INDIAN NATIONAL SCIENCE ACADEMY

Bahadur Shah Zafar Marg, New Delhi - 110002

Minutes of the "Celebration of Science Week at Delhi-2025" and 91st Anniversary General Meeting of the Indian National Science Academy held during 2-5 December 2025 at various universities/institutes of Delhi/NCR.

The following INSA Fellows/IDL-1/INSA Young Associates/INSA Associate Fellows/ INSA History of Science Young Associate/INSA Overseas Chairs were present:

1. Professor Ashutosh Sharma, President, INSA
2. Professor Madhu Dikshit, Vice-President (Fellowship Affairs), INSA
3. Professor Indranil Manna, Vice-President (Science and Society), INSA
4. Dr Debashis Mitra, Vice-President (International Affairs), INSA
5. Professor Sanjay Puri, Vice-President (RGM), INSA
6. Professor SC Mande, President-Elect, INSA
7. Dr Anurag Agrawal, Vice-President-Elect, INSA
8. Professor GD Yadav, Vice-President-Elect, INSA
9. Dr Purushothaman Chirakkuzhyil Abhilash
10. Professor Bernard P Arulanandam
11. Professor Elangannan Arunan
12. Professor Md Zahid Ashraf
13. Professor SR Athreya
14. Dr Prarabdh Chandrakant Badgujar
15. Dr Chirodeep Bakli
16. Professor Arpan Banerjee
17. Professor DM Banerjee
18. Dr Anirban Basu
19. Professor Suddhasatwa Basu
20. Professor Himender Bharti
21. Dr Sabhyata Bhatia
22. Professor Satya Sundar Bhattacharya
23. Professor Suryasarathi Bose
24. Dr Indranath Chakraborty
25. Professor Niranjan Chakraborty
26. Dr Subhra Chakraborty
27. Professor Supriya Chakraborty
28. Dr Tanmoy Chakraborty
29. Dr Dibyendu Chatterjee
30. Professor BVR Chowdari
31. Professor Patrick D'Silva
32. Professor Amita Das
33. Professor Benu Brata Das
34. Professor Chandrima Das
35. Dr Dibyendu Das
36. Dr Santosh Kumar Das
37. Professor Sarit Kumar Das
38. Dr Ved Vivek Datar
39. Dr Rajib Deb
40. Dr Amaranatha Reddy Devulapalli

41. Professor Debangshu Dey
42. Professor Suman Kumar Dhar
43. Professor Dipyaman Ganguly
44. Professor Subi Jacob George
45. Dr Uttam Kumar Ghorai
46. Professor Anish Ghosh
47. Professor Aswini Ghosh
48. Professor Sujit Kumar Ghosh
49. Professor Sundargopal Ghosh
50. Professor Jagadeesh Gopalan
51. Professor Samudrala Gourinath
52. Dr Purvi Gupta
53. Dr Durga Prasada Rao Hari
54. Professor Mukesh Jain
55. Dr Jomon Joseph
56. Professor CJ Joshi
57. Professor Suhas Sitaram Joshi
58. Professor Jayantee Kalita
59. Professor Tarun Kant
60. Professor Santosh Kapuria
61. Dr Suphiya Khan
62. Dr Dhiraj Kumar
63. Dr Prashant Kumar
64. Professor Vinod Kumar
65. Dr HN Kumara
66. Dr Charu Lata
67. Dr Kinjalk Lochan
68. Professor Meena Bhaskar Mahajan
69. Professor Tapas Kumar Manna
70. Professor Ujjwal Maulik
71. Professor Amit Mishra
72. Professor Rahul Mitra
73. Professor Supriyo Mitra
74. Dr Kutubuddin Ali Molla
75. Professor Tapan Kumar Mondal
76. Professor JN Moorthy
77. Professor Ashis Kumar Mukherjee
78. Professor Partha Sarathi Mukherjee
79. Professor Prasanta K Panigrahi
80. Professor N Parthasarathy
81. Professor G Parthasarathy
82. Dr Rakesh Kumar Pilania
83. Dr Bhanu Prakash
84. Dr Kalika Prasad
85. Professor Manoj Prasad
86. Professor Munukutla Radhakrishna
87. Professor Jaikumar Radhakrishnan
88. Dr Rajesh Ramachandran
89. Professor Ravishankar Ramachandran
90. Professor Dhevalapally B Ramachary
91. Professor Sadiq Ali Rangwala
92. Professor Diwan S Rawat

93. Professor Samit Kumar Ray
94. Professor BM Reddy
95. Dr Sriparna Saha
96. Dr Amiya Kumar Samal
97. Dr Nitika Sandhu
98. Professor Sripada S. V. Rama Sastry
99. Professor Samir V Sawant
100. Professor Ashoke Sen
101. Professor Pankaj Seth
102. Professor Chandra Shekhar Sharma
103. Professor Shilpi Sharma
104. Professor Shobhona Sharma
105. Professor Aradhana Shrivastava
106. Professor Saurabh Kumar Shrivastava
107. Professor Brajesh Kumar Singh
108. Dr Dheer Singh
109. Professor Jayant Kumar Singh
110. Dr Surya Prakash Singh
111. Dr Swati Singh
112. Professor Aninda Sinha
113. Professor Rajiv Sinha
114. Dr Somlata
115. Professor Ramanathan Sowdhamini
116. Professor Binod Sreenivasan
117. Dr Rahul Srivastava
118. Professor RI Sujith
119. Professor Basker Sundararaju
120. Dr Swati Tripathi
121. Dr Amit Tuli
122. Dr Mohit Tyagi
123. Dr Amit Kumar Upadhyay
124. Professor KC Upadhyaya
125. Dr Mohit Verma
126. Dr Sudesh Kumar Yadav

In the "Celebration of Science Week at Delhi-2025" and 91st Anniversary General Meeting (2-5 December 2025), the following activities were organized: Presidential address, lectures from Past-Presidents of INSA, lectures from new INSA Fellows, INSA Young Associates, INSA Associate Fellows, INSA Distinguished Lecture Fellows-I, INSA Distinguished Lecture Fellows-II, INSA Overseas Chair, INSA Women Associates and INYAS Chair.

2nd December, 2025

AMITY UNIVERSITY, NOIDA

Sectional Committee IV- Chair: Professor G Parthasarathy

Lecture of INSA Distinguished Lecture-2 Fellow

1. Dr Shailesh Nayak

Lecture New Fellow

1. Professor M Radhakrishna
2. Professor Rajiv Sinha
3. Professor Binod Sreenivasan

Lecture of INSA Distinguished Lecture-1 Fellow
1. Professor Supriyo Mitra

Lecture INSA Young Associate
1. Dr Swati Tripathi
2. Dr Amiya Kumar Samal

Lecture INSA Associate Fellow
1. Dr Prashant Kumar

Sectional Committee IX- Chair: Professor Shally Awasthi

Lecture of INSA Distinguished Lecture-2 Fellow
1. Professor Rakesh Aggarwal

Lecture New Fellow
1. Professor Dipyaman Ganguly
2. Professor Jayantee Kalita
3. Professor Ganesan Karthikeyan
4. Dr Dhiraj Kumar
5. Professor Pankaj Seth

Lecture New Foreign Fellow
1. Professor Bernard P Arulanandam

Lecture of INSA Distinguished Lecture-1 Fellow
1. Dr Rakesh Kumar Pilania

Lecture INSA Young Associate
1. Dr Swati Singh

Lecture INSA Associate Fellow
1. Dr Amit Tuli
2. Professor Arpan Banerjee
3. Professor Amit Mishra

The programme of Amity University, Noida is attached at ***Annexure-I***. Summary of the lectures and brief profiles are attached at ***Annexure-II.***

DELHI UNIVERSITY, NEW DELHI

Sectional Committee III- Chair: Professor Amitava Das

Lecture New Fellow
1. Professor Elangannan Arunan
2. Professor DB Ramachary
3. Professor SJ George
4. Professor SK Ghosh
5. Professor Sundargopal Ghosh

6. Professor PS Mukherjee
7. Professor DS Rawat
8. Professor BM Reddy

Lecture of INSA Distinguished Lecture-1 Fellow
1. Dr Surya Prakash Singh

Lecture INSA Young Associate
1. Dr Indranath Chakraborty
2. Dr Uttam Kumar Ghorai
3. Dr Durga Prasada Rao Hari

Lecture INSA Associate Fellow
1. Dr Dibyendu Das
2. Professor Sripada S. V. Rama Sastry
3. Professor Basker Sundararaju

The programme of Delhi University, New Delhi is attached at ***Annexure-III***. Summary of the lectures and brief profiles are attached at ***Annexure-IV.***

JAWAHARLAL NEHRU UNIVERSITY, NEW DELHI

Sectional Committee VII- Chair: Dr Uday Bandyopadhyay

Lecture of INSA Distinguished Lecture-2 Fellow
1. Professor Anand Kumar Bachhawat

Lecture New Fellow
1. Professor Chandrima Das
2. Dr Jomon Joseph
3. Professor TK Manna
4. Dr Kalika Prasad

Lecture of INSA Distinguished Lecture-1 Fellow
1. Dr Dimple Notani

Lecture INSA Young Associate
1. Dr Somlata

Lecture INSA Associate Fellow
1. Dr Rajesh Ramachandran

The programme of Jawaharlal Nehru University, New Delhi is attached at ***Annexure-V***. Summary of the lectures and brief profiles are attached at ***Annexure-VI.***

3rd December, 2025

A. The Inaugural Session

The opening remarks were delivered by Professor Sanjay Puri, Vice-President (Resource Generation and Management). This was followed by the welcome address delivered by

Professor Santishree Dhulipudi Pandit, Vice-Chancellor, Jawaharlal Nehru University, New Delhi.

