protein fragments, out of which 62 peptides have been reported for different functional properties. Among these peptides, 126 and 66 peptides were predicted to be antihypertensive and antioxidant respectively, using bioactivity prediction webservers. Further, a total of 287 peptide fragments originating from different bacteriocins were identified and out of which 128 were predicted to antimicrobial using bioactivity prediction webservers. *In silico* molecular docking analysis predicted 20 each antihypertensive, antioxidant, and antimicrobial peptides, exhibiting strong non-bond interactions between soft *chhurpi* peptides and the catalytic residues. Peptides, VYPFPGPIH, PVLGPVRGPFPI identified in the seasonal soft *chhurpi*, showed a stronger binding affinity towards ACE and MPO respectively. Further, antimicrobial peptides, MGAIAKLVAKFGWPFIKKFYKQIMQFIG, ATVNIVWLANKFGVH, LVLVVGGYTAKQCLQAIGSWGIAGTGAGAAGGPAGAFVG, FIKGFGKGAIKEGNKDKWKN, GAAGLGAGVSGGLWGMAAGGIGGELAYMGANGCL and DGGYTPKNCAMAVGGGMLSGAIRGGMSGTV demonstrated stronger binding affinity towards the transcriptional regulator protein and surface protein of food-borne pathogens, such as *E. coli*, *L. monocytogenes* and *S. aureus* respectively. Therefore, the identification of ACE-inhibitory, antioxidant, and antimicrobial peptides in soft *chhurpi* cheese adds value to them as functional foods.

ISESFEC/23/P-102

Immunomodulator and antibacterial activity of a polyherbal formulation, derived from traditional Indian medicinal plants

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The proposed study aimed to develop a characterized polyherbal combination as an immunomodulator containing *Phyllanthus emblica* L., *Piper nigrum* L., *Withania somnifera*

(L.) Dunal, and *Tinospora cordifolia* (Willd.) Miers. The combination was also explored for its *in vitro* antibacterial potential against foodborne pathogenic bacteria *E. coli* and *S. aureus*.The ratio of aqueous extracts of four plant materials were optimized through response surface methodology (RSM). The optimized ratio of the polyherbal combination was metabolically characterized and evaluated for *in vitro* immunomodulator and antibacterial activity. Antibacterial properties were analyzed through the well diffusion method and minimum inhibitory concentration (MIC) was determined through the broth dilution method, against *E. coli* and *S. aureus*. Confocal microscopy and transmission electron microscopy (TEM) was also performed against both the strains in the presence of polyherbal combination. The comprised ratio of aqueous extracts 49.76% of *P. emblica*, 1.35% of *P. nigrum*, 5.41% of *W. somnifera* and 43.43% of *T. cordifolia* for optimum immunomodulator activity. The optimized ratio of the polyherbal combination was chromatographically characterized. *In vitro* immunomodulator activity showed higher splenocytes proliferation and pinocytic activity with the polyherbal combination. Polyherbal combination showed MIC of 2 mg/mL and MBC of 6 mg/mL against *E. coli* and *S. aureus*. A significant zone of inhibition was also determined against *E. coli* and *S. aureus*. Confocal microscopy and TEM analysis of the combination shows DNA damage and morphological changes, respectively in both the strains. The study confirmed that along with the immunomodulation potential of the developed polyherbal combination could be the good alternative against diseases caused by food borne pathogens *E. coli* and *S. aureus*.

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Antioxidant activity, total phenolic and total flavonoid content of extract and fractions of *Aerides odorata* Lour (Orchidaceae)

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Based on the study results of a preliminary ethnomedicinal survey; the leaves of *Aerides odorata* Lour (Orchidaceae) were collected from Tinsukia district of Assam. The plant was identified with the help of BSI, Shillong and a voucher specimen was obtained. The collected leaves were washed properly with tape water followed by distilled water to remove any contamination and dried under shade. Dried leaves of *A. odorata* were extracted with ethanol by following the process of maceration. The obtained extract was further fractionated by using the different polarity of solvents like petroleum ether, ethyl acetate, n-butanol, etc. The percentage yield of the ethanol extract as well as the fractions was calculated. The antioxidant activity of the extract as well as the fractions were measured by different techniques like DPPH, ABTS, FRAP, etc. Their total phenolic content and total flavonoid content were also estimated by following earlier reported methods. The ethanol extract of *A. odorata* leaves has shown potential antioxidant activity. Among the various fractions, ethyl acetate fraction has shown higher antioxidant activity with high total phenolic and flavonoid contents. The result of the present investigation will be described in detail in the presentation. In the present study, an ethnomedicinally important plant *A. odorata* was studied, and antioxidant activities as well as total phenolic and total flavonoid content of ethanol extract and its fractions were estimated. The findings of the present investigation will help in future studies related to this area as well as systematic scientific validation of the ethnomedicinal claim.

ISESFEC/23/P-104

Biochemical analysis and proximate composition of traditional beverage of Assam, India

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Assam is inhabited with many native tribal communities. The traditional ethnic beer is an essential cocktail among them and is consumed by almost all the tribes of the region. It was

an attempt to compile the biochemical profile and nutritional value including the antioxidant property of two of the rice beer and its starter culture prepared by tribal community (Tiwa and Kachari) of Assam, India. Sample are collected and stored on the stability chamber for further study. The biochemical properties and proximate composition of this ethnic beverages consists the analysis of moisture content, Ash content, crude fiber, crude fat, ascorbic acid, reducing sugar, alcohol percentage. The preliminary test of both the sample AsRb1 and AsRb2 showed the presence of biochemical properties. Alcohol Percentage of the Sample AsRb1 was found to be higher with 9.3%. The ascorbic acid content in all the samples was within the range of 2.06mg/100mg to 3.23mg/100mg.The proximate composition result of both the rice beer samples and starter culture reported the moisture content ranges from 10% to 15%, ash content ranges from 0.16% to 0.39%, Crude fiber and crude fat of rice and starter culture ranges from 1.6 to 0.42%. The titratable acidity and antioxidant property was found to be higher in AsRb2 and reducing sugar was found to be higher in AsRb1.The biochemical properties found to be unique due to the use of indigenous rice varieties, plant species and yeast which is the primary source in the preparation of starter culture. Studies on this liquor can enhance its value addition and also might create a public awareness with respect to its nutritional value and also help to modify and formulate this beverage aseptically with novel remedial properties thereby offering better health benefits.

ISESFEC/23/P-105

Drug repurposing for antiviral drug discovery and membrane permeability

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Due to the prevalence of viral infections, particularly during the current pandemic, the discovery of new antiviral drugs has become a task of paramount significance. Despite the recent advancements, the development of antiviral drugs has not made parallel progress. Reduction of the time frame and cost of the drug development process is the major advantage of drug repurposing. One of the key parameters required to identify effective drug candidates is membrane permeability, as a compound intended for an intracellular target with poor permeability will have low efficacy. Therefore, this study presents a drug repurposing strategy using various molecular modeling and poly-pharmacological approaches as well as the development of molecular property diagnostic suite for COVID-19 (MPDS COVID-19) to find promising repurposing candidates for viral infectious diseases. Steered molecular dynamics simulations to further elucidate the permeability of the repurposing candidates. The biological activity prediction of drug molecules based on PASS analysis showed 1401 drug molecules as antiviral drug candidates. The intrinsic interaction of these drugs with viral non-structural proteins and conformations of protein-drug complexes were exhaustively examined using molecular docking and simulation calculations. A total of nine drug molecules were prioritized as promising repurposing candidates with the potential to inhibit various non-structural viral proteins. The permeability of drug molecules needs to be further evaluated to examine their efficacy, and therefore, the heterogeneous bilayer model that mimics the human cell membranes are systematically studied. Our proposed potential candidates with poly-pharmacological properties can be repurposed for viral disease. It may assist the experimental study with higher chances of identifying a new antiviral drug for the selected viral infectious diseases with fewer experiments and higher reliability. In addition, the developed MPDS COVID-19 may assist in identifying the potential leads with polypharmacological properties that can be repurposed for COVID-19 disease.

ISESFEC/23/P-106

A study on traditional home remedial measures for the control of gastritis

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Gastritis is a common cause of stomach discomfort that may be either brief or persistent. It may be caused by eating junk food, drinking alcoholic and non-alcoholic beverages, and other unhealthy foods. Due to various internal organ failure, eating typical daily diet might also cause gastritis. In general, symptoms of gastritis include indigestion, abdominal pain, acid reflux, burping, passing gas, and a sense of pressure or fullness in the belly. The study aims to highlight the importance of home remedial measures by using locally available medicinal herb *Allium hookeri* or *Allium odorum* for instant relieve from gastritis. Local people of Manipur relieve the symptoms of gastritis using medicinal herbs. One of the commonly used traditional home remedial measures is a grounded paste of mustard seed with *Allium odorum* or *Allium hookeri* using mortar and pestle grinding till oil exudation. The paste can be stored in a glass jar at room temperature. The paste is steamed and consumed 2 times a day, (if severe 3 times a day) to relieve the symptoms of gastritis. A little salt and chilli flakes can be added to the paste to taste. The present study shows the importance of *Allium hookeri* and *Allium odorum* ethnobotanic connection to the Manipuris. These plants are widely and very popularly used as vegetables and spice and hence can act as a nutraceutical, possessing the medicinal properties. The study uses the locally accessible medicinal herbs *Allium hookeri* and *Allium odorum* to provide immediate relief from gastritis in an effort to emphasise the value of at-home remedial methods.

ISESFEC/23/P-107

Scientific validation of traditional claims of nephroprotective Unani drugs

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The present study aimed to evaluate the nephroprotective potential of traditionally claimed Unani medicinal plants including *Cichorium intybus* L.*, Nigella sativa* L.*,* and *Solanum nigrum* L. The selected plants were screened from Unani pharmacopeia of India reported for kidney related disorder. The plant materials were extracted in water and hydro alcohol at room temperature using Soxhlet apparatus. Total phenolic and flavonoid contents of the extracts were measured by Folin Ciocalteu (FC) and aluminum chloride method. DPPH (2,2-Diphenyl-1-Picrylhydrazyl) and FRAP (Ferric Reducing Antioxidant Power) assay was used to determine the antioxidant activity of the extract. The metabolites of the plant materials were separated and quantified using High Performance Thin Layer Chromatography (HPTLC). Human embryonic kidney-293 (HEK-293) cell line was used to assess nephroprotective potential of the plant materials. All the hydroalcoholic extract showed a higher amount of total phenolic and flavonoid content. DPPH and FRAP assay showed the significant antioxidant potential of all the extracts. Qualitative HPTLC analysis of the extracts revealed numbers of metabolite at 254 and 366 nm. A significant amount specific marker compounds present in both the extracts of plant materials. The *in vitro* cell line assay of the extract showed significant nephroprotective potential. The selected plants showed good antioxidant potential and were found to be significant nephroprotective potential.

ISESFEC/23/P-108

Enrichment and metabolomic profiling of low assayed molecules - Quinic acid, Myo-inositol, and 2,4-Di-tert-butylphenol in *Aegle marmelos* fruit and leaves

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Cyclic polyols and polyphenols are known for their multipurpose uses in terms of medicinal as well as nutraceutical values. Quinic acid, Myo-inositol, and 2,4-Di-tert-butylphenol are known as potent anti-oxidant with additional therapeutic activities. Almost every plant has these classes of compounds in varied quantity. However, their availability in *Aegle marmelos* has first been reported in our study. Enrichment process development, detection and quantification of Quinic acid, Myo-inositol, and 2,4-Di-tert-butylphenol from a. marmelos fruit and leaves. Compound(s) enrichment was done by simple liquid-liquid partitioning and column chromatography. Quinic acid was enriched in leaves, while the other two components were targeted in fruit. Detection and quantification of the aforementioned compounds were done by HPTLC, HPLC, and NMR. For NMR profiling, both 1D and 2D were applied. Compound quantification by NMR was by both internal calibrant method and automated Simple Mixture Analysis (SMA) method. The percentage content of Quinic acid, Myo-inositol, and 2,4-Di-tert-butylphenol in the enriched fraction were detected to be 0.134%, 0.29%, and 0.267% respectively. The assays of all three compounds were found to get increased by more than 200% from raw materials. This is one of the firstly reported methods which have eluted low assayed small molecules from raw materials. The method can be applied for natural compound(s) isolation of high therapeutic activity but rare availability.

ISESFEC/23/P-109

Carica papaya seed oil demonstrated promising anti-diabetic efficacy in a battery of *in-vitro*, *in-silico*, and *in-vivo* assays

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As per the report of the World Health Organization, diabetes is accountable for 48% of 1.5 million reported deaths in 2019, and more than 95% of people have type 2 diabetes. Although there are a number of anti-diabetic drugs on the market, most of them affect the quality of life due to their adverse effects like flatulence, hypoglycemia, hypersensitivity, hepatotoxicity, drug-induced erythema multiforme, photodermatitis, etc. So, drugs from natural sources have become safer alternatives due to their fewer side effects and multi-targeted approach. The extract of *Carica papaya* is reported to have potent anti-diabetic, anti-inflammatory, and antioxidant effects. *Carica papaya* seed oil (CPSO) is reported to have a repertoire of bioactive phytoconstituents; however, its anti-diabetic potential is yet to explore. CPSO is subjected to conduct a series of *in-vitro* assays like α-glucosidase and DPPH. Molecular docking was performed on limonene, a bioactive compound of CPSO, targeting α-glucosidase and α-amylase. CPSO is administered orally to streptozotocin-induced diabetic Wistar rats and blood glucose level was monitored at regular intervals. CPSO demonstrated potent inhibition of α-glucosidase and DPPH activity. Limonene was found to demonstrate good binding energy with α-glucosidase and α-amylase which co-relates with the blood glucose lowering effects of orally administered CPSO in diabetic Wistar rats. CPSO demonstrated promising anti-diabetic efficacy in a battery of *in-vitro*, *in-silico*, and an experimentally induced *in-vivo* model of diabetic Wistar rats. However, studies at the molecular level are warranted for a better assessment of the anti-diabetic efficacy of CPSO.

ISESFEC/23/P-110

Marker based standardization by HPTLC and in-silico network analysis of polyherbal formulation in the management of ulcerative colitis

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Ulcerative colitis (UC) being one of the forms of inflammatory bowel disease (IBD) is a chronic illness that damages the mucosal lining of the colon, causing ulcers and inflammation. Natural products can be used for the treatment of ulcerative colitis since it contains multiple constituents which can act upon multiple targets of the disease. The market offers "Zealous IBZESS bowel soothing tablet," a polyherbal medicine of this category with active components like *Terminalia arjuna* (Quercetin, Gallic acid), *Curcuma longa* (Curcumin), *Cuminum cyminum* (Luteolin). However, the formulation demands a method for its quality control. To standardize the "Zealous IBZESS bowel soothing tablet" with respect to selected markers by HPTLC and to investigate the mechanism using network pharmacology. A HPTLC method was developed for simultaneous estimation of quercetin, luteolin, curcumin and gallic acid using mobile phase consisting of Toluene-ethyl acetate-formic acid; (6:4:0.5) and validated using the ICH guidelines Q2 (R1) for linearity, precision, robustness, limit of detection (LOD), and limit of quantification (LOQ). Binding DB was used to identify the targets relating to UC for the above constituents. A network of formulation-extract-phytoconstituents-target was constructed in Cytoscape 3.9.1. Protein-Protein interactions, gene ontology and enrichment analysis were done using the STRING, KEGG and DAVID database respectively. A rapid, precise, accurate and robust method was developed and standardized with respect to quercetin, luteolin, curcumin and gallic acid in the formulation. Therefore, this method can be used for quality control check of the product. The hit constituents identified were quercetin, luteolin, curcumin and gallic acid and the major ulcerative colitis targets identified were matrix metallopeptidase 9, ATP binding cassette subfamily B member 1 and prostaglandin-endoperoxide synthase 2. The study finally provides preliminary evidence of the selected polyherbal formulation in management of ulcerative colitis.

ISESFEC/23/P-111

Extraction, nutraceutical evaluation and development of granules of oyster mushroom

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The oyster mushroom (*Pleurotus ostreatus*) which belongs to Basidiomycetes class and the Agaricaceae family grows naturally in temperate, tropical forest and in wooden logs, dying deciduous and coniferous tree trunks. It possesses antibacterial, antiviral, antioxidant, hypotensive, hepatoprotective, immunomodulatory, and hypocholesterolaemia and anti-ageing properties. However, the extracts have some limitations like chemical instability, unpleasant taste and therefore difficulty in patient compliance. To formulate nutraceutical granules of oyster mushroom first by extraction of crude oyster mushroom, then developing and evaluating the nutraceutical granules. Crude samples were collected from Ramkrishna Biotech, Tal. Daund, Dist Pune and authenticated from Botanical survey of India, Western Regional centre Pune. The extraction was done by maceration method by using 95% v/v of commercial grade ethanol followed by phytochemical screening and estimation of nutritional value. The nutraceutical granules were developed in-house and evaluated for particle size, angle of repose, bulk density, and Hausner's ratio. The extraction yield was found to be 20% w/w. The moisture content was found to be 7.22%, whereas the protein, fat, fibre, carbohydrate and mineral content were found to be 22.43%, 1.96%, 13.94%, 27.15% and 6.50% respectively. The microelements i.e., calcium-62.69mg/g, magnesium-107.43mg/g, iron – 82.60 x 10^{-6} mg/g, manganese - 8.30 x 10^{-6} mg/g, zinc – 43.9 x 10^{-6} mg/g with arsenic present below detection limit i.e., 0.50 x 10^{-6} mg/g. In the evaluation studies, the granules

yielded particle size of 0.3 mm diameter, angle of repose - $38^{0,}$ Bulk density - 0.320g/cm^3 and Hausner's ratio was found to be 1.25. The study outcomes suggest it can be used as a nutraceutical product even for patients suffering from diabetes, chronic constipation and patients with low Mg levels.

ISESFEC/23/P-112

Scientific validation of traditional claims of anti-viral Unani formulations

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The present study aimed to evaluate the anti-viral potential of traditionally claimed Unani medicinal formulations including Khamira Banafsha, Khamira Abresham, Laooq-e-Katan, Laooq Sapistan, Sharbat Toot Siyah and Sharbat Zoofa. The selected formulations from Unani literature are already recommended by AYUSH as prophylactic and their constituents have been reported as best antioxidant, immunomodulator, anti-allergic and anti-inflammatory plant agents, the four major criteria in selection of plants for development of drugs for COVID 19. The plant materials were extracted in water and hydro alcohol at room temperature using Soxhlet apparatus. Total phenolic and flavonoid contents of the extracts were measured by Folin Ciocalteu (FC) and aluminum chloride method. DPPH (2, 2-Diphenyl-1-Picrylhydrazyl) and FRAP (Ferric Reducing Antioxidant Power) assay was used to determine the antioxidant activity of the extract. The metabolites of the plant materials were separated and quantified using High Performance Thin Layer Chromatography (HPTLC). Human embryonic kidney-293 (HEK-293) cell line was used to assess anti-viral potential of the plant materials. All the hydro-alcoholic extract showed a higher amount of total phenolic and flavonoid content. DPPH and FRAP assay showed the significant antioxidant potential of all the extracts. Qualitative HPTLC analysis of the extracts revealed numbers of metabolite at 254 and 366 nm. A significant amount specific marker compounds present in both the extracts of plant materials. The in vitro cell line assay of the extract showed significant anti-viral potential. The selected plants showed good antioxidant potential and were found to be significant anti-viral potential.

ISESFEC/23/P-113

Phytochemical analysis and antifungal activity of essential oils of some traditionally used medicinal herbs against skin dermatophytes

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Several human skin diseases and disorders are associated with two groups of fungi, the dermatophytes and *Malassezia*. These groups of filamentous fungi invade keratinized tissues including skin, hair, and nails. Numerous medicinal herbs are traditionally used in the treatment of various skin diseases. The present study evaluated the antagonistic property of essential oils extracted from medicinal herbs against fungal dermatophytes. The essential oils of 4 medicinal herbs were obtained by standard hydrodistillation method using Clevenger's apparatus. The chemical composition of the essential oil was determined by gas chromatography-mass spectrometry (GC-MS) and the major bioactive components were quantified using HPTLC analysis. The anti-dermatophytic activity was carried out using disc diffusion and modified microdilution method. The minimum inhibitory concentration (MIC) and the minimum fungicidal concentration (MFC) values for all the oils and their bioactive component were determined. Based on the *in vitro* assays, the essential oil and its bioactive components of the medicinal herbs (*Elsholtzia communis*, *Ocimum basilicum, Acmella calva* and *Ageratum* sp.) have shown great potential against the selected dermatophytes (*Trichophyton* sp., *Microsporum* sp., *Epidermophyton* sp. and *Malassezia* sp). The essential

oils of the medicinal herbs may serve as effective alternatives to synthetic antifungal drugs in combating fungal diseases like ringworm.

ISESFEC/23/P-114

A network pharmacology study of Unani medicinal plants to explore its multi-compound and multi target mode of action in urinary tract infections

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After respiratory tract infections, urinary tract infections (UTI) are the second most prevalent infectious disease in people. *Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumoniae, Proteus mirabilis, and Staphylococcus aureus* are the bacteria most frequently responsible for UTIs. The standard UTI treatment included a wide range of medications. However, there have been several reports of uropathogenic bacteria developing resistance to almost every antibiotic currently in use. Due to this reason an urgent need to find new classes of antibacterial substances, especially from natural sources. However, the underlying mechanisms of action are not always systematically examined. The purpose of this study was to determine the multi-targeted compounds, and their possible mode of action pathways of selected Unani medicinal plants using network pharmacology. The active components of plants and their targets and genes associated with uropathogens were retrieved from database. The target proteins of active compounds were further analyzed by further bioinformatics tools. Finally, the interaction networks between essential compounds, targets, and disease-associated pathways were constructed, and the essential compounds binding to their possible target proteins were verified by molecular docking. In the current study, core components of selected plants and genes in UTIs were reported based on network pharmacology. The results of this study not only identified the therapeutic targets of plants but also provided a theoretical framework for the use of these plants as UTI preventatives.

ISESFEC/23/P-115

Network pharmacology and molecular docking-based approaches to explore the potential bioactive components and potential targets of Saraswata Ghrita in the treatment of Alzheimer's disease

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Multi-target therapeutic strategies are the need of the hour for the cure of complex diseases like Alzheimer's. Ayurveda has a dedicated branch for management of ageing disorders termed as Rasayana (rejuvenate)-Vajikarana (revitalize). Saraswata Ghrita (SG), a multicomponent Ayurvedic formulation quoted in around fourteen classical treatise is being used as a memory enhancer. However, the molecular mechanism of its use in neuroprotection is still to be understood. The objective of the study was to utilize network pharmacology to understand the multilevel mechanism of ingredients present in Saraswata Ghrita for the management of Alzheimer's disease. The chemical constituents in Saraswata Ghrita were identified using an in-house HPTLC method. Binding DB and DisGeNET databases were used to identify the potential Alzheimer molecular targets and disease associations for the active constituents present. The extract-constituent-target network was constructed using Cytoscape 3.9.1. Protein-Protein interactions, gene ontology and enrichment analysis were done using the STRING, KEGG and DAVID database respectively. The network pharmacology-based analysis showed that the hit Saraswata Ghrita constituents related to Alzheimer targets were β-asarone, Piperine, chebulic acid,

berberine, α-carotene whereas the main Alzheimer associated targets were APP, ACHE, MAOB, BCHE, PTGS2, CYP2D6, ESR1, MAPT, NFE2L2. Molecular docking analysis was carried out for the hit compounds against the top protein targets in AutoDock and the interactions were visualized in Discovery Studio and PyMOL. The outcomes provide preliminary scientific evidence of Saraswata Ghrita as a potential nootropic product.

ISESFEC/23/P-116

Nephroprotective potential of *Apium graveolens* and *Piper cubeba* exploring *in silico, in vitro*, and metabolomic approaches

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Apium graveolens (AG) and *Piper cubeba* (PC) are well-known Indian medicinal plants used in traditional formulation for treating various diseases including kidney disease. Due to lack of scientific evidence, the study is aimed to evaluate the nephroprotective potential of AG and PC. The plant materials were extracted in water and hydro alcohol using Soxhlet apparatus. Total phenolic and flavonoid contents of the extracts were measured by Folin Ciocalteu (FC) and aluminium chloride method. DPPH (2, 2-Diphenyl-1-Picrylhydrazyl) and FRAP (Ferric Reducing Antioxidant Power) assay was used to determine the antioxidant activity of the extract. High Performance Thin Layer Chromatography (HPTLC) analysis was performed for quantification of metabolites followed by *in silico* analysis to investigate the multi-mechanistic role in alleviating chronic kidney disease (CKD). Human embryonic kidney-293 (HEK-293) cell line was used to assess nephroprotective potential of the plant materials. Hydroalcoholic extract showed a higher amount of total phenolic and flavonoid content. DPPH and FRAP assay showed good antioxidant potential of all the extracts. Qualitative HPTLC analysis of the extracts revealed numbers of metabolite at 254 and 366 nm. A significant amount specific marker compounds present in both the extracts of plant materials. *In silico* analysis showed multiple physiological roles of identified metabolites in kidney malfunction by regulating several genomes. The *in vitro* cell line assay of the extract showed significant nephroprotective potential. *Apium graveolens* (AG) and *Piper cubeba* (PC) showed significant nephroprotective potential.

ISESFEC/23/P-117

Formulation and optimization of phytoextract loaded phytosome targeting wound

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Most of the recently found bioactive constituents provide poor bioavailability because of their large size molecules or their poor miscibility with oils and lipids, thereby limiting their ability to pass across a biological membrane. However, researchers have conducted exhaustive research on herbs and natural products for their notable clinical efficacy in recent years. This study aimed to design a novel drug delivery system of phytoextract to increase its bioavailability. This might be accomplished by increasing its solubility and absorption capacity via biological membranes. The ethanol extract of *Allium hookeri* was used to synthesize the phytosome, which was then optimized via the use of the solvent evaporation method in accordance with a rigorous quality-by-design method. Surface morphology, TEM analysis, FTIR, drug content, drug entrapment efficiency, and the dissolution behaviour of phytosome were studied to define the improved phytosome. Entrapment efficiency, particle size, and yield for phytosomes were measured, and they ranged from 20.02 to 95.88% w/w, 769 nm to 2.35 m, and 40.03 to 96.03%, respectively. The sustained release characteristics of the optimized phytosome, which reached 68.80% at 8h compared to a high of 45.08% at

4h, were shown by comparative *in vitro* drug release research. TEM analysis was also conducted for the optimized phytosome. This research demonstrates the value of a quality-by-design approach to pharmaceutical product development, highlighting the need for optimization throughout the formulation phase.

ISESFEC/23/P-118

Systematic review on *Dolichos biflorus* (Kulthi) and *Foeniculum vulgare* (Baadiyaan) for their nephroprotective potential

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Chronic Kidney Disease (CKD) has been considered one of the leading public health problems. A projection of health concerns by 2040 ranked CKD as the fifth leading cause of death worldwide. The adoption of nephroprotective phytochemicals present in plants poses a promising and futuristic potential to combat drug-related nephrotoxicity and prevent the progression of CKD. The selected plants for study have been reported to be diuretic and lithotriptic. The present systematic review aimed to provide an in-depth study of the nephroprotective potential of *Dolichos biflorus* (Kulthi) and *Foeniculum vulgare* (Baadiyaan) as per Unani traditional literature and its role in nutritional therapeutic intervention in order to prevent or delay the progression of CKD. Detailed information was explored exhaustively on electronic databases namely PubMed, ScienceDirect, Wiley, Scopus, Google scholar and Springer to find relevant information for medicinal plants with nephroprotective potential. Numerous articles were explored with the search criteria “nephroprotective plants and CKD”. A considerable number of articles were selected from them. The phytochemicals with different research evidence along with a varied number of plants and functioning reported for nephroprotection have been selected and reviewed. This review is based on data fetched from articles regarding nephroprotective plants as per our traditional medicinal plants used ages ago for the treatment of various diseases providing scientific grounds for rational discovery, development and utilization of the same. In addition, a precise and more comprehensive evaluation of these plants needs to be carried out in order to obtain a therapeutic solution for CKD.

ISESFEC/23/P-119

In silico study for screening of suitable phytoconstituent/s from *Boswellia serrata* for the treatment of wound healing

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Treating chronic wounds is a tedious job with the risk of losing life and a financial burden on the patient, also affects the peace of mind. Natural products have been used to treat wounds for ages, but working with natural products has always been challenging for scientists because of their complex nature. In recent years, in silico studies have proven to be an essential tool for high-quality prediction in drug development and healthcare. In this study, we are presenting the various parameters of drug, *B. serrata*, evaluated using different databases and softwares available. Various databases and softwares were used for data mining, i.e., PubMed, Binding Database, PubChem, Cytoscape, Autodock Vina etc. Phytochemicals were chosen by literature survey. Information about possible targets and and gene associated with it was gathered using various databases mentioned above. A network was created by Cytoscape and analysed. The phytoconstituents were shortlisted for docking studies. Finally docking study helped to identify some of best molecules suitable for formulation.Study planned and designed seems to be very useful in terms of providing

information about phytochemicals from *B.serrata*. It helped in deciding which phytochemical to be used in formulation along with suitable route of administration.

ISESFEC/23/P-120

Arbuscular mycorrhizal fungi and other beneficial microorganisms in the rhizosphere soil of *Myrica esculenta* (Buch-Ham. ex D. Don)

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A study was done to explore the beneficial microorganisms in rhizosphere soils of *Myrica esculenta (*Buch-Ham. ex D. Don). Ten triplicate samples from ten different villages of Jorhat, Golaghat, and Sivasagar districts, Assam were collected from rhizosphere soils of *Myrica esculenta* and beneficial microorganisms were cultured, isolated and identified. The study revealed that the plant species has arbuscular mycorrhizal fungi (AMF) association in roots. Average percent root colonization of AMF of the plant species was recorded for 57.2 with a range of 40 to 66 per cent. The variation recorded may be due to difference in locality of sample collections. AMF spores were isolated from rhizosphere soils and identified tentatively up to the genus. Twenty-five (25) types of AMF spores were isolated from *Myrica esculenta* rhizosphere soils belongs to nine (9) genera of 6 families of Glomeromycota i.e., *Glomus, Acaulospora, Diversispora, Steptoglomus, Funneliformis, Rhizophagus, Entrophospora, Scutellospora* and *Gigaspora*. Apart from arbuscular mycorrhizal fungi, from the rhizosphere soils of the plant species isolated phosphate solubilizing micro-organism (PSM) and plant growth promoting rhizobacteria (PGPR), which have been reported as useful for sustaining soil health and plant survival. Some such beneficial bacteria i.e., Flouresent *Pseudomonas* and *Bacillus* spp. were isolated from rhizosphere soils of *Myrica esculenta* and cultured them in media and identified. Some phytostimulator, PSM and decomposer microfungi such as *Penicilliun, Aspergillus, Curvularia, Mucor* etc were also isolated from rhizosphere soil of the plant species.

ISESFEC/23/P-121

Edible *Anomala* species and its host plant as a potential source of protein and pharmacological components

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The edible leaf chafer beetle *Anomala* sp. (Coleoptera: Rutelinae) is a potential pest to an important cash crop of Arunachal Pradesh, Kiwi fruits (*Actinidia deliciosa*) by extensive defoliation of its leaves. This beetle is collected from a kiwi plantation by ethnic tribal people and consumed fresh or cooked. Fresh consumption of edible beetles gets exposed to uncooked host plant's leaf-derived chemicals, which the beetle consumes along with insect matters. This study aims to explore bioactive compounds with nutritional and medicinal properties in edible beetle and their host plant. For amino acid analysis, 200mg of the harvested samples were flash-frozen in liquid nitrogen and grounded. Each homogenized sample was extracted with 80% methanol, followed by centrifugation and filtration. These extracts were diluted in a ratio of 1:20 (v:v) in water containing the 13C, 15 N-labelled algal amino acid mix (Cambridge Isotope Laboratories, Inc., USA) at a concentration of 10 µg of the mix per mL. Amino acids in the diluted extracts were directly analyzed by LC-MS/MS Sciex QTRAP 6500+. And for volatile analysis, 5g fresh samples in a vial sealed with PTFE/BYTL septum were sampled using SUPELCO SPME fiber 75µm carboxen/poly-dimethylsiloxane, fused silica 23Ga for 30 minutes at room temperature for the equilibration process of the volatile components. The analysis was carried out on gas chromatography mass spectrometry (GCMS). Chromatographic analysis of this beetle species and its host plant revealed the presence of various bioactive compounds with good nutritional value and

different therapeutic characteristics, such as anti-inflammatory, analgesic, and antipyretic effects.

ISESFEC/23/P-122

Deciphering the in-vitro anticancer potential of selected marine extracts of Chilika Lagoon

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The marine ecosystem harbors a wide source of organisms like seaweeds, seagrasses, bacteria, fungi, etc. Due to their adverse environmental challenges, they produce some secondary metabolites for adaptability which possess important biological activities such as anticancer, antiviral, anti-inflammatory, antibacterial, antifungal, antidiabetic, etc. In this project, our group focuses on the extraction of the bioactive compounds from different marine organisms and screening for bioactivities such as anticancer, antiviral (SARS-CoV-2) and anti-inflammation properties. At first, we have screened different extracts of three seaweeds and three seagrasses collected from Chilika and Satapada by using solvents e.g., Hexane, Ethyl acetate, Acetone, Ethanol, and Water for extraction. To decipher the anticancer activity, we initially screened by MTT assay for the cytotoxicity level of each extract on three different Human cancer cell lines- MDA-MB-231(Breast cancer), HT-29(Colon cancer), and A549 (Lung cancer) and found that 1b (Ethyl acetate extract of *Enteropmorpha* sp.*)* and 6a (Hexane extract of *Halodule* sp.*)* have shown potential cytotoxic effect with IC_{50} in the range of 49-74 µg/mL and 58-85 µg/mL respectively. Further, we performed clonogenic, wound healing, and apoptosis assays (AO/EtBr staining and western blot) in the breast cancer cell line MDA-MB-231 and both the extracts have shown anticancer properties even at a lower dose. We are in the process to isolate the bioactive molecules and characterize them in different analytical techniques to reveal the molecular pathway for anticancer outcomes. Overall, the results will provide a new avenue in the field of drug development from marine sources from the Odisha coast.

ISESFEC/23/P-123

Caselpenia bonducella l. extract with antioxidant potential improves etiological conditions in an experimental diabetic neuropathic rat model

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In recent times, medicinal plants have played a significant role in both human and animal health, helping to treat sickness and preserve optimal health. The treatment of diabetic neuropathy is challenging, so in search of medicine from nature, *Caesalpinia bonducella* L. (CB) was chosen. The plant CB is a member of the Caesalpiniaceae family, also known as Nata Karanja, and is native to Sri Lanka, India, and other warm regions of Asia. It has adaptogenic, antidiabetic, anticancer, and anti-filarial properties, etc. We wanted to evaluate its potential in diabetic neuropathy and underlying mechanism. To find out the potential of an ethanolic extract of *Caesalpinia bonducella* L. (ECB) in the treatment of diabetic neuropathy. Preparation of the extract and its acute oral toxicity were done following OECD guidelines. The experimental diabetic rat model was developed with a single dose of streptozotocin (55 mg/kg I.P.), and the treatment (ECB) was started 6 weeks after diabetes induction and continued for 2 weeks. Plasma glucose levels, behavioural parameters such as hyperalgesia and allodynia as measured by the Randall Selito and Von Frey filaments and antioxidant activity were also measured. The percentage yield for ECB was 6.21% w/w, and it was found

to be nontoxic in an acute toxicity study. The treatment with ECB for two weeks improves the conditions of neuropathic circumstances like mechanical hyperalgesia and allodynia, reduces high plasma glucose levels, and has been shown to have antioxidant activity. With more molecular-mechanistic research, it will be conceivable to conclude that the ECB is a promising therapeutic target for diabetic neuropathy.

ISESFEC/23/P-124

Aqueous extract of *Ficus racemosa* L. ameliorates diabetic neuropathy in an experimental Wistar rat model

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Diabetic neuropathy (DN) is a secondary consequence developing from persistent hyperglycemia, oxidative stress, and mitochondrial dysfunction, causing peripheral nerve damage or non-traumatic amputation, and there is currently no medication available for the treatment of DN. *Ficus racemosa* L. (Moraceae) is a plant that has been used as medicine for a long time. It has both anti-diabetic and analgesic potential, based on its traditional use the study was conducted as a hypothesis. The study investigated the efficacy of aqueous extract of *Ficus racemasa* L. (AFR) in the treatment of diabetic neuropathy**.** An aqueous extract of FR (AFR) was prepared. A single dose of streptozotocin was used to produce the experimental diabetic rat model, which was subsequently left untreated for six weeks before receiving 14 days of AFR therapy. Determination of plasma glucose levels, mechanical hyperalgesia, allodynia by Randall Sellito and the Von Frey apparatus, antioxidant activity, and an acute oral toxicity study were conducted following OECD 423.The percent of aqueous extract of FR (AFR) was 4.70 percent (w/w). AFR therapy reverses the sensory loss observed from mechanical hyperalgesia and allodynia and reduces the elevated plasma glucose. In an acute toxicity assessment, it was found to be safe at levels greater than 2,000 mg/kg and showed antioxidant activities. In conclusion, it may be inferred from the current investigation that AFR may be a promising target for diabetic neuropathy.