The abstract booklet of the *Celebration of Science Week at Delhi–2025*, the legacy volume *INSA@90* titled *"The Scientific Enterprise in India"*, and a special issue of *IJPAM* were released by the dignitaries on the dais, namely Professor Ashutosh Sharma, President, INSA; Professor Ajay K. Sood, Principal Scientific Advisor, Government of India and Past President, INSA; Professor Santishree Dhulipudi Pandit, Vice-Chancellor, JNU; Professor S. C. Mande, President-Elect, INSA; Dr V. M. Tiwari, Vice-President (Informatics/Publications); Professor Sanjay Puri, Vice-President (Resource Generation and Management); and Professor Indranil Manna, Vice-President (Science and Society). Professor Jugal K. Verma was specially invited for the release of the special issue of *IJPAM*. In addition, a coffee table book titled *"Science20, 2023 – One Earth, One Family, One Future"* was released during the inaugural session. Professor Debashis Mitra, Vice-President (International Affairs), and Professor Narinder K. Mehra, FNA, were also invited for the release of the coffee table book. Further, the portal for the INQUA Congress 2027 was launched by the President, INSA.

Thereafter, Professor Ajay K. Sood, Principal Scientific Advisor, Government of India and Past President, INSA, delivered a lecture, followed by the Presidential Address titled *"Creating a Stable, Inclusive, Robust, and Sustainable Knowledge Ecosystem: Evolving Roles, Structure, and Processes of Academies at a Crossroads"* by Professor Ashutosh Sharma, President, INSA. A summary of the lecture and a brief profile are attached as ***Annexure-VII***.

Further, online and recorded lectures were presented by Dr R. A. Mashelkar, Professor Chandrima Shaha, Professor M. M. Sharma, and Professor P. N. Tandon, Past Presidents of INSA.

Dr V. M. Tiwari, Vice-President (Informatics/Publications), presented the slides of Professor R. Gadagkar, Past President of INSA.

Inaugural session was ended by the lecture of Professor S.C. Mande, President-Elect, INSA.

B. Lectures by New Fellows of Science in Translation and Science for Society.

Chair: Professor Ashutosh Sharma, President, INSA
Co-Chair- Professor Madhu Dikshit, Vice-President (Fellowship Affairs), INSA

Dr Anand S Deshpande
Dr Ajit K Mohanty
Dr Anil P Joshi
Professor Naima Khatoon
Mr Saurabh Srivastava
Dr Renu Swarup
Mr Sumant Sinha *(Pre-recorded talk)*
Dr Devi Prasad Shetty *(Pre-recorded talk)*

A summary of the above lectures and brief profiles are given at ***Annexure-VIII.***

C. Admission of Fellows under Rule 11

Professor Ashutosh Sharma, President INSA, presented Scrolls and Angavastram to the 54 Fellows (w.e.f. 1.1.2026) and 4 Foreign Fellows (w.e.f. 1.1.2026). Fellows were, thereafter, inducted into the Fellowship, took the oath, and signed the Fellowship Register. The list is given in ***Annexure-IX***.

17 INSA Young Associate, 18 INSA Associate Fellows, 1 INSA History of Science Young Associate received the Certificate and Angavastram from President of INSA. They also took oaths, signed the Register, and were inducted. In addition, 12 INSA Distinguished Lecture Fellows I and II received the Citation and Angavastram from President of INSA. The list is given in ***Annexure-X* .**

Following the presentations mentioned above, regular agenda items were taken up:

1. Condolence at the passing away of the distinguished Fellow:

The sad demise of Professor Vidyeswaran Rajaraman was reported. The President, INSA, read the obituary note, and all those present stood in silence for two minutes as a mark of respect to the deceased.

2. Confirmation of minutes of the Annual General Meeting held on 9 September, 2025.

The minutes of the AGM held on 9 September 2025 were presented by Professor Madhu Dikshit, Vice-President (Fellowship Affairs) INSA. These minutes were uploaded on the INSA website, and no comments were received. Thereafter, the minutes were confirmed.

3. To read as required under Rule 40(c) the name of nominees for election as INSA Fellow from 26th August, 2025 to 23rd November, 2025.

Professor Madhu Dikshit, Vice-President (Fellowship Affairs), INSA read the name of nominee for election as INSA Fellow.

4. Retirements of INSA staff during the year 2025.

Professor Madhu Dikshit, Vice-President (Fellowship Affairs), INSA announced the Retirements during the year 2025.

RETIREMENTS:

S No.	Name & Designation	Level in Pay Matrix	Date of Retirement	Retirements
1.	Shri Manoj Kumar MTS	4	31.01.2025	Retirement
2.	Smt. Vandana Gajare Program Officer	9	31.05.2025	Retirement

5. Removal of Dr Ashok Pandey from the INSA Fellowship.

The complaints were received about possible plagiarism committed by Dr. Ashok Pandey in some of his research papers and the retraction of many of his papers by the journal for which Dr. Pandey was the Executive Editor for several years. The complaints were examined by a scrutiny committee and subsequently by INSA Panel on Ethics in Science and discussed in the Council on 9th September, 2025. Further, the Council re-referred the Case to INSA Panel on Ethics in Science. The Panel has discussed the case and recommended that the election of Dr Ashok Pandey is NOT tenable. The Council in its meeting held on 2nd Dec. 2025 also endorsed the recommendation of the committee and decided to remove Dr. Ashok Pandey from INSA Fellowship.

As per the rule at the next General Meeting, if three-fourth of the Fellows present vote for the removal of Dr Ashok Pandey, he shall be removed from Fellowship of the Academy.

6. Restructuring and Recategorization of Sectional Committees.

The Council has constituted a committee Chaired by Prof. Spenta R Wadia to look after the Restructuring and Recategorization of Sectional Committees. The final recommendations of the committee approved by the Council at its meeting held on 2nd Dec. 2025 are as follows:

NEW SECTIONAL COMMITTEES

1. Mathematical Sciences
2. Physical Sciences
3. Chemical Sciences
4. Earth and Environmental Sciences
5. Engineering and Applied Sciences
6. Biological Sciences
7. Biomedical and Health Sciences
8. Plant and Agricultural Sciences
9. Interdisciplinary Science and Engineering: Deep Tech and Critical Technologies.

7. New Initiatives.

Professor Madhu Dikshit, Vice-President (Fellowship Affairs) briefed about the new initiatives taken during the tenure of Professor Ashutosh Sharma, President, INSA.

8a. Presentation of Mementos to Outgoing Officers and Members of the INSA Council.

During the presentation ceremony honouring the outgoing Officers and Members of the INSA Council, special recognition was accorded to Professor Madhu Dikshit, Vice-President (Fellowship Affairs); Professor Sanjay Puri, Vice-President (Resource Generation and Management); and Dr Anirban Basu, Council Member. The President, INSA presented them with a shawl as a symbolic token of respect.

Acknowledgement was also extended to other esteemed members who were unable to be present at the event, namely Professor Sanghamitra Bandyopadhyay, Professor Arup Bose, Professor Srubabati Goswami, Professor Sriram R. Ramaswamy, and

Professor Sunil Kumar Singh (Members); Professor Kaustuv Sanyal, Additional Member (Government of India); Professor Nikhil Tandon, Additional Member (NASI); Professor Arup Kumar Pal, Additional Member (IASc); Dr Ashok Kumar Singh, Additional Member (NAAS); and Dr S. P. Thyagarajan, Additional Member (NAMS).

Expressing profound gratitude, the President, INSA conveyed heartfelt thanks to all Council members for their unwavering support and dedicated service.

8b. Presentation of memento to outgoing President, Professor Ashutosh Sharma.

Professor S. C. Mande, President-Elect, presented a shawl and an album containing representative photographs highlighting the major activities of INSA during the presidency of Professor Ashutosh Sharma. He also addressed the General Body. Professor Mande thanked Professor Ashutosh Sharma for his guidance in steering the Academy and for initiating several new programmes under his leadership. Prof. Mande further expressed his sincere appreciation to the INSA Council, both outgoing and incoming members, for their immense support.

The meeting ended with a vote of thanks to the Chair.

4th December, 2025

ASHOKA UNIVERSITY, SONIPAT

Sectional Committee I- Chair: Professor CS Rajan

Lecture of INSA Distinguished Lecture-2 Fellow
1. Professor SR Athreya

Lecture New Fellow
1. Professor Anish Ghosh
2. Professor Meena Bhaskar Mahajan

Lecture New Foreign Fellow
1. Professor Michael Batty *(Pre-recorded talk)*

Lecture of INSA Distinguished Lecture-1 Fellow
1. Dr Ved Vivek Datar

Lecture INSA Young Associate
1. Dr Purvi Gupta

Lecture INSA Associate Fellow
1. Professor Saurabh Kumar Shrivastava

Sectional Committee VI- Chair: Professor NG Prasad

Lecture of INSA Distinguished Lecture-2 Fellow
1. Professor Vinod Kumar

Lecture New Fellow
1. Professor Himender Bharti
2. Dr HN Kumara
3. Professor AK Mukherjee
4. Professor N Parthasarathy

Lecture INSA Associate Fellow
1. Dr Purushothaman Chirakkuzhyil Abhilash
2. Dr Suphiya Khan

Lecture INSA Overseas Chair
1. Professor Adam K. Chippindale

The programme of Ashoka University, Sonipat is attached at ***Annexure-XI***. Summary of the lectures and brief profiles are attached at ***Annexure-XII.***

INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI

Sectional Committee X- Chair: Dr Sneh Lata Singla-Pareek

Lecture of INSA Distinguished Lecture-2 Fellow
1. Professor Paramjit Khurana

Lecture New Fellow
1. Dr SS Bhattacharya
2. Professor Mukesh Jain
3. Dr TK Mondal
4. Professor SV Sawant
5. Professor Shilpi Sharma
6. Dr Dheer Singh
7. Dr SK Yadav

Lecture New Foreign Fellow
1. Professor Brajesh Kumar Singh

Lecture of INSA Distinguished Lecture-1 Fellow
1. Dr Dibyendu Chatterjee

Lecture INSA Young Associate
1. Dr Nitika Sandhu
2. Dr Prarabdh Chandrakant Badgujar
3. Dr Bhanu Prakash

Lecture INSA Associate Fellow
1. Dr Kutubuddin Ali Molla
2. Dr Charu Lata
3. Dr Rajib Deb

The programme of Indian Agricultural Research Institute, New Delhi is attached at ***Annexure-XIII***. Summary of the lectures and brief profiles are attached at ***Annexure-XIV*.**

INDIAN INSTITUTE OF TECHNOLOGY DELHI, NEW DELHI

Sectional Committee II- Chair: Professor Tanusri Saha-Dasgupta

Lecture of New Fellow- Science in Translation
1. Mr Nadir B Godrej *(Pre-recorded talk)*

Lecture of INSA Distinguished Lecture-2 Fellow
1. Professor Ashoke Sen

Lecture New Fellow
1. Professor Anjan Barman
2. Professor PK Panigrahi
3. Professor SA Rangwala
4. Professor Aradhana Shrivastava
5. Professor Aninda Sinha

Lecture New Foreign Fellow
1. Professor BVR Chowdari
2. Professor Jürgen Hartmut Eckert *(Pre-recorded talk)*
3. Professor Chandrashekhar Janardan Joshi

Lecture of INSA Distinguished Lecture-1 Fellow
1. Dr Mohit Tyagi

Lecture INSA Young Associate
1. Dr Kinjalk Lochan
2. Dr Rahul Srivastava

Lecture INSA Associate Fellow
1. Dr Santosh Kumar Das

The programme of Indian Institute of Technology Delhi, New Delhi is attached at ***Annexure-XV***. Summary of the lectures and brief profiles are attached at ***Annexure-XVI.***

SRMIST, GHAZIABAD

Sectional Committee V- Chair: Professor YM Joshi

Lecture of INSA Distinguished Lecture-2 Fellow
1. Professor Jaikumar Radhakrishnan

Lecture New Fellow
1. Professor Suddhasatwa Basu
2. Professor SK Das
3. Professor Jagadeesh Gopalan
4. Professor SS Joshi
5. Professor Ujjwal Maulik
6. Professor Rahul Mitra
7. Professor SK Ray
8. Professor JK Singh
9. Professor RI Sujith

Lecture of INSA Distinguished Lecture-1 Fellow
1. Dr Sriparna Saha

Lecture INSA Young Associate
1. Dr Amaranatha Reddy Devulapalli
2. Dr Chirodeep Bakli
3. Dr Tanmoy Chakraborty
4. Dr Mohit Verma

Lecture INSA Associate Fellow
1. Professor Chandra Shekhar Sharma

Sectional Committee VIII- Chair: Dr RP Roy

Lecture of INSA Distinguished Lecture-2 Fellow
1. Professor Ramanathan Sowdhamini

Lecture New Fellow

1. Dr Shantanu Chowdhury
2. Professor Patrick D'silva
3. Professor BB Das
4. Professor Ravishankar Ramachandran

Lecture of INSA Distinguished Lecture-1 Fellow

1. Professor Timir Tripathi

The programme of SRMIST, Ghaziabad is attached at ***Annexure-XVII***. Summary of the lectures and brief profiles are attached at ***Annexure-XVIII.***

5th December, 2025

MIRANDA HOUSE (DU), NEW DELHI

INYAS Lecture was delivered by Dr. Nishant Chakravorty, Chairperson, INYAS

A summary of the lecture and brief profile is attached at ***Annexure-XIX.***

26 Lectures and 29 inductions of INSA Women Associates (IWA) were organized.

The programme of Miranda House (DU), New Delhi is attached at ***Annexure-XX***.

A summary of the lecture and brief profile is attached at ***Annexure-XXI.***

The list of inducted INSA Women Associates (IWA) is attached at ***Annexure-XXII.***

INSA SCIENCE WEEK CELEBRATION

DELHI 2025

DAY – 1

Hosted By:

Amity University Uttar Pradesh

Technical Sessions

- ***Sectional Committee IV***
  Earth & Environmental Sciences

- ***Sectional Committee IX***
  Health Sciences

Date:

December 2, 2025 (Tuesday)

Venue:

Amity University Uttar Pradesh
Sector - 125, Noida

PROGRAMME SCHEDULE – December 2, 2025

TIME	PROGRAMME
10:00AM-11:19AM	**INAUGURAL PROGRAMME (**VENUE: I-2 MOOT COURT)
11:20AM-11:45AM	High Tea
11:46AM-2:15PM	**PARALLEL SESSIONS FOR SECTIONAL COMMITTEE PRESENTATIONS**
Session 1 - Sectional Committee IX (Health Sciences) **Venue:** I2 Moot Court **Session Chair:** Prof. Shally Awasthi, Department of Pediatrics, King George's Medical University, Lucknow **Co-Chair-** Prof. Chanderdeep Tandon, Additional Pro-VC, Dean, Faculty of Biosciences & Biotechnology	
11:46AM-12:00PM	Prof. (Dr.) Dipyaman Ganguly, Head of the Department, Biology, Professor of Biology, Ashoka University
12:01PM-12:15PM	Prof. (Dr.) Jayantee Kalita, professor, Department of Neurology, Sanjay Gandhi Post Graduate Institute of Medical Sciences.
12:16PM-12:30PM	Professor Ganesan Karthikeyan, Executive Director Translational Health Science and Technology Institute Ministry of Science & Technology, Govt of India
12:31PM-12:45PM	Dr Dhiraj Kumar Group Leader, Cellular Immunology Group, International Centre for Genetic Engineering and Biotechnology, New Delhi
12:46PM-1:00PM	Professor Pankaj Seth, Scientist VII and Senior Professor Molecular and Cellular Neuroscience, Neurovirology Section, National Brain Research Centre
1:01PM-1:15PM	Professor Bernard P Arulanandam, Vice Provost for Research and Professor of Immunology, Tufts University
1:16PM-1:30PM	Dr Amit Tuli, Principal Scientist & Wellcome Trust-India Alliance Intermediate Fellow, Division of Cell Biology & Immunology, CSIR-Institute of Microbial Technology, Chandigarh.
1:31PM-1:45PM	Professor Arpan Banerjee, Scientist VI, National Brain Research Centre, Gurgaon.
1:46PM-2:00PM	Professor Amit Mishra, Professor, Department of Bioscience & Bioengineering, Indian Institute of Technology Jodhpur.
2:00 PM-2:15PM	Dr Swati Singh, DM, Clinician Scientist, Consultant Ophthalmologist, LV Prasad Eye Hospital, Hyderabad

Session 2 - Sectional Committee IV (Earth and Environmental Sciences) **Venue:** F2 Seminar Hall **Session Chair-** Prof G. Parthasarathy, DAE- Raja Ramanna Chair, Atomic Minerals Directorate for Exploration & Research (AMD), Bengaluru **Co-Chair:** Dr. S. P. Singh, Director, ASNRSD, AIGIRS	
11:45AM-12:00PM	Prof. (Dr.) M Radhakrishna, Professor and Head, Department of Earth Sciences, Indian Institute of Technology-Bombay
12:01PM-12:15PM	Prof. (Dr.) Rajiv Sinha, Professor (HAG), Department of Earth Sciences, Indian Institute of Technology-Kanpur
12:16 PM-12:30PM	Prof. (Dr.) Binod Sreenivasan, Centre for Earth Sciences, Indian Institute of Science, Bengaluru.
12:31 PM-12:45PM	Dr. Prashant Kumar, Scientist – SF, Atmospheric Sciences Division, Atmospheric and Oceanic Sciences and Applications Group EPSA, Space Applications Centre, ISRO, Ahmedabad.
12:46 PM-1:00PM	Dr Swati Tripathi, Scientist-E, Birbal Sahni Institute of Palaeosciences, Lucknow.
1:01 PM-1:15PM	Prof. (Dr.) Amiya Kumar Samal, Assistant Professor, Department of Geology, Banaras Hindu University, Varanasi.
2:01 PM-2:45PM	**Lunch**