ISESFEC/23/P-125

Potential probiotic properties of ethnic food-derived bacteria

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The human gastrointestinal (GI) tract contains 10-100 trillion microbes, collectively called 'gut microbiome' has a tremendous influence on our health. Maintaining a healthy gut microbiome is very essential for gut homeostasis and health. Probiotic microorganisms are getting much attention due to their role in good gut health. Traditional fermented foods used by ethnic groups are a good source of potential probiotic microorganisms. Northeast India has more than 200 ethnic groups, having unique cultures, customs and cuisines of their own. The food habits of these ethnic groups are passed on from generation to generation. One such common food habit that still exists for many years and is found in almost all groups is fermented foods. This research will help in finding some potential probiotics from these fermented foods of Northeast India by evaluating their probiotics and safety properties. To explore potential probiotics from ethnic fermented foods of Northeast India. Bacteria were isolated from ethnic fermented foods in different agar media. Morphological and biochemical tests were conducted. Lactic acid bacteria were screened for potential probiotics as per ICMR guidelines, viz. Simulated gastrointestinal condition (Acid, Bile, Pepsin and

Pancreatin) tolerance tests, Antibiotic Sensitivity, Antimicrobial test, Molecular Identification, Cell surface Hydrophobicity, Cellular auto-aggregation and Adherence to HT-29 cells. Out of 780 isolates, 18 isolates were found to have potential probiotic properties. This study indicates that the ethnic fermented food can be a good source of potential probiotic microbes. However, further *in-vivo* studies are needed to understand their health beneficial effects.

ISESFEC/23/P-126

Study on the bacterial diversity and metabolite profiles of ethnic fermented bamboo shoots of North East India

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Fermented food products are widely valued due to nutritional and functional properties. Fermented bamboo shoots are widely consumed by the ethnic groups of the northeast India having health benefits due to its low cholesterol, high dietary fibre, antioxidant and vitamin contents. Being a fermented plat product, it is also a potential source of prebiotics and probiotics. In this study the traditional fermented bamboo shoots of Assam (*Gajtenga*), Manipur (*Soibum*, *Soidon*, *Soijin*), and Tripura, (*Melye-amiley)* were characterised for biochemical and nutritional properties. Further, the bacterial and metabolite profiles were also determined. To assess the microbial diversity and metabolite profile of different fermented bamboo shoots of North East India, *viz*. Assam, Manipur and Tripura. The microbial diversity was assessed by both culture dependent and culture independent approaches. Biochemical and nutritional characterization, antioxidant activity, phenolic and flavonoid content were determined using standard protocols. Metabolite profiling was performed by GCMS analysis. The fermented bamboo shoots had abundance of lactic acid bacteria (*Firmicutes* and *Proteobacteria*). *Lactiplanti bacillus* sp., *Lactococcus* and, *Bacillus* sp. were commonly observed by both approaches. The presence of *Weissella* sp. and *Sphingobacterium* sp. was also observed. These bacterial communities may have played a significant role in the fermentation process contributing to the overall changes in the nutritional and organoleptic properties. Several aroma-active compounds, metabolites having antioxidant and antimicrobial activity, short-chain fatty acid, and essential amino acids were detected in the metabolite profiles. The study reports the diverse microbial community associated with the fermentation process and metabolite profiles of traditional fermented bamboo shoots of north east India and their potential for promotion as functional food.

ISESFEC/23/P-127

Yangonin, one of the kavalactones isolated from *Piper methysticum*, acts through Cannabinoid 1 (cb_1) receptors to induce anintrathecal anti-hyperalgesia in rats

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Kava (*Piper methysticum*) is consumed throughout the Pacific Ocean cultures of Polynesia for its sedating effects. Its root is used to produce an entheogenic drink with a sedative property and the active ingredients are called kavalactones. Among the kavalactones, Kavain and Yangoninare are two important components known to act on $GABA_A$ receptors and cannabinoid receptor CB_1, respectively. Since these two receptors were both known to be involved in anti-nociception at the spinal level, we speculate these compounds are also effective in the reduction of hyperalgesia and allodynia. We used intraplantar carrageenan-

induced inflammatory hyperalgesia model of rats and partial sciatic nerve ligation (PSNL) model of neuropathic allodynia in mice. Intrathecal injections of drugs were performed prior to the plantar test and von Frey test, which were employed for the measurement of hyperalgesia and allodynia, respectively. Both compounds did not show any significant effect on PSNL-induced allodynia. However, Yangonin caused a clear effect of anti-hyperalgesia, which could be blocked by PF514273, CB_1 receptor antagonist. Surprisingly, Kavain had no effect on hyperalgesia at an even higher dose. Yangonin, but not Kavain, showed a clear anti-hyperalgesia when given intrathecally. This effect of Yangonin is through its activation on CB_1 receptors. Because the structural difference between Yangonin and Kavain is only one methoxyl group, our data suggest this group is essential for this biological effect. These results can help the development of new drugs for the treatment of hyperalgesia.

ISESFEC/23/P-128

UV spectrophotometric method for simultaneous estimation of Donepezil HCL and memantine HCL in tablet after prederivatization process by simultaneous equation method

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Donepezil Hydrochloride (DNP) is a reversible inhibitor of acetyl cholinesterase, chemically as (RS) -2- [(1-benzyl-4-piperidyl) methyl]- 5,6-dimethoxy-2,3-dihydroinden-1-one hydrochloride and Memantine Hydrochloride (MEM) is NMDA receptor antagonist, chemically as 1-amino-3,5-dimethyladamantane hydrochloride. Both drugs in combination used in treatment of Alzheimer's disease. Literature survey reveals many methods are reported for estimation of DNP and MEM individually and only one RP-HPLC method is reported in combination of DNP and MEM. In this communication, a simple, accurate, precise Spectrophotometric method with prederivatization have been developed and validated for simultaneous estimation of DNP and MEM in Pharmaceutical dosage form. DNP and MEM obtained as gift sample from Alembic, India and Anonima materie sintetiche & affini, Italy respectively. All reagents used during the study were of analytical grade. In this research work DNP gives maximum absorbance at 313nm while MEM does not give absorbance in UV range due to absence of chromophoric group. So, MEM was derivatized O-phthaldehyde (OPA) in presence of β-mercaptoethanol under alkaline medium results in OPA-MEM derivative having maximum absorbance at 338 nm in methanol for UV method. UV Spectrophotometric method includes Simultaneous equation method was developed at 313 nm and 338 nm as λ_{max} of DNP and MEM, respectively in methanol. Linearity range was observed in the concentration range 10- 90 µg/ml with mean % recovery was 99.039-101.22 % and 100.16-101.06 %, for DNP and MEM, respectively. The % assay of DNP and MEM in marketed formulation was found to be 100.71 % and 100.16 %. The validated Simultaneous equation method was successfully applied for estimation of DNP and MEM in commercially available Pharmaceutical dosage form, yielding very good and reproducible result and used for routine quality control of Pharmaceutical formulation.

ISESFEC/23/P-129

Biochemical analysis of traditional rice beer of Arunachal Pradesh

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The Himalayan state of Arunachal Pradesh situated in the Northeast extremity of the country. The traditional beverages of the tribal people of the state are very popular. Various tribal communities of the state generally use traditional beverage drink prepared from rice, called Apong by Nyishis, Adis & Apatanis and Tchang by Monpas. The biochemical properties of various rice beer of Arunachal Pradesh consist of analysis of moisture content,

ash content, crude fiber, crude fat, and soluble sugar. The information was collected by searching various data bases such as Pub-med, Science direct, Google scholar and Scopus. From this review, it was found that the alcohol content of traditional beverages of Arunachal Pradesh ranges from 4.5-5.0 % and formic acid was found to be present in apong rice beer. Although most of the common carbohydrates were present, the disaccharides, namely sucrose, maltose and melibiose, were not found in any rice beer sample. This review paper reflects the up-to-date datas of the biochemical study of few traditional beverages prepared by the tribes of Arunachal Pradesh. Determining these values, it can increase the nutritional value and also help in creating public awareness and modifying the therapeutic properties with an enhanced health benefit.

ISESFEC/23/P-130

Exploiting dfg in and out conformation of kinase inhibitors against CDK2 targets- an insilico approaches

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Cyclin-dependent kinase 2 (CDK2) is a vital target for anti-cancer drug discovery approaches. The elucidation of the CDK2 structure paved the way to investigate the molecular basis understanding towards the selectivity. Delineating the DFG conformation focusing towards sequence, structure and Hotspot residues analyses of CDK2 Kinase. A multiple sequence analysis was performed using ClustalW to study the similarity, highly conserved domains and mutations among the organisms. We have collected 137 crystallographic structures from protein data bank (PDB) based on the good resolution and binding affinity for CDK2. Similarly, FDA drugs was collected from the DrugBank database. Further, we employed this large data for molecular docking approach using Glide module of Schrödinger package to understand the protein-ligand interaction (DFG in and out conformations). Multiple sequence alignment result comprises of six different sequences with 95% sequence similarity, highly conserved regions and mutations in the activation domain. Molecular docking studies reveals the crucial CDK2 residues involved in molecular recognition with the help of structural and affinity data that are available for CDK2. Designing CDK2 inhibitors requires a thorough explanation of the structural underpinnings of ligand binding. Our research reveals the importance of Ala31, Glu81, Leu83, Asp86, Lys89 and Leu134 residues in terms of binding affinity. Owing to its key therapeutic potential the drug-receptor interactions play pivotal role in inhibition as demonstrated via molecular docking deciphering the role of interaction-network in inhibitor binding. This highlights the use of target precise fragments for the design of kinase leads.

ISESFEC/23/P-131

"*In-vitro* microrhizome induction of *Kaempferia parviflora* (Family Zingiberaceae): a potent medicinal plant of India."

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This study initially aimed at identifying the protocol for induction of microrhizome of *K. parviflora* which is commonly known as "Black ginger". This species was known for its enriching medicinal values in traditional medicine. Therefore, in our study, we examined the effects of several factors on microrhizome induction to create a production protocol for the cultivar found in Manipur, North-east India. Different concentrations of plant growth regulators at constant 6% sucrose (g/L) were investigated to determine the optimal conditions for its microrhizome induction. From our experiment, Murashige and Skoog (MS) medium supplemented with 60 g L^{-1} sucrose and 1mgL^{-1} Indole Acetic Acid (IAA) + 2mgL^{-1}6-

benzylaminopurine (BAP) is found to be the optimum combination for the microrhizome induction of *K. parviflora*. We also found that IAA is the most effective growth regulator for microrhizome induction than that of BAP and NAA (Naphthalene Acetic Acid). But the addition of BAP to IAA further enhanced microrhizome formation. In addition, the best number, size, and texture of microrhizomes are observed after 90 days of inoculation, comparing 30 and 60 days. Further, the highest number of shoots is observed in MS media supplemented with 4mgL^{-1}BAP and IAA (1mgL^{-1}) + BAP (1mgL^{-1}). Likewise, the highest number of leaves and shoot length were best observed in media composition IAA (3mgL $^{-1}$), whereas the highest number of roots and roots length is observed in MS media supplemented with IAA (1mgL^{-1}) and BAP (2mgL^{-1}). In conclusion, *in-vitro* microrhizomes can be used as disease-free planting materials for the commercial cultivation of black ginger to overcome the demand of rising pharmaceuticals industry.

ISESFEC/23/P-132

Assessment of anti-inflammatory and anti-arthritic properties of *Equisetum diffusum* D. Don whole plant methanolic extract as a complementary medication in rheumatoid arthritis

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Equisetum diffusum D. Don is an important medicinal pteridophyte of sub-Himalayan region traditionally used in the treatment of bone fracture and rheumatoid arthritis (RA) by tribal communities of India. The current study, for the first time, was aimed towards validating ethnobotanical use of plant potency in the treatment of RA through appropriate *in vivo* and *in silico* studies. The *Equisetum diffusum* D. Don whole plant methanolic extract (EDME) was prepared and screened for acute and sub-acute toxicity studies to determine the lethality value. For *in vivo* anti-inflammatory studies, carrageenan-induced acute inflammatory paw-edema modeland Freund's Complete Adjuvant (FCA)-induced chronic arthritic models were established and the efficacy of EDME was evaluated through paw-circumference measurement, biochemical, haematological, radiological, histopathological analyses. The bioactives of EDME were identified using GC-MS and major inflammatory markers were screened for docking in Schrödinger Maestro platform. The LD_{50} value of EDME was found to be "unclassified" up to the feeding range of 2000 mg/kg of body weight. The sub-acute administration of EDME also considered as safe and nontoxic up to 28 days experimental feeding schedule. Our single-day acute anti-inflammatory study showed 50.86% and 65.38% reduction in paw edema of both dose groups when compared to the carrageenan control group. The chronic anti-arthritic study also showed significant reduction in paw circumference in both extract-treated groups compared to the FCA treated control group. Moreover, chronic anti-inflammatory properties of EDME were also supported by biochemical, haematological, radiological, histological analyses. The GC-MS study of EDME showed 47 unique phyto-compounds out of which some showed potent inhibition against inflammatory markers like COX-2, IL-6 and TNF-α in docking analysis. All of our findings support the plant's anti-inflammatory and anti-arthritic properties, indicating the use of the plant as a potent complementary medication for treatment of RA.

ISESFEC/23/P-133

Role of Non-Mulberry Silkworm Pupae Oil in Lipid metabolism

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Edible insects are gaining acceptance as an important functional food known for its high protein, fatty acid, minerals, and vitamin content. However, the prophylactic role of edible

insect oil in the regulation of altered fat metabolism in liver diseases has not been explored yet. This study for the first time examined the beneficial role of non-mulberry silkworm oil against fatty acid induced hyperlipidaemia. Silkworm pupae were collected from the local market of Jorhat, extracted with hexane and petroleum ether. Human hepatocyte cell line (HepG2) was purchased from NCCS Pune and cultured in EMEM medium. Cells were treated with different concentrations of oil extracts for 2 hours followed by fatty acid (palmitic acid, 0.75mM) exposure for the next 20 h. Intracellular lipid deposition was measured by Oil red O staining. The levels of intracellular reactive oxygen species (ROS) were measured using the fluorescent dye H_2DCFDA (2′,7′-dichlorofluorescein diacetate). Cell viability was performed by Alamar blue reduction assay. Results showed that treatment with various concentration (10, 25, 50, 100, 200, 250µg/ mL) of silkworm pupae oil significantly deceased the intracellular ROS production and intracellular lipid accumulation as shown by H_2DCFDA assay and Oil Red O assay in HepG2 cell lines treated with or without palmitic acid (PA, 0.75 mM). Chemical Profiling (HPLC) demonstrated the presence of tocopherol (vitamin E) as one of the bio-active principle in insect oil. Treatment with various concentration of silkworm pupae oil showed no signs of toxicity on HepG2 liver cells as confirmed by Alamar blue reduction assay. Combining all, the present study demonstrated the anti-hyperlipidemic effect of silkworm oil in fatty acid treated HepG2 hepatocytes.

ISESFEC/23/P-134

Antibacterial and phytochemical analysis of water extracts of *Azadirachta indica* and *Ocimum tenuiflorum* leaves

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Azadirachta indica and *Ocimum tenuiflorum* are well known for their therapeutic applications in traditional medicine. In this study, water-based leaf extracts from *Azadirachta indica* and *Ocimum tenuiflorum* were examined for their antibacterial and phytochemical potentials. Since *Azadirachta indica* and *Ocimum tenuiflorum* were commonly used in traditional medicine, they were selected for the study.The antimicrobial activity of the extracts was tested against both Gram-positive (*Enterococcus faecalis* and *Staphylococcus aureus*) and Gram-negative (*Escherichia coli* and *Pseudomonas aeruginosa*) bacteria. Water was used as the solvent to dissolve the plant extracts, and the dried leaf powder was extracted by decoction and digestion. Phytochemical analysis for secondary metabolites was done using standard industry protocols. Therefore mentioned microorganisms were added to nutrient agar plates by spreading bacterial inoculum over the surface of the media. On the agar, 10 mm-diameter wells were punched. After allowing the phytochemical extracts of *Azadirachta indica* and *Ocimum tenuiflorum* to diffuse into the medium, the zones of inhibition were visible after a 24-hour incubation period at 37 °C. Then, using standard measurements, their Minimum Inhibitory Concentrations, and Minimum Bactericidal Concentrations were determined. According to the findings, both the gram-positive and gram-negative bacteria are significantly inhibited by four different extracts of both plants. Alkaloids, flavonoids, phenols, glycosides, steroids, tannins, and terpenoids were all found in the samples after the phytochemical studies were conducted.

ISESFEC/23/P-135

Evaluation of the antioxidant, anti-inflammatory and anti-arthritic potential of essential oil (Nerolidol) by *in vitro* and *in vivo* analysis

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Nerolidol was assessed for *in vitro* anti-oxidant activity using DPPH, ABTS, Superoxide, nitric oxide and Hydrogen peroxide radical inhibition assays and anti-inflammatory through protein denaturation, HRBC Membrane stabilization method and proteinase inhibitory assay. Antiarthritic Activity of Essential oil (Nerolidol) was performed in collagen induces arthritis (CIA) animal models. The obtained result showed that Nerolidol have the potential to minimize the harsh effect of arthritis. It has good antioxidant properties which will act on oxidative stress to reduce the rheumatoid arthritis and also showed positive anti-inflammatory activity. Moreover *in vivo* studies showed the lowering of liver enzymes ALP (alkaline phosphatase), ALT (alanine transaminase), and AST (aspartate aminotransferase) when treated with nerolidol as compared to negative control. Paw volume also significantly lowered after the 28th day of treatment with nerolidol. Taken all together, nerolidol has a great potential to be used as a new chemical or as an alternative drug in the treatment of arthritis.

ISESFEC/23/P-136

Revealing anti-rheumatoid properties of *drynaria quercifolia* rhizome methanolic extracts combining experimental and molecular docking strategies

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The tribal population of sub-Himalayan communities has traditionally utilized the fronds of *Drynaria quercifolia* to treat rheumatic illness. In this study we have evaluated the anti-rheumatoid properties of the methanolic-extract of its rhizome in Freund's complete adjuvant (FCA)-induced arthritic Wistar rat model. The plant was collected; authenticated and *D. quercifolia* rhizome methanolic extract (DME) was prepared. Acute toxicity test was done to determine oral feeding dose. The *in vivo* anti-rheumatoid potential was assessed in FCA-induced Wistar rat model through inflammatory paw-edema, haematological, biochemical, radiological and histopathological parameters. Moreover, liver and kidney histology were done to screen out the possible toxicological effects of DME feeding. Metabolites of DME were screened by GC-MS and 3D molecular structures of active components were utilized for *in silico* docking study using AutoDock. Lethality value of DME was considered 'unclassified' as per safety guidelines. DME significantly ameliorated inflammatory paw edema in Wistar rat models. Treatment with DME also normalized the haematological (RBC, WBC, platelet counts and hemoglobin content) and biochemical (total protein, albumin, creatinine and ceruloplasmin) parameters which were further supported by histopathological and radiological data. No significant alteration was observed in liver and kidney sections in all experimental groups. Furthermore, GC-MS analysis of DME identified 41 unique phytochemical compounds. Compounds like squalene, gamma tocopherol, n-hexadecanoic acid showed potent inhibition of inflammatory marker proteins in docking analysis. According to the findings of *in vivo* experiments, treatments with DME alleviated the inflammatory paw edema, haematological, and biochemical parameters without presenting any symptoms of hepatotoxicity or nephrotoxicity in Wistar rat model. Through *in silico* study, it was determined that several bioactive phyto-components have significant inhibitory effects on inflammatory biomarkers like IL-6, TNF- α, and COX-2. Therefore, the efficacy of the *D. quercifolia* rhizome methanolic extract suggested a potent safe remedy in arthritic disease conditions.

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GC-MS based untargeted metabolite profile, phytochemical analysis and *in vitro* antioxidant activity of the methanolic extract of *Solanum indicum* fruit

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Solanum indicum is a prickly shrub found predominantly in the north-east region of India and is known to be of ayurvedic relevance. The present communication reports the GC-MS based untargeted metabolite profile as well as the phytochemical properties of the methanolic extract of *Solanum indicum* fruit (SIFE). Fresh *Solanum indicum* fruits were collected, shade dried and grounded to fine powder. The powder obtained was weighed followed by extraction with methanol by the process of maceration. The extract was filtered and the filtrate was evaporated to dryness to obtain the crude SIFE. Untargeted metabolite profile of SIFE was performed using GC-MS and the major metabolites were identified by matching the mass spectra with the National Institute of Standards and Technology library, USA. Phytochemical analysis of SIFE involved investigating the total phenolic content, total flavanoid content and determination of antioxidant activity by $DPPH^+$ free radical scavenging assay, $ABTS^+$ radical cation decoloration assay and reducing antioxidant power assay. Some of the major compounds identified by GC-MS were Ricinoleic acid (24.31%), Octadecadienoic acid (16.15%), hexadecanoic acid (13.49%), Oleic acid (12.3%), Octadecanoic acid (6.89%), Stigmasterol (6.31%) and γ-sitosterol (4.65%). Total phenolic content and total flavanoid content of SIFE was found to be 134.5 ± 40.7 µg of gallic acid equivalent per milligram dry weight and 189.0 ± 35.8 µg of quercetin equivalent per milligram, respectively. Additionally, SIFE also demonstrated significant antioxidant capacity. This is first report focusing on the metabolite profile of the methanolic extract of *Solanum indicum* fruit with the aim to identify the major active components and correlate it with the phytochemical and biological activities.

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Phytochemical properties of selected four plant extracts used traditionally and phytosome formulation

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Northeastern India has a rich repository of medicinal plants and many of which are still used by the local population for treatment of number of ailments. Most of the polyphenol extracts from the medicinal plants may show high activities under *in vitro* conditions but low activities *in vivo*. Macromolecular size and poor lipid solubility of the polyphenols may lead to poor absorption. To overcome this challenge, application of some delivery system such as phytosome will help in increasing the bioavailability of the polyphenols. Therefore, the present study determined the antioxidant and hypoglycemic properties of extracts from four plants viz. *Poschotia* (*Vitex negundo*), *Tulsi* (*Ocimum tenuiflorum*), *Kothona* (*Tabaermontana divaricata* L.) and *Bormanimuni* (*Centella asiatica* L.) used traditionally in Northeastern India and developed a phytosome formulation. The aqueous extracts were analysed for total phenolic (TPC) and flavonoid content (TFC), ferric reducing antioxidant property (FRAP), DPPH radical scavenging activity, metal chelation capacity (MCC) and GC-MS study. To measure the hypoglycemic activity of the sample extracts, glucose adsorption capacity, alpha amylase, glucose uptake by yeast cells and glucose diffusion rate were estimated. For the phytosome formulation the aqueous sample extracts were lyophilized. The four lyophilized sample extracts were then combined into two combination ratios viz. 5:1:1:5 and 5:5:1:1 (Tulsi: *Bormanimuni: Poschotia: Kothona*); labelled as PH1 and PH2, respectively. The extract combinations were then refluxed with lecithin (1:2 ratios) at 25˚C. The obtained dried phytosome powders were studied for the quality parameters like yield, binding efficiency, solubility, bio accessibility, particle size, surface morphology etc. Significant phytochemical content and hypoglycemic properties was observed in the selected plant samples. The GC-MS study showed presence of diterpene alcohol, bicyclic sesquiterpene, phenylpropanoids etc. The obtained phytosome's quality parameters showed promising results. The phytosome yield was 93.31 % and 91.53% for PH1 and PH2, respectively. The binding efficiency (75.41%) and solubility (41.60%) was more in PH2. Compared to PH1 variant, the bioaccessibility values of PH2 was low in gastric (42.86%) and high in intestinal fluid under simulated condition. Therefore, PH2 variant is comparatively

more resistant to gastric pH. The selected four plant leaf samples are rich in phenolic and flavonoid content. They showed significant FRAP, DPPH, MCC and glucose lowering properties. The developed phytosomes showed increased solubility and bio accessibility. Maximum increase was observed in variant PH2. The efficacy of the health promoting properties of the phytosomes can be studied further using an *in vivo* model.

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Development of Herbal Formulation Database

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Herbal formulation is one of the ancient and traditional methods in India for the treatment and diagnosis of diseases. Development of herbal formulation database is essential to document available herbal formulations in India. Thus, we have collect and collate different herbal formulations available in India. The herbal formulations are manually curated and text mining approaches were applied to get the different formulations in India. A total of 485 formulations with 7791 ingredients and 33 medicinal plants of NE, India and continually being updated. These information are stored in the MySQL database. Various information such as ingredients, name of the formulation, plants names, diseases treated by the formulation will be updated in the database. The front-end will be developed with HTML and CSS script. Different clustering and classification methods will be applied to understand the same class of molecules, same group of plants for treating different diseases and same group of diseases that are treated by different plants will be analyzed in detail.

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Can vitamin D and K co-supplementation help to reduce obesity better than individual?

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Obesity, a condition marked by excessive accumulation of fats in the body, is linked with several health complications, like diabetes, cardiovascular diseases, etc. Micronutrients are gaining importance in modulating the health complications associated with metabolic disorders. The present study aimed to examine the combinatorial potential of vitamin D and K in lowering the adipogenesis. Pre-adipocyte cell line (3T3L1) purchased from ATCC (Manassas, VA) was cultured in DMEM high-glucose medium containing 10% (v/v) FBS, 100 U/mL penicillin, and 100µg/mL streptomycin. After achieving confluency, cells were allowed for differentiation into adipocytes by incubating in high-glucose DMEM medium supplemented with 100mU/mL insulin, 0.5mM IBMX (3-isobutyl-1-methylxanthine) and 250nM dexamethasone. From the first day of differentiation, cells were incubated with or without vitamin D (25nM) or K (5nM) either alone or in combination along with differentiating medium. Nine days after the induction of differentiation, cells were ready to be used in experiments. Intracellular lipid accumulation was examined using Oil Red O and Nile Red O staining. Cell viability was performed by Alamar Blue reduction bioassay, triglyceride levels were measured by commercially available kit, and protein expressions for adipogenic factors were examined by immunoblotting. Microscopic analysis showed that co-supplementation of vitamin D and K at low doses were effective in lowering intracellular lipid deposition as well as triglyceride levels compared to cells supplemented with vitamin D or K alone. Immunoblotting studies further demonstrated the beneficial effect of vitamins D and K co-supplementation in down-regulating the protein expression of adipogenic factors, like PPAR-gamma, SREBP1, and FKBP-5 compared to their individual treatment. Different treatment did not cause any cytotoxicity. The present study demonstrated that co-supplementation of

vitamin D and K at low doses was more effective in lowering the adipogenesis compared to their individual supplementation.

ISESFEC/23/P-141

Kolakhar- not just a food additive of Assam, India: an introduction

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Kolakhar a traditionally prepared food additive in Assam is made by filtering water through ashes of banana tree (local term of Banana, “kol” or “kola”). It can be made from various parts of banana plant like stem, rhizome and peel. Amongst the available varieties of banana in North East India, Khar made from *Musa balbisiana* Colla is considered as best variety for preparation of kolakhar. Along with its routine use as food additive in cooking, it is used as antilice. Traditionally, Kolakhar has been used to treat various ailments like digestive disorders of stomach and to prevent bacterial attacks on freshly cut injury to heal fast. Traditionally, people are using kolakhar as soaps and detergent for washing clothes and shampooing hair. Farmers widely use kolakhar to kill leaches and prevent their attack while working in leech infected fields. It is also used to cure and prevent certain cattle diseases. *M. balbisiana* (athiyakol/ bhimkol) is an indigenous variety of banana in Assam, India. Young banana pseudo-stem is used as vegetable (called Posola) which is a very rich source of iron and fibres. Rhizomous stem exudates of this plant treat dysentery, pinworm infection as well as sore throat. Ability of liquid exudates of banana trunk is used in treatment of reproductive disorder in males. Banana plant has been found to possess insecticidal, anthelminthic, anti-ulcergenic, anti-microbial, anti-venom, anti-allergic, anti-hyperlipidemia, antidiabetic, anti-oxidant as well as anticancer properties. Banana and its pseudo-stem also have antimicrobial properties. Traditionally, this product is used as boiling agent instead of marketed baking soda. Due to its alkaline nature, kolakhar is used to wash cloths. The local people of Assam use kolakhar for different purposes like to kill leaches, to get healthy hair and as pesticides in cropping field. Many people of Assam are taking kolakhar as an antacid.

ISESFEC/23/P-142

PGPR mediated induction of systemic resistance in Bhut Jolokia (*Capsicum chinense* Jacq.) against collar rot disease

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Bhut Jolokia (*Capsicum chinense* jacq.) is an important spice crop in North-East India due to its high capsaicin (3-5%) content and medicinal properties like anticancer, natural ability to thaw blood clots, fast relief from heart pain, neuropathic pain, etc. in addition to its pickle preparations and culinary uses. Collar rot disease caused by *Rhizoctonia solani* in Bhut Jolokia and other chilli plants is considered one of the most destructive fungal diseases in North-East India that results in extensive damage leading to productivity loss. Plants are closely associated with diverse beneficial microorganisms in their rhizosphere, some of which can improve resistance of plants against various pathogens. The phenomenon in which resistance against disease is systemically induced by treatment with microbes or products etc. is termed induced systemic resistance (ISR). The recent focus on defense mechanism against pathogen infections has led to renewed interest in understanding molecular mechanism of specific PGPR-mediated resistance. *In vitro,* antagonistic activities were carried out using dual culture method. Induced systemic resistance was determined *in vivo* condition by standard protocol. Detection of pathogen infection was identified using bright field, confocal laser scanning microscopic and PGPR root colonization by FESEM. Expression analysis of defense-related genes in ISR plant was carried out by real-time

qPCR. Our data suggested that application of PGPR was found to be significant (p<0.05) suppressed collar rot disease, as well as improved growth in plants and hence, could be employed as a biocontrol agent for mitigating collar rot disease in Bhut Jolokia. Overall findings demonstrated that PGPR exhibit a complex phenomenon in Bhut Jolokia that induced resistance against collar-rot by enhancing expression of ISR-mediated defense response genes and improved plant health by inducing metabolic activities. Thus, use of PGPR to reduce diseases in agriculture has emerged as a highly promising approach to improve crop resilience and reduce use of harmful chemical agents.

ISESFEC/23/P-143

Studies on the effect of *Abutilon indicum* (L.) sweet seed extract on insulin-resistance caused polycystic ovarian syndrome in wistar rats

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Traditionally *Abutilon indicum* seed is used to treat gynaecological problems, including anovulation and irregular menstruation. The present study was designed to evaluate effectiveness of the methanolic extract of *Abutilon indicum* seed on ovarian functions of letrozole-induced polycystic ovarian syndrome (PCOS) rats. Adult female *Wistar Rats* were randomly assigned into different groups and fed daily with letrozole (0.5 mg/kg body weight) in 1 % Carboxymethylcellulose (CMC) as vehicle for 21 days to develop PCOS. After PCOS induction, rats were treated daily with oral supplementation of *Abutilon indicum* seed extract (AISE) with high and low dose (500 mg/kg and 250 mg/kg body weight) respectively and metformin (500 mg/kg body weight) as a standard drug for 28 days. Potentiality of AISE was assessed through different biochemical and histological measurements. Moreover, phytochemical screening of methanolic extract was done by gas chromatography-mass spectrometry (GC-MS) and 3D molecular structures of active components were utilized for *in-silico* docking study using AutoDock. All the letrozole treated rats had irregular estrous cycle, abnormal glucose clearance rate ($AUC_{Glucose}$) and increased body weight when compared to vehicle control group. Treatment with AISE and metformin the treatment groups normalize body weight, estrus cycle, $AUC_{Glucose}$, lipid profile (HDL-C, Total cholesterol, Triglycerides), oxidative stress (MDA, catalase, GSH, SOD) significantly ($p<0.05$) when compared with negative control group which were further supported by histological analysis. Furthermore, GC-MS analysis of AISE demonstrated the presence of 19 major phytochemical compounds. Among these, compounds like Acetaphenone, α-Linoleic acid, n-Hexadecanoic acid showed potent inhibition of Cytochrome P450 CYP17A1 (3RUK) in the docking analysis indicating treatment potential for androgen-dependent, PCOS. Exogenous administration of AISE to PCOS rats have shown beneficial results. It is unquestionably cost-effective and may provide a safe drug that could emerge as a potential therapeutic agent for PCOS in the future.

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Phytochemical profiling and anti-diabetic efficacy of *Antidesma alexiteria* L. - an endemic plant to southern India and Sri Lanka

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Antidesma alexiteria L., belongs to the family Phyllanthaceae, is endemic to Southern India and Sri Lanka. Different species of *Antidesma* were traditionally used for human ailments, but no detailed analysis on phytochemical activity of this plant. So the present study was aim to evaluate the antidiabetic potential of *A. Alexiteria* acetonic bark extract by α-amylase and α-glucosidase assay. The fresh bark of the plant collected from

Kerala University campus, Kariavattom, Thiruvananthapuram, and Kerala was dried, powdered using electric blender and stored in container. About 15g of bark powder was subjected to successive solvent extraction using petroleum ether, chloroform, acetone, methanol and water based on the polarity. Preliminary phytochemical analysis was carried according to Harborne 1973, Sofowara 1982, Trease and Evans 1989. The α-amylase enzyme inhibition assay was performed using Worthington Enzyme Manual with slight modifications (Worthington, 1993; Known *et al.,* 2006) and the assay on α-glucosidase activity was determined by Shai *et al.* (2011) with slight modification. Preliminary phytochemical analysis revealed highest number of phytochemical constituents in acetone extract followed by methanol and distilled water. The quantitative estimation also showed that acetone bark extract of *A. alexiteria* contains high levels of total phenol, tannin, flavonoid and saponin whereas total alkaloids yield was highest in aqueous extract. So methanol, acetone and aqueous extracts were selected for the α-amylase and α-glucosidase inhibition assays. The percentage of inhibition and EC_{50} values showed that, acetone bark extract had strong inhibition against both enzymes when compared to methanol and aqueous extracts. From the study it suggests that acetone extract of *A. alexiteria* bark have strong antidiabetic property. So the bark extracts of *A. alexiteria* may serve as a possible source of natural anti-diabetic drug.

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Gut bacterial xylanase an emerging green tool from potential strain of Eri silkworm (*Samia ricini* Donovan) from North East India

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The suitability of xylanases for their application in biotechnology, pharmaceutical, food and feed industries has led to an increase in demand globally. The poly-phytophagous, *Samia ricini* Donovan is capable of digesting foliage from different plant species, which are mainly composed of lingo cellulolytic materials. Some of the digestive enzymes that degrade these carbohydrates might be produced by gut bacteria. The aim of this study is to investigate the beneficial gut bacteria for sustainable development of biomolecules with possible application in xylanase enzyme production and lignocelluloses degradation. A total of 250 bacteria were subjected to isolation during summer and winter seasons. Qualitative screenings of gut bacterial isolates based on xylan utilization were tested by modified Congo red plate assay method (Huang *et al.,* 2012). Further to identify the isolates, 16S rRNA gene sequencing analysis was performed. The optimization of the fermentative conditions for maximum extracellular xylanase activity enzyme activity was carried out using one factor-at-a-time (OFAT) approach and the optimum pH, temperature and incubation time. Bacterial interaction and lignocellulosic material utilization were verified using Scanning Electron Microscope and Fourier-Transform infrared spectroscopy analysis. The present study, 16S rRNA gene sequencing analysis revealed 3 phyla, 13 families and 22 genera. Comparative analysis across five instars during summer and winter seasons indicated higher bacterial diversity in the summer. *Paenibacillus xylanilyticus* SB6 was found to be the most promising strain and was selected for further study. The maximum extracellular xylanase activity was recorded at pH 11, 32°C and 72h respectively. The maximum activity was observed with 2% xylan (6.27 ± 0.07 U/mL) and 0.5% yeast extracts (8.64 ± 0.11 U/mL). The present study confirmed the perspective of silkworm *Samia ricini* Donovan gut bacteria as a model for further application in the development of low-cost xylanase enzymes that will help to meet the rising xylanase demand.