2:46PM-3:15PM	**INSA DISTINGUISHED LECTURES**
Lecture Session 1 - Sectional Committee IX (Health Sciences) **Venue:** I2 Moot Court **Session Chair:** Prof. Shally Awasthi, Department of Pediatrics, King George's Medical University, Lucknow **Co-Chair-** Prof. Chanderdeep Tandon, Additional Pro-VC, Dean, Faculty of Biosciences & Biotechnology	
2:45 PM- 3:00 PM	Prof. (Dr.) Rakesh Aggarwal, Professor and Head, Department of Gastroenterology, Sanjay Gandhi Postgraduate Institute of Medical Sciences
3:01 PM- 3:15 PM	Dr Rakesh Kumar Pilania, Asst. Professor, Department of Pediatrics, Advanced Pediatrics Centre, Postgraduate Institute of Medical Education and Research

Lecture Session 2 - Sectional Committee IV (Earth and Environmental Sciences) **Venue:** F2 Seminar Hall **Session Chair-** Prof G. Parthasarathy, DAE- Raja Ramanna Chair, Atomic Minerals Directorate for Exploration & Research (AMD), Bengaluru **Co-Chair:** Dr. S. P. Singh, Director, ASNRSD, AIGIRS	
2:45PM-3:00PM	Dr Shailesh Nayak, Director National Institute of Advanced Studies, Indian Institute of Science Campus
3:01PM-3:15PM	Prof. (Dr.) Supriyo Mitra, Professor, Department of Earth Sciences, Indian Institute of Science Education and Research Kolkata.
ROUND-TABLE SESSION (Venue I-2 Moot Court)	
3:46 PM- 4:45 PM	Discussion of visiting INSA fellows with senior professors/ researchers of Amity in I-2 Moot Court for both sectional committees: With Sectional Committee -IV Environmental Sustainability and Climate Change Earth Sciences and Geoinformatics Sectional Committee-IX Immunology Neuroscience Cardiovascular and Metabolic Disorder Infectious Disease and Public Health
4:46 PM- 5:15 PM	**WRAP-UP SESSION**

Sectional Committee -IV
Earth & Environmental Sciences

Chair
Prof G. Parthasarathy, FNA

Professor G Parthasarathy FNA is currently a DAE-Raja Ramanna Chair Professor at DAE-Atomic Minerals Directorate for Exploration and Research, Sothern Region, Bengaluru. He obtained his PhD in 1984 from IISc Bangalore, AvH fellow 1987-88, and worked for CSIR-NGRI from 1990-2018. He joined as an Adjunct Professor and INSA Senior Scientist at National Institute of Advanced Studies, Bengaluru (2019-2024) in Earth and Planetary Sciences. He was a President of Indian Social Science Academy (Allahabad) during 2021-22. He has published about 330 research papers in peer reviewed journals, in the area of Condensed Matter Physics, and Materials Science, Earth and Planetary sciences

Earth System Science: The Science of Sustainability

Shailesh Nayak

National Institute of Advanced Studies (NIAS), Bengaluru
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Sustainability to be approached at three levels of 'system' – global, social and human (Komiyama and Takeuchi, 2006). The Global or earth system comprises the planet Earth and its components – the geosphere, atmosphere, hydrosphere, cryosphere and biosphere. The earth sustains human being by providing natural resources, energy and conducive ecosystem to survive and Earth system science provides a physical basis for understanding the world in which we live and upon which sustainability depends. The social system consists of the political, economic and industrial structures created by human beings to provide a societal base for the human existence. The human system is connected to the social system and requires following certain lifestyles and values for well-being of people.

In broad sense, the earth system science brings together, geo- and ecosystem sciences, space science and applications, technology, engineering along with social science, economics and cognition. Remote sensing provides information about components of the Earth system and facilitates the understanding about interactions between these components and anthropogenic activities. The changing global and regional climate and their impact on components of earth systems is critical for sustainability. Some of the aspects discussed include water resources, both surface and ground water, their storage and recharge; snow and glaciers and mass balance; agro-ecosystems (landscapes and soils) and their management; Response of marine ecosystems and fisheries to climate Change, hazards, prediction and warning systems, increased demand of critical minerals and rare earths. The interaction of ecological, economic and social processes and their understanding and modelling are basis for the sustainable development.

Speaker's Profile

Dr. Shailesh Nayak is Director, National Institute of Advanced Studies, Bengaluru and Editor-in-Chief, Journal of the Indian Society of Remote Sensing, Dehradun. He was Secretary, Ministry of Earth Sciences, during 2007-2015 and provided leadership for programs related to earth system sciences. His current research interest includes building strategy for blue economy and sustainable development. While at the Space Applications Centre, ISRO, he pioneered the development of algorithms for the application of remote sensing to the coastal and marine environment, and generated baseline database of the Indian coast, and developed services for fishery and ocean state forecast. He had set up a state-of-the-art Early Warning System for Tsunami at the Indian National Centre for Ocean Information Services (INCOIS), Hyderabad.

Dr Nayak is a Fellow of the Indian National Academy of Science, Delhi, Indian Academy of Sciences, Bengaluru, National Academy of Sciences, India, Prayagraj, International Society of Photogrammetry & Remote Sensing (ISPRS), Academician of the International Academy of Astronautics (IAA). He has published about 200 papers in peer-reviewed journals.

The Govt of India awarded the 'Padma Shri' in the field on science and engineering in 2024.

Structure and Evolution of the Indian Continental Lithosphere

Supriyo Mitra

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The Indian Lithosphere has been shaped by multiple tectonic processes, which include break-up from the Gondwana Supercontinent, traversing over the Reunion and Kerguelen hotspots, collision with Eurasia, and underthrusting beneath the Himalaya and Tibetan Plateau. Seismic velocity structure and radial anisotropy of the lithosphere preserves imprints of these tectonic processes and related deformation. We perform joint-modeling of fundamental-mode Rayleigh (LR) and Love (LQ) wave group-velocity dispersion, for periods between 10 and 120s, to obtain radially anisotropic shear-wave velocity structure across India, Himalaya and Tibet. 1D path-average dispersion curves, computed for ~14700 regional earthquake-receiver raypaths, has been passed through systematic quality control of signal-to-noise ratio (>3), elimination of multipathed energy using polarization analysis, and removal of overtone interference, by synthetic tests. These 1D dispersion data are combined through a tomographic formulation to obtain 2D maps. LR and LQ fundamental-mode group-velocity dispersion data at 4906 tomographic nodes are jointly inverted for an anisotropic Vs structure. Results are presented as 2D depth-slice maps and cross-sections constructed using bilinear interpolation. The main findings from our models provide: (i) a characteristic voigt-average Vs structure and radial anisotropy of the Indian continental lithosphere, structure of the sedimentary basins, and the geometry of the Moho; (ii) the disposition of the Indian Plate beneath Himalaya-Tibet, its lateral variations and internal structure; and (iii) the signatures of plume-lithosphere interactions, mainly between the Reunion hotspot and the Indian lithosphere.

Speaker's Profile

Supriyo Mitra is a seismologist interested in earthquake source physics, internal structure of the Earth, attenuation characteristics of seismic waves and simulation of earthquake ground motion. He obtained his PhD from the University of Cambridge, UK and is a Professor in the Department of Earth Sciences, IISER Kolkata. He pioneered broadband-seismological-field experiments in the Himalayas, and studies velocity structure and earthquake source properties, to test hypotheses of lithospheric evolution. He is a recipient of the INSA Young Scientist medal, NASI-Scopus Young Scientist Award, National Geoscience Award, Cambridge-Hamied Fellowship, INSA Associate Fellowship and Associateship of the International Center for Theoretical Physics, Trieste.

Unravelling the crustal architecture and basin evolution of the eastern Indian continental margin using the constrained potential field modelling

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The crust underlying the Eastern Continental Margin of India preserves the imprints of the rift-drift episodes associated with the eastern Gondwana breakup and resulted complex crustal architecture and the development of several major sedimentary basins. Due to lack of identifiable magnetic anomalies, the location of continent-ocean boundary, nature of rifting and subsequent breakup along the margin remain poorly constrained. This knowledge gap hinder our understanding of the pre-rift configuration of India within the East Gondwana. I present here, the results from seismically constrained potential field and process-oriented gravity modelling of the margin which revealed the crustal architecture across different segments of the margin. In the southern and central conjugate segments, magma-poor margin characteristics are evident, with exposed mantle and hyperextension primarily found in the Krishna-Godavari basin of the Indian margin. Conversely, the northern conjugate segments display thick magmatic underplating at the Ocean-Continent-Transition zone indicating magma-rich margin characteristics. Further, the tight-fit reconstruction model, developed based on palinspastically restored conjugate margins and available geological constraints, suggests that the central part of the East Indian margin (16°-20°) is the ideal pre-rift location for the Elan Bank.

Speaker's Profile

Dr. Munukutla Radhakrishna is Professor and Head, Department of Earth Sciences, IIT Bombay. He is teaching geophysics for the last 32 years, guided 25 Ph.D students and published 76 research papers. His research interest includes multi-scale potential field modelling to delineate the crustal structure, rheology, basin formation along Indian continental margins and contiguous regions. Dr.Radhakrishna is the recipient of numerous awards and recognitions which include the Krishnan Medal and Decennial awards of the Indian Geophysical Union, National Geoscience Award, the S.P Sukhatme Award of Excellence in Teaching by IIT Bombay and the UGC Commonwealth Academic Staff fellowship.