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Piper betle activates NRF2-regulated antioxidant defenses, attenuates lipopolysaccharide-induced inflammation and improves survival in rotenone-induced *drosophila* model

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Chronic exposures to environmental toxicants are linked with age-associated neurodegenerative, primarily driven by persistent oxidative stress, which elicits cell death (ferroptosis) and inflammation. Activation of transcription factor, NRF2 diminishes cellular oxidative stress by upregulating a battery of cytoprotective defenses. There is an urgent need for identifying natural pharmacological activators of NRF2 to promote healthy aging. The aims of our study is (i) to screen medicinal or food plants and identify lead pharmacological activator of NRF2 using NQO1 bioassay and (ii), systemically characterize the antioxidant, cytoprotective, anti-inflammatory activity of the lead candidate. We screened 50 medicinal plant extracts by NQO1 bioassay and identified organic extract of piper betle leaf (PB) as the lead candidate. The cytoprotective activity of PB against diverse oxidants (AAPH, rotenone, ferroptosis inducer, RSL3) was evaluated in vitro. The anti-inflammatory activity of PB was evaluated in macrophage cell lines (J774A.1) stimulated with lipopolysaccharide (LPS) by measuring nitric oxide, *NOS2* and cytokine expression. The efficacy of PB to mitigate rotenone-induced neurotoxicity was investigated in Drosophila model. PB treatment significantly increased NQO1 activity and NRF2-regulated antioxidant genes (*NQO1*, *HMOX1*, *GCLC* & *GCLM*) and total GSH levels. PB significantly inhibited cytotoxicity elicited by AAPH and rotenone in BEAS-2B and SK-N-SH cell lines. PB treatment significantly inhibited ferroptosis induced by RSL3, which correlated with significant reduction in lipid peroxidation compared to vehicle group. Co-treatment of PB markedly inhibited nitric oxide production and concomitantly, *NOS2* mRNA and secretory levels of cytokines (IL-6 and TNF-α) in LPS stimulated macrophages. Lastly, we found that prophylaxis treatment of rotenone-exposed flies with PB significantly decreased neurotoxicity as indicated by improved survival and locomotor dysfunction. PB leaf extract suppress oxidative stress, inflammation and exert neuroprotective effects, potentially by activating NRF2 pathway.

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Validated HPTLC method for quantification of bioactive markers and evaluation of hepatoprotective effect of ayurvedic polyherbal formulation

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HEPASAVE is a herbal based potent hepatoprotective, antioxidant and bitter tonic formulation. In this study, a new, easy, accurate, sensitive, reproducible and robust high performance thin layer chromatography protocol was established and validated for the quantitation and standardization of andrographolide (AG), gallic acid (GA) and kutkin (KT) in the HEPASAVE syrup. The quantification of three biomarkers was assessed and development of tested samples was achieved using the solvent system (toluene: ethyl acetate: formic acid: methanol) at the ratio of (3:3:0.8:0.4, v/v/v/v) scanned at 254 nm. In addition, the hepatoprotective effect of HEPASAVE against alcohol-induced liver injury in rats was assessed. Data showed clear spots for AG, GA and KT at the R_f values of 0.74,

0.66 and 0.21, respectively. Calibration plots showed stable linear relationship for AG with r^2 = 0.995, GA with r^2 = 0.993 and KT with r^2 = 0.992 with variable concentrations ranging from 200 ng to 800 ng, 80 ng to 320 ng and 2000 ng to 6000 ng, respectively with respect to peak area. The present method was validated by linearity, accuracy, and precision according to ICH guidelines. Results showed that the method implemented was statistically reproducible and selective for the quantitation of AG, GA and KT simultaneously. The quantities of AG, GA and KT in the formulation were found to be 1.27% w/v, 1.15% w/v and 0.014% w/v, respectively. HEPASAVE treatment reduced the activities of serum alanine aminotransferase (ALT), aspartate aminotransferase (AST) and Alkaline phosphatase (ALP) levels in pre and post treatment groups. HEPASAVE also alleviated histopathological changes induced by alcohol. The results revealed that the established method is reproducible for the quantification of AG, GA and KT, simultaneously in HEPASAVE syrup. Further, HEPASAVE showed its effectiveness as therapeutic agent against alcohol-induced liver injury.

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Comparative phyto-metabolite studies of different *Phlogacanthus sp.* and evaluation of their antioxidant and enzyme activities

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Phlogacanthus species is one of the most important medicinal plants found in the North Eastern part of India. It has high ethno botanical references and is widely consumed as a non-conventional edible plant. Around 10 species of *Phlogacanthus* is found in the sub-tropical region of India with 5 species in Manipur alone. In the present study a comparative phyto metabolite analysis of plant extracts of *Phlogacanthus thyrsiformis* (Roxb. ex Hardw.) Mabb., *Phlogacanthus pubenervis* T. Anderson and *Adathoda vasica* (L.) Nees was done using various analytical techniques. Hydroalcoholic solvent using (methanol: water) was used for extraction. The total extract was used for preliminary phytochemical profiling using GC-MS and LC-MS and enzyme activity assays. A preliminary examination of the hydroalcoholic extract of *Phlogacanthus thyrsiformis*, *Phlogacanthus pubenervis* and *Adathoda vasica* showed a total phenolic content of 147.2± 0.1, 154± 0.35 & 140± 0.3 mg gallic acid equivalent/g and a total flavanoid content of 70±0.14, 88 ± 0.03 & 72± 0.15 mg quercetin equivalent/g of *Phlogacanthus thyrsiformis*, *Phlogacanthus pubenervis* and *Adathoda Vasica* respectively. Maximum antioxidant activity was observed in *Phlogacanthus* thyrsiformis followed by *Phlogacanthus pubenervis* and *Adathoda Vasica* with an IC_{50} of 0.434mg/ml, 0.866 mg/ml and 0.06 mg/ml respectively. Phytochemical screening of the total extracts showed the presence of alkaloids, steroids, tannins and saponins in *Phlogacanthus thyrsiformis,* while only alkaloids, steroids and saponins were identified in *Phlogacanthus pubenervis* and *Adathoda vasica* respectively. A cursory examination of the phytometabolite from the different varieties identified different metabolites, including phenols, terpenes, glycosides and alkaloids. To the best of our knowledge this is the first report on the comparative phytometabolite analysis from *Phlogacanthus* species.

ISESFEC/23/P-149

Potential aspect of *Asimina triloba* methanolic extract- an anti-cancerous property in lung cancer cell lines

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The *Asimina triloba is* commonly known as the Pawpaw tree which is highly cultivated in the eastern USA and Canada. It possesses numerous medicinal properties and has been

traditionally used for various disorders including malignancy. Very few researches were conducted to study the therapeutic effects of this plant such as anti-tumoral, diuretic, and anti-ulcerative properties. However, none of the studies have been conducted to study the cytotoxic effects of Pawpaw leaves extract on lung cancer cells. The cytotoxic activity of the extract was assessed by MTT at various concentrations 25µl, 50µl, 75µl, and 100µl. The results showed that the methanolic extract exhibits the best anticancerous activity at the IC_{50} value of 75µl due to the presence of active phytoconstituents which might be involved in showing the anticancer activity. The cytotoxicity of leukemia cells was increased with the addition of methanolic extract, hence showing dose-dependent activity. Thus, the aim of the present study is to examine the effect of the methanolic extract of *Asimina triloba* leaves on Human lung cancer cell lines (A549). Since the leaves extract of the Pawpaw plant possesses antiproliferative activity, it is well required to study the effective molecular pathway which can serve as an immune adjuvant in vaccine therapy.

ISESFEC/23/P-150

Plant-mediated synthesis of iron nanoparticles using extract of *Cedrus deodar* and its anti-cancer activity against lung cancer

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The synthesis of iron oxide nanoparticles has attracted increasing interest due to their importance in biomedical and technological applications to circumvent off-target cytotoxicity and other side effects from conventional chemotherapy. In this study, *Cedrus deodar* wood aqueous extract was used as a green stabilizer to synthesize iron nanoparticles followed by a series of characterization experiments and *in vitro* anticancer evaluation. The synthesized nanoparticles were characterized using XRD, SEM, FTIR, and UV spectroscopy. The UV–Vis absorption spectrum of iron oxide nanoparticles displays one peak at 260 nm and another peak at 265 nm. The iron oxide nanoparticles that were produced had a cubical shape, and the XRD results indicated that their average size was 28.16 nm. By using the MTT assay, the substance's anticancer potential was examined against A549 (Lung Cancer) cells. The cytotoxic reaction that was seen was concentration-dependent. Overall, this study demonstrates the properties of iron nanoparticles produced by green synthesis and their prospective application as anticancer therapeutics against lung cancer cell lines.

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Traditional fermented bamboo shoot mitigates the diversity loss of gut microbiota induced by atherogenic diet in C57BL/6NTac mice

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Cardiovascular diseases have been a major cause of death globally. A sedentary lifestyle and unhealthy diets rich in fats and processed foods increase the serum level of low density lipids leading to the deposition of lipids and plaque formation inside the arteries causing atherosclerosis. Fermented foods are known to modulate the host microbiome and ameliorate metabolic disorders. The present study aimed to investigate the effect of the traditional fermented bamboo shoot (FBS) in the gut microbiota of mice model fed with atherogenic diet. C57BL/6NTac mice strain was used as the disease model of atherosclerosis. The animals were divided into four groups (each group: 3 male, 3 female). The control group mice were fed a standard chow diet (NC) and an atherogenic diet (20% fat, 1.25% cholesterol, 0.5% sodium cholate) (HFHC) for 3 weeks. The experimental group mice were fed a standard chow diet supplemented with 1.67 g/kg body weight of (FBS) (NCEF1) and an atherogenic diet with 1.67 g/kg body weight of the same fermented food

(HFHCEF1) for 3 weeks. Fecal samples were collected weekly, metagenomic DNA was extracted, and 16S metagenomic sequencing was carried out to profile the gut microbiota. The feed consumption of experimental groups increased compared to the control group ($p<0.001$). Mice fed with the atherogenic diet showed a significant increase ($p<0.001$) in feed consumption when supplemented with FBS. In contrast, the control and experimental groups showed no significant changes in body weight. 16S V3-V4 metagenomic sequencing revealed that the FBS-supplemented diet reduced the diversity loss in the gut microbiota induced by the atherogenic diet. Supplementation of diet with FBS changes the relative abundance of *Bacteroidetes*. In conclusion, the consumption of fermented bamboo shoots helped in mitigating the effect of atherogenic diet on the gut microbiota.

ISESFEC/23/P-152

DNA barcoding of traditionally used medicinal plant from North East region of India

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The field of molecular identification of plants i.e., DNA Barcoding of plants is still in developing stages. The availability of these DNA barcodes for this medicinal and edible plant species will be helpful for correct identification of its raw material and control market adulteration. To perform DNA barcoding of traditionally used medicinal and edible plants of Manipur. The process of DNA barcoding follows two basic steps: (a) building the DNA barcode library of different species and (b) matching the barcode sequence of the unknown sample against the barcode library for identification. DNA barcodes were amplified using Maturase K (matK), chloroplast intergenic spacer (trnH-psbA), Internal transcribed spacer (ITS), and ribulosebisphosphate carboxylase (rbcL) regions. Phylogenetic trees of medicinal plants were also constructed following the neighbour joining (NJ) method, based on ITS, rbcL, matK and trnH-PsbA which clearly distinguish this species. The availability of these DNA barcodes for this species of medicinal and edible plants would help with accurate raw material identification and market adulteration control.

ISESFEC/23/P-153

Green synthesis of iron oxide nanoparticles from *Jateorhiza palmata* root extract

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The green synthesis of nanoparticles from bioactive chemicals from plants has drawn a wide variety of applications. Due to the improved therapeutic efficacy and decreased toxicity in the nano-sized mediated drug delivery model, the root of *Jateorhiza palmata* (calumba) extract was used in this study to synthesize iron nanoparticles. To characterize the synthesized nanoparticles, Fourier transforms infrared (FTIR), UV-visible was used. Interestingly, as a result, a strong peak at 261 nm was visible in the UV-Vis spectra. The presence of plant bioactive compounds attached to the iron oxide nanoparticle surfaces was confirmed by FTIR spectroscopy. Further, the application of newly synthesized nanoparticles and their anticancer potential will be studied on lung cancer. Therefore, the objective of the current study was to synthesize the green iron nanoparticles and to characterize them by different techniques and examine the anticancer potential of the green iron nanoparticle synthesised from *J. palmate* root on lung cancer cell lines.

ISESFEC/23/P-154

Ethnopharmacological survey on the medicinal plants used by Urali tribes from the Periyar tiger reserve, Kerala, India

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Western Ghats are well known for their high diversity and ethnobotanical use of regional medicinal plants. In spite of that, all the areas of the regions of the Western Ghats are not well studied. The study area was Vanchivayal, a tribal hamlet situated inside the Periyar Tiger Reserve, Idukki district, Kerala. The area is about 3000 feet above sea level. The Urali tribes have very good indigenous knowledge about the native medicinal plants used for curing human illness. Among 42 medicinal plants surveyed the roots of *Hemidesmus indicus* (L.) R.Br. is used for skin diseases and urinary infections. The seeds of *Ensete superbum* Roxb. are used for diabetes, kidney stone and burns. The dried seed powder of *Terminalia chebula* Retz. is used for ailments of liver dysfunction and kidney failure. The yam *Dioscorea oppositifolia* (L.) is used in this diet to reduce blood pressure and cholesterol. The leaf juice of *Hemigraphis colorata* (Blume.) Hall. f. treated for healing wounds. Documentation of traditional knowledge helps to guard the unconventional method of knowledge and provide recognition to knowledge holders. In this regard, traditional knowledge of using medicinal plant species as an invaluable source has been evaluated using information from local people. The survey knowledge gathered by the present study is important in preserving indigenous knowledge of Urali tribes and revitalizing traditional herbal medicine.

ISESFEC/23/P-155

In-vitro screening of leaf extracts of *Kalanchoe pinnata* and *Moringa olifera* for anti-urolithiatic activity

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Urolithiasis or stone formation is one of the oldest and serious painful urological diseases with significant prevalence in the population due to change in lifestyle and dietary factors. Lithiasis is characterized by calculi formation. Calculi formation in urinary bladder, ureter or any part of urinary tract rather than kidney is known as urolithiasis while nephrolithiasis is characterized calculi formation in the kidney.Surgical operation lithotripsy and local calculus disruption using high power laser are widely used to remove the calculi however these procedures are expensive and recurrence is also common. The recurrence rate is approximately 10% at one year, 33% at 5 years and 50 % at 10 Years. Due to high recurrence rate and expensive treatments the development of new treatment becomes essential. The alcoholic leaf extracts of *Kalanchoe pinnata* and *Moringa olifera* were prepared by Soxhlet extraction method and standardized by physicochemical and phytochemical parameters. Different concentrations of the extracts were used to study the inhibitory effect using *in-vitro* models for urolithiasis. The anti-urolithiatic activity of leaf extracts of *Kalanchoe pinnata* and *Moringa olifera* was explored by using *in-vitro* crystallization method with nucleation and aggregation assays. Homogenous precipitation method was used to prepare artificial stones and dialysis membrane-150 was used as dissolution bags. Dissolution models were incubated for 72 hrs and after that, the entire content in dissolution bags was estimated spectrophotometrically. The leaf extracts of *Kalanchoe pinnata* and *Moringa olifera* showed significant anti-urolithiatic activity by inhibiting nucleation and the rate of aggregation of calcium oxalate and calcium phosphate crystals.

ISESFEC/23/P-156

Genomic resources in *Vigna radiata*: an important legume of India

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Mung bean (*Vigna radiata*) is one of the most popular legume crops of India. The seeds and sprouts of this plant are a great source of carbohydrates and proteins especially, essential amino acids, such as total aromatic amino acids, leucine, isoleucine, and valine. In addition to these macro-elements, mung beans are also a very good source of flavonoids such as vitexin and polyphenols that protect the plant against stress. However, these measures still fall short of protecting the plant against some major abiotic and biotic stresses, which lead to considerable loss in crop yield. Stress response in plants is a highly regulated process with much yet to be discovered regarding the molecular mechanisms involved. We believe that much of this information is embedded in the genome and many such regulatory mechanisms could be deciphered by understanding the genome of an organism. Therefore, we have assembled a high quality chromosome level assembly of the mung bean genome for *V. radiata* cv. IPM02-3. We have annotated the genome to identify about 27,000 protein coding genes. The long-reads based sequencing of transcripts has helped generate full-length transcripts which are a valuable asset for functional studies. Besides, we have also identified molecular markers such as SSRs in the genic and genomic regions of the mung bean genome. This data has also helped us develop a differential gene expression profile for drought response based on the publicly available short read data for mung bean in well-watered and drought conditions. The high-quality genome assembly will also act as a reference to identify other structural variants. Therefore, this study will prove to be a credible addition to the repertoire of genomic resources for important pulses of India.

ISESFEC/23/P-157

Useful insights on the cellular details of how the human body responses for coronavirus infections in the light of human proteins and genes

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The devastating waves of COVID-19 wave have had hit almost every person across the globe on various grounds like psychological, social and economical extensively. Even today, COVID-19 is a public health emergency according to the World Health Organization (WHO). So, it is of prime importance to make combined efforts to fix this pandemic to the best of the possibilities. Since the cases are still coming to the notice both in India and across several countries so it poses a question that needs to be addressed at various levels. Researchers and Scientists across the globe are still working to provide the best solutions for this pandemic as it has n number of variants that are a cause of great concern. SARS-CoV-2, SARS-CoV, and MERS-CoV are highly pathogenic and have caused a great threat to the public health, affected the economy and have inflicted persistent influence on society across the globe. Endeavours to develop antiviral measures have been impeded by the inadequate useful insights on how the human body responds to viral infections both at cellular and molecular levels.

ISESFEC/23/P-158

High throughput identification of bioactive natural products isolated from *Magnolia grandiflora* that impact human embryonic stem cell growth

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Human embryonic stem cells (hESCs) are a unique cell type isolated from the inner cell mass of pre-implantation blastocysts. Theoretically, hESCs possess self-renewal ability and differentiate to every somatic cell type in the body. In addition, they may provide a system to study early human development in *vitro*, and in the future, differentiated populations can be used for cell replacement therapies. The advent of defined media and controlled differentiation has enabled the screening of hESCs to discover molecules that impact growth, differentiation, or apoptosis in undifferentiated and differentiating populations. Natural products could be highly valuable in the progression of cell therapy technologies or could be novel therapeutics in their own right, providing tools for embryonic cell populations that cannot be targeted with other approaches. In our ongoing research program of screening pre-fractionated and semi-purified extracts of plants to discover compounds that impact hESCs growth using a 96-well plate real-time cell electronic sensing (RT-CES) system, activity was discovered for the extract of the *Magnolia grandiflora*. A large-scale extraction and purification yielded two new diterpenoids (**1-2**) and four known compounds (**3-6**). The cell growth inhibitory activities of compounds **1-6** were evaluated against hESCs (BG02) and a pancreatic cell line (BxPC-3) using an RT-CES system. Compounds (**1**) showed the highest growth inhibition against the BG02 and BxPC-3 cells with EC50 values of 2.4 and 9.3 μM, respectively.

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Piper longumine-loaded smart polymeric nanoparticles suppress cancer progression and metastasis by regulating FoxO signaling

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Metastasis is the major cause of cancer mortality and is responsible for over 90% of cancer deaths. Failure of conventional clinical therapies such as tumor resection and chemotherapy is mainly due to the ineffective control of cancer cells, development of drug resistance, and metastasis. Looking into the molecular mechanism, FOXOs (forkhead box proteins of the class O subgroup) are considered to have a pivotal role in both oncogenesis and tumor suppression. Further, FOXOs have also emerged as key modulators of metastasis and angiogenesis. Altogether, the literature studies suggest that FOXO functions as a tumor suppressor, and therefore may serve as a target for cancer therapy. Piper longumine (PL), a biologically active alkaloid found in the root of long pepper (*Piper longum* L.), is a naturally occurring small molecule with multiple pharmacological activities. Recent studies have documented that it selectively targets tumor cells, with minimal harm to normal cells. However, the poor solubility of PL limits its intensive investigation and clinical application. Therefore, we developed PLGA-based smart nanoparticles (smart PL-NPs) to enhance the potential therapeutic effect of PL and thus, target metastatic cancer. To investigate the effect of PL and smart PL-NPs against metastatic cancer, anti-metastatic activity of PL and smart PL-NPs was evaluated in different metastatic models *in vitro and in vivo*. We found that both PL and smart PL-NPs displayed significant anti-proliferation and anti-metastasis activities, with smart PL- NPs being more efficient in suppressing cancer metastasis. Our results suggest that the smart PL-NPs can potentially be used to target different metastatic cancer.

ISESFEC/23/P-160

Antibacterial & antifungal activity of 'Majoon najah': a classical unani formulation

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Unani System of medicine is one among the oldest systems of medicine that prevails till date with its efficient drugs derived from animal, plant and mineral resources. Among the compound drugs Majoon Najah (MN) is one of the polyherbal Unani preparations and it has been traditionally used for Neurological disorders such as melancholia, epilepsy, hysteria, insanity, colitis and for saudavi amraaz. However, this formulation has not been scientifically evaluated for its claimed uses. Most of the plants present in MN have been experimentally reported the antimicrobial activity. But no experimental study has been carried out on the formulation MN for its antimicrobial activity. Hence in the present study an attempt has been made to check the antibacterial and antifungal activity. A plant derived antibiotic may be a possible alternative to modern antibiotics and at the same time can minimize the economic constrain of the hectic process of drug development. MN formulation is a preparation which is made from the qiwam of white sugar or honey and a medicinal safoof (powder) having the plant ingredients as per the description of National Formulary of Unani Medicine. *In vitro* analysis of three extracts (Aqueous, Alcoholic & hydro alcoholic) of MN formulation were done by Agar disk diffusion method against the selected bacterial and fungal strains. Results obtained in the present study showed that the tested MN formulation possesses promising antibacterial and antifungal activity against the selected microbes. The formulation has been found to possess strong antibacterial and antifungal activity, it may validate the classical claims about use of this drug in case of various infective conditions and further studies are mandated.

ISESFEC/23/P-161

CSIR-NEIST herbarium, a national repository of more than half a century aiding in the correct identification of plants

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Herbaria are the archives of natural plant resources of a region and a repository of the collected plant specimens deposited over the years. It reflects the documentation of plant wealth in specific geographic locations. Any herbarium helps in correct species identification traditionally, by comparing and matching the correctly identified sheet with the newly collected specimens. North East India is bestowed with abundant flora and fauna and the early herbarium documentation started from the region in the early 19th century. On the other hand, CSIR-North East Institute of Science and Technology (formerly Regional Research laboratory), Jorhat has been engaged in plant exploration in the region for documentation and identification, characterization of medicinal, and aromatic properties, and for other commercial uses since its inception and as an outcome, a quantifiable archive had generated. An exhaustive exercise was done to update and upgrade the herbarium to include it under global repository. In recent times, all the herbarium sheets are accessioned both manually and digitally. The first-hand information on the herbarium labels were also recorded electronically in MS-Access. More than 7500 sheets were scanned at 600 dpi at flatbed scanner, HP ScanJet N9120. The names of the species were verified and updated vide authentic websites viz., https://powo.science.kew.org/; http://www.worldfloraonline.org/; https://ipni.org/ and by consultation of authentic taxonomic literature, and several international and national herbaria. The recently organized herbarium as per Bentham and Hooker's system of classification (1862-1883) housed approximately 12000 specimens with the oldest record since 1956 comprising 200 families, 800 genera, and 1100 species. The record showed 325 historical collections of Dr E.K. JanakiAmmal and a few of N.L. Bor, D.B. Deb, U.N. Kanjilal. Recently, the herbarium got registered under Index Herbariorum

(http://sweetgum.nybg.org/science/ih/) with the acronym (CSIR-NEIST) to cater to the need for correct identification of the region.

ISESFEC/23/P-162

Evaluation of polyherbal formulation on letrozole induced polycystic ovarian syndrome in experimental rat model

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PCOS was first described by Stein and Leventhal as a syndrome of oligo-amenorrhea and polycystic ovaries that was variably accompanied by hirsutism, acne, and obesity it is one of the most common endocrinopathies among women of reproductive age. Induction of polycystic ovarian syndrome was done on animal model using letrozole to evaluate the polyherbal formulations effects on rats. Acute oral toxicity studies were done as well. The various Estrous cycle patterns were observed in control and other treated group. The LH, FSH and progestesterone level estimation in letrozole induced polycystic ovary syndrome rat has been used to compare the activity of polyherbal formulation with the standard drug.The results shows that higher dose of this formulation is effective with minimal side effects and toxicity.

ISESFEC/23/P-163

A comparative study on *Tinospora cordifolia* (Giloy) (willd.) Miers:, based on folk or traditional uses

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Tinospora cordifolia, a medicinal shrub (thunb.) Miers is a mediterranean herb. *T. cordifolia* used in Siddha, Unani, Ayurvedic and folk medicines. The shrub is also used in predictable medicine to treat including diarrhea, asthma, inflammation, pain, respiratory infections, diabetes, cancer and gastrointestinal disorders. To gather information on this plant, we used a variety of logical/ scientific databases, including pubmed, scopus, google scholar, springer link and science direct. These informations focus on the plant taxonomy, traditional use, ayurvedic formulation, ethnopharmacological relevance and further detail study on its properties. The outcomes of the study reveal a connection concerning the use of this plant in conventional medicine and its anti-inflammatory, antihypertensive, antioxidant, antidiabetic, anticancer, immune-modulatory and further biological effects. The entire plant, stem, root, leaves and extracts of *T. cordifolia* have been given away to have a variety of biological activities. *T. cordifolia* contain various phytochemicals such as alkaloids, terpenoids, steroids, flavonoids and phenolic acids. Based on the reports, researched for this review, we consider that phyto-chemicals in *T. cordifolia* may activate NRF2, leads to the overexpression of antioxidant enzymes such as GPX, GST, CAT, and GR induces the adaptive response to oxidative stress. *T. cordifolia* is also capable to reduce NF-KB signalling by PI3K/AKT inhibition, activating AMPK and down-regulate PI3K/AKT.

ISESFEC/23/P-164

Antioxidative and anti-inflammatory effects of hypoglycemic herbal medicines: an *in vivo/in vitro* systematic review

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This systematic review was performed by obtaining relevant studies from PubMed, Scopus, Web of Science, and Cochrane Library according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist until 17 August 2021. All eligible studies investigating the effectiveness of hypoglycemic herbal treatments on simultaneously inflammatory and oxidative stress biomarkers in animal models of diabetes were included.The "diabetes", "herbal medicine", "antioxidant", "Inflammatory biomarker", and their equivalents were used as key words. Total of 202 experimental studies were summarized as 8 distinct groups considering diabetes or its complications: retinopathy, cardiovascular disease, neuropsychiatric disorders, reproductive dysfunctions, nephropathy, liver injury, and other complications such as musculoskeletal problems, skin wound, gastric ulcer, hematologic complications, and lethal sepsis. The most commonly assessed inflammatory and oxidative stress biomarkers were Tumor necrotizing factor (TNF)-a, interleukin (IL)-6, IL-1b, IL-10, malondialdehyde (MDA) and nitric oxide (NO). Also, activity of antioxidant enzymes including superoxide dismutase (SOD), glutathione (GSH), and catalase (CAT) were assessed. Among herbal treatments *Trigonella foenum-graecum Linn*, *Centella asiatica (L.) Urb., Vitis vinifera L.,* and *Moringa oleifera Lam.* were commonly used. Due to the dispersion of the herbal treatments, meta-analysis was not applicable. Using different hypoglycemic herbal treatments among animal models has improved diabetes and its complications and modulated concomitant inflammatory and oxidative stress biomarkers. Our results showed the plant-based anti-diabetic medicine's potential in the management of diabetes and its complications; hence, for future studies conducting well-designed clinical trials is essential.

ISESFEC/23/P-165

Therapeutic Potential of Bioactive Compounds from the Edible Mushroom to Attenuate SARS-COV-2 Infection and Complications in Coronavirus Disease

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The novel SARS-CoV-2, a highly infectious positive RNA virus, has spread from its epicentre to other countries with increased mortality and morbidity at a very rapid rate with changes in strains and the same variants from region to region. Its expansion has hampered humankind's social, economic, and health realms to a large extent. Global investigations are underway to understand the pathophysiology and mechanism of infection of coronavirus disease (COVID-19) induced by SARS-CoV-2 infection. Though numerous therapeutic strategies have been introduced to combat COVID-19, none are fully proven or comprehensive, as several key issues and challenges remain unresolved. At present, natural products have gained significant momentum in treating metabolic disorders. Mushrooms have often proved to be the precursor of various therapeutic molecules or drug prototypes, such as polysaccharides, proteins, organic molecules and secondary metabolites. In this study, an attempt has been made to highlight the exploration of bioactive molecules in mushrooms to combat the various pathophysiological complications of COVID-19. This review presents an in-depth and critical analysis of the current therapies against COVID-19 versus the potential of natural anti-infective, antiviral, anti-inflammatory, and

antithrombotic products derived from a wide range of easily sourced mushrooms and their bioactive molecules. We demonstrated that repurposing natural products and herbal medicines as prophylactic will be a robust approach to stop or at least slow down SARS-CoV-2 transmission. Overall, it can be concluded that bioactive and functional foods containing these compounds can be used as a nutraceutical for boosting the immune system and minimising the disease's severity.

ISESFEC/23/P-166

Headspace GC/MS analysis and phytochemical profiling from the leaves of *Perilla frutescens* (l.) Britton

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Perilla frutescens (L.) Britton which is commonly known as Thoiding in Manipur is an herb belonging to the family Lamiaceae. Recently, Perilla plant is gaining more attention because of its medicinal benefits and phytochemical contents. The leaves and seeds of *Perilla* contain volatile compound such as beta-caryophyllene and rosmarinic acid in the leaves and omega-3 fatty acid in the seeds. The aim of our study is to find out the presence of different volatile compounds and quantitative phytochemical profiling from the fresh leaves and methanolic extracts of *Perilla frutescens (L.) Britton.* The leaf sample of the *Perilla frutescens* (L.) Britton was collected from Khongman, Manipur. The fresh leaves were washed under running tap water, shade dried at room temperature, and powdered for further quantitative analysis. Some of the fresh samples were stored in 4 ºC. The powdered leaf sample was extracted using methanol as solvent and was stored in 4◦C for further analysis. Preliminary phytochemical analysis for Phenols and flavonoids and quantitative estimation for Total phenolic content and Total flavonoid content was done on the leaf extract. Analysis of Volatile compounds was also done from the fresh sample by using Headspace GC/MS. The leaf extract showed the presence of considerable amount of total phenols and total flavonoids. From the Headspace GC/MS analysis among the volatile components the major proportion was of beta-caryophyllene followed by perilla ketone and elimicin. From the study, we can conclude that the plant *Perilla frutescens* (L.) Britton has many important secondary metabolites, volatile compounds and it has a potential for pharmaceutical application.

ISESFEC/23/P-167

The effect of freeze-dried root extract of *Persicaria bistorta* (l.) samp on acetic acid colitis model in rat

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Affecting 6.8 million people worldwide, Inflammatory Bowel disease is achronic disease with vast inflammations, hematochezia, cramps, and weight-shedding. Despite various drug regiments for IBD, most of the patients remain unresponsive. Therefore, it is necessary to seek new medications. According to Persian medicine, the roots of *Persicaria bistorta* (L.) Samp. (polygonaceae), Anjebar, is frequently prescribed for colitis. In this study, the effect of Anjebar has been investigated in rat model of colitis. After authentication of the plant (voucher No.:PMP-1239), Anjebar aqueous extract was prepared with freeze-dryer and

analyzed by LC-MS to provide a phytochemical profile. Subsequently, gallic acid was measured by HPLC on a C18 column and an isocratic mobile phase of acetonitrile: acidified water (10:90) at λ=270 nm. Colitis was induced by rectal administration of 4% acetic-acid in 20 Wistar rats. Animals were divided into 5 groups: disease control, dexamethasone (1 mg/kgi.p.), 300, 500, and 700mg/kg of extract (orally). The medications were administered for 2 successive days. The rats were euthanized on day 3. Their distal colons were cut open and the macroscopic scores were determined from the most severe (5) to the healthy tissue (0). Data were analyzed by ANOVA and Tukey's post-hoc test; $p < 0.05$ was considered significant. According to LC-MS results, major components of the extract include phenolic compounds. The concentration of gallic acid was 2.08 mg/g. The scores in the control group and 300mg/kg of extract were significantly higher ($p<0.001$, $p<0.05$, respectively) vs. dexamethasone group. However, the extract (300, 500, and 700mg/kg) significantly decreased the scores in a dose-dependent manner ($p<0.01$, $p<0.001$ and $p<0.001$) vs control. Anjebar, as a Persian medicine recommendation for colitis, could significantly improve macroscopics scores of the colon tissues in rat. Future studies are needed to confirm the anti-colitis properties of Anjebar.

ISESFEC/23/P-168

Exploration of ethnomedicinal knowledge to treat various diseases prevalent in the region of Ladakh

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An extensive field study was conducted using semi-structured questionnaires and interviews. The data collected included names of plant species, plant parts used, diseases treated, methods of preparation, and mode of administration of the herbal remedies. A total of 200 informants (120 males and 80 females), including traditional herbal specialists known as Amchi. Data were analyzed both through descriptive and quantitative analysis, viz., use value (UV), relative frequency citation (RFC), and informant consensus factor (Fic). In the present study, a total of 120 medicinal plant species and 104 genera from 45 families were used by inhabitants of various indigenous communities of Ladakh to treat 18 diseases. *Asteraceae* and Fabaceae *were found to be dominant in terms of species used in medicinal preparation.* Leaves were the most commonly used plant parts, and decoction was the most common method of herbal preparation. The most preferred and relatively important species based on UV and RFC were *Aconitum heterophyllum* Wall. and *Thymus linearis* Benth. Maximum numbers of plant species were used for generalized body-related (52, 43% of the total), followed by gastrointestinal disorders (35, 29% of the total) and respiratory problems (33, 28% of the total). There is a high degree of consensus among informants of the region used to treat diseases of different categories. Highest Fic was recorded for respiratory diseases (Fic =0.9). Indigenous communities of Ladakh use a wide range of medicinal plants to treat diseases prevalent in the region. There is an adequate flow of traditional information from the previous generation to the current ones in this region. The importance of these medicinal plants is still intact and plays a crucial role in the primary health care system.

ISESFEC/23/P-169

Anti-pathogenic potential of a polyherbal formulation Enteropan® against *Staphylococcus aureus* and multidrug resistant *Pseudomonas aeruginosa*

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Novel alternatives to conventional bactericidal antibiotics are urgently sought in face of rapid spread of antimicrobial resistance among bacterial pathogens. Polyherbal formulations

exerting 'multiplicity of targets' may curb virulence of pathogens without necessarily killing them. The aim of our study is to investigate anti-pathogenic potential of a polyherbal formulation Enteropan® against *Staphylococcus aureus* and multidrug resistant *Pseudomonas aeruginosa.* Enteropan® formulation was assayed for its *in vitro* effect on bacterial growth and quorum-regulated pigment production through broth dilution assay. It's *in vivo* anti-infective, prophylactic, and post-infection treatment efficacy was evaluated using *Caenorhabditis elegans* as a model host. The test formulation could alter quorum-regulated pigment production, biofilm formation, and antibiotic susceptibility of both pathogens without a heavy effect on bacterial growth. Enteropan® (500 µg/ml) pre-treated *S. aureus* could kill 26.66% ± 5.77 lesser worms than control bacteria over a 24 hour observation period. Enteropan® (600 µg/ml) pre-treated-*P.aeruginosa* could kill 70%±6.32 lesser worms over a 5-day observation period. Enteropan®(600 µg/ml) conferred prophylactic protection on the worm population to the extent of 20%±5.77 against subsequent *P. aeruginosa* challenge. When the worms were allowed to be attacked by bacteria in presence of Enteropan®, *S. aureus*- or *P. aeruginosa*- induced death in worm population was reduced by 46.66%±5.16 and 52.22%±6.66 respectively over a five day period. This study besides validating the anti-pathogenic as well as immunomodulatory potential of Enteropan® in the nematode worm model, lends support to the concept of polyherbalism, so well-embraced by various systems of traditional medicine.

ISESFEC/23/P-170

A tool for quality control: HPTLC fingerprint analysis with the presence of antioxidants by effect directed activity and quantification of biomarkers in *Terminalia* species

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Along with the increase in demand for herbal raw materials, there is an increasing requirement for quality control to evaluate the stability and chemicals of such raw materials. The suggested study focuses on HP-TLC profiling after hydro-alcoholic bark and fruit extracts from *Terminalia*. Gallic acid (GA) and Ellagic acid were quantified using a cost-effective, sensitive, highly precise, and reproducible RP-HPTLC approach that was developed and validated (EA). The HP-TLC fingerprinting identified the presence of antioxidants, flavonoids, alkaloids, phenols, and tannins. GA and EA were verified by spectro-densitometric scanning, a four-way Rf spectral chromatogram, and visual examination of an RP-HPTLC plate. Because the method was verified with the International Council for Harmonization (ICH) requirements, it can be used to validate and standardize the hydro-alcoholic extract of *Terminalia* that contains GA and EA present in other related herbal products.

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MedPServer 2.0. A Cadd and machine learning approaches for therapeutic targets and novel natural product lead discovery

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Medicinal plants have been the main source of treatment for various diseases in ancient time and still for many developing countries. We have developed a curated database of medicinal plants from NE region of India. It contains traditional, scientific and medicinal information about plants and their active constituents, obtained from scholarly literature and local

sources. Further, computer-aided drug design (CADD) and machine learning approaches were implemented to discover new therapeutic targets and novel natural product leads. Moreover, the platform can be used to validate traditional medicinal system by elucidating therapeutic molecular mechanism of actions for natural products. Data collection and compilation were undertaken with elaborate investigations, selecting only those plants which were widely used in traditional medicinal system and has information about their active constituents. MySQL relational database management system was implemented to store molecular structure and related plant and disease information. Shape-based and ligand based CADD methods were implemented to explore the in-house natural product database. Further, machine learning models were developed for selected target diseases such as cancer, Alzheimer, etc. to identify natural product lead. The database currently contains 2,102 natural products, isolated from 414 different medicinal plant sources from North-East region of India. A total of 2,211 literature references were strictly collected for each of the bioactive molecules. The integrated platform was tested on known systems to validate the implemented computational methods capability to predict therapeutic targets and natural product leads. Sufficient knowledge of therapeutic mechanism of action is required if traditional system of medicine is to lead modern drug discovery. Therefore, to accelerate natural product-based drug discovery, we have developed an integrated platform containing natural product database, CADD and machine learning methods to identify therapeutic targets and novel leads based on natural products. This integrated platform, with analytical capabilities, could be an ideal resource to guide experimental studies toward natural product-based drug discovery.

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Bioanalytical method development for simultaneous estimation of herbal drugs and its application for bioavailability studies

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Glycyrrhizin from *Glycyrrhiza glabra* and Curcumin from *Curcuma longa* are traditionally used as antiasthmatic agent. Therefore, extracts containing these phytoconstituents were formulated into orodispersible tablets. The aims of our study are (i) to develop bioanalytical HPTLC method for simultaneous estimation of glycyrrhetinic acid, curcumin and piperine in human plasma and (ii) to apply the validated HPTLC bio-analytical method for bioavailability studies of the orodispersible tablet. Standard glycyrrhetinic acid was procured from Sigma Aldrich, and curcumin and piperine were isolated in laboratory. The marker compounds were spiked in human serum. Liquid liquid extraction technique was used as sample preparation method for extraction of marker compounds from Plasma. The chromatographic separation was achieved on pre coated silica gel 60F 254 thin layer chromatographic plate using mobile phase as toluene: ethyl acetate: Methanol (7.15:1.9:0.9 v/v). The detection was carried out at 343nm. The validation of bioanalytical method was carried out for all parameters as per ICH guidelines. The validated HPTLC bioanalytical method was applied to determine bioavailability of orodispersible tablet containing glycyrrhizin, curcumin and piperine. Glycyrrhetinic acid, curcumin and piperine were resolved with Rf value 0.41 for glycyrrhetinic acid, 0.51 for curcumin and 0.71 for piperine. The linearity was found over a concentration range of 10,000-20,000 ng/spot for glycyrrhetinic acid and 50-100 ng/spot for curcumin and piperine in human plasma. Percent recovery was found to be 57% for glycyrrhetinic acid, 59% for curcumin and 71% for piperine. The method was found to be reproducible with %RSD value < 2%. Bioavailability studies revealed the Cmax values for Glycyrrhetinic acid and curcumin, to be 10.69 and 8.6 µg/ml respectively. The developed bioanalytical HPTLC method was found to be rapid, reproducible, selective, and accurate which can be used for bioavailability studies.

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Formulation and standardization of orodispersible tablets containing extracts of *Glycyrrhiza glabra* and *Curcuma longa*

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Docking studies on glycyrrhizin and curcumin indicated good binding with tryptase and IL-5 proteins, the targets for asthma receptors.Therefore, extracts containing these constituents were formulated into orodispersible tablets. The aims of our study are (i) to formulate orodispersible tablets containing glycyrrhizin and curcumin rich extracts and (ii) to evaluate the formulation for its orodispersible properties. The roots of liquorice and rhizomes of curcuma were extracted with alcohol and vacuum dried. The orodispersible tablets were prepared using these extracts (containing 75mg and 50mg of glycyrrhizin and curcumin respectively). Various formulations were tried using different super disintegrants. The combination of super disintegrants (Sodium starch glycolate and cross carmellose) gave the best results. The extracts and tablets were standardized for the content of glycyrrhizin and curcumin using validated HPTLC method [Silica gel as stationary phase and toluene: Ethyl acetate: Methanol (14.3:3.8:1.9) as mobile phase] for simultaneous estimation of the marker compounds. The pre compression and post compression parameters of tablets were studied. The dissolution studies were carried out using USP Paddle type apparatus. The average drug content in orodispersible tablet was found to be 70.9mg and 42.92mg for glycyrrhizin and curcumin respectively. The disintegration time of Orodispersible tablets were found to be 40 sec. *In vitro* dispersion and wetting time were found to be 70 and 90 seconds respectively. Weight variation, hardness and friability were found to be in the range. The dissolution studies indicated 90 and 85 % release of glycyrrhizin and curcumin respectively within 5min when analysed by HPTLC method. The formulation is found to be stable in the accelerated stability studies. The orodispersible tablet formulations developed using standardized extracts of Liquorice and Curcuma qualified all the parameters and found to be stable.

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Formulation and evaluation of hydrogel for sunscreen and moisturizing effect

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UV radiations from sun rays are harmful to skin, causing sun burns, skin cancer. A *Punica granatum* (Punicaceae) fruit peel is rich in antioxidant of polyphenolic class which have main constituents such as an Ellagic acid, used in skin cosmetics as well as in medicine. Hydrogel has 99% water content which helps to enhance drug absorption, decrease drug dose. Therefore attempts were made to prepare hydrogel formulation which contains Ellagic acid as active ingredients. Toutilize Ellagic acid is used in development of herbal skin cosmetics products for its sunscreen and moisturizing properties. The methanolic extract of pomegranate fruit peel powder was standardized for the content of ellagic using HPTLC method. Hydrogel gel was prepared by incorporating pomegranate peel powder extract in hydrogel base prepared from guar gum and chitosan. Moisturizing effect of hydrogel was evaluated on 10 Healthy female volunteers with their informed consent. The moisture content of stratum corneum was measured by using Digital Moisture detector pen (brand: Sutinna) before and after the application of gel. Also, gel formulation was evaluated for *in vitro* SPF activity by using Mansur's equation and boot star rating. The prepared hydrogel formulation was found to be smooth, homogenous and elegant in appearance when applied on the skin with finger. Mean Initial moisture content of skin was found to be 20.0 %, which was significantly ($P< 0.05$) raised to 40.0% at the end of 5 hours later after the application of gel formulation. *In vitro* SPF activity was performed and it was found to be Moderate with 2

star ** rating which can block about 95% of UV rays. Hydrogel formulation containing ellagic acid offered sunscreen and moisturizing effects. The ingredients of the formulations are safe and are readily available. The formulation has the capability to protect the skin from UVR, dryness and photoaging by forming a hydrated film on the skin and by absorbing harmful ultraviolet radiation. Also, the formulation was found to be stable in the accelerated stability studies.

ISESFEC/23/P-175

Ethnomedicinal use of animals and animal products by the Meitei community in Manipur, North East India

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The Meitei community in Manipur has been practicing traditional healing based on plants and animals since time immemorial. This study aimed to document traditional knowledge of zootherapeutic use of animals and their parts/products by Meitei community in Manipur. Data were collected from traditional healers (Maiba/Maibi) of Meitei community from different villages in Manipur, who are well-experienced in diagnosing and treating ailments using animals and animal products. Information was collected using semi-structured questionnaires, and personal interviews or group discussions were also conducted with 40 (35 male and 5 female) respondents who provided information on different uses of animals and their products. A datasheet was prepared to enlist common English name, local vernacular name, scientific name, medicinal use and mode of preparation. A total of 57 animal species consisting of 10 invertebrates and 47 vertebrates that have zootherapeutic applications in treatment of various ailments including asthma, tuberculosis, night blindness, general weakness, jaundice, diabetes, urinary problems, stomach disorders, mouth ulcers, oral cancer, anaemia, rheumatoid arthritis, wounds, burns, boils, sexual incompetency, skin problems, haemorrhoids, etc. were recorded. The highest percentage of animals used for traditional treatment is accounted by mammals (36.8%) followed by fishes (35%) and birds (7%). Mammals possessing important medicinal uses include protected wild species like Indian pangolin (*Manis crassicaudata*), Asiatic black bear (*Ursus thibetanus*), Indian jackal (*Canis aureus*), and Sambar (*Cervus unicolor* unicolor). This study revealed that Meitei community has been using different species of animals for therapeutic purposes before the advent of modern medicine. It is also expected that the findings from the present study will be necessary to protect traditional knowledge for conservation and sustainable use of rich biodiversity of Manipur for future generations. Further experimental studies are required to elucidate the pharmacological properties of various animal species reported in this work.

ISESFEC/23/P-176

Nutraceutical properties of fruit extract of *Myrica esculenta* an underutilized fruit of North east India

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The present study deals with the evaluation of nutritional and pharmaceutical properties of *Myrica esculenta* (Family-Myricaceae) from Manipur an underutilized fruit of North Eastern India. The fruits were collected from different parts of Manipur. The fruit was washed and dried in an oven and then grounded to powder. The determination of the nutritional composition (Carbohydrate, fat, protein, and ash) of the sample was performed according to AOAC method. For the evaluation of the pharmaceutical property, the powdered sample of the fruit was extracted with two different solvents: water and methanol. The water and methanol fractions were dried using a lyophilizer and rotator evaporator respectively. Then the extracts were screened for antioxidant, antihyperglycemic, and xanthine oxidase inhibitory activity. The total phenolic and flavonoid content of the extracts were also determined. The proximate content analysis revealed that the fruit contained protein

(10.15±0.25%), fat (0.975±0.18%), total carbohydrate (82.2±4.2%), and ash (4.2±0.2%).The phenolic and flavonoid content was higher in the methanolic extract (MExt) than in the water extract (WExt). Both extracts showed high antioxidant activity. The IC_{50} value of methanolic (MExt) and water extract (WExt) were recorded as (MExt-170.6 ± 4.8 µg/mL; WExt-319±4.2µg/mL) in the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay and (MExt-70.2±2.4µg/mL; WExt-91±3.6 µg/mL) in 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) (ABTS)assay. The fruit extract also exhibited pharmaceutical properties such as anti-hyperglycemic (α-amylase and α-glucosidase inhibitory), anti-hyperuricemia (xanthine oxidase inhibitory).The activities were higher in methanolic extract than in the water extract. The present study established that the fruit of *Myrica esculenta* could be a potential candidate for the formulation of functional foods.

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Synthetic trioxanes having potential antimalarial activity against multidrug-resistant *Plasmodium yoelii nigeriensis* in a swiss mice model

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Novel 6-arylethyl-1,2,4-trioxanes 6a–i and 7a–i are easily accessible in one step from the diimide reduction of 6-arylvinyl-1,2,4-trioxanes 5a–i. All of these new trioxanes were assessed for their oral antimalarial activity against multidrug-resistant *Plasmodium yoelii nigeriensis* in a Swiss mice model. Most of the saturated trioxanes 6c, 6f, 6g, 6h, and 6i, the active compounds of the series, provided 100% protection to the malaria-infected mice at a dose of 24 mg/kg × 4 days. Further, trioxane 6i, the most active compound of the series, also showed 100% protection even at a dose of 12 mg/kg × 4 days and 20% protection at a dose of 6 mg/kg × 4 days. In this model, β-arteether provided 100% protection at a dose of 48 mg/kg × 4 days and only 20% protection at a dose of 24 mg/kg × 4 days via the oral route, which was found to exhibit 4-fold antimalarial activity compared with the currently used drug β-arteether. In conclusion, in our efforts to assess the role of the double bond of 6-arylvinyl-1,2,4-trioxanes toward antimalarial activity, we have prepared a new series of saturated 1,2,4-trioxanes using the chemistry of the double bond and studied their structure–activity relationship. Several of these trioxanes (6a–i) have shown a better activity profile than the parent trioxanes 5a–i. The trioxane 6i, the most active compound of the series, has four times better oral antimalarial activity than that of the clinically used drug, β-arteether. Hopefully, the outcome of our finding, the antimalarial activity of current trioxanes by oral route, helps scientists in finding the better drug candidate in fighting against malaria.

ISESFEC/23/P-178

Prospects of Zebrafish as a model in the ethno-pharmacological study

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Zebrafish (*Danio rerio*) belongs to the vertebrates and shown around 70% similarities (Howe *et al.*, 2013) with human genome. These similarities of zebrafish genome with human make them superior over other available invertebrate models for bioactivity screening purpose. Many interesting characteristics of zebrafish which make them a good model organism are due to high fecundity rate, small size, rapid developmental process and transparent embryos in early stages (Wang *et al.*, 2009; Au - Hao *et al.*, 2010; Bowman and Zon, 2010). The

organ development of zebrafish embryo is completed in 72-hour post fertilization and this stage is frequently used for rapid screening of drug. Even though the other higher vertebrates such as rat, mice are more preferred, use of such model at preliminary stage is cumbersome and maintenance cost are very high. Compare to higher vertebrates, the use of zebrafish doesn't require ethical clearance at least at the embryonic stage as per EU Directive 2010/63/EU. Zebra fish embryos can be used to evaluate the toxicity of medicinal plants used in ethno-pharmacological treatment and also the bioactivities such plants (Rajiv *et al.*, 2021; Rajiv *et al.*, 2022). A disease model zebrafish can be generated by simple chemical treatment or by sophisticated genetic manipulation. A preliminary bioactivity screening such as anti-oxidant, anti-inflammatory and anti-hyperglycaemic can be easily studied by using a model zebrafish developed by simple chemical treatment. Such preliminary screening can be performed in conjunction with microscopy, spectroscopy, and other molecular biology techniques.

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Evaluation of anthelmintic activity of methanolic extract of *Cajanus cajan* leaves

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Cajanus cajan (L.) also called Pigeonpea, is an important legume crop of the Papilionaceae family. It has been widely used traditionally for treating diabetes, sores, skin irritations, hepatitis, measles, jaundice, dysentery, for expelling bladder stones, and many other illnesses. This plant has been reported to have anti-oxidant, anti-cancer, anti-tumor, anti-malarial, and anti-bacterial properties. The aim of the study was the quantitative estimation of phenolic content in the methanolic extract of leaves of *Cajanus cajan* (*C. cajan*) and *in vitro* anthelmintic activity. Leaves of *Phyllanthus acidus* were extracted with methanol and the extract was carried out for the total phenolic content and the adult Indian earthworms-*Pheretima posthuma* were used for *in vitro* anthelmintic activity. The total phenolic content of the extract was estimated as 0.541±0.15 mg GAE/g. The extract showed dose-dependent *in-vitro* anthelmintic (100 and 200 mg/ml) and100 mg/ml was observed as the minimum lethal amount of the extract for anthelmintic activity. At this concentration, the death of *Pheretima posthuma* was observed in 38.09 ± 1.31min while with a standard dose of albendazole, the lethal time was found to be 32.94 ± 1.47 min. The study concluded that the *Cajanus cajan* has promising anthelmintic activity and its extract is a potentially rich source of anthelmintics to combat helminthic diseases.

ISESFEC/23/P-180

Phytochemical investigation of *Phyllanthus acidus* leaves

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Phyllanthus acidus Skeels, popularly known as star gooseberry, is an important economic and medicinal plant of the genus *Phyllanthus* (Euphorbiaceae). *P. acidus* is a small tree and is widely distributed in Thailand, Indonesia, Malaysia, Philippines, Vietnam, Laos, and India.Different parts of this plant have been used for the treatment of various conditions such as jaundice, bronchitis, constipation, diarrhea, biliousness, urinary concretions, and piles. Several therapeutic properties reported include antibacterial, antiviral, neuroprotective, antifibrosis, hepatoprotective, and anticancer activities. To identify the bioactive compounds in n-hexane leaves extract of *Phyllanthus acidus* (*P. acidus*) by Gas Chromatography-Mass Spectrometry (GC-MS). Also, quantitative estimationof the total steroid and total terpenoid contents in the leaves extract. Leaves of *Phyllanthus acidus* were extracted with n-hexane and the extract was subjected to Gas chromatography – Mass Spectrometry Analysis (GC-

MS), total steroid, and total terpenoid content estimations. Fourteen bioactive compounds $C_3H_{10}N_2$, $C_6H_{14}O_2$, C_4H_9ON, $C_{13}H_{27}O_2N$, $C_{12}H_{26}$, $C_{25}H_{44}O_6$, $C_{20}H_{40}O$, $C_{19}H_{41}N$, $C_{20}H_{38}$, $C_{30}H_{50}$, $C_6H_8O_4$, $C_{19}H_{31}NCl_2S$, $C_{29}H_{50}O_2$ were identified by GC-MS method. The total steroid and total terpenoid contents of the extract were estimated and compared with standards. The study concluded that the n-hexane extract of leaves of *Phyllanthus acidus* is enriched with phytochemicals that boast its therapeutic properties and also its traditional uses in folklore medicines.

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Phytochemical investigation of *Pupalia lappacea*

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Pupalia lappacea belongs to the Amaranthaceae family, also known as the forest burr. It is a perennial herb that can reach heights of 0.6 to 0.9 metres and grows either upright or spreading out on the ground. Nagadamini is a common name in India. It is a weed that has been brought to many tropical regions of Africa and Asia, from Arabia to India and Malaya. This plant have been used for the treatment of various conditions such as the fruit extract is used as an enema, a treatment for boils, burn wounds, and leprosy wounds. Several therapeutic properties reported include Anti-inflammatory, Anti-oxidant, Antimicrobial activity, Anti-diabetic, Hypolipidemic, hepatoprotective, and anticancer activities. The aim of our study is (i) to identify the bioactive compounds in the n-hexane leaves extract of *Pupalia lappacea* (*P.lappacea*) by Gas Chromatography-Mass Spectrometry (GC-MS) and (ii) quantitative estimation of the total steroid in the leaves extract. Leaves of *Pupalia lappacea* were extracted with n-hexane and the extract was subjected to Gas chromatography – Mass Spectrometry Analysis (GC-MS), total steroid content estimation. Thirteen bioactive compounds C_3H_3OCl, $C_{13}H_{26}O$, $C_{10}H_{20}O_2C_{13}H_{22}O_4$, $C_{11}H_{20}$, $C_{10}H_{16}O_3$, $C_{15}H_{32}$, $C_{12}H_{26}$, $C_{12}H_{25}I$, $C_{13}H_{28}$, $C_6H_{12}O_2$, $C_{14}H_{24}O$, $C_{10}H_{16}O$ were identified by GC-MS method. The total steroid contents of the extract were estimated and compared with standards. The study concluded that the n-hexane extract of leaves of *Pupalia lappacea* is enriched with phytochemicals that boast its therapeutic properties and also its traditional uses in folklore medicines.

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Determination of anti-dengue potential of prepared unani formulation: *Habb-e-Tap-e-Balghami*

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Habb-e-Tap-Balghami (HTB) is a solid dosage preparation of Unani system of medicine and used since ancient times for the management of Dengue and associated fevers. The formulation is composed of *Karanjwa* (*Ceasalpinia bonducella* Flem.), *Filfil Daraz* (*Piper longum* Linn.), *Zeera Safaid* (*Cuminum cyminium* Linn.) and *Barg-e-Babool* (*Acacia Arabica* Wild.). An attempt has been made to evaluate the anti-viral potential of the prepared formulation along with assessment of its cytotoxicity and its chemoprofile. HTB was formulated in the laboratory using pharmacopoeial standards. *In vitro* cytotoxicity was assessed in C6/36 cell lines using MTT assay. *In vitro* antiviral activity was evaluated using immunofluorescence assay along with viral RNA quantification using RT-PCR. Quality control analysis of the bioactive extracts was done using HPTLC. HPTLC analysis of HTB showed separation of eleven metabolites. Piperine (R_f 0.55), Piper longumine (R_f 0.69) and Apigenin (R_f 0.72) were identified at 254 nm upon comparison with biostandards. IC_{50} of aqueous extract of HTB was found to be 500.75µg/mL showing least toxic effect. HTB showed significant reduction in viral load signifying anti-viral potential. The prepared

formulation showed significant anti-viral potential and quality control using HPTLC showed separation of eleven metabolites. The *in vitro* results suggest significant anti-viral potential. Thereby, it can be concluded that HTB may be used as a potential anti-dengue formulation.

ISESFEC/23/P-183

Phytochemical investigation of *Terminalia catappa* fruit

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Terminalia catappa Linn, popularly known as Indian almond, is an important economic and medicinal plant of the genus *Terminalia* (Combretaecea). *T. catappa* is a tall deciduous and erect free which has been introduced, and frequently naturalized, in many tropical parts of the world including Brazil, the Caribbean, and East Africa. Different parts of this plant have been used for the treatment of various conditions such as diarrhoea, leprosy, liver diseases, headache, scabies, asthma and tonsillitis. Several therapeutic properties reported include anti bacterial, antiinflammatory, anti oxidant, hepatoprotective, wound healing, anti diabetic, anti fungal, anti tumor and anthelmintic activities. The aim of the study is (i) To identify the bioactive compounds in n-hexane fruit extract of *Terminalia catappa* (*T.catappa*) by Gas Chromatography-Mass Spectrometry (GC-MS and (ii) quantitative estimation of the total terpenoid contents in the fruits extract. Fruits of *Terminalia catappa* were extracted with n-hexane and extract was subjected to Gas chromatography – Mass Spectrometry Analysis (GC-MS), for total terpenoid content estimations. Six bioactive compounds $C_5H_{13}NO$, CH_4S_2, $C_7H_{17}N$, $C_5H_7NO_2$, $C_4H_{10}O_4$, C_4H_8O, were identified by GC-MS method. The total terpenoid contents of the extract were estimated and compared with standards. The study concluded that the n-hexane extract of fruits of *Terminalia catappa* is enriched with phytochemicals that significantly enhanced its therapeutic potentials and also its traditional uses in folklore medicines.

ISESFEC/23/P-184

DNA fragmentation and anti-angiogenesis potential of ethnomedicinal plant from Western Ghats

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Ethnomedicinal plants play an important role in the treatment of many diseases, as well as for mitigation and cure. In this research work *Achyranthes coynei* family Amaranthaceae, an endemic species was explored for its traditional claim. The attempt was made to evaluate the extracts activity at the molecular level in some extent. The whole plant hydroalcoholic extract was projected on lung cancer cell lines (A-549) for cytocompatibility (morphological changes), MTT assay, DNA fragmentation assessment by fluorescent microscope assisted single cell gel electrophoresis (Comet assay), Chorioallantoic membrane assay (CAM assay) to evaluate the anti-angiogenesis effect. There was no sign of morphological degradation on lung cancer cell lines (A-549), which confirms its cytocompatibility with extract. The extract sensitized the cell viability in MTT assay. Further, Comet assay findings, provided the DNA breakdown pattern (Comet formation) which was observed by fluorescent microscopy, the anti-angiogenesis effect was corroborated in CAM assay. The findings of the study substantiate the scientific validation and evidence for its traditional claims and help to understand the various aspects of ethnomedicinal plants.

ISESFEC/23/P-185

GC-MS analysis and total phenolic and flavonoid content of leaf extract of *Ceiba pentandra*

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Ceiba pentandra tropical tree belonging to the family *Malvaceae* has been traditionally used for years as a local source of wood, fodder, oil, and fibre. Parts like leaves, bark, and roots are also employed for the treatment of various ailments. The aim of this study is to carry out Gas Chromatography with Mass Spectra (GC-MS), total phenols, and flavonoid content estimation of the methanolic leaf extract of *Ceiba pentandra.* The methanolic leaf extract is analysed for identification of bio-active compounds by GC-MS and estimation of total phenolic and flavonoid content as compared to Rutin and gallic acid. The Obtained Results by GCMS analysis are reported based on retention time, area of peak, molecular weight, molecular formula, % area, and estimation of total phenol and flavonoid contents that are identified by standard gallic acid, rutin, and leaf extract. From the phytochemical investigation of *Ceiba pentandra* we conclude the presence of rutin, gallic acid, and bioactive compounds in the leaf extract.

ISESFEC/23/P-186

GC-MS analysis and total phenolic and flavonoid content of *Syzygium cumini* leaf extract

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Syzygium cumini (*S. cumini*) (L.) of the family Myrtaceae is one of the widely used medicinal plants in the treatment of various diseases particularly diabetes. The aim of the present study is to carry out Gas Chromatography Mass Spectrometry (GC-MS) analysis and total phenolic and flavonoid content in the leaf extract of *S. cumini*. The leaf extract is subjected to GC-MS analysis and quantitative estimation of total phenolic and flavonoid content has been compared to Gallic Acid and Quercetin as standard. Results of leaf extract *S. cumini* in GC-MS obtained has shown a number of bioactive compound and are identified based on peak name, molecular formula, molecular weight, molecular structure, and % area in total phenolic and flavonoid content gallic acid and quercetin are compare with methanolic leaf extract of *S. cumini*. From the phytochemical investigation of *S. cumini*, we conclude the presence of bioactive compounds like quercetin and gallic acid in the leaf extract.

ISESFEC/23/P-187

Phytochemical investigation and total phenolic and flavonoid content of flower extract of *Bauhinia purpurea*

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Bauhinia purpurea of the family Fabaceae which is also typically referred to as the butterfly tree possesses a wide range of medicinal uses and tremendous pharmacological capability. The aim of the present study is a phytochemical investigation of the methanolic flower

extract of *B. purpurea*. The methanolic extract of *B. purpurea* is subjected to Gas chromatography with mass spectra (GC-MS) analysis and estimation of total phenolic and flavonoid content in flower extract. Obtained results of *B. purpurea* in GC-MS analysis have identified the bio-active compounds based on retention time, area of peak, molecular weight, molecular formula, % area, and estimation of total phenol and flavonoids contents are estimated by standard gallic acid and rutin. From the phytochemical investigation of *B. purpurea* we conclude the presence of rutin, gallic acid, and presence of bioactive compounds in flower extract.

ISESFEC/23/P-188

GC-MS analysis and anthelmintic activity of methanolic extract of *Nigella sativa* seed

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Nigella sativa (Ranunculaceae) commonly known as black cumin seed acclaimed to have great medicinal importance as it possesses many medicinal properties particularly in the Greco-Arab, Unani-Tibbi, and Ayurvedic systems of medicine. The seeds have claimed to have several traditional applications. The study aim is to use Gas chromatography with Mass spectra (GC-MS) and *in vitro* anthelmintic activity of the methanolic extract of *Nigella sativa* seeds. The *Nigella sativa* extract was analyzed by GC-MS and *in vitro* anthelmintic activity was carried out on adult Indian earthworms-*Pheretima posthuma* with concentrations of 50, 100, 150, and 200 mg/mL and compared to Albendazole as standard. From the GC-MS *Nigella sativa* extracts was identified with 43 bioactive compounds based on Peak name, Molecular formula, Molecular weights, Molecular structures and % area. The extract has shown results in a dose-dependent manner in anthelmintic activity (150 and 200 mg/mL). At this concentration, the death of *Pheretima posthuma* was observed in 34.12 ± 1.46 min while with a standard dose of Albendazole, the lethal time was found to be 26.11 ± 1.01 min. The study concluded that the *Nigella sativa* has promising anthelmintic activity and its extract is potentially rich bioactive compounds as anthelmintics to treat helminthic diseases.

ISESFEC/23/P-189

Phytochemical evaluation and in-vitro α-glucosidase enzyme inhibitory activity of *Houttuynia cordata* Thunb

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Houttuynia cordata Thunb. of Saururaceae plant family is widely distributed in North Eastern regions of India. In the treatment of dysentery, cold, fever, mumps, lowering blood glucose level etc. and strengthening the immune system it widely used traditionally and consumed daily as food. In the present study, hydroalcoholic plant extract of the plant *Houttuynia cordata* was standardized by HPTLC method and evaluated for *in-vitro* α-glucosidase enzyme Inhibition assay to determine antidiabetic potential. The collected plant parts are shade dried and pulverized to moderately coarse powder. After that the plant materials were extracted by cold maceration method using hydro-alcoholic solvent (Methanol: Water = 80:20). Qualitative chemical tests for different types of secondary metabolites were done for the plant extract. Standardization of the extract was done by HPTLC assay, using suitable marker compound Chlorogenic acid, and mobile phase was Ethyl acetate, Methanol, Formic acid (15:1:2). Photo documentation of the HPTLC plates were done in 254 nm UV-light. In-vitro α-glucosidase enzyme Inhibition assay was performed using 96 well plate method,

using Acarbose as a standard. The absorbances were measured using a Spectramax M5 micro plate reader. In *H. cordata* extract presence of Alkaloids , Polyphenol, flavonoids, tannins, phenolics, sterols, amino acid, carotenoids and triterpenoids were found. By HPTLC study exhibited chlorogenic acid content in the extract was 0.386% w/w. *Houttuynia cordata* was found to have promising α-glucosidase enzyme inhibition potential. The IC_{50} values of chlorogenic acid, *H. cordata* and Acarbose were found to be 6.648 mg/ml, 9.704 mg/ml and 6.059 mg/ml, respectively. The results suggested that *Houttuynia cordata* was found to have α-glucosidase inhibitory activity comparable to the standard, Acarbose. The present study provides scientific support for the antidiabetic activity of hydroalcoholic leaf extract of *Houttuynia cordata* Thunb. May be the presence of chlorogenic acid in the standard responsible for the proposed activity. Further in-vivo, in-silico studies regarding their antidiabetic potential can be developed for the betterment of human health.

ISESFEC/23/P-190

Development and characterization of novel formulation of lycopene for diabetic wound healing

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Diabetes is the growing metabolic disease which is characterized by high blood sugar level with life threatening results. In that, diabetic wounds are the major problem because they do not resolve in few days. Major problem affecting wound healing are infection, age, stress, etc at wound site and other disease conditions. Lycopene is a red pigment obtained from fruits such as tomato, watermelon, and guava. It is a powerful antioxidant that scavenges reactive oxygen species. It has reported antidiabetic, antioxidant, anti-obesity, anti-inflammatory, antihyperglycemic, antiaging activities based on literature. The Objective of the present study is to find the wound healing potential of herbal formulation and report the properties of the compound. Wound healing activity was assessed in Alloxan-induced diabetic rats and control rats. Alloxan injection (50mg/kg) was used to induce marked hyperglycemia, compared with controls. Formulation was applied topically and was evaluated for efficacy. The results of this study provided evidence that diabetic wound healing activity of lycopene topical gel and emulgel respectively, was found to be novel, safe and effective in functional recovery of wound.

ISESFEC/23/P-191

In vitro antioxidant activity, phytochemical screening and HPTLC fingerprint of *Eupatorium birmanicum dc.*

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Manipur is one of the north-eastern states of India. Being a part of Indo-Burma biodiversity hotspot, it has a very rich diversity of flora and fauna including many aromatic and medicinal plants. *Eupatorium birmanicum DC*. Which is locally named “Langthrei” is among the endemic ethnomedicinal plants used by the various ethnic communities of Manipur for the treatment of many diseases including diabetes. *Eupatorium birmanicum DC*. is a wild shrubby plant that belongs to the family Asteraceae. Though the genus has several species found in many parts of the world, the species *birmanicum DC*. is endemic to Manipur and adjacent regions of Myanmar. The aim of this study was to examine the Total Phenolic Content (TPC), Total Flavonoid Content (TFC), Antioxidant activity and HPTLC Fingerprint of the methanolic extract of Eupatorium *birmanicum DC* leaves. Total Phenolic Content (TPC) and Total Flavonoid content (TFC) was determined by Folin-Ciocalteu Method and Aluminium Chloride Colorimetric Assay respectively. The antioxidant activity was performed using DPPH and ABTS assay. HPTLC analysis was also performed to obtain the HPTLC fingerprint. The methanolic extract of *Eupatorium birmanicum DC*. leaves showed good

amount of TPC, TFC and promising antioxidant activity. HPTLC profile also showed many numbers of bands which can be used for qualitative control. The results concluded that the leaves of *E. birmanicum* are rich in phytochemicals such as phenol, flavonoid and may be used as a natural antioxidant agent thus can be further studied for Ethnopharmacology.

ISESFEC/23/P-192

Traditional dietary practice to control acidity and stomach related problems of meitei community

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Dietary habits of local residents are crucial for adjusting the body's metabolic processes in modern human life to adapt to the local food availability, weather, labour practises, and environmental factors. The present study is focussing on how dietary habit or traditional food habit helps in reducing acidity or any stomach problems that arises due to food consumption and cause discomfort to health. To control such problem, Meiteis (Manipuris) since long back framed a dietary routine. Accordingly, every family consume one type of dish locally known as 'Ooti'' at least once a week. The mode of preparation is done by using ingredients like pea seeds, black grams seeds, vegetables (*Colocasia esculenta*, *Ipomoea batatas*, *Allium odorum*, *Foeniculum vulgare*, *Manihot esculenta*, *Jussiaea repens, Capsella bursapastoris)* and rice mixture using 'Khari' (locally extracted cooking soda' or 'hawai utt' (Pea plant ash). Nowadays instead of 'Khari' or 'hawai utt' or cooking soda is used to prepare the dishes.The vitamins and minerals content of *Pisum sativum* L. may play important roles in the prevention of deficiency-related diseases, specifically those related to deficiencies of Se or folate. *Vigna mungo* (L.) Hepper has essential amino acids which play a vital role in diets. *Colocasia esculenta are* rich source of minerals, dietary fibers and bioactives. *Ipomoea batatas, Allium odorum, Manihot esculenta* have anti-inflammatory effect. All the ingredients used in the preparation of this traditional dish has good medicinal properties, which may be the result of the instant relief of stomach related ailments. It can be concluded that traditional food practices if routinely followed, can keep active metabolic process and the body fit.

ISESFEC/23/P-193

RNA sequencing and transcriptome assembly of *Polygonum posumbu* to identify genes involved in flavonoid biosynthesis pathway

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Polygonum posumbu Buch.-Ham.ex D. Don is one of the medicinal plants used in Meeitei traditional system in India. This plant has the potential for using traditionally in fever, despepsia, blood pressure regulation. In previous studies we have shown that the extracts of *Polygonum posumbu* contains a good amount of total phenolics and total flavonoids and it possesses high antioxidant activity and also identified and quantified seven flavonoid compounds from stems, leaves and roots. Despite the medicinal value of *Polygonum posumbu* the plant does not have any genetics and genomics information. The aim of the study is to understand the biosynthetic pathway of flavonoid compounds of *Polygonum posumbu*. We sequenced and compared the *P. Posumbu* tisssues (leaf, stem, root) transcriptome using high throughput RNA sequencing. After quality filtration, an average of 7.6 Gb clean reads were obtained for leaf, stem and root tissues and assembled 162,546 transcripts. In total 137,711 unigenes were obtained after *de novo* assembly and were annotated with various databases such as Uniprot, KOG, NCBI nr database, Pfam, Gene Ontology and KEGG. The Kyoto encyclopedia of genes and genomes pathway prediction

analysis revealed the unigenes involved in the biosynthesis of flavonoids in the plant. Differential expression analysis showed that 8 genes were differentially expressed in the root and stem and 1 gene in leaf and stem samples, which were found to be involved in the flavonoid biosynthesis pathway. The transcriptome data and analysis of *P. posumbu* is the first report for the systematic analysis of functional genes and expression characteristics, and this study will be invaluable information for the molecular basis related to the medicinal properties of *P. posumbu* in further research.

ISESFEC/23/P-194

Antioxidant and anti-glycation potentials of different plant parts *viz*., pulp, inflorescence, pseudostem and root of *Musa balbisiana* colla

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Musa balbisiana Colla. is a seeded variety of banana, endemic to North-Eastern Region (NER) of India, commonly known as Athiyakol or Bhimkol by the different communities of this region. Previous studies showed that the different parts of the plant possess different medicinal properties, which are used for the treatment of various diseases, including diabetes, diarrhea, scabies, and inflammation. The present study focused on the comparison of nutritional properties, phytochemical content, anti-glycation and antioxidant activities of four different parts *viz*. pulp, inflorescence, pseudostem and root. Nutritional properties (i.e. Total Protein and Total Carbohydrate contents) were estimated by Bradford and Anthrone methods, respectively. The DPPH (1,-1-diphenyl-2-picrylhydrazyl) scavenging effects were determined by standard method (Brand-Williams et al., 1995), ABTS assay was performed according to the method given in Re *et al.* (1994) with some modifications. Anti-glycation assay was performed by Yagi *et al.* (2013) with slight modifications. The total protein and carbohydrate content of the inflorescence was found to be highest and the roots have the lowest. Stem showed the highest phenolic, flavonoid and tannin content and pulp showed the lowest. However, the antioxidant and anti-glycation activities were highest in the root and lowest in the pulp. This might be due to the presence of potent bioactive compounds in the root. As from the results it has been found that different parts of MB possess various pharmacological properties. Therefore, scientific exploration of different parts of *Musa balbisiana* Colla. will help in the development of nutraceutical and/or phytopharmaceutical to combat diseases associated with metabolic syndrome.