River Futures in the Anthropocene: Integrating geospatial intelligence and policy interventions for sustainable river management

Rajiv Sinha
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The term 'Anthropocene' refers to the recent period of Earth's history when human activities started to produce perceptible impacts on Earth's ecosystems. Rivers, particularly large river systems, constitute one of the most fundamental life-support systems that have sustained civilisations, and are projected to be a critical determinant for the future sustenance of human civilisations. In a world that is expected to witness a near doubling of the human population by the middle of the century, and a world that is likely to be impacted by an unprecedented rate of global change, one of the main sustainability agendas will be the construction of dynamic strategies for the management of natural freshwater systems. For more than 5000 years, civilisations have flourished in the South Asian region, leading up to a population hotspot that hosts almost a fifth of the globe's human population. In turn, this has led to significant human intervention and impacts on the freshwater systems of the region. Therefore, the understanding of water problems and water security in this region has to be embedded in holistic approaches that stress the interrelationships of earth, water, and humans. As large river systems constitute a lifeline for the future of human populations, it is important to understand them to secure their futures and thereby our futures. In India, human activities, such as structural interventions, land-use/land-cover changes, sand mining, excessive groundwater usage leading to land subsidence, encroachment of flow pathways ('river space'), and enhanced soil erosion, have significantly altered the hydrological regime of rivers and the associated landscape. This presentation will document the major impacts of human-induced changes on the riverscape using case studies from different parts of the country on problems related to hydrological flow modification, sediment dynamics, flood risk and river health degradation. The focus will be on the use of modern technologies such as geospatial intelligence and hydrological modelling to assess and mitigate these impacts from a sustainability perspective. One of the major problems in such assessments is the lack of "reference conditions" for many Indian rivers, given their long histories of human disturbance. Addressing this complexity requires a river science-based management approach—drawing upon hydrology, geology, chemistry, and ecology—to understand how these processes interact and shape river form and function and eventually river health. Incorporating hydrogeomorphic parameters into river health assessments and rehabilitation strategies is crucial, as is transitioning from "command and control" to an ecosystem-based management paradigm. This shift is essential for supporting more resilient and sustainable river futures in the Anthropocene. It is important to reshape our river management strategies with a perspective of 'River Futures', which advocates an integrated, scientific, and landscape-based approach that goes beyond traditional engineering solutions and fragmented management. This approach emphasises the inherent diversity and dynamic nature of rivers, the historical and ongoing impacts of human activity, and the necessity for integrating social, ecological, and geomorphic perspectives in river management. In essence, it envisions a new era for river management where science, practice, and society intersect to produce resilient, functional, and valued rivers—providing a practical roadmap and stressing a paradigm shift in the mindset of river managers and policy makers.

Speaker's Profile

Rajiv Sinha is a river scientist who has worked on the fundamental hydrological processes in large rivers to understand their geomorphic diversity and complexity as a function of hinterland characteristics, river form and climatic regime. Some of his noted works on flood risk assessment, river dynamics, environmental flows assessment and sediment management of the Indian rivers are being used for developing river management strategies by the stakeholders. One of his most significant research includes geomorphic and stratigraphic characterisation of paleochannels in northwest India linked to the evolution of the Harappan civilisation in this region.

The axial dipole field and its polarity transitions in Earth

Binod Sreenivasan

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The Earth's dynamo is driven by convection in the planet's fluid outer core. Our recent studies indicate that the preference for the axial dipole in Earth-like planets is due to a magnetohydrodynamic process influenced by both rotation and the self-generated magnetic field. We focus on the role of slow magnetostrophic waves, which are produced from localized balances between the Lorentz, Coriolis and buoyancy (MAC) forces in the core. While these waves are essential for dipole formation, the suppression of these waves under strong forcing results in magnetic polarity transitions, including reversals. Since convection in the core of Earth is thought to be influenced by lateral variations in heat flux in the lowermost mantle, the above ideas may be extended to core convection by decomposing buoyancy into its vertical (radial) and horizontal (lateral) parts. In the unstably stratified fluid layer, polarity transitions are induced by an equatorially anti-symmetric heat flux pattern at the outer boundary. The fact that compositional buoyancy is much stronger than thermal buoyancy in the core, together with the known order of magnitude of the peak field intensity, indicates that the core can operate under a large lower-mantle heat flux heterogeneity, of $O(10)$ times the mean heat flux at the core-mantle boundary.

Speaker's Profile

Binod Sreenivasan is a Professor of Earth Sciences at IISc, Bangalore. He earned his B.Tech (Honours) from NIT Calicut, M.S. from IIT Madras, and Ph.D. from the University of Cambridge. Prior to his current role, he served as a Scientist at ISRO and held postdoctoral positions in France and the UK, including a Leverhulme Research Fellowship. His research expertise lies in planetary magnetism, dynamo theory and geophysical fluid dynamics. A recipient of the SwarnaJayanti Fellowship (2011) and the Doornbos Memorial Prize (2014), he was elected a Fellow of the Indian Academy of Sciences in 2020.

Assimilation of Indian satellite observations in the regional atmospheric model

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The evolution of numerical weather prediction (NWP) has been strongly driven by advances in observational capabilities and data assimilation methodologies. Although ground-based measurements remain valuable, satellite observations now supply nearly 90–95% of the data assimilated into operational models, greatly improving spatial and temporal coverage. However, only a limited fraction of satellite-derived information is effectively utilized.
In current practice, most infrared radiances are assimilated only under clear-sky conditions, as cloud-affected radiances require complex cloud screening or correction procedures. This restriction is not due to the lesser importance of cloudy-sky observations, but rather to challenges in radiative transfer modelling, inaccuracies in first-guess cloud parameters, and difficulties in defining appropriate error statistics. Additionally, the nonlinear behaviour of cloud formation and evolution further complicates the assimilation of cloud-contaminated IR radiances.

Significant efforts have been made to advance all-sky radiance assimilation. In particular, assimilation of INSAT-3D/3DR water vapour channels have attempted to incorporate cloudy-sky radiance to improve monsoon prediction. These investigations have also highlighted the importance of including multivariate background-error correlations to better represent the coupling between hydrometeors and dynamical variables under cloudy conditions. Furthermore, a nonlinear filtering approach has been implemented to assimilate INSAT-3D all-sky window-channel radiances into the WRF model using a particle filter technique, demonstrating the potential of advanced assimilation frameworks for improving weather forecasting.

Speaker's Profile

Prashant Kumar earned his Ph.D. in Applied Mathematics from MNNIT Allahabad and has been a Scientist at ISRO's Space Applications Centre since 2008. His primary research interests lie in satellite data assimilation in numerical weather prediction. He has published 112 papers in international peer-reviewed journals. Dr. Kumar has received several prestigious honours, including the NASA Team Award, ISRO Team Award (twice), the Young Researcher Award from the Ministry of Earth Sciences, the Indian Meteorological Society Award, and the P. R. Pisharoty Award, Vigyan Yuva Shanti Swarup Bhatnagar Award.

Hydroclimatic Variability and Vegetation Response over the Last Four Millennia: Multiproxy Records from Majuli Island (World's Largest River Island), Northeast India

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This study integrates biotic (pollen) and abiotic (granulometric) proxies from a 150 cm deep sediment profile of an endangered wetland on Majuli Island, Assam, within the Indo-Burma biodiversity hotspot and under the influence of the Indian Summer Monsoon (ISM). Pollen analysis, supported by modern analogues from 25 surface samples, enabled reconstruction of Mean Annual Temperature (MAT) and Mean Annual Precipitation (MAP) across five pollen zones (SW-I to SW-V) using the Coexistence Approach (CA). The earliest phase (SW-I; 2090–310 BCE / 4040–2260 cal. yrs. BP) indicates warm, humid conditions (MAT ≈ 30 °C; MAP ≈ 3000 mm) with dense forest cover, suggesting regional climatic resilience during the globally arid 4.2 ka event. The presence of *Rhododendron* and *Castanopsis* points to episodic flooding under unstable conditions. Between 310 BCE and 490 CE (SW-II; 2260–1460 cal. yrs. BP), vegetation became more open and relatively less humid with reduced flood activity. A subsequent increased moist interval (850–1450 CE; SW-IV; 1100–500 cal. yrs. BP) corresponds to the Medieval Climatic Anomaly (MCA), marked by renewed deciduous forests and elevated MAP (~2750 mm). Post-1450 CE (SW-V; 500 cal. yrs. BP), declining MAT (13–22 °C) and MAP (500–1092 mm) indicate relatively less humid climate, in consonance to Little Ice Age cool and enhanced human impact, evident by anthropic pollen and savanna-like vegetation. Granulometric shifts reveal transitions from low- to high-energy fluvial regimes through time. Overall, the record highlights regional variability in Holocene monsoon responses and underscores the importance of Majuli's depositional archives for assessing the resilience and sensitivity of tropical systems to past and future abrupt climate change.

Speaker's Profile

Dr. Swati Tripathi is a Scientist-E in the Quaternary Palaeoclimate Laboratory at the Birbal Sahni Institute of Palaeosciences (BSIP), Lucknow. Her research specializes in reconstructing Quaternary vegetation, climate, and depositional environments using diverse biotic and abiotic proxies. She has notable expertise in pollen micro-morphometry, copropalynology, and melissopalynology. Dr. Tripathi received her Ph.D. (2011) and M.Sc. in Botany (2007) from Lucknow University, where she was awarded three gold medals, including the prestigious Birbal Sahni Memorial Gold Medal. Her scientific contributions have been recognized through several honors, including the Dr. B.S. Venkatachala Memorial Medal (2012), Dr. Chunni Lal Khatiyal Medal (2016), SERB Women Excellence Award (2019), and selection as an IAS Young Associate (2017–2021). Most recently, she has been elected as an Associate of the Indian National Science Academy (INSA) and has been awarded the Mani Shankar Shukla Gold Medal (2025) by the Palaeontological Society of India. She has published 62 research papers, supervised 16 M.Sc. dissertations, one awarded Ph.D., and currently mentors two doctoral scholars. Dr. Tripathi's research significantly contributes to major palaeoecological and palaeoclimatic projects across Northeast India and the Ganga Plain.