ISESFEC/23/P-195

Antioxidant activity and chemical characterization of *Bunium persicum* seeds extract

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The search for natural antioxidants, especially of plant origin, has notably increased in recent years. *Bunium persicum Boiss B.* Fedtsch is a plant of Apiaceae family called wild caraway. It is a perennial aromatic. They are economically important medicinal plant growing wild in areas with Mediterranean climate such as central and western Asia including Iran, Turkey, Syria, Pakistan, Tajikistan, Afghanistan, North India (Kashmir and Pamir), China, some parts of Europe, Northern Africa and South America. This plant has significant medicinal, antimicrobial and antioxidant properties which indicate its high potential for use in the medicine and food industry. In traditional medicine, it is used to treat or improve some cases such as digestive and urinary disorders, diabetes and obesity. In this study, chemical constituents of the hydroalcoholic extract of the seed from *Bunium persicum Boiss*. has been studied by UPLC technique. Individual antioxidant assays such as, DPPH, ABTS scavenging, Total Phenolic Content, Total Flavonoids Content activity have been carried out.

ISESFEC/23/P-196

Bioactive fraction of *Phyllanthus niruri* L. enhances free radical scavenging activity and stimulates glucose uptakethrough SIRT1 induction followed by GLUT4 translocation in C2C12 myotubes and streptozotocin induced Wistar rats

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Insulin resistance in skeletal muscle is an early feature in the pathogenesis of type 2 Diabetes. *Phyllanthus niruri* L. is a perennial traditional shrub with long-standing Ayurvedic, Chinese and Malay ethnomedicinal uses. To obtain enriched standardized (chemically defined) fraction and/or isolate active constituent(s) from *Phyllanthus niruri* to evaluate anti-diabetic potential. Bioactivity guided fractionation was carried out to obtain most active fraction and to isolate chemical constituent(s). *In vitro* efficacy was evaluated in C2C12 muscle cell line developing insulin resistance model by treating with Free Fatty Acid (FFA). *In vivo* study was carried out in STZ induced diabetic Wistar rats and study was conducted in dose dependent manner. Three compounds were isolated from the most active ethyl acetate fraction namely 1-O-galloyl-6-O-luteoyl-glucoside (C1), brevifolin carboxylic acid (C2) and ricinoleic acid (C3). Compound C1 and C2 enhanced the uptake of glucose and inhibits ROS levels in palmitate induced C2C12 muscle cell line. SIRT1, GLUT4, p-AKT levels were found to be upregulated and downregulation of PGC-1α is observed in treated cells with bioactive fraction, thereby attenuating insulin resistance in muscle cell line and STZ induced Wistar rats. Moreover, *in vivo* experiment performed in STZ induced Wistar rats treated with most active ethyl acetate fraction of 100 mg/kg body weight showed most significant activity in lowering fasting blood glucose, triglyceride and total cholesterol levels as compared to the diabetic and other treatment groups. Our study revealed the therapeutic efficacy of *Phyllanthus niruri* against T2DM *via* enhanced GLUT4 translocation in the plasma membrane and attenuation of cellular oxidative damage in muscle cell line and diabetic Wistar rats followed by upregulation of SIRT1, GLUT4, p-AKT and downregulation of PGC-1α. Moreover, the study supported the ethnomedicinal and Ayurvedic claim for the treatment of diabetes and its complications.

ISESFEC/23/P-197

Ethnomedicinal treatment approach against oral lichen planus: a case-series study in a tertiary care teaching hospital

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Oral lichen planus (olp) is a chronic mucocutaneous autoimmune-associated female-predominance (1.69:1.09) skin disorder with potential to develop oral malignant transformation of 2%. The recommended steroid therapy is effective for a limited period but has side effects. Thus, alternative potent and less toxic regimens are urgently required. The aim of the study is to assess *Curcuma longa* (cl) and *Aloe vera* (al) extracts individually and synergistically with the synthetic drugs triamcinolone acetonide (taca) and tracrolimus (tac). Further, a molecular docking-simulation study was used to check the binding efficacy of derived phytochemicals against 14 olp-associated target enzymes. For 12 weeks, the clinical efficacy of cl and al extracts with taca and tac was tested against five volunteer age groups of 18–60years (n = 5 in each group). To assess efficacy, the pre- and post-visual analogue scale (vas) and modified clinical score (mcs) were used**.** The binding efficacy and stability of

protein-docking complexes were studied using autodock 4.2 and gromacs 5.1.4 (200 nanoseconds) software. The olp lesson was reduced significantly in each group based on pre- and post-vas and mcs, without toxicity. Particularly, the synergistic effect of taca at low doses with cl (1:10 w/w) demonstrated the greatest efficacy ($p \leq 0.05$) in the case control study, and taca-curcumin (cu) showed higher binding efficacy with greater stability against the glucocorticoid receptor. Our analysis demonstrated that taca-cu/cl treatment was the most promising and least toxic regimen against olp and also encouraged the use of more herbal regimens against olp to reduce the use of synthetic drugs and avoid their side effects.

ISESFEC/23/P-198

Role of *G. morella* (Gaertn.) Desr. marker compounds in preventing disrupted intestinal barrier integrity in CaCo-2 cells

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Tight junctions are instrumental in maintaining the intestinal barrier integrity and function. Traditional medicines can be an approach in preventing leaky gut and related complications. *Garcinia morella* (Gaertn.) Desr. fruit extract has a well-documented history of their efficacy in remediation of stomach ailments. To evaluate the activity of *G. morella* marker compounds in preventing intestinal barrier disruption caused by opportunistic pathogens *in vitro*. Transepithelial electrical resistance and dextran permeability assays were performed in pathogen infected CaCo-2 cell line to check the permeability of the intestinal monolayer. Immunoblotting studies were performed to study the expression of tight junction proteins in Caco-2 cells. The marker compounds of *G. morella* namely garcinol, HCA and HCA lactone showed preventive activities against pathogen induced intestinal monolayer disruption. Amongst all the three compounds Garcinol showed maximum activity in TEER and DPA Assays. Garcinol also enhanced the expression of tight junction proteins inspected by western blotting studies. *Garcinia morella* extract and its marker compounds HCA, HCA-lactone attenuates intestinal barrier disruption by inhibiting pathogen induced inflammation and tight junction disruption. The current study has revealed the therapeutic potential of these compounds in attenuation of intestinal barrier disruption which could be further developed as nutraceutical or phytopharmaceutical drug for the treatment of leaky gut syndrome.

ISESFEC/23/P-199

Xanthosine, apurine glycoside ameliorates hyperglycemia via the AMPK/AKT/GSK3β signaling pathways in type 2 diabetic rats and CC1 hepatocytes

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Tribulus terrestris L. (*TT*), commonly known as Gokhru, has been reported to treat diabetes and diabetic nephropathy with beneficial effects in glucose metabolism. However, proper molecular mechanistic evaluation on regulating hyperglycemia by *TT* and its active marker compound is unknown. Our research aim is to investigate the effects of *TT* extract and its active constituent(s) on gluconeogenesis and glycogenesis using CC1 hepatocytes and Wistar rats. Bioactivity guided fractionation and isolation was performed to identify phytochemicals present in *TT* followed by glucose uptake and glycogen storage ability in Free Fatty Acid (FFA)-induced CC1 hepatocytes. Diabetes was developed in Wistar rats through injecting streptozotocin, followed by oral administration of most active (*in vitro*) *TT* n-butanol fraction (10, 50 & 100 mg/kg/day). Then the fasting blood glucose (FBG) and oral glucose tolerance (OGTT) tests were performed. After the treatment, rats were sacrificed

and livers were harvested. Histopathological analysis and underlying molecular mechanism of action was evaluated. Further, blood serum was analyzed for biochemical parameters. Bioactivity guided isolation of chemical constituents yielded Xanthosine as major and active constituent in the most active *n*-butanol fraction. Treatment of Xanthosine in FFA-induced CC1 cells, enhanced glucose uptake and decreased glucose production through phosphorylation of AMPK and FoxO1, and downregulation of gluconeogenic enzymes, PEPCK and G6Pase expression. Xanthosine also prevented FFA-induced decreases in the phosphorylation of AKT, GSK3β, and increased GS phosphorylation to enhance the glycogen content. Moreover, in diabetic rats, oral administration of *n*-butanol fraction enriched with compound Xanthosine improved insulin sensitivity, reduced fasting blood glucose, increased glycogen content and insulin level. Our results revealed the active constituent and underlying mechanism of action of *TT* and Xanthosine in lowering elevated hepatic glucose production. Moreover, results support the Traditional and Ayurvedic claim of *TT* for the treatment of diabetes.

ISESFEC/23/P-200

Traditional treatment of diabetes among Ao tribes in Mokokchung district, Nagaland, NE India

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Ao tribe is the major tribes of Nagaland and inhabitant of Mokokchung district. They are largely depending on agriculture and various forest products for meet up their daily needs. The people mostly prefer medicinal plants for treating health care and have deep relationship on the uses of medicinal plants. No study has been done on the medicinal plants traditionally utilized to treat diabetes by *Ao* tribes in Mokokchung district. Hence, present study aimed to document the diversity of medicinal plants uses for management of diabetes disease. It will help in preservation of traditional knowledge and identification of new medicinal plants which may lead in new drug discovery processes. Structural questionnaire format were followed by personal interview and group discussion to meet the aim and objectives of the study. Total of 24 species of medicinal plants are enumerated and identified with the help of regional flora. The plants parts such as leaves, twigs, tubers, shoot, root, bark, flower, fruit and seed are used for curing diabetes. From the study it has been found that medicinal plants can be used in many ways in food, medicine and meet daily needs. Their traditional medicine can be promoted by standard validation processes for the benefit of mankind at large.

ISESFEC/23/P-201

Anti-diabetic potential of *Vitex negundo* L. by modulating hepatic glucose homeostasis in CC1 hepatocytes

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Plants and plant derived agents have long history as source of potential therapeutic agents in the medicinal history of human civilisation. Many of modern drugs being marketed are originally sourced from natural products. *Vitex negundo* is a large aromatic shrub or sometimes a small tree up to 4.5 m in height used in ayurvedic and traditional medicine. The plant has wide traditional use for the management of inflammation, oxidative stress and related metabolic disorders. The objective of the study is to develop an active fraction and/or isolated molecule(s) from *Vitex negundo* to study antidiabetic efficacy in *in vitro* and *in vivo* model. Three different extracts were prepared in MeOH, MeOH:H20(50:50), water. The crude extracts were screened for glucose uptake activity in free fatty acid (FFA) induced CC1 hepatocytes. The best active MeOH extract was subjected for further fractionation with

increasing solvent polarity in *n*-hexane, ethyl acetate, *n*- butanol and water. The chemical constituents were isolated by using different chromatographic techniques. The methanol extract was found to be the most active extract which showed significant glucose uptake activity in free fatty acid (FFA) induced CC1 hepatocytes. Three chemical constituents were isolated from the most active methanol extract.

ISESFEC/23/P-202

Evaluation of the therapeutic effect of *Leucaena leucocephala*. (Lam.) de Wit. in the regulation of insulin resistance associated oxidative stress in C2C12 muscle cell

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Oxidative stress generated upon mitochondrial deregulation contributes to the progression of insulin resistance and eventually type II diabetes mellitus. Amelioration of oxidative stress and inflammation by the regulation of mitochondrial biogenesis can lead to increased insulin sensitivity and play a potential therapeutic role in the treatment of type II diabetes mellitus. *Leucaena leucocephala*. (Lam.) de Wit. is a tropical tree species with widespread ethno-pharmacological usage all over the globe. Although many phytochemicals have been reported from the plant proper scientific studies relating its phytochemistry and bioactivity are still limited. The present work aimed to isolate active/marker compound(s) from the plant *L. leucocephala* and preparation of bioactive enriched fraction, evaluate antioxidant and antihyperglycemic activities of the enriched fraction and isolated compounds. Matured seeds of the plant were extracted using methanol and four fractions were prepared following solvent-solvent fractionation. Preliminary radical scavenging assays with the crude and fractions were performed. The antioxidant and glucose uptake activities of the extract and fractions were further evaluated in vitro using C_2C_{12} muscle cell line. The most active ethyl acetate fraction was further processed to prepare a standardized enriched fraction and isolate four active and marker compounds. Glucose uptake and ROS inhibition assays were also studied in the isolated compounds. Four compounds were isolated from the most active ethyl acetate fraction of *L. leucocephala*. All the compounds showed varying degree of glucose uptake and ROS scavenging activity in FFA induced C_2C_{12} muscle cell line. An enriched fraction was prepared with ROS scavenging and antihyperglycemic activity. The crude extract and the fractions also showed significant radical scavenging activity. Thereof, the study supported the ethno-pharmacological use of *Leucaena leucocephala* for the management of metabolic complications.

ISESFEC/23/P-203

Anti-diabetic and anti-oxidant activities of some selected medicinal plants used by ST/SC communities of the North East India

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The ST/SC communities residing in the North Eastern Region of India have their own traditional medicine for treatment of various diseases. Through one-to-one interactions with the traditional healers and various published articles related to the diabetes treatment in North East India, we have selected 22 medicinal plants for studies. To scientifically validate the various medicinal plants used for remedies against diabetes in North East India by various ST/SC communities of India. The methanolic extracts of selected plants were screened for α-glucosidases inhibitory activity as well as anti-oxidant activities like DPPH, ABTS and FRAF reducing assays. Significant α-glucosidase inhibitory activity was found in

Euryle ferox (IC_{50} = 2.18 ± 0.5), *Ficus palmata* (IC_{50}= 4.62 ± 0.02 µg/mL), *Eurya acuminata* (IC_{50}= 5.70 ± 0.01 µg/mL) and *Neptunia oleracea (*IC_{50}= 121.84 ± 6.53 µg/mL) compared with standard drug acarbose (IC_{50}= 356.34 ±0.56). These plant extracts also showed significant free radical scavenging activity**.** Our study supports the traditional belief on the use of selected plants against diabetes by the ST/SC communities of North East India. Further research in *in vivo* models should be conducted for deeper understanding of the mechanism and the active principle should also be characterized.

ISESFEC/23/P-204

Reprogramming tumor associated macrophages towards a tumoricidal M1-like phenotype with phytochemical loaded mannose coated GMO-MNPs (Phyto@Man-GMO-MNPs) for cancer immunotherapy

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Cancer is the leading cause of death worldwide. Cancer therapy has now entered the era of immunotherapy which has tremendous scope to revolutionize cancer treatment. Tumor-associated macrophages (TAMs) are most abundant immunosuppressive cells in the tumor microenvironment and predominately exhibit pro-tumorigenic M2-like phenotype which is involved in tumor progression, drug resistance, metastasis, and poor prognosis. Thus, targeting TAMs has potential to improve cancer immunotherapy. Repolarization of TAMs towards tumoricidal M1-like phenotype is the most promising option in targeting TAMs. In this regard, we are interested to evaluate the macrophage polarization ability of phytochemical loaded mannose coated GMO-MNPs (Phyto@Man-GMO-MNPs) *in-vitro* and *in-vivo* cancer models. GMO-MNPs, Man-GMO-MNPs and Phyto@Man-GMO-MNPs were formulated and their physiochemical characterization was performed using DLS, SEM, and FTIR. The effect on polarizing ability was also evaluated using different techniques, viz., qRT-PCR, FACS and confocal imaging. Physiochemical studies showed the average size of GMO-MNPs and Man-GMO-MNPs is 241.5nm and 271.5 respectively. Man-GMO-MNPs shows higher intracellular uptake by M2-like TAMs in comparison to GMO-MNPs. Both polarized the naïve and M2-TAMs towards M1-like macrophages *in-vitro*. Phytochemicals were screened for polarizing ability and Genistein was selected as it significantly decreased the M2-like TAMs in comparison to other phytochemicals. Preliminary results, suggest that Man-GMO-MNPs have potential to polarize macrophages and incorporating phytochemical in the nanoparticle (Phyto@Man-GMO-MNPs) may result in synergistic effect and prove to be a good candidate for cancer immunotherapy.

ISESFEC/23/P-205

Future strategies for the advancement of ethno-medicines for the treatment of scorpion stings

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Scorpion stinging is a substantial public health risk worldwide due to its significant morbidity and mortality and the lack of clinical or pharmacological treatment options. The most widely approved scorpion sting treatment is the injection of anti-scorpion anti-venom, alpha1 adrenergic receptor inhibitor (e.g., prazosin), and insulin. However, these therapies also have substantial limits, which may require the urgent development of ethnomedicines, mainly traditional medicinal plants, to deal with scorpion stings. As a result, the current review provides a full assessment of the many traditionally employed approaches from ancient times to cure scorpion stings, as well as a comprehensive account of several ethnic plants that were used in ancient times to treat scorpion bites in a variety of ways. The study primarily seeks literature reporting on medicinal plants' crude extracts that have been

investigated for their neutralization potential against scorpion venom in in-vivo and in-vitro conditions. A list of such plants is presented in this study. Nonetheless, such plant extracts have yet to be commercialized for clinical use in scorpion envenomation therapy. Although research into traditional practices is still in its early stages, a detailed investigation and study might lead to the discovery of more effective and improved scorpion sting remedies. Ethnopharmacology and natural compound drug discovery is the only relevant expectancy in the current scenario, which provides diverse approaches involving indigenous knowledge with current technology for drug development using new methods. Therefore, more focus on plant products is necessary to transfer this understanding into therapeutic use.

ISESFEC/23/P-206

Stability analysis for major economic traits in *Uraria picta*- a critically endangered medicinal plant

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Uraria picta (Jacq.) Desv. ex DC. (Family Papilionaceae) is a critically endangered plant and one of the most important ingredients among the ten herbs used for ayurvedic formulation called as *Dashmula*. Genotypes are known to differ genetically for their adaptation reactions across the environments. An ideal genotype must show yield and stability performance. The regression analysis is often used for the analysis of genotype x environment interaction. The present investigation was undertaken to investigate the changes of adaptation reaction of different genotypes of the *U. picta* in for environments/years and to select a better genotypes of *U. picta*. The results revealed that the pooled analysis of variances showed differences between Genotypes (G), Environments (E) and G X E, is an indication of the variability of genotypes and environment over different years due to their genotypic variations, environment and G X E for three economic traits. The linear components of GX E interaction were relatively greater than the non- linear components for all the traits except plant height and Rhoifolin content in shoot, indicating that the performance of genotypes for these traits could be predicted reliably. Genotypes with high mean performance, regression coefficient (bi) approaching one/unity and low deviation mean square (S^2di) were considered to be an high stable genotype, which could be expected to perform uniformly over variable environments/years: UP-50 and UP-49 for plant height, UP-17 and UP-49 for aerial weight, UP-17 and UP-04 for root length, UP-02 and UP-29 for root weight, UP-31 and UP-41 for rhoifolin (%) in shoot and UP-49 and UP-50 for rhoifolin(%) in root**.** Even so, in considering the adaptive performance of the 24 genotypes in relative terms, it clearly stands that among them the 7 genotypes have registered stability for economic yield resulting those genotypes can be used for supplementation of herb to the pharmaceutical and herbal drug industries.

ISESFEC/23/P-207

Intrinsic grain characteristics of black rice protect it from false–smut of rice (*Oryza sativa L.*) even under favorable conditions for *Ustilaginoidea virens*

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The fungus *Ustilaginoidea virens,* the causative agent of false smut in rice (*Oryza sativa* L.), is responsible for one of the severe grain diseases that lead to significant losses worldwide.

In this research, microscopic and proteomic analyses were performed by comparing *U. virens* infected and non-infected grains of the susceptible and resistant rice (black rice) varieties to provide insights into the molecular and ultrastructural factors involved in false-smut formation. Prominent differentially expressed peptide bands and spots were detected due to false-smut formation as revealed by Sodium dodecyl-sulfate polyacrylamide gel electrophoresis (SDS-PAGE) and two-dimensional (2DE) SDS-PAGE profiles and were identified using LC-MS/MS. To understand how the fungus colonized grain surfaces, a scanning electron microscope (SEM) was used, and the micronutrient composition of the grain surface was measured by using the SEM energy-dispersive X-ray spectroscopy (EDX). Confocal microscope with fluorescent dyes 4′, 6-diamidino-2-phenylindole (DAPI), wheat germ agglutinin (WGA), and propidium iodide (PI) were used to stain and identify components of the plant and the fungus during the infection of susceptible grains and also to determine the dead and live cells in the interactome. The proteins identified from the resistant grains were involved in diverse biological processes such as cell redox homeostasis, energy, stress tolerance, enzymatic activities, and metabolic pathways. It was found that *U. virens* produces diverse degrading enzymes such as β-1, 3-endoglucanase, subtilisin-like protease, putative nuclease s1, transaldolase, putative palmitoyl-protein thioesterase, adenosine kinase, and DNase 1 that could discretely alter the host morphophysiology resulting in false smut. This study revealed that the dimension of rice grain spikes, their elemental composition, moisture content, and the specific peptides produced by the grains and the fungi *U. virens* play a vital role in forming false smut.

ISESFEC/23/P-208

Novel *Paraclostridium* spp. with potential industrial applications from *Ngari*- a fermented food of Manipur

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Industrial production of hygienic, homogenous, and better quality *Ngari* (a traditionally fermented fish product of Manipur) using selected starter culture consortium within a short period would be of high commercial demand in Manipur and other states of North-East India. However, up to now, no production technology has been standardized to produce quality *Ngari* using starter culture technology. Earlier studies reported the dominance of lactic acid bacteria and *Bacillus* in spontaneous Ngari fermentation. However, our metagenomic analysis showed a dominance of *Clostridium* spp. in *Ngari*. Metagenomic analysis guided selective isolation and characterization of the dominant bacteria will help in producing quality *Ngari* by starter culture technology. Our research aims to develop a simple and effective method to isolate the dominant anaerobic bacteria present in *Ngari* and characterize it by genomic and biochemical analyses. *Ngari* samples were collected from different markets in Manipur. A simple and effective method of enrichment culturing in serum bottles under anaerobic conditions was used to isolate the dominant anaerobic bacteria selectively. Methods of PCR-DGGE, ARDRA, 16S rRNA sequencing, whole genome sequencing, *in-silico* comparative genome analysis, FAME, Polar lipid comparison analysis and various biochemical assays were used to characterize the bacteria. Metagenomic analysis guided selective isolation, and comparative genomics analysis based on the ANI and DDH values identified a dominance of novel *Paraclostridium* spp. in spontaneous *Ngari* fermentation. Further biochemical characterization showed their higher proteolytic activity with potential food fermentation and industrial applications.

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Production of Xylan and Xylo-Oligoscharides as a prebiotics from rice straw residues of Manipur

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Rice straws are one of the agricultural residues and are available in huge volumes in Manipur as a waste material. These rice straws are lignocellulosic biomass, rich in polymers such as cellulose, hemicelluloses, and lignin. Hemicelluloses are the second-most abundant and underutilized biopolymers. Xylan is the most predominant polysaccharide present in the hemicelluloses of biomass. Xylans have been used in various industrial applications, such as the food industry, feed industry, pharmaceutical industry, and packaging materials. Xylan derivatives, Xylooligosaccharides (XOS), have important applications as prebiotics, both in human, animal, and pharmaceutical properties. In this present investigation we are compared the xylan and Xylooligosaccahride conversion from rice straws from two rice varieties of Manipur such as black rice and common rice. The compositional analysis of the rice straws showed that they contained 25% cellulose, 28% hemicelluloses, and 14% lignin. Xylan was extracted from the powdered rice straw by an alkaline extraction process and precipitated with 95% ethanol. Dried powder of extracted xylan was analyzed by FTIR. The characteristic functional groups present in the extracted xylan show similarities with commercial xylan. Maximum yield of xylan obtained from rice straw from black rice is 22.5 w/w % compared to normal rice staw (18.2 w/w %). Commercial xylanases are used for the XOS conversion from crude xylan, and the conversion products are analysed by TLC. The preliminary study showed that xylan and XOS can be sustainably extracted from rice straw for food and industrial applications as prebiotics, which is demand in the global nutraceuticals market. The production of this high value compounds from the agricultural residues not only solve the disposal problem of the wastes but also provide an additional income to the farmers and generate employment in this region.

ISESFEC/23/P-210

In-silico studies on caffeic acid phenylethyl ester (cape) against major cancer target

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The most common thing that is obtained from honey bees is honey and wax. Besides honey and wax they also produce a sticky substance by mixing their saliva with tree resin which is propolis. It has many bioactive used in variety of therapies out of which its use as an anti-cancer agent is most studied. Caffeic acid phenylethyl ester (CAPE) is the main component responsible for anticancer activity in propolis. However, prior to understanding the molecular mechanism involved, it is essential to screen CAPE against the potential targets associated with cancer. The present study aimed to study the binding interaction of CAPE with different protein targets in cancer and to determine its potency as an anticancer agent. The common and major protein targets were selected for docking. The protein structures i.e., p53, BRCA-1, PGFR, VGFR, TGFR and their PDB IDs are 4IGK, 3D0A, 5GRN, 2QU6, 3KCF respectively were downloaded from RCSB PDB, whereas structure of CAPE was downloaded from PubChem. The protein and ligand were prepared using 'mgl tools' they're firstly the protein is taken and polar hydrogen and Kohlmann charges are being added then the grid is been prepared and the file is saved in 'pdbqt' format. The docking was carried out in 'AutoDock Vina 1.5.6 The Scripps Research Institute' and the binding scores were

computed. The visualization of protein and ligand interaction was done in 'BIOVIA Discovery Studios Visualizer 2021 version 4.5'. CAPE showed good binding affinity in comparison to the standard for all the five proteins. The most promising being TGFR protein. The key interactions responsible for binding with CAPE were at C chain of Alanine 230, Lysine 232, Serine 280, Leucine 340,278,260. The study findings further confirm the role of CAPE as a suitable alternative as an anticancer agent.

ISESFEC/23/P-211

Phytochemical profiling and FTIR analysis of *Ixora coccinea* crude extract from Munda communities of Sambalpur district of Odisha

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World Health Organization (WHO) estimated 80% people from the developing countries mostly depend on traditional herbal medicines to cure various ailments. Health problems in tribal communities are prevented and treated by traditional plants in accordance with their traditional customs, religious beliefs, myths, practices and experiences. Phytochemicals present in plants are efficient in preventing disease and promoting health by understanding the underlying mechanism of their action. *Ixora coccinea* leaves and flowers were collected from Sambalpur, Odisha. Determination of moisture content, extraction with distilled water was done by maceration method and qualitative phytochemical screening by standard methods. FTIR analysis, quantitative phenolic and flavonoid estimation was done by Follin-Ciocalteau and Aluminium Chloride methods respectively with slight modification. Flowers exhibited higher moisture content than leaves. Preliminary phytochemical screening of distilled water extract shown presence of phenol, saponin, terpenoid, steroids, flavonoid, oil and fat, carbohydrate, coumarin, fatty acid etc. FTIR analysis of leaf and flower resulted in presence of N-H, C-H, O-H, C-F, C=C=C, C=O, CH_3C-H etc. functional groups. The total phenolic and flavonoid content was calculated with respect to the calibration curve of Gallic acid and Quercetin. These results suggest that the leaves and flowers of *Ixora coccinea* is composed of essential compound, which may show antibacterial and antioxidant properties from the crude extract; these are possible due to the presence of bioactive compounds in the crude extract. Identification of the secondary metabolites would possibly lead to the development of new antimicrobial and anticancer compounds for efficient treatment of various diseases.

ISESFEC/23/P-212

Quality assessment and HP-TLC fingerprinting of Talisadi churna a classical ayurvedic preparation

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Ayurveda is the science which has very long history of medicines and is valid till date even in this modern age. The quality assessment has been the major hurdles in the way of the classical ayurvedic preparations. In order to maintain the quality among these preparations, quality assessment is of the utmost requirement. In this study, Talisadi churna which is a classical preparation is widely been used for ages for treatment of various respiratory diseases and it also acts as an immunity booster is studied for the quality assessment. The raw materials of the churna were collected and authentication was carried out. The preliminary investigations like phytochemical testing, physical characteristics and HPTLC fingerprinting were carried out. The results showed the compliance with the regulatory requirements.

ISESFEC/23/P-213

Understanding Disease of Children by Avicenna

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Unani System of Medicine is evidence-based medicine. On the basis of temperament human (*Mizaj-e-Aamar*) is categorized into *Sine Namoo* (The period of growth), *Sine Shabab* (The period of stability), *Sine Kahoolat* (The period of decline with continuing vigour), and *Sine Saikhookhat* (The period of decline with the appearance of weakness in vigour), whereas children's fall under the category of Sine Namoo, and it has hot and moist temperament. When alter the mizaj, it may lead to diseases such as; *Warm-e-Lissa, Ishal, Husr, Tashannuj, Kuzaz, Fiqdan Al-Nuwm, Allayl Al-Ahwal, Maaur Raas, Warm-e-Dimag, Qula, Baruz Al-Euyun, Silanul Uzn, Wajaul Uzn, Aidtirab fi Al-Tanafus, Alshakhayr Ghyr Tabiei, Aleuts Al-Mustamiru, Nazla wa Zukam, Zoaf-e-Meda, Qai* etc. This review paper aims to highlight the observations made in ancient Unani literature, which corresponds to the disease of children's as well as probable treatment options in Unani medicine. In this review article, literature related to disease of children, and their management were collected from most authentic source of Unani classical text (*Al-Qanoon Fit Tib*) which was written by great scholar "Avicenna". Endorsed disease description which is common among children and their management. Keywords like, and others were searched in Pubmed, Medline, Scopus, Web of Science, Publons, and Google Scholar. Finding showed that in Canon of Medicine, 31 diseases are enlisted with their management. In the phase of childhood, most of the care should be focused on adjusting manners. To protect the child from severe anger, grave fear, depression, or insomnia, attention should be paid to find out his likes and bring them closer and keep away things that the child dislikes. Ibn-e-Sina states that, "Mother's milk is for growth of the baby's body and the music is for growth of the mind" Hygiene and disorders of dentition, inflammation of gums, fevers and convulsion during dentition, aphthous stomatitis, constipation and diarrhea and their remedies also. The review article dealing with the medical care for newborn described by Ibn-e-Sina in their Canon of Medicine.

ISESFEC/23/P-214

Review on potential, prospects and research needs of a rare medicinal plant Shyonak (*Oroxylum indicum*) in Indian subcontinent

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Oroxylum indicum, commonly known as Shyonak belongs to family Bignoniaceae. The species is a medicinal tree natively distributed in Indian subcontinent from North-west Sub-Himalayan tract of Pakistan to South India, Sri Lanka, China, Nepal, Myanmar and Thailand to far-east regions of Indonesia and Philippines. Being extensively used in many formulations, the species has importance in Traditional Healthcare Systems and practices including Ayurveda, Chinese, Tibetan systems, and other regional medicinal formulation. Due to its immense benefits, it has been mentioned in many ayurvedic texts. For the medicinal purpose, its root, bark and gum are used. Principle component found in plant is oroxylin. Its cold potency makes it useful in regulating Tri-dosha, treating fever, cough and cold, diarrhoea, rheumatism, female disorders (Dashmoolarishta preparation) and other diseases. The species holds valuable place in traditional societies also. The pods, dried fruits, and seeds have been collected for religious and socio-cultural ceremonies in the region. alone in India, the estimated annual consumption of raw material is 765mt-ton/year. Ecologically, the species is categorised as rare and the population occurs in scattered

manner. Hence, possible efforts are required to make dependent communities aware on unsustainable and destructive extraction leading to species extinction. Development of protocol is required for niche modelling, propagation methods, standardization of optimum age for bark extraction in judicious manner. There is a need to bring species under mass cultivation on arable lands, development of avenue plantations and to regulate rotational harvesting methods under *in-situ* conservation in the forests. Also, focused research should be done to study tree-crop interaction as a component in agroforestry modelling and to evaluate its potential role in forest ecosystem and agro-ecology.

ISESFEC/23/P-215

Anti-obesity effect of cinnamom extracts using zebrafish models

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Cinnamon species *(Cinnamomum)* belongs to Lauraceae family. It is used in folk medicine for its antiobesity, antidiabetic, antihyperlipidemic, antioxidant and hepatoprotective activities. Cinnamom bark from 5 different districts of Manipur was collected. Antioxidant activity of the hydroalcoholic extract of cinnamom was studied using DPPH and ABTS radical cation decolorization assay. For screening the potent anti-obesity effect, Oil Red O staining and Nile Red staining was carried out in 5dpf obese larvae fed with 0.1% egg yolk. Female adult zebrafish were assigned to three groups: (a) Normal fed group (b) overfeeding group and (c) extract treatment group. Oral gavaging of the extract at 250µg/g body weight/5µL/day was administered for 5 consecutive weeks. Each week, body weight (BW) and body mass index (BMI) were measured, and, at the end of the fifth week, euthanized zebrafish were processed for both microscopic evaluations and qPCR analyses. Blood glucose was measured and blood plasma was also collected at the end of the experiment for total cholesterol and triglyceride quantification. In overfeeding zebrafish, cinnamom extract significantly decreased both BW and BMI values while it had little effect in the NF group. Cinnamom extract modulated some obesity-related genes in both gut and brain. In overfeeding group, the blood glucose level was elevated while in the extract treatment group blood glucose level was drastically decreased in comparison to normal feeding group. Our findings suggest that daily consumption of cinnamom may be beneficial for the prevention and treatment of obesity.

ISESFEC/23/P-216

Bioautography guided isolation and characterization of major phytoconstituents from *Psoralea corylifolia linn.*

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Nature has been an excellent source of many of the therapeutically beneficial medicines and lot of drugs already proved to be 'superhit' commercially for various treatments. As the demand for the natural products is ever-increasing the need for quality natural products tends to be essential. Natural product research is incomplete without extraction and isolation of bioactive phytoconstituents and these steps are very crucial for achieving a high quality product. Also, bioactivity guided fractionation and isolation is the recent trend used to identify and isolate therapeutically active phytoconstituents. Bio-autography is a novel and effective method to identify bioactive fractions and isolate such phytocompounds from those fractions. *Psoralea corylifolia* have many bioactive phytoconstituents and amongst them bakuchiol and two major furanocoumarins are responsible for most of those activities exhibited by the plant

and its seeds. Our study is focused on isolation of three major phytoconstituent from *Psoralea* with the help of bioautography techniques. The fractions obtained in our study were investigated for antimicrobial and antioxidant potential through bio-autography studies. A novel and beneficial method was used to achieve a highly pure phytoconstituent. The three isolated phytoconstituents were characterized using different analytical instruments like HPLC, HPTLC, LC-MS, NMR and single crystal XRD. Furthermore, the isolated phytoconstituents were subjected to in-vitro cytotoxicity screening on three different cancer cell lines. (MCF-7, COLO 205 and HT-29). The bioautography techniques implemented in our study were helpful in isolating potent bioactives. Different analytical techniques used in our study resulted in obtaining highly pure phytoconstituents. The isolated phytoconstituents exhibited potent anti-cancer activities which was necessary as these phytoconstituents were used for further anticancer product development. The methods involved in our work will result in isolation of phytoconstituents of better quality and quantity and can be used for further drug product development.

ISESFEC/23/P-217

Antidiabetic activity and subacute toxicity study of *Schima wallichi* (DC.) Korth

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Schima wallichi (DC.) Korth leaves is a traditionally used antidiabetic plant available in Manipur. So, far no study has reported on the toxicological profile of the plant. The present study aimed to investigate the *in-vivo* toxicological profile and *in-vitro* antidiabetic of the methanolic extract of *Schima wallichi* (DC.) Korth leaves. Per-oral subacute toxicity study was performed in rats, three dose levels (200, 400 and 800 mg/kg b.w.) of the extract was administered for 28 days while the control group received gum acacia suspension. Bodyweight was measured weekly and biochemical parameters were estimated on 28th day using serum; blood-cell count was performed using whole blood. Pathological changes were also checked in highly perfused tissues. Further, *in-vitro* α-glucosidase activity was performed to evaluate the antidiabetic activity of the extract. There were no significant alterations found in the blood-cell count and biochemical parameters analysed in the treatment group when compared with the normal control. Extract treatment showed no alteration in cellular architecture of liver, kidney, pancreas, heart and brain as confirmed by histopathological study. *Schima wallichi* showed significant α-glucosidase inhibitory activity with IC_{50} value of 1.43±0.20µgmL^{-1}. Present study showed that methanolic extract of *Schima wallichi* leaves was safe systematically after sub-acute oral administration in rats and possesses significant α-glucosidase inhibitory activity.

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Stability indicating HPTLC method for estimation of *Vitex negundo* extract and its marketed formulation

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Stability study assesses how the quality of drug substance or drug product varies with the time. Herbal medicines tend to lose its medicinal properties after some time and that needs to be studied which provides proof on how the quality of herbal product varies with the time under influence of various factors and to establish a recommended storage condition and shelf life. The medicinal plant *Vitex negundo Linn.,* commonly referred to as Nirgundi, is rich in phytochemicals and is utilised for inflammatory, respiratory conditions, including asthma and also used in the treatment of malaria. The objective of the study was to develop stability

indicating HPTLC method for estimation of *Vitex negundo* extract and its marketed formulation. In the present study, dried *Vitex negundo Linn.* leaf powder has been extracted with methanol to obtain methanolic extract. The method was optimised for the dried methanolic extract using silica gel 60 F254 precoated TLC aluminium plates as stationary phase and Toluene: Ethyl acetate: Methanol: Formic acid (4.9:3.1:2:0.5 v/v/v/v) as mobile phase. Detection was carried out in the absorbance mode at 255 nm. According to ICH guidelines, the established method was validated, and the extract was put through forced degradation studies using oxidative, thermolytic, acid, alkali, oxidative, wet, and photolytic degradation. The developed method gave Rf value of 0.59 ± 0.02. In the calibration curve linear regression data, quercetin showed an excellent linear relationship over the concentration range of 200–1200 ng/band (R^2=0.9991). It was determined that the LOD and LOQ were 20 ng/band and 200 ng/band, respectively. The mean percent recovery of quercetin was obtained 95.71 ± 0.05 % for *Vitex negundo Linn.* extract. As a result, the present method was successfully used to estimate the presence of quercetin in the methanolic extract of *Vitex negundo* Linn.

ISESFEC/23/P-219

HPTLC method development for its stability studies and antioxidant activity for estimation of *Aegle marmelos* leaves extract

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Aegle marmelos Correa, commonly known as bael or bilva is a deciduous tree used in traditional medicine to treat various diseases in humans. There is little information available in the literature on antioxidant aspects such as activity and stability. As a result, the current study was conducted to investigate the stability and antioxidant activity of *Aegle marmelos* leaves extract. The objective of the study was to develop stability indicating HPTLC method and estimate antioxidant activity of *Aegle Marmelos* leaves extract. The method was optimized for the dried methanolic extract using silica gel 60 F_{254} precoated TLC aluminium plates as stationary phase and Toluene: Ethyl acetate: Methanol: Formic acid in the ratio 4.9: 3.1: 3: 1 (v/v/v/v) as mobile phase and detection at 257 nm. The developed method was validated and subjected to forced degradation studies using acid, alkali, oxidative, thermolytic, wet and photolytic degradation as per ICH guidelines. The optimized method gave Rf value of 0.249 ± 0.02 for standard rutin and 0.254 ± 0.02 for rutin in *Aegle Marmelos* extract. A good linear relationship was achieved for rutin in the linear regression data for the calibration curves over the concentration range of 200-1200 ng/band (R^2=0.9992). The LOD and LOQ were found to be 60 ng/band and 100 ng/band respectively. The percent content of Rutin was obtained 99.87 % for marketed tablet formulation. The developed method degrades in acid condition and is stable in alkali, oxidative, thermolytic, wet, and photolytic conditions. The antioxidant activity was determined by DPPH radical scavenging activity with Ascorbic acid as standard. The IC_{50} of Ascorbic acid (standard) was 24 µg/mL and *Aegle Marmelos* leaves extract was 55.12 µg/mL. The study results provide evidence of stability indicating HPTLC method and potential antioxidant activity of *Aegle Marmelos* leaves extract.

ISESFEC/23/P-220

Tissues specific metabolomics study of *Trillium govanianum* Wall. ex D. Don

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Trillium govanianum is a perennial herb (belongs to Melanthiaceae/Trilliacea family) commonly known as “Nag Chhatri”. It is distributed in Western Himalayas (Afghanistan to

China) including Pakistan, India, and Nepal. Traditionally in folk medicines, rhizomes of this species are used to treat dysentery, inflammation, cancer, boils, menstrual, and sexual disorders. Traditionally only rhizomes of this plant are consumed, but other parts are neglected. The current study was focused to assess the similarities and discrimination in *Trillium govanianum* tissues based on metabolomics approaches. Total phenolics, flavonoids, and total saponins were determined by using spectrophotometric methods. Polyphenolics determination and antioxidant activity were determined using UPLC-PDA and DPPH/ABTS assay, respectively, in all the tissues. Further, multivariate statistical analysis of quantified parameters was performed to discriminate the different tissues. The results showed variability in total phenolics and flavonoids content in all the parts. Stems, leaves, and fruits) were enriched with total phenolics, while buds, stems, and leaves were enriched with total flavonoids content. Total saponins content were also found significant in the leaves, fruits, and stems. Further, a targeted polyphenolic (gallic acid, procatechuic acid, vanillic acid, epicatechin, p-coumaric acid, ferulic acid, rutin, luteolin) estimation was performed using UPLC-PDA and quantified in the various tissues of the plant. Stems and leaves were found inhibitors of DPPH and ABTS free radicals, which indicates that this plant have great potential to scavenge free radicals also. PCA and HCA showed the clear discrimination among the different tissues. *Trillium govanianum* is widely used as a traditional medicine, have diverse chemical constituents with biological activities. But, due to the limited knowledge of other parts only rhizomes of this plant are used, which cause excessive uprooting and bring this plant at endangered condition. Since, other parts also showed the presence of valuable metabolites that can be used as alternative for the medicinal purpose, which will also play significant role for the conservation of the plant.

ISESFEC/23/P-221

Protective effect of betulinic acid on streptozotocin induced memory dysfunction in adult zebrafish

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Streptozotocin (STZ) causes learning and memory impairment in adult zebrafish by causing the disturbance in glucose and energy metabolism of the brain. Betulinic acid has been demonstrated to improve cognitive functions due to its antioxidant property. In this study, adult zebrafish (approx 3 months old, weight range from 470–530 mg) were subjected to the STZ administration (300 mg/kg; i.p) followed by drug treatment with BA (0.25 and 0.5 mg/mL) before 24 h of STZ administration followed by blood glucose level measurement, behavioral parameters (light and dark test and T-maze test) and biochemical parameters (protein estimation, LPO and AChEs activity). Exposure to STZ in adult zebrafish showed significant alterations in behavioural and biochemical analysis. In the light-dark test STZ treated zebrafish shown their preference in dark compartment as compared to normal group and in T-maze test STZ treated zebrafish has shown more time spent in the unfavorable zone with an increase in total latency (TL) as compared to the normal group. However, drug administration with BA (0.25 and 0.5 mg/mL) significantly improved the memory deficits in both light and dark test and T-maze test as compared to the STZ treated group which indicated improved memory function with a significant decrease in oxidative stress level (decrease LPO) and AChEs activity. BA markedly improved memory functions in adult zebrafish due to its anti-oxidant potential.

ISESFEC/23/P-222

Fabrication of probiotic-loaded solid lipid nanoparticles and in vitro survival in gastrointestinal conditions

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In the present study, Probiotics (*Lactobacillus plantarum*) loaded-solid lipid nanoparticles were prepared and characterized. As probiotics have demonstrated their high potential to treat various diseases including neurodegenerative disorders, cancers, cardiovascular diseases, and inflammatory diseases. Probiotics are also effective in maintaining a balanced gut microbiota ecosystem. SLNs were prepared by using solvent emulsification-diffusion technique. The size and morphology of prepared probiotic-loaded SLNs were examined by transmission electron microscopy. Probiotics may lose their activity or viability in the harsh gastric conditions of the stomach or in the presence of bile salts as well as under thermal or oxidative stress during their preparation and storage. Therefore, stable formulations of probiotics are required to overcome the various physicochemical, biopharmaceutical, and biological barriers and to maximize their therapeutic effectiveness and clinical applicability. In vitro experiments were conducted with the objective of investigating the survival of the bacterial cells in gastro-intestinal conditions. Encapsulation of the cells protect the cell numbers (colony forming unit) when compared to free bacteria. However, the number of probiotic cells decreased in gastrointestinal acidic condition in contrast to free cells. Overall encapsulation of *Lactobacillus plantarum* in SLN's plays an important role in enhancing viability and stability which consequently enhance the survival of bacteria against gastrointestinal environmental conditions.

ISESFEC/23/P-223

Effect of PPAR alpha modulator ciprofibrate in aluminum chloride induced model of Alzheimer's in rat

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Alzheimer's disease (AD) is one of the major health problems nowadays which is featured by some neurological behavioral symptoms like- memory loss, confusion, and some pathological markers such as oxidative stress, neuro inflammation, accumulation of β-amyloid plaque. Ciprofibrate is a peroxisome proliferator activated receptors (PPAR) alpha modulator, come under the category of fibrates in antihyperlipidemic drugs. Some fibrate has shown the ameliorating effects against AD like symptoms. Therefore, this study was aimed to evaluate the beneficial effects of ciprofibrate against $AlCl_3$ induced AD model of rat. As experimental protocol rats were administered with $AlCl_3$ at the dose of 100 mg/kg of body weight to induce AD like pathological symptoms in negatively controlled group for 28 days. Donepezil was used as standard drug at the dose of 3 mg/kg along with $AlCl_3$ in positively controlled group. Two test groups were received ciprofibrate at the dose of 2 mg/kg and 4 mg/kg with $AlCl_3$ respectively. Morris water maze (MWM) test and elevated plus maze (EPM) test was used for behavioral investigation. To investigate the biochemical alteration, Anti acetylcholinesterase activity and brain total protein level was assessed. Decline in escape latency time (ELT) in MWM and transfer latency time (TLT) in EPM demonstrated improvement of amnesic symptoms of AD. Further ciprofibrate also decreased the activity of acetylcholinesterase and increased the protein level in brain homogenate. All these results suggested that ciprofibrate improved cognitive functions against $AlCl_3$ induced AD model.

ISESFEC/23/P-224

Phytosociological study of the ethnomedicinally significant wetland plants from Thanga area, Manipur, NE India

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The wetlands of Manipur are the home to a great diversity of wild plants, animals and microorganisms. However, they have little attention and are at the risk of extinction. Therefore, conservation of wetlands is the need of the hour to increase the population of ethnomedicinal wetland plants. The present work aimed to study the phytosociological status of the ethnomedicinally significant wetland plants. 10 different study sites were visited and data were collected using quadrat sampling method of 1 square meter quadrat and 10 quadrats were taken from each site. The phytosociological status of the wetland plants was studied based on the Importance Value Index (IVI). A total of 57 wetland plants under 49 genera and 28 families having significant medicinal properties are recorded from Thanga Area. The collected plants were classified into four groups based on IVI as rare (1-2), not so common (2-5), common (5-10) and very common (10-17). The rare group is represented by 7 species, not so common by 31 species, common by 14 species and very common by 5 species. The highest value of IVI is found in *Zizania latifolia* (17.48) followed by *Cynodon dactylon* (16.01) and *Alternanthera philoxeroides* (10.77) and lowest IVI is found in *Exallaga auricularia* (1.0) followed by *Acorus calamus* (1.52) and *Alpinia nigra* (1.67). Due to various anthropogenic activities the population of these plants is declining gradually. As a result, suitable conservation strategies should be taken to increase the population of native wetland plants in their natural habitats.

ISESFEC/23/P-225

Insight into legumes and associated rhizobia for enhanced crop production and soil fertility

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Leguminous plants represent one of the largest families of crops with numerous unknown and unexplored wild legumes. Both humans and animals consume legume crops in abundance and are considered important food crops with ample nutrients in them. Our research emphasized the isolation of rhizobium from explored as well as unexplored wild legumes. Therefore, to improve our knowledge and factors contributing to their overall growth with a special focus on the plant-rhizobia relationship and its interaction paving the way to increase crop production and manage disease and crop loss. Nitrogen is one of the most critically essential components in crop production and though it is present in the atmosphere sufficiently, it is in a form that plants cannot use. Legumes associated with soil bacteria, rhizobia, can convert nitrogen gas from the air into a readily available form that can be used by the plant benefiting both the plant and the farmer by supplying nitrogen to the crops. Present research highlights the isolation of rhizobium from nodulating stems and roots of indigenous legumes. The isolated rhizobial bacteria is studied for potential biochemical and enzymatic assays like protease, cellulose, siderophore, phosphate solubilization, ammonia production and IAA to check for the presence of growth hormone. So far, 250 rhizobial bacteria have been isolated and molecular techniques for the identification of the species is in progress. Our findings may have both economic as well as societal impacts in combating food production and restoring soil fertility.

SESFEC/23/P-226

New reports on the ethnomedicinal use of *Actinostemma tenerum* and *Hydrocharis dubia*

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The wetlands in Manipur are part of the Himalayan and Indo-Burma Biodiversity Hotspot. They are the habitat for a diverse range of natural plants, animals, and microbes. Therefore, it is important to document and understand the composition of the plant wealth of the wetlands along with their uses and conservation of wetlands. The main objective of the study is to investigate the ethnomedicinal uses of wetland plants. Ethnobotanical field surveys were conducted to the study site and proper data was collected using Participatory Rural Apraisal (PRA) and interview questionnaire methods. The collected specimens were identified using various literature and by critical examinations of the herbarium specimens of Department of Botany, Dhanamanjuri University. Herbarium specimens for the collected plants were prepared using standard methods. The use of *Actinostemma tenerum* in skin diseases, allergies and fever and *Hydrocharis dubia* in treating intestinal and bowel problems have been reported for the first time from the local healers. The precious wetland plants are becoming endangered day by day mainly due to the alien species invasion and the various anthropogenic activities of the lakeshore dwellers. The study highlights the need of protection of their habitats and adoption of suitable measures for long term management of wetland areas.

ISESFEC/23/P-227

Exploring the unexplored endophytes from cereal crops and its biotechnological applications

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Endophytic microorganisms with special reference to the agricultural sector are known to enhance the immune and protect plant host from invaders, helps uptake nutrient, withstand stress, promote plant growth and increase yield. The present work aims to explore the endophytes associated with healthy local cereal crops *viz.* maize, white and black rice varieties for agricultural applications through culture-dependent methods and evaluate the beneficial traits that can revolutionize agriculture with a promising bio-agent to rule out health hazard chemicals from the food chain. The study on a culturable approach for endophyte isolation associated with black rice is undoubtedly the first as no such exploration is encountered or reported. The most common isolates from the samples were *Fusarium* sp., *Penicillium* sp., *Bacillus* sp., *Pseudomonas* sp. and *Burkholderia* sp. The assays were performed for plant growth promotion, nitrogen utilization, defensive enzyme assays and biocontrol assays against notable phytopathogens of cereal crops. *Acremonium* sp. (ENF31), *Pseudomonas aeruginosa* (M183), *Paenibacillus polymyxa* (51oc), *Bacillus altitudinis* (Lc5), *Burkholderia vietnamensis* (N119s) and *Bacillus siamensis* (sdc15) were the potent endophytes. There was an observation of successful colonization established by SEM analysis of 2 weeks old maize and rice root samples. The pot experiment was conducted for nine treatments using the endophytes as single and as a consortium of all, including non-treated control and disease marker sample plants inoculated with just the pathogens. The T1, T2 and T7 treatments was effective with less disease incidence with notable flourishing growth compared to control plant. The whole genome analysis study of Lc5 and M183 reveals putative genes of interest relevant to the research objectives and hence the reason behind its beneficial properties. Therefore, selected endophytes have the potential for application in sustainable agricultural practices against the use of anti-ecological chemicals.

ISESFEC/23/P-228

Therapeutic potential of aquatic macrophytes used as traditional salad food (*Singju*) in the freshwater ecosystems of Canchipur, Manipur (India)

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'*Singju*', the traditional salad food of the Manipuris, is often eaten as a side dish in day/night meal or afternoon snack. This tradition of eating *singju* has been passed down from generation to generation and is still relished with great delight by the local people. *Singju* is prepared by roasted red dried chillies with roasted fermented fish (*ngari*), salt and finely chopped raw plant parts. It is considered that more the varieties of the plants, the better will be the preparation. It is regarded as an appetizer and believed that the consumption of traditional salad food is not just for its taste but provides benefit for health and wellbeing. The present study was conducted at Canchipur to identify and document the indigenous wild edible aquatic plants being used by the local community as traditional salad (*singju*) as well as their therapeutic potential in the management and cure of various health conditions. The present research was carried out through extensive field survey, personal interviews, and careful documentation of wild edible aquatic plants in the study area. In the present study, 16 edible plant species under 14 genera belonging to 12 families were recorded. These plants were identified and listed with their botanical names, vernacular names, family and the plant parts used both in salad and therapeutic purposes. Some of the plants recorded were *Sagittaria trifolia, Centella ariatica, Oenanthe javanica, Alocasia indica, Ipomoea aquatica, Euryale ferox, Trapa natans,* etc. Most of the collected plants are used for special remedial purposes in the treatment of certain types of ailments and diseases like cough, fever, ulcer, diarrhoea, sore throat, insect bites, snake bites, skin diseases, diabetes, hypertension, eye problems, etc. The present work will be of immense help to future researchers in evaluating the therapeutic potential of these wild edible aquatic macrophytes by applying in the field of medicine.

ISESFEC/23/P-229

Physiochemical and phytochemical screening of extracts of *Solanum viarum* and *Thevetia peruviana* used for diabetes by tribal people of Tripura, India

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Natural plants may be favored to treat diabetes because of minimal effort, lesser reactions and longer time span of usability. The North-eastern tribes also possess an enormous traditional knowledge of herbal drugs. The tribal edible plant sources used to treat diabetes are identified in Tripura, India and among them two were chosen for physicochemical and phytochemical screening, which will be subjected for further course of studies in future. Whole fruits of *Solanum viarum* (Sv) and bark of *Thevetia peruviana* (Tp) were collected and duly identified by Department of Botany, Tripura University and then washed, air dried, powdered and then sieved through 22 meshes. Powders were extracted separately by using Soxhlet apparatus with methanol, ethanol and water. The physiochemcial properties like yield, color, P^H, density, specific gravity of the extracts were evaluated. Qualitative evaluation for alkaloids, carbohydrates, glycosides, protein, amino acids, flavonoids, and steroids were carried out by following the standard methods. The reagents were used of analytical grade. Colour of the extracts were recorded as light to dark brown for Sv and dark brown to black for Tp with % of yield 38 (methanol: mSv), 21(ethanol: eSv), 40 (water: wSv) and 22 (methanol: mTp), 18 (ethanol: eTp), 20(water: wTp). The P^H and Specific gravity were recorded as 6.1 & 0.771 for mSv, 6.4 & 0.778 for eSv, 6.6 & 0.712 for wSv, 6.6 & 0.770

for mTp, 6.5 & 0.745 for eTp, 6.4 & 0.763 for wTp. Chemical constituents were present - alkaloids in mSv, eSv; carbohydrates in mSv, eTp; Protein & amino acids in mSv, mTp; Glycosides in mTp, eTp; Saponin & Steroids in mSv, eSv, mTp, eTp. Among the extracts, methanolic were showing presence of constituents prominently in case of both the plant Sv and Pt. Ethanolic extracts also showed the presence of few constituents, but water extracts were not able to show any prominent result. The P^H found in all the cases nearer to neutral. Methanolic extracts were showing decent yield. Presence of alkaloids, carbohydrates, protein, amino acids, saponin and steroids were recorded in *Solanum viarum* and carbohydrates, protein, amino acids, glycosides, saponin, steroids were found in *Thevetia peruvinia*.

ISESFEC/23/P-230

An insight into the ethnopharmacological significances of *Sonneratia caseolaris* by isolating major compounds and its hepatoprotective efficacy with *in silico* methods

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Despite the fact that mangroves are ecologically significant plants in marine regions, many of their parts are consumed in folk medicine and are claimed to be beneficial in treating a variety of human ailments. The intricacies of how these marine habitats were traditionally used can offer excellent natural product leads and crucial knowledge for upcoming therapeutic research initiatives. *Sonneratia caseolaris,* derived from the family Lythraceae, often referred to as Apple Kandal/ Chakkara Kandal (Mangrove apple), is a plant that grows mostly in estuaries; and in folk medicine, it is used as an astringent and antiseptic, sprain poultices, in treating piles, as skincare products, and in arresting haemorrhage. Present research work was aimed towards the extraction and isolation of compounds from *S. caseolaris* leaves; and the isolated compounds were characterised by recording its Nuclear Magnetic Resonance Spectra (1D NMR, 2D NMR) together with Mass Spectra under ESI/HRMS and IR Spectra. The molecular level hepatoprotective activity of major compounds isolated was virtually screened with the docking process using Autodock Vina and Autodock 4.2 against the crystal structures of both HGF (PDB ID: 1R0P) and PDGFRA (PDB ID: 5GRN). The major compounds were characterized as β-sitosterol (1), β-sitosterol β-D-glucoside (2), stigmasterol (3), daucosterol (4), lupeol (5), oleanolic acid (6), ursolic acid (7), and gallic acid (8). Our docking analysis revealed that every drug like compound has favourable interactions with key hinge area residues, which is a unique characteristic of kinase domain inhibitors. These mangroves have numerous advantages that have yet to be fully recognised. This endangered species' chemo-profiling can be used to demonstrate their therapeutic advantages and protection of mangrove forests has significant global advantages for both human and the ecosystems they support.

ISESFEC/23/P-231

Amalgamation of bioprospective and combinatorial drug chemistry to develop novel 'isoniazid-phytochemical' hybrid drugs against *mycobacterium tuberculosis*

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Mycobacterium tuberculosis (Mtb) causes tuberculosis (TB) disease, a leading infectious killer globally. WHO-recommended first-line drugs (isoniazid, rifampicin, and pyrazinamide) and multi-regimen therapy (DOTS and DOTS-plus) are even ineffective, and long-term anti-

TB drug therapy also produces several side effects. Thus, the development of potentially less toxic anti-TB medications is urgently required. To fulfil the drug unavailability and counter emerging drug-resistant Mtb strains, we have designed novel "isoniazid-phytochemical hybrids" (IPH1–IPH20) through medicinal chemistry protocols. The potency, drugg-ability, and toxicity profiles were evaluated using various *in silico*, *in vitro*, and *in vivo* methods. The potency and drugg-ability of designed hybrids were validated through molecular docking-simulation (inhA and katG mutant enzymes) with various bioinformatics tools before synthesis and spectral characterizations. Further, the anti-TB activity against clinically isolated INH-resistant Mtb strains (inhA and katG mutants) was monitored using the resazurin microtiter assay (REMA) and toxicity profiles *in vitro* (HCT-116, A549) and *in vivo* (*Caenorhabditis elegans* and zebrafish) models. Hybrids exhibit greater binding affinity and stability against mutant inhA and katG enzymes and produce higher drug-ability scores than native isoniazid. Hybrid drugs were effective within the MIC range of 10–30 µg/mL, whereas the native isoniazid was > 50 µg/mL. Further, hybrids are safer up to 50 µg/mL, as > 94% cell viability with no behavioural changes was observed in the toxicity study. The results indicated that the IPH5, IPH7, and IPH18 could be used in place of the isoniazid. Overall, the concept of amalgamating bioprospective and combinatorial drug chemistry may consider novel methods to reactivate existing clinically inactive drugs and a way to utilize a higher number of phytochemicals in mainstream medicine.

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Tolypothrix column fraction exhibits anti-cancer efficacy against human cervical cancer cells due to G0/G1 cell cycle arrest and caspase-3-dependent cell death

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Studies on freshwater cyanobacteria have shown some therapeutic potential for cancer cells. However, the potential of freshwater cyanobacteria from North-eastern India to inhibit the growth of human cervical cancer cells has not been investigated. Therefore, the purpose of this study was to examine the ability of *Tolypothrix* extract to inhibit the growth of cervical cancer cells. Bioassay-guided column fractionation was used to separate the crude extract of *Tolypothrix* sp. Cell viability was assessed using the MTT and LDH test. Cell cycle analysis and apoptosis detection were carried out using flow cytometry and annexin V/Propidium iodide (PI) labelling, respectively. Cell migration investigation involved the use of a wound healing experiment. Protein expression was examined by Western blot analysis. Cell cytotoxicity was observed in the Tolypothrix Dichloromethane: Methanol (2:1) extract with an IC_{50} of 42.46 g ml-1; however, this cytotoxicity was found to be more prominent in the column fraction at 22.65 g ml-1. The results of the Western blot demonstrated the significant effects of PARP cleavage, caspase 3 activation, and Bcl-2 inhibition w.r.t time and concentration. Nevertheless, annexin V/PI staining demonstrated that the enriched column fraction led to cell death in Hela cancer cells. Cell cycle studies revealed that it resulted in an increase in the proportion of Hela cells in the G0/G1 phase, causing G0/G1 cell cycle arrest. Additionally, a wound healing assay was carried out, and the results revealed that it inhibited the migration of Hela cancer cells, demonstrating its anti-metastatic potential. The human cervical cancer cells exhibit strong growth inhibitory effects from the enriched column fraction of *Tolypothrix*, which may be helpful in treating human cervical cancer.

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Effect of *musa balbisiana* seed on brain and liver redox imbalance and intestinal barrier dysfunction induced by D-galactose in rats

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D-galactose-induced aging is a well-established model for aging studies. Prolonged D-galactose administration impaired memory and learning, antioxidant enzyme status, increased intestinal permeability, and altered the gut microbiome, thereby mimicking normal aging. Antioxidant-rich dietary intervention plays a vital role in preventing and treating age-related dysfunctions. *Musa balbisiana* (MB) is a wild banana species with potent antioxidant, anti-inflammatory, and anti-diabetic properties. The aim of the study is to evaluate the effect of *Musa balbisiana* seed on brain and liver redox imbalance and intestinal barrier dysfunction induced by D-galactose in rats. Male Wistar rats (3-month-old) were subcutaneously injected with D-galactose (200 mg/kg body weight) for eight weeks with simultaneous feeding of the bioactive fraction of MB (EAF 25 and 50 mg/kg) from the first day of D-galactose injection. At the end of the experiment, the animals were fasting overnight and sacrificed. The results suggested that consuming EAF (25 and 50 mg/kg) increased body weight, restored the organ indices affected by aging, and decreased fasting blood glucose. In addition, EAF increased the reduced glutathione, superoxide dismutase, catalase, and glyoxalase I enzyme activity and decreased malondialdehyde, protein carbonyl, and advanced glycation end product formation in the brain and liver. EAF also decreased the intestinal epithelial barrier permeability by increasing the mRNA expression of tight junction molecules. The bioactive fraction of MB ameliorated oxidative stress and glycation in the brain and liver and by enhancing antioxidant defense and intestinal epithelial barrier functions.

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Ethnomedicine used for hemorrhages among Williche people

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This ethnobotanical study was undertaken in Pucomo, Los Lagos Region, Southern Chile, to get a data collection of plants used for medicinal purposes by Williche people during field trips from February to December 2017. Medicinal plants were gathered using semi-structured interviews, participant observation and in-depth informal conversations with seven informants (five were local healers). Thirteen medicinal plants in 13 genera belonging to 13 families were registered. They were listed with scientific name, vernacular name, plant parts used, method of preparation, and traditional use. All families were represented with one specimen and some of the most mentioned ones were Elaeocarpaceae (1), Proteaceae (1), Bromeliaceae (1), Equisetaceae (1), Parmeliaceae (1), and Hymenophyllaceae (1). The documented plants were used to treat internal and external hemorrhages, but also lung and stomach disorders, cold, asthma, and kidney problems. Herbs (7 species) and trees (2) were the most used life forms followed by climbing plants (2). The most frequently used plant parts were leaves (33.3 %) followed by whole plant (22.2 %), twigs (16,6%), flowers and barks (11.1 % each). The plants used were 9 native, 2 endemic, and 2 introduced. The most frequently used preparation methods were infusion (72.2 %), followed by poultice application (16.6 %) and decoctions (11.1 %). Most of these plants belong to high humid microclimate areas with abundant water fluxes, a wide range of altitude (0-2000 m.) and can resist low temperatures (below 0° C). As a conclusion, traditional folk medicine and plant indigenous knowledge from Williche people was recorded to understand treatments for internal and external hemorrhages. More ethnobotanical studies on healing practices are required for this

biogeographic region that has a long tradition of using wild medicinal species that people from rural areas of Los Lagos Region still continue to depend on for their own healthcare.

SESFEC/23/P-235

Ali ibn Sahl Rabban al-Tabari " A graduated of the Indian School of Medicine"

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Abu al-Hasan Ali ibn Sahl Rabban al-Tabari (c. 838 – c. 870 CE; also given as 810–855or 808–864also 783–858), was a Persian scholar, physician, and psychologist, who produced one of the first encyclopedias of medicine titled Firdous al-Hikmah ("Paradise of wisdom"). It is divided into 7 sections and 30 parts, with 360 chapters in total. In the introduction of his book, he mentions that in addition to the books of Hippocrates and Galen, he has translated and used the books of Indian physicians then he knows the Indian language. He uses a lot of Indian simple drugs in the medicine section. According to his report about the head of Jundi Shapur Hospital in his book and the examination of historical books, it seems that the head of the hospital during his time was an Indian named Menhm Dehshtak and the method of medicine could be Indian in this part of the time. It seems that the examination of such works, which are taken from the Indian medical school, sheds light on the hidden corners of the history of medicine and pharmaceuticals of the two countries.

ISESFEC/23/P-236

Phytoconstituents and antimicrobial activity of *Gardenia resinifera* flower extract

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Gardenia resinifera Roth (Rubiaceae) is a large woody flowering shrub. *Gardenia* species are used in traditional medicine as a carminative, diaphoretic, antiseptic, expectorant, and *G. resinifera* for skin diseases. The present study aimed to identify chemical constituents and screen the antimicrobial potential of the flower extract of *G. resinifera*. The flowers of *G. resinifera* were extracted by hexane and analyzed by gas chromatography-flame ionization detector and gas chromatography-mass spectrometry. The extract was tested against Gram-positive, Gram-negative bacteria and fungus by broth dilution method. The flower extract found monoterpene hydrocarbons, oxygenated monoterpenes, sesquiterpene hydrocarbons, oxygenated sesquiterpenes, and long-chain hydrocarbons type constituents. *Bacillus cereus*, *Staphylococcus epidermidis,* and *Candida albicans* were found more susceptible to the extract with a MIC value of 250 µg/mL, followed by *Escherichia coli* and *Staphylococcus aureus* with MIC values of 550 and 600 µg/mL, respectively. The extract of *G. resinifera* showing antimicrobial activity against bacteria and fungi, validates the traditional use of the plant as an antiseptic.

ISESFEC/23/P-237

Unravelling the Mechanism of Protein-Protein Interactions in Selected Viral Diseases and Breast Cancer

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Nearly all cellular processes and biological functions depends on protein-protein interactions. Most of the proteins associate with other proteins to function, forming complexes that are essential to almost all physiological processes. Despite the biological importance of protein-protein interaction (PPI), yet figuring out their structures and interaction mechanisms is still a difficult task. Protein-protein interaction are disturbed due to genetic mutation, viral or bacterial infections, environmental effect etc., thus causes various diseases. Even though there is an increasing knowledge of PPI through network pharmacology, still there is a

lacuna in understanding the PPI at atomistic detail. Here, I have highlight some of the selected virus-virus PPI complexes of SARS-CoV-2/SARS-Co/MERS-CoV responsible for viral replication-transcription processes, and host-virus PPI complex of henipavirus, responsible for viral entry into the host and studied the effect of breast cancer causing point mutations of BRCA1-BARD1 dimer. Molecular dynamic simulation followed by binding free energy calculations were carried out on all the selected PPI complexes to understand the molecular mechanism of interaction, effect of specific mutations on the structure and function and by utilizing in silico tools identified interface hotspot residues which are considered to be important for complexation process. Identifying interface hotspot through experimental alanine scanning mutagenesis (ASM) is expensive and time-consuming, hence, with the aid of computational methods, the researchers can perform ASM only in those amino acid locations identified as hotspot by computational methods. Additionally understanding the PPI interface in atomistic detail along with hotspot residues in the dynamic motion, will be helpful in designing potential modulators of PPI.

ISESFEC/23/P-238

Bioeconomy from banana biowaste

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Banana (*Musa* spp.) belonged to the family Musaceae of order Zingeberales are giant herbaceous monocotyledonous plants. Manipur located at the biodiversity hotspot harbours a wide range of banana varities (both cultivated and wild). After the harvest of banana fruits or male bud, banana pseudostems are cut down and thrown as biowaste making it unmanageable to dispose areas. This work focus on conversion of banana pseudostem into quality fibers for fabrics by comparing different genome groups of banana found and identifying the best banana cultivars for fibre extraction.Ten (10) banana cultivars of different genotypes were used in the present study namely- Changbi (BB), Meitei hei (ABB), Jahaji (AAA), Champa colla (AAB), korbot (AA), Teralaphoi (ABB), Heijao angouba (ABB), Amrit sagar(AAA),Hangou (ABB),Graine (AAA). The fibers were extracted with different concentrations of sodium hydroxide at different time intervals. Fibers obtained were test for their diameter, tensile strength, breaking loads. The mechanical test revealed that Changbi (BB) has better tensile strength compares to others cultivars and can be used for production of quality fibers for fabrics.The present findings will be great used to textile industry and future research programs.

ISESFEC/23/P-239

Anti-asthma activity and phytoconstituents analysis of *Quisqualis indica* extracts in mice

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Asthma is a chronic inflammatory disorder of the airways, involving the various cells and cellular elements precisely eosinophils, mast cells, neutrophils, T lymphocytes, epithelial cells, and macrophages. Worldwide, about 300 million peoples affected by asthma and is expected that 100 million peoples may get affected, in 2025. The objective was to evaluate the Quisqualis indica leaf extracts for anti-asthmatic activity and analyze the phytoconstituents of bioactive extract by HR-LCMS/MS. The petroleum ether (60-80^{o}C) and methanolic extract of the *Quisqualis indica* leaves were analyzed for the anti-asthmatic activity by mast cell degranulation and Milk induced eosinophilia and leukocytosis in mice. It was found that the *Quisqualis indica* leaf extracts exhibited the protection against the degranulation of mast cells and reduction in difference count of leucocytes and eosinophile. LPE and LME extracts have shown 33 % and 63% of mast cell protection. LME have shown

the most significant mast cell stabilizing action comparable with the standard drug. The LME has shown difference in eosinophil count and reduction in leukocyte count most comparable with the standard drug Dexamethasone. The methanolic extract was analyzed for phytochemicals by HRLCMS/MS method which shown the presence of various phyto-compounds such as Apigenin7-glucoside, Gallic acid, Kurigalin, Punicacortein B, Quercetin, Quercitrin, Kaempferol, Luteolin, etc. *Quisqualis indica* shown significant decrease in eosinophil and leukocyte count which signifies that *Quisqualis indica* may inhibit clustering of eosinophil cell around nerves or inhibit eosinophil cell recruitment and inhibition of interleukins such as IL4, IL-5 and IL-13 which play important role in eosinophil cell recruitment. Decrease in leucocytes and eosinophile is mediated by adaptogenic and type I hypersensitivity hence *Quisqualis indica* may be useful in allergic condition such as asthma.

ISESFEC/23/P-240

Standardization and quality control evaluation of herbal drugs for assessments of Indian traditional herbal medicines

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Herbal medicine has a long-standing history of preventing and curing various ailments as natural remedies since ancient times. With the growing market and exceptional demands for herbal drugs worldwide, the contamination and adulteration of herbal drugs have also become a major concern. Adulteration and substitution affect the efficacy of herbal medicines and can also cause severe threats to human life. The authentication of raw drugs is determined using standard quality control parameters, viz., macroscopic, microscopic and chemical profiling, etc., mentioned in standard Pharmacopoeias. The current compendia have described the global representative methods for general standardization of herbal drugs or botanicals and mainly by the pharmacopoeias, including the Chinese Pharmacopoeia (Ch.P), the European Pharmacopoeia (Ph. Eur.), the Japanese Pharmacopoeia (JP), the United States Pharmacopeia (USP), Ayurvedic Pharmacopoeia of India (API) and WHO guidelines. This study will discuss the traditional and advanced standardization and quality control parameters of Indian herbal medicines per global standards. The present study will help to identify and measure quality-related attributes for detecting correct botanical species in herbal drugs for commercial purposes.

ISESFEC/23/P-241

Phytochemistry and therapeutic potential of *Piper peepuloides* roxb

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Piper peepuloides Roxb. (Piperaceae) is a dioecious plant, commonly known as Himalayan pepper. In a developing country like India, people from rural areas, mostly depend on the traditional healing practices involving medicinal plants as their first defense to treat diseases which come up with benefits, fewer side effects, and more economic. Particularly, the plant *P. peepuloides* have been described as a true potential plant in terms of ethnomedicine, inbuilt with many important phytochemical compounds and pharmacological activities with great potential for therapeutic purposes and agricultural practices. Present study is conducted to evaluate the antioxidant and anti-inflamatory activities using different methods. Samples were collected from Arunachal Pradesh and did all the parameters and found good antioxidant activity in 50 ug/ml concentration. Proximate, mineral, vitamins and phytochemical compositions of nine accessions of *P. peepuloides* fruits were investigated in order to assess their nutritional value. This study highlights the antioxidant and anti-

inflammation potential of *P. peepuloides*. The result obtained in this study indicates that the leaves and fruits of *P peepuloides* contain nutrients and mineral elements that determine their nutritional value. The presence of bioactive compounds may justify their medicinal value and confirm its nutritive importance for body health. The role of phytocompounds present in the bioactive extract is needed to be explored further for herbal drug research.