Reconstructing Precambrian magmatic histories of the Indian Shield: From dyke swarms to LIPs

Amiya K. Samal

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The diverse crustal features of the Indian Shield reflect a long and complex history of geological processes, among which magmatism has played a pivotal role in modifying the crust and lithosphere through time. The Indian Shield preserves one of the most extensive and diverse archives of Precambrian magmatism on Earth. Beyond its well-documented volcanic and plutonic records, the shield hosts several Archean and Proterozoic Large Igneous Provinces (LIPs)—vast, short-lived (<5 Myr) episodes of mantle-derived magmatism emplaced on a continental scale. These LIPs are expressed through diverse plumbing system components, including mafic dyke swarms, sill complexes, and layered intrusions, which together constitute key lithological units across different cratonic blocks. An integrated approach combining field relationships, dyke geometry, geochemical and isotopic systematics, and high-precision U–Pb geochronology has enabled the recognition of major Precambrian magmatic events across the Indian Shield. Collectively, the record reveals three Archean and thirteen Proterozoic LIPs, manifested as two Archean and twenty-three Proterozoic mafic dyke swarms, four Proterozoic sill complexes, four Archean tholeiite–komatiite associations, and five kimberlite–lamproite–alkaline–carbonatite suites, supplemented by minor felsic dyke intrusions. Together, these magmatic systems delineate a long-lived history of several plume-driven magmatism, reflecting cycles of lithospheric growth, and reactivation linked to evolving mantle dynamics and supercontinent assembly processes during the Precambrian.

Speaker's Profile

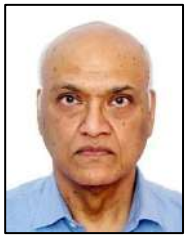
Dr. Amiya Kumar Samal is an Assistant Professor in the Department of Geology, Banaras Hindu University, since 2017. His research specializes in igneous petrology and geochemistry, focusing on the subcontinental lithospheric mantle beneath Archean cratons of the Indian Shield. He has extensively investigated Paleoproterozoic mafic dyke swarms to unravel mantle evolution and identify Precambrian Large Igneous Provinces (LIPs) through geochemical, isotopic, and U–Pb geochronological studies. Dr. Samal has published 35 research papers and received the Associate of IASc, NASI Young Scientist Award, and National Young Geoscientist Award, Ministry of Mines, Govt. of India.

Sectional Committee -IX
Health Sciences

Chair
Prof. Shally Awasthi, FNA

Prof Shally Awasthi is a Paediatrician and epidemiologist. She is former Dean R and D, Head of Department of Pediatrics King George's Medical University Lucknow. Her name has been included in the top 2% scientists in the Stanford list for the last 6 years. Her areas of research interest are paediatric pulmonology(childhood pneumonia), geohelminthic infestations, micronutrient deficiencies and lead toxicity.

Using modelling to make medical decisions



Rakesh Aggarwal

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Mathematical modelling of disease uses mathematical equations to represent disease transmission, progression and outcomes, and helps inform public health policies by forecasting changes in disease burden over time, assessing the impact of various public health interventions, such as contact tracing, vaccination programs, and drug treatment, and comparing their cost-effectiveness and budget impact. This technique permits a rapid comparison of various interventions, whereas clinical trials to compare these often take years, delaying introduction of useful healthcare interventions, are costly, and may be unethical or impossible. In early 2000s, we used modelling techniques to show that universal newborn hepatitis B vaccination in India would be highly cost-effective, and preferable to the then proposed strategy of vaccinating only children born to hepatitis B infected mothers. In fact, we showed that universal vaccination was cost-saving if healthcare costs of cirrhosis and liver cancer were also factored in. These findings played a role in the introduction of universal hepatitis B vaccination in the country, with a consequent major reduction in liver disease burden.

During the 2010s, when generic direct-acting anti-viral agents (DAAs) against hepatitis C virus (HCC) became available in India, our modelling analysis showed that treatment of HCV with these drugs would be cost-saving, and that these savings would be achieved within a few years. Based on these, HCV treatment guidelines for India's National Viral Hepatitis Control Programme and the World Health Organization adopted a universal HCV treatment policy. Further analysis helped determine a price point at which velpatasvir, a newer but costlier DAA whose use did not need viral genotype testing, would be price-neutral with the DAAs that were already available, leading to a reduction in its price. The consequent simplification of HCV treatment has helped a more widespread adoption of HCC treatment in the country, benefitting several HCV-infected people.

Using the above examples, the talk will argue for a greater use of mathematical modelling techniques in health policy decisions.

Speaker's Profile

Professor Rakesh Aggarwal is a hepatologist, with training also in epidemiology and laboratory sciences. He has been working in the field of viral hepatitis, including on clinical, epidemiologic, laboratory, public health and preventive aspects of this disease for over three decades. He is also active in the field of vaccine science. He has contributed to public policy in the field of liver disease and immunization at both national and international level, having served on several committees and expert groups of the Government of India and the World Health Organization.

Kawasaki disease in India: Epidemiology, cardiovascular outcomes and public health implications

Rakesh Kumar Pilania

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Kawasaki disease (KD), an acute childhood vasculitis, has emerged as the leading cause of acquired heart disease in children worldwide, surpassing rheumatic heart disease. Research from India has made significant contributions to understanding the epidemiology, cardiovascular manifestations, and immunopathogenesis of KD. Through hospital-based analyses, we demonstrated a rise in KD incidence in Chandigarh over the years, emphasising its growing public health burden. Using coronary CT angiography, we characterised distal and left circumflex coronary artery abnormalities, reshaping the understanding of long-term cardiac outcomes in KD. Our studies have also elucidated macrophage activation syndrome as a serious complication of KD, explored genetic and immunopathogenic pathways, and identified potential biomarker genes through integrative genomic approaches. Investigations into treatment intensification and IVIG resistance mechanisms have informed clinical management strategies tailored for resource-limited settings. Despite advances, underdiagnosis remains a particular concern. Predictive modelling projects an increase in disease burden, necessitating improvements in surveillance, awareness, and equitable access to treatment. KD in India is transitioning from a rare condition to a significant pediatric cardiovascular health challenge. Establishing a national KD registry, expanding clinician training, and integrating molecular research into clinical practice are crucial to reducing long-term coronary morbidity and mitigating the future public health burden of KD in India.

Speaker's Profile

Dr. Rakesh Kumar Pilania is Associate Professor at the Pediatric Allergy Immunology Unit, Advanced Pediatrics Centre, PGIMER, Chandigarh, India—accredited as both a WHO Collaborating Centre (2022–2026) and an APLAR Centre of Excellence for work in Kawasaki disease (KD). His research focuses on the epidemiology, genetics, and outcomes of KD, supported by several extramural grants (ICMR, DBT, DST, APLAR) and over 182 publications, including 60 on KD. He has received several prestigious national and international awards, including the IRA Young Rheumatologist Oration (2024), Early Career Investigator Highlight Award and Science Digest Award at the International KD Symposium (2024), Young Investigator Award from APSID (2024), APLAR Research Award (2022), and Associate Fellowship of INSA (2023). Dr. Pilania has also received the Dr. Balagopal Raju Endowment Award (2022) and Dr. James Flett Endowment Award (2024). He recently conducted the GIAN Program (2025) on KD and currently serves as Secretary, Indian Society of Kawasaki Disease.

Immunotherapeutic Approaches Against Acinetobacter baumannii

Bernard P Arulanandam

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The ESKAPE pathogen Acinetobacter baumannii (Ab) has become a critical hospital-acquired pathogen due to its widespread multi-drug resistance (MDR) ability and is associated with bacteremia leading to sepsis. Considering the rapid disease progression of Ab infection along with no available licensed vaccine, monoclonal antibody (mAb) therapy has great potential as a modality of life-saving treatment for Ab. Employing an immunoinformatics AI-based approach, our laboratory created a novel multipeptide vaccine (AMEV2) for protection against major lineages of Ab containing 5 major peptides from proteins associated with Ab pathogenesis (displaying putative B- and T-cell epitopes). Through rigorous in vitro and in vivo studies, we have shown that the protection afforded by the AMEV2 vaccine is antibody-based, acting through opsonophagocytic killing. AMEV2-vaccinated mice that were protected from A. baumannii challenge had significantly more pTonB-specific antibodies compared to those that were unprotected. Moreover, pTonB-depleted antibodies exhibited significantly reduced opsonophagocytic killing of A. baumannii. These combined in vivo and in vitro data indicate that pTonB peptides contain epitopes (involved in iron acquisition systems) that have therapeutic potential against drug-resistant Acinetobacter. We have now developed anti-Ab pTonB mAbs using hybridoma technology and are currently characterizing the role of antibody-mediated immunity of the pTonB mAb and its associated transporter, focusing on opsonophagocytic activity, metabolism, and iron transport. These studies will lead to further insight(s) on the use of the pTonB mAb alone or in combination with a vaccine as an effective therapy for Ab infection.