ISESFEC/23/P-242

Discovery of two new furostane type steroidal saponins from rhizomes of *Trillium govanianum* and their potential to treat lung and colon cancer

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Two new steroidal saponins, trilliumosides A (1) and B (2), were isolated by bio-activity-guided phytochemical investigation from 20% aqueous-methanol extract of *Trillium govanianum* (rhizomes), together with eight previously known compounds protodioscin (3) govanoside-B (4), borassoside E (5), 20-hydroxyecdysone (6), 5-20-hydroxyecdysone (7), govanic acid (8), diosgenin (9) and pennogenin (10). The structures of new compounds 1 & 2 were elucidated based on spectroscopic methods (1D & 2D NMR) data and HR-ESI-MS. The isolated compounds 1-10 were evaluated for *in-vitro* cytotoxicity against a panel of different human cancer cell lines. Both new compounds 1 & 2 showed significant cytotoxic effects with IC_{50} values of 1.83 and 1.79 µM on A-549 (lung) and IC_{50} of 1.85 µM against SW-620 (Colon) cell lines, among known compounds protodioscin (3), borassoside E (5) and diosgenin (9) also showed good cytotoxic effect with IC_{5o} values ranging from 5-10 µM. Furthermore, Compound 2 on detailed anticancer study was seen to inhibit the colony forming potential as well as in-vitro migration of A-549 cell line. Moreover, mechanistic study results of Compound 2 revealed nuclear morphological changes, increased generation of ROS, reduced MMP and induced apoptosis through upregulation of apoptotic proteins BAX and cleaved (active) Caspase-3 followed by down-regulation of anti-apoptotic protein BCL-2.

ISESFEC/23/P-243

The nutritional and anti-hyperglycaemic activity of the edible insect *Brachytrupes orientalis*

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Edible insects are gaining more popularity as alternative food sources due to their high nutritional value with environmental sustainability. Being one of the most culturally diverse regions of the globe, North East India is home to 200 fascinating tribes that are distinguished by their distinctive blending of food habits and sociocultural behaviour consuming more than 200 species of insects. Entomophagy (the eating of insects) and entomotherapy (the therapeutic use of insects) are mostly linked with this region in India. *Brachytrupes orientalis* (Gryllidae) is a common edible insect species commonly consumed by the different tribes of North East, India. The goal of this study is to investigate the nutritional aspects of *Brachytrupes orientalis* as well as the potentiality of hydro-alcoholic extracts on glucose utilisation and free radical scavenging activity. The nutritional composition, the protein, fat, ash and moisture content were determined by following the protocol as recommended by the Association of Official Analytical Chemists (1990). Further, to find out the free radical scavenging of the extract, we examined it against DPPH, hydroxyl, and superoxide radicals. Furthermore, to find out the molecular mechanism of anti-hyperglycaemic activity, Glucose utilization assay and Glucose 6 phosphate (G6P) concentration was analysed in the high glucose-treated C_2C_{12} cell line. It has been observed that hydro-alcoholic extracts of *B.*

orientalis dose-dependent increase in the inhibition of DPPH, hydroxyl and superoxide radical. Further, supplementation with hydro-alcoholic extracts significantly increased glucose utilization and increased the intercellular glucose-6-phosphate level in high glucose-treated C_2C_{12} myotubes.This study revealed the nutritional and therapeutic potential of *B. orientalis* for further study.

ISESFEC/23/P-244

Nutritional and antioxidant property of *Oecophylla smaragdina*: a traditional edible insect of N.E. India

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Oecophylla smaragdina is a widely consumed edible insect of North-East India mainly amongst the tribal communities in Assam. Ethnic communities have been traditionally using the insect (egg, larva and pupa) as food and therapeutics. The study aims to investigate the nutritional and antioxidant properties of the aqueous extract of Red Weaver ant pupae and larvae of the North-East region of India mainly Assam. The aim of the present study is to understand the science behind the traditional use of Red Weaver ant (*Oecophylla smaragdina*) mainly from the perspective of entomophagy and entomotherapeutics. The present study focuses on exploring the nutritional composition and antioxidant activity of the Weaver ant pupae and larvae (WPL). The nutritional composition of the WPL has been determined by analysing the minerals, protein, fat, ash, carbohydrate and moisture content by following the protocol as recommended by the Association of Official Analytical Chemists (1990). Further, to find out the antioxidant activity of the aqueous extract of WPL, we examined the DPPH, hydroxyl, and superoxide radicals scavenging activity along with antioxidant power.The findings of the study showed that *O. smaragdina* pupae and larvae are nutritionally rich with high protein (53.86±1.04) and mineral (Zn, K, Na, Mn, Cu, Mg, Ca) content. Further, the cell-free assays with aqueous extract of *Oecophylla smaragdina* showed potent free radical scavenging activity. Considering the high nutritional and antioxidant value of *O. smaragdina*, it has the potential for entrepreneurship development in food and nutraceuticals through processing and mass multiplication.

ISESFEC/23/P-245

Valorisation of bio-wastes generated from Indian silk industry for development of economically viable products

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The Indian sericulture industry which is estimated to generate revenue of 248.56 million USD in FY22 is a flourishing venture, especially in North-Eastern India. In addition to silk production, silkworm pupae and larvae are savoured as food and are known to have high nutrition value. Indian silk industry, however, produces more than 40000 tones (dry weight) of silkworm pupal waste annually. Management of this bio-waste is a huge challenge and calls for it's upscaling into products having good commercial value. Chitin, the major component of the pupal exoskeleton, with some chemical modifications, can have multiple applications in biomedical and food packaging industries. The major goal of this study is to extract, isolate and produce Chitosan (deacetylated chitin) from the exoskeleton of *Samia ricini* pupae and its characterization to investigate its potential applications. The chitin & chitosan from *Samia ricini* pupae were obtained through chemical extraction process. Purity of the chitosan produced was checked by Bligh-Dyer method for lipid, BCA for protein and ash content analysis for minerals. Elemental analysis was done to assess the deacetylation degree (DD) while the solid-state NMR and FT-IR reported the molecular structure. SEM

was performed to understand the surface morphology. Swelling properties, biodegradability, and Alamar Blue test for cytocompatibility were performed to investigate the biological properties. All tests were performed in triplicates and compared with commercially available chitosan. The removal efficiency of lipids, proteins and minerals were observed to be more than 95%. The DD% was calculated to be 92%. The SEM analysis showed that chitosan surface has fibrous and honeycomb-like structures, making them a promising biomaterial for tissue regeneration. Significant biodegradability and swelling properties and no cytotoxic effect were observed in the obtained chitosan. All the parameters were observed to be at par with commercial chitosan. The study revealed good potentiality of the *S. ricini* pupal chitosan for biomedical applications at an affordable cost and utilization of biowaste into value added products.

ISESFEC/23/P-246

Chemical and biological evaluation of herbal drug *Caesalpinia bonducella*

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Caesalpinia bonducella L. is a medicinal plant belonging to the family Caesalpiniaceae. It is a prickly shrub widely distributed all over the world especially in Indian tropical regions such as Kerala, Andaman and Nicobar Islands and Sri Lanka. There are claims that its leaves or seeds/ seed kernel possess antipyretic, antidiuretic, antibacterial, antiviral, antiestrogenic and antidiabetic activities Due to the above properties several preparations of the plant were used in folk medicine. The aqueous extract of *Caesalpinia bonducella* nut containing the seed and the shell, has been evaluated for qualitative analysis of secondary metabolites (tannis, flavonoids, alkaloids, saponins, coumarins, quinone and phenols), in-vitro anti - inflammatory, anti-diabetic assay, antioxidant, antimitotic and antimicrobial activity. The studies were carried out using HRBC membrane stabilization, inhibition of alpha amalyse enzyme, DPPH method, green gram growth inhibition, agar diffusion method respectively. Our results indicate the presence of Alkaloids, Flavanoids and Saponins. We report in our study the antidiabetic, anti-inflammatory, anti-oxidant, anti-microbial and antimitotic activity of *Caesalpinia bonducella.*

ISESFEC/23/P-247

Ayurvedic polyherbal formulation induces anti-anxiety activity in hippocampal neurons by effectuating SOD2 mediated protection against oxidative stress

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Anxiety is a common neuropsychiatric disorder which either occurs independently or in comorbid other neuropsychiatric diseases like depression and bipolar disorder. Currently available anxiolytic drugs have been known to cause several side effects. Hence, to nip the anxiety like symptoms in bud, it is the need of hour to switch to the natural products which could be safely consumed without causing any side-effects. In the present study, anxiolytic activity of an ayurvedic polyherbal formulation, *Shramahara Mahakasya* (SM) was assessed by establishing its neuroprotective potency in HT22 hippocampal cells and Sprague Dawley rats. Effect of SM on glutamate induced cell death, intracellular ROS accumulation, Ca^{2+} imbalance, MMP loss and expression levels of antioxidant enzyme SOD2, in HT-22 cells were analyzed. Further, effect of SM on caffeine induced anxiety like behavior in Sprague Dawley rats was explored. The overall study exhibited that SM attenuated the glutamate induced intracellular ROS accumulation, calcium ion imbalance and MMP loss in HT22 cells.

SM increased SOD2 expression in neuronal cells and reversed the caffeine induced anxiety-like behavior in Sprague Dawley rats. SM is a potential anxiolytic agent that exerts its activity by protecting neurons from oxidative stress.

ISESFEC/23/P-248

The nutritional and antioxidant potential of *Vespa affinis* L.: a traditional edible insect of north east India

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Edible insects are becoming a popular source of nutrition and pharmaceutical compounds day by day. North Eastern states record the highest percentage of entomophagy and entomotherapeutic practice among different states of India. *Vespa affinis* L. is an edible insect widely consumed by tribal communities of North East India. A very limited number of available reports encouraged to investigate the insects. The aim of this study is to analyse the nutritional content and antioxidant activity of *Vespa affinis* pupae. The nutritional composition of *Vespa affinis* pupae has been determined by analysing the protein, lipid, ash, carbohydrate and moisture content following the protocol as recommended by the Association of Official Analytical Chemists (1990). Further, the antioxidant potential of the aqueous extract of *Vespa affinis* was determined by analysing against DPPH, hydroxyl, superoxide radicals and the antioxidant enzymes. THP1 monocyte cells were used in cell culture study for investigating the antioxidant potential. The analysis of nutritional content showed the protein as (25.2±1.39) % of dry matter followed by carbohydrates and lipids. The aqueous extract of *V. affinis* showed free radical scavenging activity in a dose-dependent manner. Supplementation with extract increased the activity of antioxidant enzymes along with inhibition of the ROS production in H_2O_2 treated monocyte cell line.

ISESFEC/23/P-249

Role of monosaccharides present in Indian honey in stimulating hepatic glucose uptake in type 2 diabetes mellitus by regulating chrebp/glut4 axis

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Diabetes mellitus is one of the most prevalent as well as incurable diseases worldwide in spite of the increasing medical care. Honey is being used in several medicinal purposes including diabetes recently. But till now, since it is a mixture of various compounds, there is no particular studies which can tell us the actual mode of mechanism behind the anti-hyperglycemic activity of honey. In this piece of work, Indian lychee honey has been used to validate its anti-diabetic efficacy. LC-MS and HPLC were performed to establish bioactive polyphenol and sugar profile of lychee honey, respectively. Furthermore, in vitro enzymatic as well as cell-based assays were performed to study the glucose uptake efficacy of lychee honey in HepG2 cells challenged with palmitic acid to mimic insulin resistant condition. In vivo study in high fat diet (HFD) fed C57BL/6 mice was also performed to replicate and confirm the in vitro results. Sugar composition of Indian lychee honey were efficient to upregulate the expression as well as the nuclear translocation of ChREBP-β (carbohydrate response element binding protein-β) to bind to Glut4 promoter (its downstream target gene) and increase the expression of Glut4 in diabetic condition. We also showed that, by activating ChREBP/Glut4 pathway, honey sugars can actually increase hepatic glucose uptake activity by bypassing the insulin signalling pathway in insulin resistant condition. This study clearly depicts the beneficial role of honey sugars (particularly monosaccharides, 65-70% of dry weight) in regulating the blood glucose level in diabetic condition.

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Therapeutic potential of bamboo shoots: a systematic review

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Bamboo shoots are one of the most commonly consumed foods by the people all over the world. However, to our knowledge limited data on systematic review of the therapeutic potential of bamboo shoots is available. Our aim is to systematically present the reports of scientific findings done by other researchers about therapeutic and nutraceutical potentials of bamboo shoots in order to provide complete information to other researchers. Published Research articles on the therapeutic potentials of bamboo shoots were searched through PubMed and Google Scholar from 2010-2022 using related keywords. Out of the 20 Research articles collected, 2 were excluded due to non-fulfilment of selection criteria and 18 were selected for the study.From the study, it is indicated that the bamboo shoots have protective potential to prevent cancer, blood vessel injury, ageing, hypertension, diabetes, obesity, ulcer, cardiovascular diseases, inflammation and oxidative activity. Further investigation on scientific validation of bamboo shoots reveals the presence of phytochemicals, phytosterols, antioxidants such as phenols, flavonoids, vitamin C, E, flavones and glycosides. It has also been reported that ACE inhibitory peptide present in the bamboo shoot extract reduces systolic blood pressure and decreases hypertension. In addition, Flavonoids found in bamboo shoots have the capacity to lower blood triglycerides and cholesterol and also inhibit apoptosis by blocking the mitochondrial apoptotic pathway. Moreover, administration of bamboo shoots extract in STZ-induced diabetic mice increased insulin signaling by increasing phosphorylation of AMPK in HepG2 cells, glucose uptake and suppressed the expression of gluconeogenic genes. This review will provide an insight to the researchers of different fields for further in-depth research for future drug development and utilising bamboo shoots as healthy food for humans.

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Neutraceuticals potential of fermented foods: a systematic review

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Fermented foods represent an important segment of current foods, especially traditional or ethnic food and is one of the consumed food stuffs in different parts of the World. However, no systematic review and proper compilation of neutraceutical potential information of the fermented food has been Carried out. A search of literature has carried out in PubMed and Google Scholar using keywords related to the topic published during 2010-2022. Out of more than 35 research articles collected 5 papers are excluded due to non-fulfilment of inclusion criteria. The Study indicates that some of the consumed fermented foods of different parts of the world are natto, Chongkukjang, miso, kefir, tempeh goyang, Khameer, pole, seera, kombucha, sauerkraut, kimchi. Further it is reported that the presence of probiotic microbes, bioactive compounds, various nutrients composition like iron, zinc and copper, some minerals, vitamins A, D, E, B6, B12, antioxidants, phenolic substances, and metabolites like lactic acid, malic acid, fructose, citric acid, phosphoric acid which demonstrates strong immunity boosting potential in addition to that fermented foods contains highly species-specific of the microbes that contributes to the authenticity of the fermented foods and therapeutic health benefits such as diabetes, cardiovascular disease, blood pressure, atherosclerosis, hyperlipidaemia, obesity, gastrointestinal disorder, cancer and neurodegenerative disorders and highly praised by several authors. The present review will provide more insight to the other researchers of the various fields for future in-depth researches for future drug discovery and inclusion of fermented foods as a part of normal healthy diet for the management of diseases *per se*.

ISESFEC/23/P-252

PCR based identification of entomopathogenic fungi *Cordyceps spp.* found in Eastern Himalayan region of India

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Mushrooms have long been used as functional food as well as medicinal suppliments from time immemorial. North-East being rich in dense flora and fauna have been blessed with numerous macrofungi, *Cordyceps spp.* are one such group of entomopathogenic fungi which have been explored for its tremendous medicinal attributes(Anti-diabetic, anti-cancer, as an aphrodisiac etc). The high market value and demands leads to its counterfeits to be sold and use without proper identification. The present study aimed to identify *Cordyceps spp.* collected from Sikkim and Arunachal Pradesh, India, through PCR based approach and phylogenetic analysis. The genomic DNA was isolated from fungal stalk (fruiting body) and carried out with Qiagen Plant Genomic DNA purification kit (Qiagen, Germany) and genomic DNA from host insect (Larva) was carried out with Wizard SV Genomic purification kit (Promega, USA). The DNA samples were quantified on Qubit4 fluorometer (Thermo Fisher Scientific). The genomic DNA was visualized on 0.8% agarose gel electrophoresis. The molecular approach involved the amplification of internal transcribed spacer (ITS) region from the stroma and cytochrome oxidase subunit-I (COI) from host larva for phylogenetic studies. Subsequently, the DNA was used for sequencing in a AB13730XL, Applied Biosystem Sequencer following sanger sequencing method. The ITS and COI sequences were subjected to homology search by BLAST tool in the NCBI nucleotide blast portal (https://blast.ncbi.nlm.nih.gov/Blast.cgi?PAGE_TYPE =BlastSearch). The sequences were edited with Bioedit version 7.2.5 and subjected to multiple alignments using fast fourier transform (MAFFT) database. Model testing was performed using MegaX version 10.2.5, and the best model was utilized to construct the maximum likelihood tree. To confirm the results of the maximum likelihood tree, a Bayesian tree was also constructed using MrBayes 3.2.7. Subsequently, the study confirmed that the collected specimen from Sikkim is *Ophiocordyceps. sinensis* and sample collected from Arunachal Pradesh to be *Metacordyceps liangshanensis*.

ISESFEC/23/P-253

Osmoprotective microemulsion: new insights into the ocular drug delivery

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Optimum ophthalmic drug delivery required to design to enhance bioavailability by prolonging retention time. It is still challenging for pharmaceutical technologists, despite various scientific efforts. Delivery of drugs into eyes using conventional drug delivery systems, such as solutions, is a considerable challenge to the treatment of ocular diseases. Drug loss from the ocular surface by lachrymal fluid secretion, lachrymal fluid-eye barriers, and blood-ocular barriers are main obstacles. Microemulsions (MEs) are such colloid systems that present sizes between 5 and 200 nm with significant thermodynamic stability and low surface tension. In addition, MEs as topical ocular carriers can lead to great ocular drug adsorption due to their enhanced retention time. One of the current encouraging approach is the utilization of colloidal carriers with the characteristic submicron-nanometer size. Osmoprotective formulations is recently introduced which is tolerated *in-vitro* and *in-vivo*, protecting cells from hypertonic stress. Osmoprotective microemulsions stable and compatible with the ocular surface that could constitute a novel tool for treatment of ophthalmic diseases.

ISESFEC/23/P-254

Role of chrysin nanoformulation in cytotoxicity study of colon cancer

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The nano-formulation of chrysin is formulated, chacterized and evaluated for the cytotoxic effect. The formulation is prepared by anti-solvent precipitation technique. The characterization of the prepared nano-formulation is done for particle size, polydispersity index, zeta potential, entrapment efficiency, SEM and FT-IR analysis. The cytotoxicity study of the nano-formulation is carried out on HT29 cell lines. The developed nano-formulation of the Chrysin showed particle size <100nm, and all the other parameters like polydispersity, zeta potential and entraptment efficiency also showed good results. The increased cytotoxic effect on HT-29 cell line was shown by the chrysin nano-formulation. The study performed shows confirmative indication for utilization of Chrysin nano-formulation. The results can be used as the background to further analyze the effect of the formulation on experimental animals.

ISESFEC/23/P-255

Metabolomics study of *Ajuga parviflora* with anti-obesity and antidiabetic activity

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Ajuga parviflora (Benth.) has been used extensively to cure a wide range of illnesses, including fever, diarrhoea, insect bites, diabetes, malaria, and digestive issues since ancient times. Due to *A. parviflora's* numerous advantages, pharmaceutical and ethnopharmacological studies are ongoing, although further research is still needed to verify its metabolomics and anti-obesity claims. To investigate the metabolome analysis of *A. parviflora* and its inhibitory potential against obesity and type II diabetes Metabolomics approach was used to explore the chemical diversity of *A. parviflora* (ethanol, water and hydroalcoholic extracts) using Ultra-Performance Liquid Chromatography coupled to Electrospray Ionisation and Time-of-Flight (UPLC-ESI-TOF) and multivariate statistical analysis. The polyphenols and free amino acids were quantified by UPLC-PDA. Anti-adipogenic effect of extracts was evaluated on 3T3-L1 cellular model of adipogenesis. To ascertain the behaviour of all extracts on lipid accumulation, Oil Red O staining was performed. Further, glucose uptake assay was performed to assess insulin sensitivity, which is useful in type 2 diabetes mellitus. In metabolomics study, sixty metabolites were tentatively identified by UPLC-ESI-MS and 790 were detected using UHPLC/Q-TOF/IMS search against METLIN database. The UPLC-PDA based quantification showed major presence of vanillic acid (0.057 ± 0.002 mg/g extract), caffeic acid (0.002 ± 0.001 mg/g extract) and ferulic acid (3.766 ± 0.054 mg/g extract) in ethanolic extracts of *A. parviflora*. Further, Cell viability of extracts for 48 hours was performed by MTT assay and cyto-compatible doses were evaluated for further experimentations. Our findings demonstrated the inhibitory effect of various Ajuga extract in lipid accumulation during adipogenesis. Quantitatively, ethanolic extracts of leaf (5, 10, and 15 µg/mL) significantly inhibited lipid accumulation in comparison to differentiated control (***P<0.0001). Similarly, root (25, 50 and 100 µg/mL) dosages also decreased lipid accumulation significantly (***P<0.0001). *A. parviflora* leaf extract enhanced the insulin sensitivity and protected cellular health in hydrogen peroxide stressed differentiated adipocytes. The study suggested that *A. parviflora*

ethanolic extract had good anti-adipogenic activity via reducing oxidative stress and improving glucose absorption. Additionally, it improved the insulin sensitivity of differentiated adipocyte cells that had been subjected to oxidative damage by H_2O_2.The study suggested that ethanolic extract of both (aerial and underground) part exhibited a good anti-adipogenic activity by modulating oxidative stress, enhancing Glucose uptake. It also enhanced insulin sensitivity in differentiated adipocytes cells exposed to H_2O_2-induced oxidative damage.

ISESFEC/23/P-256

Evaluation of *in vitro* anti-cancer activity of different extracts of mangrove from Bhitarkanika, Odisha

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Cancer is one of the leading causes of morbidity and mortality worldwide. Research suggests that currently available chemotherapeutics exhibit several side effects with poor prognosis. Recently, much attention has been given to herbal plants of tropical origin for their anti-cancer activities with much of the unexplored ethnopharmacological significance of the mangrove plant extracts. Mangroves have been known to possess several bio-active compounds which are biologically active against various types of diseases, including different cancer. We collected fresh leaf samples of Mangroves from Bhitarkanika, Odisha, shade dried and different organic extracts of the leaf samples were prepared using the ethos apparatus. *In vitro* anti-cancer activity of mangrove plant extract (four extracts of genus Aglaia) was preliminarily analyzed through MTT assay and found a significant reduction of cell viability with IC_{50} value < 5 µg/mL by treating different concentrations of the above extract in MDA-MB-231 cells (human triple-negative breast cancer cells). Further, annexin V and EB/AO apoptosis studies confirmed that at lower concentrations all four extracts of Aglaia induced apoptosis in a concentration-dependent manner. Clonogenic assay suggested that upon treatment with the above extracts cell survival was significantly reduced. Hence, our study provides a proof of concept that Mangroves (Aglaia) extracts have potent anti-cancer activity *in vitro,* and further *in vivo* studies may provide its anti-tumor efficacy that can provide a better idea for its clinical application.

ISESFEC/23/P-257

In silico identification and molecular characterization of flavonoid biosynthetic genes and their expression analysis in wheat (*Triticum aestivum* l.) during leaf rust infection

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Puccinia triticina. Eriks forms infectious urediniospores causing leaf rust disease in bread wheat (*Triticum aestivum* L.) leading to an annual yield loss of upto 15% globally. Evolution of new virulent strains pose a question-mark on the prevailing leaf rust eradication techniques. Therefore, significant knowledge is required about the genes in wheat plants that can restrict the disease development. This study focuses on investigating flavonoid biosynthetic genes in wheat and their response during leaf-rust pathogenesis. Molecular studies of defense pathways and defense signalling can help in understanding the complex wheat-leaf rust interaction. The flavonoid biosynthetic pathway was discerned through KEGG mapping of the identified contigs and the key genes like Chalcone synthase, Flavanone 3- dioxygenase and Anthocyanidin synthase were stipulated and characterized. *In silico* identification of contigs from four SOLiD-SAGE libraries and functional annotation depicted the involvement of secondary metabolite metabolism and disease development. Expression analysis of genes at varied time points of pathogen infection on both resistant and susceptible wheat Near-Isogenicc Lines, revealed that the genes were associated with development, metabolism and defense response regulation. The gene expression decreased significantly during rust

pathogenesis in susceptible wheat isolines compared to the resistant variety, indicating the transition in the expression of flavonol accumulation possibly to combat rust disease progression. The resistance plants, signify the protective role of *Lr28* gene under leaf rust infection. It might be imperative that these genes encode regulatory proteins that are activated by a signal cascade of the biosynthetic pathway and further branch into various pathways for the accumulation of several protective molecules in safeguarding the plant against pathogenesis.

ISESFEC/23/P-258

Investigation of *in-vitro* α-amylase enzyme inhibitory potential and oral glucose tolerance test (ogtt) of mangrove plant *Ceriops decendra*

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Mangrove species plants have been investigated for various therapeutic purposes. Type-2 diabetes is the most common form in which co-morbidity is significantly higher and various synthetic molecules that target different pathways are used to treat the diabetes. However, synthetic molecules for a long period of time have serious negative consequences and the traditional medical system might be good choice for treatment of pathological condition in proper manner. Hence, Natural product need to be explored which might have better therapeutic efficacy for the treatment. In this present study investigation of oral glucose tolerance test and α-amylase inhibition activity of *Ceriops Dcendra* from Rhizophoraceae family was performed. The aerial part of *Ceriops Decendra* specially stem was procured from the Sunderban region and the dried stem part is extracted by the hydroalcoholic solvent (methanol: water = 70:30) by the soxhletion process and extract was lyophilized to get the final yield. Therefore, oral glucose tolerance test and *in-vitro* enzyme inhibition assay was performed. The yield value of the stem extract is 15.63% and IC_{50} of stem in α-glucosidase inhibitory assay is found 2.47±3.48 mg/ml whereas the IC_{50} value of Acarbose was found at 2.32±0.57 mg/ml. Presence of high amount of alkaloidal component specially diterpinoids and triterpinoids which shows potent effect on oral glucose tolerance test as well as inhibitory alpha amylase activity and further *in-vivo* pre-clinical study need to be done.

ISESFEC/23/P-259

Evaluating the hypolipidemic potential of mangiferin loaded n-succinyl chitosan-alginate grafted nanoparticles against streptozotocin induced diabetes mellitus

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Mangiferin (MGF), from *Mangifera indica* is well reported for its hypoglycaemic activity. However, MGF suffers major therapeutic limitation due to poor solubility resulting in very poor bioavailability. MGF, Chitosan powder, Streptozotocin, Nicotinamide and Succinic anhydride, Glacial acetic acid, Sodium alginate used. All other chemicals and reagents were of analytical grade and were used without further modification. To increase the therapeutic potential of MGF, MGF was incorporated in alginate grafted N-succinylated chitosan (NSC) nanomatrix. The NSC-MGF nanoconjugate revealed a spherical particle geometry of 100~200 nm size. The encapsulated MGF showed significantly improved release profile *in vitro*. In order to evaluate the anti-atherosclerotic efficiency of the prepared delivery system, the serum lipid profile such as total cholesterol (TC), triglyceride (TG), high-density lipoprotein (HDL) and LDL cholesterol was determined in streptozotocin induced diabetes mellitus. Treatment with MGF loaded nanoparticles caused 41.8 % decrease in serum TG concentrations, and 43.39 % decrease in serum TC concentrations respectively ($p < 0.05$).

Similarly, LDL cholesterol levels were significantly reduced in diabetic rats treated with MGF loaded nanoparticles (51.9 %). The results indicate the successful preparation of NSC-MGF nanoconjugate which may be a promising nanomedicine for management of atherosclerosis associated with hyperglycaemia in future.

ISESFEC/23/P-260

Optimization of broth culture of *D. nodosus* under aerobic condition and development of a serogroup B specific footrot vaccine

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Footrot, is a highly contagious disease of sheep and goats that leads to lameness and heavy economic losses to the farmers. The disease is caused by a highly fastidious anaerobic bacterium *Dichelobacter nodosus* along with synergistic actions of some other bacteria like *Fusobacterium necrophorum*. There are 10 different serogroups (A to I and M) of *D. nodsus* based on fimbrial antigen which is protective in nature and there is no cross protection among the serogroups. Serogroup B of *D. nodosus* was found to be predominant (> 90%) in Kashmir. A serogroup B specific whole cell vaccine against footrot was formulated with culture of *D. nodosus* grown in plate culture in our Division. For large scale production of vaccine, the organism needs to be grown in broth culture under anaerobic environment, which is very tedious. Therefore, in the present study, broth culture was optimized as well as simplified to grow *D. nodosus* under aerobic condition. The bacterial cultures were grown in TAS broth containing Na_2CO_3 and varying concentrations of Na-thioglycolate (4 to 10 mM). The Na_2CO_3 was added in the TAS broth adjusted to different pH (4.6 to 5.0) after autoclaving. Optimum growth of *D. nodosus* strain JKS-07B was observed in broth that was adjusted to pH 4.8 before addition of Na_2CO_3 and Na-thioglycolate concentration at 6 mM. The culture was harvested and a vaccine was formulated with Montanide ISA 61 VG as adjuvant. The trial of the vaccine was carried out at MRCSG, SKUAST-Kashmir, Shuhama. A booster dose of the vaccine was given after 30 days of primary vaccination. Serum antibody titres in the vaccinated animals were measured at 0, 30, 60, 90, 120 and 150 days of the trial using microplate agglutination test. Serum antibody response in vaccinated animals reached protective levels (≥ 3000) by 30^{th} day after primary vaccination in all the animals. The antibody level peaked at 60^{th} day of the vaccination and thereafter, it declined progressively. The protective level of the antibody titre remained upto 120 days after primary vaccination.

ISESFEC/23/P-261

MA, a plant lignan regulates lipid metabolism in androgen independent prostate cancer cells

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In prostate cancer (PCa), aberrant lipid metabolism is one of major hallmark for development of castration resistant prostate cancer (CRPC).Thus, targeting dysregulated lipid metabolism could be the effective strategy for prostate cancer treatment. MA is a plant lignan which has been reported to exert cytotoxic effect against different types of cancer. We have earlier reported cytotoxic and HDAC8 inhibitory potential against breast and prostate cancer cell lines. However, the potential of MA in modulation of aberrant lipid metabolism in PCa has not been elucidated. To evaluate the effect of MA on dysregulated lipid metabolism in PCa cell line. PC-3 cells were treated with different doses of MA (0-100 µM) and expression of SREBP1 and SREBP2 was evaluated by using qPCR. The changes in intracellular lipid accumulation were detected by nile red staining. Treatment with MA downregulated the

expression of denovo fatty acid synthesis genes SREBP-1 and cholesterol synthesis genes SREBP2 in androgen independent PCa cells. Our results also showed that the MA treatment significantly decreased the accumulation of lipid droplets in PCa cells. Overall, MA treatment resulted in regulation of lipid metabolism-related genes and affected lipid synthesis. Thus, Intervention of lipid metabolism could be a preventive and therapeutic approach for PCa treatment.

ISESFEC/23/P-262

Ichthyofaunal diversity of lesser Himalayan river and its bioeconomic importance

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The present investigation was conducted in the spring fed river Gaula, a tributary of river Ramganga, flows through the lesser Himalayan region in Uttarakhand, from July to December, 2022 to assess the present status of ichthyofaunal diversity and limnological parameters. The study revealed a moderate fish diversity with average limnological parameters. Fortnightly sampling was made to study the variation in fish diversity and water quality parameters. The fish were collected from three selected sites at the stretch length of five kilometers using gill net, fry net and scoop net. The water quality parameters were recorded using multiparameter water analyser following standard methods. The statistical analysis was done applying PAST 4.0 software. The study revealed that average value of important water quality parameters was recorded as pH (7.6), water temperature (21.3℃), dissolved oxygen (8.27mg/l), TDS (113.36 mg/l) and total alkalinity (120 mg/l). Five species viz. *Tor putitora* (EN)*, Labeo dyocheilus* (LC), *Barilius barna* (LC), *Puntius sophore* (LC) and *Garra lamta* (LC) were documented during the study period and various indices were estimated to find the biodiversity status in the form of relative abundance, Shannon –Weiner index, Margalef's index and Menhinicks index. Relative abundance results showed that *B.barna* is the most abundant species (67.74%) followed by *P. sophore* (16.12%), *L. dyocheilus* (9.6%), *T. putitora* (4.83%) and *G.lamta* (1.61%). The Shannon Weiner, Margalef's index and Menhinicks index values were 0.254, 1.67 and 0.508 respectively.The result of present investigation shows that water quality parameters of river is in optimum range and it is endowed with important economical fishes which play an important role in the ecological goods and services of the aquatic ecosystem. Having an important role in the economy as most of them are food and ornamental fishes (*L. dyocheilus*, *B. barna*, *P. sophore* and *G. lamta)* as well as important sport fish (*T. putitora*). Understanding ichthyofaunal diversity will help both to understand the status of fish diversity in river Gaula as well as formulate management strategies for catch and conservation.

ISESFEC/23/P-263

Use of herbs for gonadal maturity and breeding of himalayan snow trout fish

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Snow trout belongs to the family Cyprinidae and subfamily Schizothoracinae and form an important natural fishery in uplands. In Indian uplands, 17 recognized members of snow-trout are widely distributed in mountain regions above 670 MSL. In winter months, when water in the upper reaches of the streams nearly touches 0°C, snow trout migrates downstream for a considerable distance in the Shiwalik Himalayan streams. This is a preferable fish species in Himalayan region to the consumers having rich nutritive value, but is not under the aquaculture practice due to slow growth and non availability of seed. Wild population for this fish is fragmented due to HEPs and anthropogenic activities. Breeding, seed production and conservation is priority for this commercially important indigenous food

fish. Breeding protocol has been developed for three species of this fish ie. *S. richardsonii, S. progastus* and *S. Plagiostomus.* During the breeding season, maturity was achieved in 88% brooders keeping at optimal thermal regime i.e. 16-18°C for 15-18 days having less diurnal fluctuation in water temperature (> 1.5°C).1.0 % dietary supplementation of the blend of Ashwagandha (*Withania somnifera*) root powder, dried powder of garlic (*Allium sativum*) is beneficial for gonadal maturity of females and better spawning in captive coldwater conditions. Voluntary spawning was achieved successfully with inducing hormone, environmental manipulation and providing gravel bed covered with muslin cloth. Protocol has also been developed for the triploidy induction for this fish. Breeding is feasible for all three species round the year except the winter months (Dec. to Feb.). Findings would be helpful for the seed production and aquaculture of this fish.

ISESFEC/23/P-264

Breeding and seed production of *Labeo dero*

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Labeo dero is an indigenous species of minor carp category in the Himalayan streams is widely distributed all along the foot hill regions of Himalayan ranges of India, Pakistan, Bangladesh, Nepal, Myanmar and China. This species has food value and consumers preference among the hill dwellers. Gonadal maturation was achieved in captive condition and female stock having the size of 450 to 530 g were selected by their bulging soft abdomen, oval-shaped reddish vent slit and smooth pectoral fins, while mature males of 318-360 g body weight were selected by observing pale reddish vent slit and rough pectoral fins. Females and males were injected intramuscularly with ovaprim hormone @ 0.5 and 0.3 ml/kg body weight respectively at the water temperature of 18-20 ^{0}C. Females having an average body weight of 0.510±0.14 showed larger egg size, more fecundity, better fertilization rate and better hatching rate than the females of less body weight (0.450±0.12 to 0.500±0.08 kg). It was found that the optimum temperature range for the egg incubation in coldwater conditions was 18-20 ^{0}C with an incubation period of 28-32 hrs. The average size of one-day hatchling was found to be 3.42±0.32 mm, weighing 0.006 g and the survival percent of the hatchling was 78%. Fry were reared in cemented tanks and achieved 52% recovery of advanced fry of the size of 12 mm in 30 days. It is concluded that success in seed production would be helpful for developing *L. dero* as a new candidate species for the coldwater aquaculture practice.

ISESFEC/23/P-265

Antibacterial activity of *Aegle marmelos* extract based novel formulation

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The science and practice of drug discovery and development is largely being benefitted from the bioactive leads obtained from plant sources. Aegle marmelos (Family- Rutaceae), is used to cure several diseases in the Indian traditional medicine system of Ayurveda such as nervine tonic, in stomach upset and many more. The plant parts have most essential natural bioactive components are tannins, alkaloids, flavonoids, phenolics, carotenoids, cinnamic acids, folic acid, tocotrienols, and tocopherols. The flavonoids present in Aegle displayed significant anticancer as well as antibacterial potential. The study included presently aims exploration of potential extract of *Aegle marmelos* from its fruits. Plant, collected from lower Shivalik region has been identified at Botanical Survey of India, Dehradun. All the chemicals used for extraction has been of AR Grade. Thus, 100 gms of pulp was used for extraction of

potent bioactive compounds. Two methods were utilised for extraction, one is maceration and other one was hot percolation method. Methanol was used a s solvent for both the methods. Both the extract were dried under rotary evaporator and lyophilized. The dried samples were submitted for IR and GC-MS Analysis and formulated to nanosuspension in water. The preliminary chemical testing suggest that the methanolic extract from both methods have alkaloid, flavonoids and terpenes content. Samples have been sent for GC-MS analysis have also confirmed the presence of coumarin, xanthotoxol, imperatorin, aegeline, and marmeline. The formulated nanosuspensions using Methanolic extract has been further screened for its antibacterial potential against *E. coli* (MTCC 739) with Zone of Inhibition as 8.22 ± 0.2 mm as compared to positive control Gentamicin which showed zone of inhibition of 7.47 ± 0.3. The developed formulation will be further screened against more pathogenic organisms to prove its potentiality against developing resistant microbes.

ISESFEC/23/P-266

Utility of Meghalaya's traditional medicine in the treatment of kidney stones disease utility of meghalaya's traditional medicine in the treatment of kidney stones disease

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The study on traditional treatment of ailments or diseases is a colossal subject, however this study emphasized the usage of medicinal plants, traditional formulation in healing practices with particular reference to the treatment of kidney stones diseases (KSD) which is known to be a prevalent disease in India, with an expectancy of 12% in a total population reported to be prone to urinary stones. It also highlights the contribution of the healers in primary health care concerning rise of kidney stones cases among the population in the state of Meghalaya which can generates interest in further research & development in traditional medicine. The documentation work for the study of various ailments treated were done on 105 traditional healers at present from the four districts of Meghalaya by collecting informative data on traditional healing and medicines – medicinal plants, formulations from the respective traditional healers with the help of structured questionnaires and thorough discussions with the knowledge holders. Out of 105 traditional healers, 24 healers were found to treat KSD cases - wide usage of medicinal plants belonging to Zingiberaceae family, projection of rhizome as part used, decoction as preparation of formulation, and per oral as route of administration were established in the research document. The efficacy of these traditional medicines was ascertained through interviews with the patients availing the treatments. In accordance with the results, we anticipate for further research in ethnopharmacology, pharmacognosy, drug development in the future prospects and to initiate in a demographic survey of KSD cases in order to obtain and assess the statistical record on its prevalence and incidence in the state.

ISESFEC/23/P-267

Antimotility, anti-diarrheal and antibacterial activities of hydroalcoholic extract of *Cordia dichotoma* leaves in Wistar rat

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The leaves of *cordia dichotoma* is used as treatment fodder by locals in animals' diarrhea, therefore investigated for its anti-diarrheal potential. Antimotility, antibiotic and antidiarrheal activity of *Cordia dichotoma* hydroalcoholic extract of leaves (CDHALE) to validate the local claim. The study included three parts. 1st part included smooth muscle preparation assembly for evaluation of effect of CDHALE on dose-response curve (DRC) of acetylcholine (Ach). 2nd part included *in vivo* studies, comprised of five groups of six rats each. Group I received 0.1% Carboxymethylcellulose (CMC) @ 1ml/100g b. wt., Group II got loperamide @2.5 mg/Kg b.w., Group III, IV and V received CDHALE @ 125 mg/Kg, 250 mg/Kg and 500 mg/Kg respectively. After an hour of this treatment, diarrhea was induced and observed for five hours. 3rd part included antibacterial screening against *E. coli* and *Staph. aureus* using positive, negative control and different concentrations of CDHALE. As a result of 1st part of the study, it was found that CDHALE shifted the DRC of Ach towards right with a change in E_{max} value. In the 2nd part, CDHALE produced significant and dose-dependent decline in castor oil-induced diarrhea. The 3rd part of the study revealed antibacterial activity of CDHALE which was comparable to standard antibiotics in case of *E. coli* but the results in context to *S. aureus* were mild. It can be concluded that CDHALE is effective in preventing castor oil-induced diarrhea,has good activity against diarrhea (few) causing microorganisms, including reduced intestinal motility. This finding suggests that CDHALE has a composite activity as anti-diarrheal.

ISESFEC/23/P-268

Introduction of low chilling varieties of apple (*Malus domestica* borkh.) In North east India

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Apple (*Malus x domestica* Borkh.) is a deciduous tree of *Rosaceae* family that originated in western Asia. Apple usually grows in temperate regions; however, low-chilling apple varieties can be grown under mild winter to moderately warm conditions, as they require 300 to 500 chilling hours. The apple demand is projected to increase by 4% upto 2027 as compared to the current production. An attempt has been made by CSIR-IHBT Palampur, HP, to introduce apples in North East (NE) India to reduce the import from neighbouring regions, which also decreases carbon footprints caused due to apple supply. CSIR-IHBT has developed and standardized meristem tip culture techniques for raising quality virus-tested apple rootstocks of commercial value. The low-chilling apple varieties on these rootstocks were introduced in the NE states by CSIR-IHBT in association with North Eastern Region Community Resource Management Project (NERCORMP) and financial assistance from North-Eastern Council. The low chilling apple varieties, *viz.*, Anna, Dorsett Golden, Red Fuji, Early Fuji, Sun Fuji and Scarlett Gala etc. were introduced in areas receiving ≤500 chilling hours, of Mizoram, Manipur, Meghalaya, Arunachal Pradesh states on a trial basis from 2016-2022 in an area of 118 acres. To further enhance area under these varieties, CSIR-IHBT, in association with the Institute of Bioresources and Sustainable Development (IBSD), Imphal, Manipur, India, is implementing a project entitled "Surveillance, multiplex virus diagnostics, raising quality rootstocks for promotion of low chilling varieties of apple (*Malus domestica* Borkh.) in Manipur to improve the livelihood of local farmers". The apple plants, which were introduced in 2016-2018, started bearing fruits, and they were analyzed for their phenotypic properties and proximate nutritional composition. The result showed that all the attributes are comparable with the commercial apple and thus suggested that these low chilling apple varieties might be promising for the eastern Himalayas, where the cultivation of apples is not reported yet. In order to understand the disease-free status of introduced cultivars, monovalent and multiplex RT-PCR has been standardized for the introduced

cultivars to detect major viral diseases of apples. Further enhancement of area under these varieties in Northeast India is under progress. Initial efforts show that the introduction of low-chilling apple varieties in Northeast India will pave the way for the commercial cultivation of apples in non-traditional areas with quality planting material.

ISESFEC/23/P-269

Organic production technology of *Mentha piperita*: a silver lining to increase farmer's income in the Himalayan region

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Peppermint (*Mentha piperita*) is known for its essential oil, which is widely used in the phytopharmaceuticals, food, flavour, and perfumery industries. The productivity of peppermint is largely governed by plant nutrition, which is supplied through synthetic fertilizers. However, the demand for organically produced essential oils is increasing steadily. Thus, this study aimed to test the hypothesis of whether seaweed *(Solieria chordalis*) – based biostimulant would act as an alternative to synthetic fertilizer to maintain the yield and quality of the essential oil of peppermint. Henceforth, a field experiment was conducted at the CSIR-IHBT, Palampur, (HP) India during the 2022 cropping season. The experiment was laid out in a randomized block design with six treatments (i.e. control, a recommended dose of NPK, and 4 different concentrations of seaweed extract from 4-16%). Each treatment was replicated three times. The results suggest that the application of synthetic fertilizers produced significantly ($p \leq 0.05$) higher biomass yield compared with the rest of the treatments. However, the plants treated with biostimulants registered about 39-45% higher biomass yield compared with the control plants. No significant ($p \geq 0.05$) differences in essential oil concentration were observed due to the different treatments. Irrespective of the treatment, the major essential oil constituents of *M. piperita* were menthol, menthone, 1,8 – cineole, and menthyl acetate. The maximum menthol concentration was recorded with the application of *S. chordalis* extract at 16%. The result suggests that *Solieria chordalis* extract may be an alternative to synthetic fertilizer for the organic production of peppermint. Crop diversification through aromatic plants is a logical entry point for the efficient management of natural resources and for improving rural livelihoods. *Mentha piperita* possesses the ability to grow under mild-temperate conditions in the Himalayan region. Keeping in mind the potential of this unique crop and the results of the present experiment, CSIR-IHBT and IBSD are, therefore, jointly promoting the cultivation of *Mentha piperita* in the Himalayan region.

ISESFEC/23/P-270

Occurrence and Genetic Diversity of *Mycobacterium avium* subsp. *Paratuberculosis* in Yak and Double Humped Camel from Western Himalayas

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Mycobacteria are Gram-positive, acid-fast organisms that include a number of significant animal and human pathogens. Mycobacterium avium subsp. *paratuberculosis* (Map) is the causative/etiological agent of a severe gastroenteritis in ruminants, both domestic and wild, viz., Johne's disease. The studies on occurrence and genetic diversity of Map are scarce in wild animals. Hence this study was planned with similar objectives. Present study was conducted in regions of Western Himalayas i.e., Kashmir and Ladakh, for detection of Map in Yak and Double-Humped Camel. For confirmation, 60 Fecal samples were taken randomly and subjected to PCR analysis after DNA extraction by commercially available kit. Thirty samples each from Yak and Double-Humped Camel were collected from Govt. Yak breeding farm, Bodh Kharbu, Kargil and Govt. Double Humped Camel Breeding farm Chichot, Leh, Ladakh respectively. The extracted DNA was subjected to IS900 gene

amplification-based PCR. Of the total 30 yak samples collected, 16.66% (5 of 30 samples) showed amplification of IS900 gene while, all the fecal samples of double humped camel were detected negative. Representative positive samples were outsourced for Sequencing by Sangers di deoxy chain termination method to detect genetic diversity if any. Molecular genetic aspects including the marker description used for identification of strains, diagnostic analysis as well as phylogenetic analysis need to be emphasized in lesser studied wild animals like Yak and Double humped camel.

ISESFEC/23/P-271

Potential psychrophyllic mineral solubilizing bacterial strains for reducing chemical fertilizer use in north western Himalayas

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The research has been conducted at Biofertilizer Laboratory, Faculty of Agriculture, Wadura Sopore under Himalayan Bioresource Mission' of the Department of Biotechnology New Delhi, GoI. In this study, Rhizospheric soil samples were collected from apple, walnut and almond orchards across the Kashmir Valley. Ten locations each from district Baramulla/ Kupwara/ Bandipora/ Budgam/ Ganderbal/ Pulwama/ Shopian /Anantnag and Kulgam were chosen for sample collection. Three samples were collected from each location. Mineral solubilizing bacterial strains (P, K and Zn) were isolated from soil samples. Based on halo zone diameter and mineral solubilization index, ten most potential isolates of each mineral solubilizing group i.e P, K and Zn were retained for further screening. Furthermore, the mineral solubilizing strains were screened for their phosphorus, potassium and zinc solubilisation ability under different temperatures, pH values and incubation periods and characterized using cultural, morphological, biochemical techniques. The results of the study revealed that under *invitro* conditions the most ideal incubation period and temperature combination was 15 days (360 hours) and 28^0C with significantly highest P, K and Zn solubilization hallow, colony diameter and solubilization efficiency (4.43 cm, 2.0 cm, 221.5%),(4.46cm, 3.04cm,146.71 %) and (3.57cm, 2.16cm, 165.27%) shown by the isolate PSBnp, KSBsng, ZnSBkkn, respectively as compared to control isolates. In addition to mineral solubilization these isolates were subjected to production of some plant growth promoting substances and all these showed HCN and ammonia production. Indole acetic acid to the tune of 34.77 µmol ml^{-1}, 30.12 µmol ml^{-1}, 41.36 µmol ml^{-1}, protease activity of 628.45µmol ml^{-1}, 568.20 µmol ml^{-1}, 491.50 µmol ml^{-1}, chitinase activity of 8.35µmol ml^{-1}, 9.22 µmol ml^{-1}, 7.46 µmol ml^{-1} and cellulose activity of 653µmol ml^{-1}, 427 µmol ml^{-1}, 398 µmol ml^{-1} was shown by PSBnp, KSBsng, ZnSBkkn respectively. Finally after compatibility test a consortium of these three most compatible isolates was developed with an optimum cell count of 10^8 cfu ml^{-1} for reducing the dependence on chemical fertilizers under North western Agro ecosystem.

ISESFEC/23/P-272

Monitoring invasive alien plant species and exploring value-added products for community-based entrepreneurships in the Darjeeling and Kalimpong districts of West Bengal, India

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Rapid assessment was conducted along an altitudinal gradient of 900m-2400 m in Darjeeling-Kalimpong Districts of West Bengal, India for listing and mapping invasive alien plant species. 36 villages, were purposefully chosen and surveyed. 47 species were documented while the ILORA database of alien vascular flora of India (link) has documented 36 species as invasive in the Darjeeling Himalayas. Based on the rapid assessment and the extent of distribution five invasive species -*Lantana camara, Eupatorium adenphorum, Chromoleana odorata, Ageratum conyzoides/A. houstonianum, and Mikania micrantha* was identified as priority species for monitoring and value added product development. The documentation of invasive species was also linked to the Mapping Invasive Alien Plants (MIAP) website. This is a pilot effort by ATREE and other partner organisations to create an invasive plant atlas for India using Google's Open Data Kit and its android application, ODK Collect (http://miap.atree.org/). Three potential value-added products were identified from the priority list to engage with for developing community entrepreneurships in the surveyed villages-i) bio-briquettes from *Lantana camara*, ii) natural dye from *E. adenphorum*, *C. odorata, A. conyzoides,* and *M. micrantha* and iii) crafts from *L. camara*. Training on bio-briquettes making with *L. camara* was held in two of the assessed villages in the Kalimpong district, where 47 participants, from 24 Self-Help Groups were trained. Further exploration on value added products is being conducted in the project sites.

ISESFEC/23/P-273

Holistic evaluation of lignocellulosic invasive species biomass for bioenergy production using proximate and compositional studies

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One of the major challenges to ecosystems and the species diversity they support is the spread of invasive plant species. To investigate the possibility of using the invasive plant species for energy production, the physico-chemical characterization of seven invasive plants *(Lupinus polyphyllus, Alianthus altissima, Leucanthemum vulgare, Rubinia pseudoacacia, Phragmites austrailis, Anthemis cotula, Typhae angustifolia)*commonly found in the Himalayan region of India, was carried out based on the proximate and compositional analysis. The biomasses were evaluated and characterized to understand their compositional and structural properties. The Volatile Matter, Ash and the Fixed Carbon content in the selected species was found to be in the range of 66.9-79.67, 2.1-11.83 and 3.97-17.8 wt% respectively. *Typhae angustifolia* recorded the highest VM content while as *Rubinia pseudoacacia,* was found to possess highest carbon content. The cellulose, hemi-cellulose and lignin contents were found to be within the range of 33.12- 47.36, 24.70-34.31and 8.21-28.74wt% respectively. The bulk density of the above-mentioned species was also determined. The results demonstrate that the collected lignocellulosic biomass could be a potential candidate for bioenergy production and lignocellulosic based value-added products as well.

ISESFEC/23/P-274

Utilization of invasive alien species for improving livelihoods of local communities in Kashmir, India

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Invasive alien species (IAS) are the organsism introduced outside their native range with largely harmful impacts to native biodiversity, ecosystem services and human well-being. IAS are the second most significant threat to biodiversity, after habitat loss, and these species undermine progress towards achieving several United Nations Sustainable Development Goals by impacting livelihoods, human health,

and food security. In India, IAS cause huge damage to the economy worth crores of rupees every year (approx. Rs. 8.3 trillion in last 60 years). Since invasive plant species are locally accessible and highly abundant, we propose here the innovative solutions to deal with these obnoxious species by developing new ways to process them into useful products like novel food sources, fodder, paper products, and natural dyes etc. In Kashmir, we shortlisted 11 IAS based on their abundance and potential for utilization viz. *Anthemis cotula* (Chamomile), *Ailanthus altissima* (Tree of Heaven), *Lupinus polyphyllus* (Lupin), *Leucanthemum vulgare* (Ox eye daisy), *Lemna minor* (Duckweed), *Nymphaea mexicana* (Water Lily), *Phragmites australis* (Common reed), *Robinia pseudoacacia* (Black Locust), *Rubus ulmifolius* (Wild blackberry), *Typha angustifolia* (Cattail) and *Urtica dioca* (Common Nettle). These species are being evaluated in laboratories for their potential use. Gas Chromatography Mass Spectrometry (GCMS) analytical technique showed presence of commercially and medicinally important chemicals such as ethanol, ethyl acetate, Pinene, Germacrene and Famesene in Chamomile and Ox eye daisy plant samples. Proximate analysis of Lupin flour showed protein content of 30.2 % which is more than found in black gram lentil (22.4 %). Further, the functional properties of Lupin seed flour showed its usefulness for making various commercialized food products such as cakes, biscuits. The cellulose fibres from *P. australis* and *T. angustifolia* will be used to produce paper and textiles with an aim to promote the replacement of plastic with paper bags. Utilization of IAS can help control their spread, offset management costs by creating markets for their use, increase awareness about IAS issues

ISESFEC/23/P-275

Synthesis and biological screening of Glutamine analogues for the management of chronic myeloid leukemia

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Glutamine is a potential nutrient for rapidly growing cancer cells and inhibition of glutamine catabolism induces apoptosis and sensitized metastatic cells to hydrogen peroxide and methotrexate toxicity. Glutamine triggers Bcl-2 protein which is anti-apoptotic and also inhibits CD 95 which is pro-apoptotic in nature. Inhibition of glutamine uptake suppresses mTOR signalling, resulting autophagy and cell death. Thus, compounds having structural similarities with glutamine may be considered for designing of anticancer agents. Synthesis of some compounds considering glutamine-like structural fragment into the structure, characterization of synthesized compounds as well as biological screening comprises the objectives of current work. Some glutamine analogues are synthesized, characterized and screened against human cancer cell lines (K562 and MDA-MB-231) as well as normal human peripheral blood mononuclear cells (PBMCs) for their possible cytotoxic activity by MTT assay. The mechanisms of cytotoxicity of better active compounds were confirmed by DNA deformation assay. All these synthesized compounds are cytotoxic towards chronic myeloid leukemia cell line (K562) and inactive against breast cancer cell line (MDA-MB-231) as well as normal human PBMCs. In conclusion, better active compounds may be considered as potential lead molecules for the development of target specific anti-leukemic agents with minimal untoward events to normal human cells.

ISESFEC/23/P-276

Phytochemical analysis, *in-vito* antimalarial activity and antioxidant activity of *Rotheca serrata* (L)

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Rotheca serrata (L.) Steane and Mabb. Belonging to Lamiaceae family is reported as regionally “vulnerable” in Northern India. The aim of the present work is phytochemical investigation, antioxidant and antimalarial activity of *Rotheca serrata*.
Present investigation deals with quantitative study of bioactive compounds like total phenolics and total flavonoids. Three different solvents systems (hexane, ethyl acetate and methanol) of leaves parts were used for extraction. The antioxidant activities of of *R. serrata* were determined by 2,2 diphenyl-1-picrylhydazyl (DPPH) and ABTS assay. *In-vitro* antiplasmodial activity was assessed using *Pf*3D7 (chloroquine sensitive strain) and *Pf*ARTCam3.I^{R539T} (artimisinin resistant strain). [3 H]-hypoxanthine uptake assays was performed for both the strains and confirmed through Giemsa-stained smears. The major phytochemicals constituents were identified by GC-MS.The highest phenol and flavonoid content were obtained in ethyl acetate extract (453 ± 3.60 mg gallic acid/equivalent and 16.51 ± 1.29 mg quercetin/equivalent). Of the 3 extracts, ethyl acetate showed significant antimalarial activity (IC_{50} values 9.06 ± 0.99 µg/mL in *Pf*3D7 strain and 17.72 ± 1.83 µg/mL in *Pf*ARTCam3.I^{R539T}). Similarly, ethyl acetate extract showed high potency of antioxidant with IC_{50} value < 100 µg/mL in both assays. GC-MS analysis of ethyl acetate extract revealed the presence of phytol and γ- sitosterol as a major phytoconstituent. High antioxidan, and antimalarial results of ethyl acetate extract were strongly correlated with the high phenol and flavonoid content of the plant.

ISESFEC/23/P-277

Green synthesis of ZnO nanoparticles using *Flemigia macrophylla* (Willd.) Ex. Kuntze Merr. and its Antioxidant, Antidiabetic and Anti-inflammatory activity

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Nanoparticles have wide applications in both biomedical and physiochemical fields. They may be used for drug delivery, biosensing, bio-imaging and biomolecular recognition. Development of plant based nanoparticles has many advantages over conventional physico-chemical methods and has various applications in medicine and biology. In present study, zinc oxide (ZnO) nanoparticlewere synthesized using leaf extracts of Flemingia macrophylla (Willd.). 0.01 M zinc acetate dihydrate was used as a precursor in leaf extracts for NPs synthesis. The structural and optical properties of the NP were investigated by X-ray diffraction (XRD), Fourier transform infrared (FTIR) spectroscopy, scanning electron microscope (SEM), Transmission Electron Microscopy (TEM) and ultraviolet-visible spectrophotometer (UV-Vis). The *in-vitro* antioxidant, antidiabetic activity and anti-inflammatory potential of ZnO NPs was also examined. The appearance of UV spectrophotometric peak of 328nm for the green synthesized of Zinc oxide confirmed the formation of Zinc oxide nanoparticles which is of low absorption intensity i,e in between 320-360nm . Change in color of the reaction mixture from brown to white as well as the reflectance peak at 365nm signifies the formation of ZnO nanoparticles. The Flemingia macrophylla ZnO NPs showed strong antioxidant, antidiabetic and anti-inflammatory activity compared to standard drugs.The present study suggest that plant based synthesis of NPs can be an excellent strategy to develop versatile and eco-friendly biomedical products.

ISESFEC/23/P-278

Ethnomedicinal plants used for burn injury in Manipur

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Burn wound healing is a complicated biological process involving inflammation, re-epithelization, granulation, neovascularization and wound contraction. In spite of the availabilities of various formulations regeneration of healthy and functional skin remains a huge challenge because of its multilayer structure and complex organization of different cell types. As such there is still necessity of searching for efficacious medicine including those of traditional therapies. Considering this backgrounding, attempts have been made to document the medicinal plants used in skin rejuvenation after burn injury in Manipur.The study was conducted covering all district of Manipur. Semi-structured questionnaires were used during interview with traditional healers from different communities for their knowledge on burn injury therapies. Details of medicinal plant used, mode of treatment, method of preparation and types of administration were collected. Information collected was compared with various related literatures. Medicinal plants were collected, identified and voucher specimens were deposited. Traditional healers in Manipur used different herbal recipes for treating burn injury and skin rejuvenation. Different herbal recipes were documented and enumerated in the paper. Almost all of the herbal recipes are used as tropical medications.This presentation provides an ethnobotanical account about the medicinal plants used in Manipur for wound healing and skin rejuvenation after burn injuries. Natural products present in the formulation may have bioactive components. Identification and comprehensive evaluation on these compounds may lead to development of new drugs in burn injury treatment.

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पालमपुर (हि.प्र.) भारत/ Palampur-176061 (H.P.) INDIA

परिकल्पना: जैवआर्थिकी के उन्नयन हेतु प्रौद्योगिकीय उद्भवता एवं विकास में हिमालयी जैवसंपदा के संपोषणीय उपयोग द्वारा विश्व स्तर पर अग्रणी होना

उद्देश्य: सामाजिक, औद्योगिक, पर्यावरणीय और अकादमिक हित हेतु हिमालयी जैवसंपदा से प्रक्रमों, उत्पादों और प्रौद्योगिकियों की खोज, नवोन्मेष, विकास एंव प्रसार।

संस्थान की निम्नलिखित व्यवसायिक उत्पादन के लिए प्रौद्योगिकीयाँ

- रेडी टू ईट क्रिस्पी फ्रूट एंव परम्परागत व्यंजन
- मूल्यवर्धित बक्कवीट
- बहु-अन्नीय (मल्टीग्रेन) उच्च प्रोटीन पेय एंव तत्काल (इन्स्टेंट) सूप
- स्पिरूलीना आधारित एनर्जी बार
- पादप वृद्धि हेतु राइजोबेक्टीरिया
- हींग
- केसर
- कैला लिली, जरबेरा, गुलदाउदी की उन्नत किस्में
- टी-वाइन
- रेडी टू सर्व चाय निर्माण
- हर्बल चाय
- मिनी डिस्टिलेशन यूनिट (हर्बोस्टिल ट्रेडमार्क)
- कम्पोस्ट बूस्टर
- आयरन युक्त फ्रूट बार और केन्डी
- टी विनेगर
- चाय कैटेकिन,
- हर्बल सोप
- हर्बल इन्सेन्स कोन
- हैंड सैनिटाइजर
- गुणवत्तायुक्त और स्वच्छ शहद हेतु उन्नत बी हाइव
- स्टीविया पाउडर और स्टीविया तरल द्रव्य (कम कैलोरीयुक्त स्वीटनर)
- अर्नेबिया यूक्रोमा से नेफ्थोकीन (लाल रंग) के लिए *इन विट्रो* उत्पादन प्रणाली
- खाद्य प्राकृतिक रंग, हर्बल लिपस्टिक
- हाइड्रोपॉनिक खेती की तकनीक से लिलियम और ट्यूलिप के पुष्पण काल में कमी
- वेलेरियाना जटामांसी अपस्थानिक जड़ संवर्धन प्रौद्योगिकी
- विटमिन डी$_2$ युक्त शिटाके मशरूम
- एल-एस्परजिनेस
- हाइड्रॉक्सीमिथाइलफ्यूरल (5-एचएमएफ)
- सेल्यूलोसिक बायोमास से टेक्सटाइल फाइबर में परिवर्तित करने की पर्यावरण अनुकूलन प्रक्रिया

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About CSIR-Indian Institute of Integrative Medicine

CSIR-Indian Institute of Integrative Medicine (IIIM) was established in 1941 as a research and production centre, known as the Drug Research Laboratory of J&K State. It was later taken over by the Council of Scientific & Industrial Research (CSIR) of Govt. of India in December 1957 as Regional Research Laboratory, Jammu. Given its core strength in natural products-based drug discovery, the Institute redefined its mandate in 2005, and its name changed to the Indian Institute of Integrative Medicine (IIIM). Today, CSIR-IIIM, Jammu, has state-of-the-art facilities to discover new drugs and therapeutics for mankind. The vision of the Institute is to position IIIM as an International center of excellence for natural products chemistry, chemical biology, pharmacology and biotechnology to discover new chemical entities (NCEs) as drugs for unmet medical needs and provide scientific rationale and validity to various Indian systems of medicine.

The Institute offers consultancy services in the following areas:

1. New Drug Discovery from natural products (NCEs as well as phyto-pharmaceuticals).
2. Natural products chemistry (isolation synthesis and medicinal chemistry)
3. Metabolic Engineering of Biosynthetic pathways in plants, bacteria, and fungi
4. Pharmacology of NCE and Phyto-pharmaceuticals
5. Bioprospecting of medicinal & aromatic plants and microbes

Facilities/Infrastructures:

1. IIIM, Jammu has world class Janaki Ammal herbarium and crude drug repository
2. IIIM, Jammu has a state of the art Quality Control & Quality Assurance CMC Division.
3. The institute has well established and operational pilot scale extraction (cGMP) plant.
4. There are very well-established departments of enzymology and fermentation technology.
5. GLP standard Invivo laboratory Animal House.

Contact: Director, Indian Institute of Integrative Medicine, Canal Road, Jammu- 180 001, J&K (INDIA)
Tel No.: 0191-2584999, 2585222 **Fax:** 0191-2586333 **Website:** www.iiim.res.in,
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P.O.: Changsari, Dist: Kamrup, Assam,
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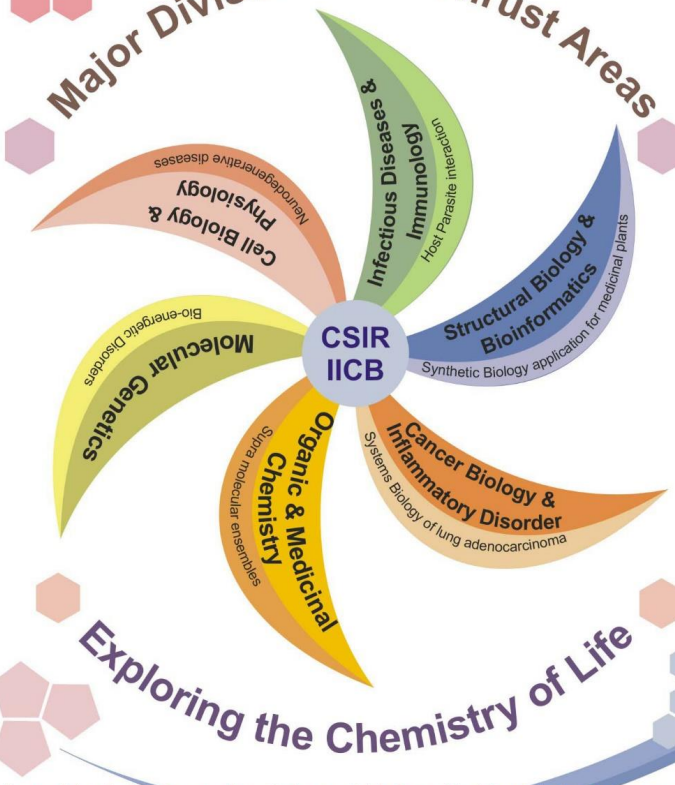
CSIR-INDIAN INSTITUTE OF CHEMICAL BIOLOGY

The Institute was established in 1935 as the Indian Institute of Medical Research and became a unit of CSIR in 1956. It owed its origin to the inspiration of prominent personalities like Gurudev Rabindranath Tagore, Acharya Prafulla Chandra Roy, Pandit Jawaharlal Nehru and many others. Today, by its mandate CSIR-IICB is engaged in research on diseases and certain biological problems of global interest.

Major Divisions and Thrust Areas



Exploring the Chemistry of Life

Generating Knowledge Globally
- ❖Publishing Papers/ Year > 185
- ❖Average Impact Factor > 3.3

Transforming Knowledge into Wealth (IP)
- ❖Filing Patents/Year > 8
- ❖Patents Granted/Year > 4

Potential Technologies Developed Recently
- ❖Biomarker for valvular heart disease
- ❖Microbicidal Contraceptive to Prevent HIV
- ❖Gene Therapy for Mitochondrial Diseases
- ❖Visceral Leishmaniasis Detection Kit
- ❖Anti-leishmanial Drug Candidates
- ❖Anti-asthmatic Drug Candidates
- ❖DNA Vaccine against Kala-Azar
- ❖Anti-cancer Drug Candidates
- ❖Anti-ulcer Drug Candidates

A symbiosis between chemistry and biology that translates to a commitment to higher standards of health for all.
Institute-Industry tie up recently rolled out PROSTALYN - a herbal composition for Prostate diseases.
Other products or processes accepted by industries for marketing: a herbal composition against chronic myeloid leukemia (CML), a potent DNA vaccine against Kala-azar, a diagnostic technology to detect a protein associated with pregnancy and embryo, a herbal extract & composition for peptic ulcer diseases.

Building People and Institution
Initiated and nurtures NIPER, Kolkata (National Institute of Pharmaceutical Education and Research); PhD Registration under AcSIR; Three schools adopted & receives laboratory aids.

Infrastructures to be operationalized
Salt Lake Campus; New Laboratory Building, Jadavpur Campus;
CSIR Innovation Complex, Baruipur, South 24-Parganas


CSIR-IICB, Salt Lake Campus

Major Facilities Available
- State of the art Instrumental facilities
- Modern Animal House
- Modern Library Computer Division

Contact:
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About IASST

Institute of Advanced Study in Science and Technology (IASST) is a premier scientific research organization in the north-east region, IASST was conceived and nurtured by the Assam Science Society in its initial years and was inaugurated by Noble Laureate Dorothy C. Hodgkin on 3rd November 1979. Subsequently, it was supported by the state govt. as its only autonomous R&D institute till March 2009. The institute was taken over in March 2009 by the Ministry of Science and Technology, Govt of India as one of its autonomous R&D Institutes. The Institute is engaged in multidisciplinary research activities, both in fundamental and applied, across frontier areas of science and technology such as Plasma Physics, Polymer Sciences, Biochemistry, Drug Design & Development, Nano-science, Medicinal Plants, Seri Biotechnology, Microbial Biotechnology, Environmental Sciences, Microbial Fuel Cell, etc.

Vision

To emerge as a Centre of excellence in frontier research areas of Physical and Life Science with international visibility and building human resources towards advanced scientific knowledge for societal development.

Mission

- Building state-of-the-art infrastructure for basic and applied research in the area of Physical & Life Sciences.
- Generation of technology from natural resources of NE region and their application for socio-economic upliftment.
- Generation of quality scientific manpower from among human resources of NE region.

Academic Programme

PhD Programme	Post-Doctoral Programme	Internship Programme	Special Fellowship to Brilliant Research Students	Undergraduate/ Masters Dissertation

Major Facilities

Sophisticated Analytical Instrumentation Center	Knowledge Resource Center	Bio Nest	QC/QA Lab	Incubation/ ISVEC	SC/ST Training Center	Animal House Facility	Bio-resource Conservation Hub	IT Service
Bioinformatics Infrastructure Facility	Mini Sports Complex	Medicinal Plant Garden	Orchid Resource	Observatory Center	Chintan Chora	Covid 19 Testing and Research Laboratory	Students and Scientists Home	

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Knowledge for Empowerment

CSIR-NEIST

Science & Technology for Sustainable Development

Established as a national R&D Institute under the Council of Scientific & Industrial Research (CSIR) in 1961, CSIR-North East Institute of Science & Technology, Jorhat has been engaged in multidisciplinary R & D activities contributing to the region's as well as country's industrial growth and economic prosperity.

Translational Research for Transforming Indian Economy

The Institute has generated more than 120 technologies and developed expertise in the areas like natural products chemistry, herbal products for quality life, drug intermediates, agro–technologies, petrochemicals, crude-oil transportations, paper and paper products, foundation design engineering, bioreactors and bioremediation, soil investigations and building materials.

Societal Acitivities & Agrotechnologies

CSIR-NEIST has been extending awareness, training and skill development programmes on cultivation of Mushroom, Vermicompost Medicinal & Aromatic Plants; Welding, Plumbing, Fitting, Weaving; benefitting large number of women, unemployed youths and marginal farmers of this region for livelihood generation and self employment under CSIR-AROMA mission and various other programmes.

Testing/Analytical Services

The institute has been extending analytical services for testing of various samples like water, soil, fertilizers, building materials, cement, iron & steel, stones, oil & petroleum products, coal, minerals, fibres, paper, boards, natural products, etc to Indurstries, PSUs, Govt Organizations, Academic Institutions, Students and Farmers of North East Region.

For Details Contact

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BRIEF ABOUT THE INSTITUTE

The North Eastern Institute of Ayurveda & Folk Medicine Research (NEIAFMR), Pasighat is an autonomous institute under the Ministry of Ayush, Government of India. The institute was first established as North Eastern Institute of Folk Medicine (NEIFM) on 21st February 2008 with the objective to strengthen and develop traditional health practices for the benefit of the nation, with a special focus on the North Eastern region. In August 2021, the Government changed the nomenclature and mandate of the institute and renamed it as North Eastern Institute of Ayurveda & Folk Medicine Research by adding Ayurveda Academic Courses. The institute is spread over an area of 40 acres and is located at Pasighat, East Siang District, Arunachal Pradesh.

The North Eastern region of India, comprising the states of Arunachal Pradesh, Assam, Manipur, Nagaland, Meghalaya, Mizoram, Sikkim and Tripura endowed with a rich biodiversity of flora and fauna, has a rich heritage of traditional folk medicine practices, remedies and therapies. The information available with traditional healers is required to validate scientifically, so that novel compounds can be discovered which may possess the potential to cure many diseases. Ministry of Ayush, Govt. of India is addressing this aspect by establishing NEIAFMR, which is mandated to act as an apex research institute in all aspects of Folk Medicine. It is high time to document such invaluable medical knowledge and validate it scientifically, so that many unanswered health problems can be addressed. It is the responsibility of scientists and researchers to investigate this thrust area. The NEIAFMR will also help to upgrade the skills and build and enhance the capacities of folk medicine practitioners by protecting their intellectual property rights.

This institute is equipped with essential infrastructure, including a 50 bedded indoor hospital and necessary equipments for research on folk medicine. The institute will create an interface between traditional/folk medicine practitioners and research institutions to enable proper understanding of folk medicine. Where feasible, validated folk medicine practices will be integrated into the mainstream health care system, and made available to the public. The institute has been registered as Society with the Govt. of Arunachal Pradesh under Societies Registration Act, 1860.

AIM AND OBJECTIVES

- To provide UG & (PG in future) teaching facilities and quality patient care service under the Ayurvedic system of medicines.
- Promoting the growth and development of Ayurveda in the North Eastern Region.
- Generate public awareness about the potential of Ayurveda and Local Health Practices.
- Functioning as an apex Research Centre for all aspects of Local Health Traditions and Ethno-Medical Practices.
- To create an interface between Traditional Healers and Scientific Research.
- Survey, documentation, and validation of folk medicine practices, remedies and therapies for possible usage in public healthcare and research.
- To enhance capacities, and upgrade skills of traditional healers to enable the delivery of standardized healthcare services, increasing robustness and sustainability of the profession.

Institute of Life Sciences, Bhubaneshwar

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North Eastern Council
Government of India

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