Speaker's Profile

Professor Bernard Arulanandam is the Vice Provost for Research at Tufts University. As an established Immunologist, Dr. Arulanandam holds an appointment as Professor at the Tufts University School of Medicine. His research focuses on elucidating host-microbial interactions and the cellular and molecular mechanisms involved in the induction of immune responses against infectious diseases. Dr. Arulanandam is a fellow of the American Association for the Advancement of Science and an elected fellow of the American Academy of Microbiology and the US National Academy of Inventors.

Understanding the role and regulation of human plasmacytoid dendritic Cells

Dipyaman Ganguly

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Our research in human immunology and cell biology focused on a particular innate immune cell subset called the plasmacytoid dendritic cells (pDC) for past two decades. PDCs are professional type I interferon producing cells in the body, driven by endosomal toll-like receptor activation in response to nucleic acid ligands of both pathogen and host origin. Accordingly, pDC function is crucial in the context of infectious as well as autoimmune diseases. On the other hand, dysregulation of pDC function is a major hindrance to effective anti-cancer immunity. Apart from discovering crucial role of pDCs in the contexts of autoimmune diseases like systemic lupus and psoriasis, our laboratory in India was the first to show a crucial role of these cells in obesity associated metabolic disorders. We also explored the regulatory pathways in human pDCs and identified crucial role of several novel modules that control human pDC functions and can be targeted for therapy, viz. a rheostat involving endocannabinoid receptors and hydrolases, inhibitory role of lactate receptor signaling, regulation of endolysosomal pH by a polyamine transporter as well as a chloride-bicarbonate exchange channel. While working on the cell biology of pDCs we were also the first group to show crucial role played by Piezo1 mechanosensors in human immune cells, e.g. in receptor- ligand endocytosis in pDCs, T cell activation and migration.

Speaker's Profile

Prof. Dipyaman Ganguly is currently Professor and Head, Biology, Ashoka University, Sonipat, Haryana. He earned his MBBS from Medical College, Kolkata, did a PhD in Biotechnology from Indian Institute of Chemical Biology Kolkata, another PhD in Immunology and Biomedical Sciences from UT MD Anderson Cancer Center, Houston, USA, and postdoctoral research in Columbia University, New York City, USA. His research interests are in human immunology and cell biology. He is a recipient of the Shanti Swarup Bhatnagar Prize in Medical Sciences, National Bioscience Award and Swarnajayanti Fellowship. He is an elected fellow of the Indian Academy of Sciences, Bangalore, India, and National Academy of Medical Sciences, New Delhi, India.

A slippery path in the diagnosis and management of tuberculous meningitis

Jayantee Kalita

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Tuberculous meningitis (TBM) is the commonest cause of sub-acute and chronic meningitis in South East Asia, and occurs in about 0.9% patients with tuberculosis (TB). The burden of TB is the highest in India. TBM has a high mortality (15%-40%) and neurological squeal (25%-50%). Tuberculous meningitis is a paucibacillary state; therefore, less than 40% patients have smear or culture positivity. TBM may be compounded with seizure, stroke, hydrocephalous, hyponatremia and drug induced hepatitis occurring in 30% to 60% patients. Paradoxical response is another issue during the treatment, and observed during 6-12weeks of antitubercular treatment. Our group has evaluated neuro-immunological and neuroendocrine basis of paradoxical response, drug induced hepatitis and cerebral salt wasting syndrome. The findings in the laboratory have been translated to bedside. In a randomized controlled trial, adjunctive fludrocortisone resulted in early normalization of serum sodium compared to standard treatment (4 vs 15 days). Fludrocortisone however did not correct fluid deficit. We have demonstrated association of cerebral salt wasting with severe stress leading to alteration in catecholamines, atrial natriuretic hormone (ANP), brain natriuretic peptide (BNP) and antidiuretic hormone (ADH). We have found early correction of hyponatremia and fluid deficit using adjuvant propranolol compared to placebo in CSW. We have reported TNFα as a biomarker of prolonged fever, and TNFα and IL6 as biomarkers of paradoxical tuberculoma. Rifampicin has a poor CSF penetration; therefore, we have done 2 randomized controlled trials evaluating the efficacy of levofloxacin in place of rifampicin in one, and add on levofloxacin on the other. After demonstrating the stroke and MR angiographic abnormalities in TBM, we also have evaluated the role of aspirin in preventing stroke. These challenges will be discussed.

Speaker's Profile

Dr Jayantee Kalita, Professor of Neurology, SGPGIMS, Lucknow has contributed to the diseases of national importance. She has original contributions in the field of encephalitis, dengue, tuberculous meningitis, peripheral neuropathy, stroke, cerebral venous sinus thrombosis, vitamin B12 deficiency, migraine and Wilson disease. Received Amrut Mody ICMR award, Fellow of Indian Academy Medical Sciences, National Academy of Medical Sciences, American Neurological Association and European Academy of Neurology. She is author of 5 books- Clinical Neurophysiology, Clinical electroencephalography, Tropical neurology, Management of neurological disorders, and Neurological consequences of nutritional deficiencies. She has published 588 original articles with a Citations of 20017, h-index: 72 and i10-index:338. Her outstanding contributions in Neurology have included her in the top 2% of global researchers in Stanford university list. She was also adjudged as top neuroscientist during 2015-17 based on her publications by CAREER 360, India. Dr. Jayantee is an excellent clinician, always willing to take clinical challenges. She enjoys teaching and is popular with students and residents.

Clinical research: Make in India

Ganesan Karthikeyan

Translational Health Science and Technology Institute, Ministry of Science & Technology, Govt of India
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Many reasons underlie the poor quality and quantity of clinical research in the country. Of the research that does occur, much of it is not relevant to the needs of our people. This talk will focus on how we should address this need both generally, and with specific examples of work that we have done in the last 2 decades.

Speaker's Profile

Professor Karthikeyan is a clinical cardiologist and Professor of Cardiology at AIIMS, New Delhi, and currently serves as Executive Director of THSTI, an institute of BRIC, Department of Biotechnology. He trained at AIIMS and McMaster University, Canada, and is a Senior International Fellow at the Population Health Research Institute. He is a Fellow of the Academy of Medical Sciences, NASI, and the Royal College of Physicians, London. He is Editor-in-Chief of Open Heart (BMJ) and Associate Editor of several cardiology journals.

His research focuses on cardiovascular diseases in low- and middle-income countries, including rheumatic heart disease, mechanical valve thrombosis, anticoagulation, and indigenous stents. With 200+ publications in NEJM, Lancet, and JAMA, he is among the top 2% most-cited scientists globally. He serves on MTAB, chairs national cost-effectiveness reviews, contributes to PMJAY reimbursement packages, serves on the RhEACH Board, and advises the IAEA on research in resource-limited settings.

Immunological features defining correlates of protection against Tuberculosis

Dhiraj Kumar

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Tuberculosis (TB) elimination is among the top priorities of the government. A crucial element required for TB elimination is having an effective vaccine. BCG, which is the only vaccine currently in use, provides very limited protection against adult TB. In recent times, several vaccine candidates have grown through pre-clinical and clinical development; however, much remains desired in terms of achieving a vaccine which is superior to BCG. Added to the above, failure to explicitly identify key immunological features which define the protective efficacy of any vaccine against TB makes pre-clinical assessment of new vaccine candidates vulnerable to subsequent failures at later stages of development. Our recent results on studying diverse cellular niches of Mycobacterium tuberculosis (Mtb) provide attractive clues towards the above. We report neutrophils as a critical cell type harboring intracellular bacteria in the TB lesions. Pathological neutrophil recruitment is driven by IL-17, which, contrary to its perceived protective role, triggers more pathology.

Our results show that neutrophils in the TB lesions are key producers of IL-17, thereby establishing a self-amplifying loop, exaggerating TB pathology. We show that lowering neutrophil infiltration and IL-17 production not only helps control TB pathology but also enhances the efficacy of protection by BCG. These pre-clinical results present exciting prospects of defining correlates of protection against TB and provide a framework for a new vaccine development strategy against TB.

Speaker's Profile

Dr Dhiraj Kumar is the group leader of the Cellular Immunology Group at ICGEB, New Delhi. His group works towards understanding innate immune responses during Mycobacterium tuberculosis infection with the aim of developing novel host-directed therapy against tuberculosis. His seminal work has earned him several national and international recognitions. As a part of a national consortium, he is also contributing to the TB genome surveillance program at the Pan-India level.

Cellular and molecular mechanisms of virus induced neurodegeneration

Pankaj Seth

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Central Nervous System (CNS) are rare but can result in severe, life-threatening, or debilitating consequences. Several RNA viruses cause long-term effects post-infection, leading to neurocognitive and motor impairments, as well as neurodevelopmental disorders. The 2D and 3D cell culture models of human origin have emerged as ideal model systems due to their ability to accurately represent diseases and their physiological relevance. Our laboratory has developed well-characterized primary cultures of human fetal brain derived neural stem cells (hNSCs) to investigate viral neuropathogenesis caused by HIV-1, Zika virus, SARS-CoV2 and their associated proteins. Our findings provide novel insights into understanding the molecular mechanisms underlying Zika virus induced microcephaly via alteration in miRNA circuitry and disruption of BBB integrity. We have also identified SARS-CoV2 viral components that induce neuronal damage through a necroptosis pathway and involve mitochondrial dysfunction. These findings have been validated in brain sections from autopsy samples of COVID-19 patients. Currently, we are using iPSC derived human brain organoids to study if SARS-CoV2 may cause any defects in early events of brain development. Overall, the presentation would provide a spectrum of understanding of the cellular and molecular mechanisms for viral neuropathogenesis and cutting-edge tools employed for these studies.

This research is funded by NBRC Core funds and an extramural grant from the Department of Biotechnology, New Delhi, India.

Speaker's Profile

Novel insights gained through Dr Pankaj Seth's research has significant clinical importance in advancing the understanding of neurological complications arising as a consequence of CNS infections by RNA viruses, particularly the cognitive and motor deficits in HIV/AIDS, Zika virus induced microcephaly and Post-acute sequelae of COVID-19 in Long-COVID patients. He was the first researcher in India to establish human fetal brain derived neural stem cells, neurons & glia for neuroscience research. His pioneering development of iPSC-derived human brain organoids with microglia at NBRC marks a major advancement that has greatly enhanced India's capacity for personalized neuroscience research and translational medicine.

Hijacking lysosomes for infection by SARS-CoV-2

Amit Tuli

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Lysosomes are the acidic cellular organelles responsible for the degradation of cargo from endocytosis, autophagy, and phagocytosis pathways. Along with this, lysosomes are shown to play an important role in maintaining the homeostasis of several cellular processes like cell signaling, metabolism, etc. Therefore, it's not surprising that many human pathogens alter the lysosome's functioning for their survival and pathogenesis. In my talk, I will discuss our recent findings on how SARS-CoV-2 viral infection affects lysosome functions. We found that the SARS-CoV-2 accessory protein, ORF3a, causes the deacidification of lysosomes and blocks endocytic and autophagic cargo degradation in lysosomes. Importantly, SARS-CoV-2 infection blocks the GTP hydrolysis of small G protein Rab7 (a key GTPase required for maintenance of lysosomal homeostasis) in an ORF3a-dependent manner, resulting in the hyperactivation of Rab7. These findings suggest that a key role of ORF3a is to promote Rab7 hyperactivation, which further facilitates viral replication and pathogenesis. Furthermore, ORF3a-mediated Rab7 hyperactivation impairs the transport of newly synthesized hydrolases to lysosomes and the fusion of lysosomes with other compartments consequently, thus promoting the exocytosis of the virus via de-acidified lysosomes. Taken together, the findings imply that during SARS-CoV-2 infection, ORF3a stalls the GTPase cycling of Rab7, an indispensable regulator of the endolysosomal pathway. This impairs the fusion of late endosomes with lysosomes, promotes the egress of the virus via lysosomal exocytosis, and supports the viral infection inside the host.

Speaker's Profile

Dr. Amit Tuli obtained his B. Tech. (Biotechnology) from Guru Gobind Singh Indraprastha University, Delhi; his Ph.D. (Biochemistry and Molecular Biology) from the University of Nebraska Medical Center (USA); and a postdoctoral fellowship from Harvard Medical School (USA). He is currently a senior principal scientist at the CSIR-Institute of Microbial Technology (CSIR-IMTECH), Chandigarh. Dr. Tuli's lab at CSIR-IMTECH is interested in investigating the host-pathogen interactions of highly infectious agents for which there are no effective treatments, and which pose serious health concerns.

Title: Dynamic repertoire of resting brain to characterize healthy aging and common mental disorders

Arpan Banerjee

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Temporally stable patterns of neural coordination among distributed brain regions are crucial for survival. Recently, many studies highlight association between healthy aging and modifications in organization of functional brain networks, across various time-scales. Nonetheless, quantitative characterization of temporal stability of functional brain networks across healthy aging remains unexplored. Our lab has developed a data-driven unsupervised approach to capture high-dimensional dynamic functional connectivity (dFC) via low-dimensional patterns and subsequent estimation of temporal stability using quantitative metrics. Healthy aging related changes in temporal stability of dFC were characterized across resting-state, movie-viewing, and sensorimotor tasks (SMT) on a large (n = 645) healthy aging dataset (18–88 years). We reveal that temporal stability of whole brain resting-state follows a U-shaped curve along lifespan—a pattern shared by sensorimotor network stability indicating their deeper role in governing lifespan scale changes to brain dynamics. The unsupervised approach to chracterize temporal stability was extended to classify common mental disorders from fMRI cohorts (N = 408 participants). Patients with schizophrenia and ADHD demonstrate significantly reduced temporal stability compared to healthy controls. Whereas, bipolar disorder showed no quantifiable differences in functional connectivity dynamics compared to healthy controls/ Thus, through a series of studies ranging from healthy ageing to common mental disorders I highlight the potential of temporal stability as a biomarker for characterizing human well-being.

Speaker's Profile

Arpan completed his BSc Physics from Presidency College Calcutta; MSc Physics from University of Pune and PhD in Neuroscience from Center for Complex Systems and Brain Sciences, Florida Atlantic University. He has served in editorial boards of NeuroImage, Imaging Neuroscience, BMC Neuroscience, Discover Neuroscience (formerly Neural Development) and Frontiers in Computational Neuroscience. Dr Banerjee has received many awards and fellowships, Swartz Foundation post-doctoral fellowship (2007-2009), Ramlingaswami fellowship (2012), Bill and Melinda Gates Foundation award (2023-2025); Innovative Young Biotechnologist Research Award (2013). He was elected Fellow (Medical Sciences 2024) in the National Academy of Sciences in India (NASI)

Cellular Proteostasis Therapeutic Interventions & Challenges for Critical Diseases

Amit Mishra

Cellular and Molecular Neurobiology Unit, Indian Institute of Technology Jodhpur, Rajasthan
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Cellular proteins are essential biomolecules that in their three-dimensional structures perform a diverse array of functions, which are essential for cellular homeostasis. Proteins are continuously being synthesised and degraded and protein quality control (PQC) machinery is needed for native folding via chaperones as well as regulated degradation of specific proteins by ubiquitin proteasome system (UPS). The components of PQC machinery chaperones and UPS can get dysfunctional or overwhelmed in neurodegenerative diseases, like Alzheimer's, Parkinson's, Huntington's and Amyotrophic Lateral Sclerosis, leading to protein misfolding and aggregation. Contrastingly, these components are overexpressed in many types of cancer cells and are associated with their protection, proliferation, and resistance to cell death. The modulation of these PQC components is an attractive strategy and some drugs have also been approved. However, the slow pace of drug discovery as well as acquisition of resistance in cancer cells are tough medical challenges. We utilise drug repurposing to find PQC modulators that exhibit anti-malignant action by studying effects on proteasome function, apoptosis, cell cycle molecules. For instance, NSAIDs like ibuprofen, indomethacin, and diclofenac induce proteasomal dysfunction, increase protein accumulation, promote cell death by mitochondrial pathway, and affect molecules associated with cell cycle in cancer cell line. Treatment of cell lines with anti-fungal drug itraconazole and natural compounds, like myricetin, lanosterol, and trehalose lead to increase in proteasome function as well as clearance of aggregates, which are linked with improved cellular health.

Speaker's Profile

Professor Mishra has developed a significant concept regarding selective E3 ubiquitin ligases that function as a first line of defence in quality control, offering ameliorative strategies against multifactorial proteostasis failures linked to neurodegenerative diseases and the challenges of ageing. His contributions to the field have been recognized through several prestigious national awards, including accolades from NAMS, INSA, NASI, BRNS, RIKEN, Max Planck and DBT, as well as international recognition. With over 150 high-impact publications in reputable international journals, Professor Mishra has established himself as a leading figure in neurobiology.

Lacrimal glands in dry eye disease: A Study of human and animal models

Swati Singh

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Lacrimal gland (LG) secretes the aqueous component of tears, and inflammation of the LG causes aqueous-deficient dry eye (ADDE), a condition affecting millions worldwide. Most ADDE patients notice symptoms late in the disease when the gland has suffered significant damage. Current treatments for ADDE are only palliative, and there are no targeted therapies for regenerating the lacrimal gland. The pathophysiology of LG in ADDE was studied through clinical, histological, and molecular analyses of human glands and mouse models. The distribution and response of progenitor cells within human LGs to inflammation were examined using immunostaining and gene expression studies. Progenitor cells were found around the intercalated and interlobular ducts. Spatial transcriptomics of healthy human LGs identified Car6+ acinar cells and basal ductal cells as progenitors. Inflamed lacrimal glands show a significant increase in mesenchymal stem cell (MSC) expression but a decrease in epithelial progenitor cells. An autoimmune NOD-dacryoadenitis model and a microvascular clip-assisted duct ligation model (to mimic two subtypes of ADDE) were used to evaluate the regenerative and anti-inflammatory effects of MSC-derived extracellular vesicles. LG exhibited acinar atrophy and immune cell infiltration similar to that observed in diseased human lacrimal glands, but showed only mild recovery after EV injection into the gland. Single-cell analysis revealed increased stress responses, including autophagy, heightened immune cell activity, and a reduction in acinar clusters and progenitor cells within ADDE mouse glands. EVs did not influence the activity of acinar or myoepithelial cells but improved the response to stress and hypoxia in the injected glands.

Speaker's Profile

Dr. Swati Singh is a clinician-scientist who has been working on "Ocular surface & adnexa services" at the L.V. Prasad Eye Institute since January 2021. She recently completed her doctorate from Friedrich Alexander University, Germany, at the Institute for Clinical and Functional Anatomy as a part of her Alexander von Humboldt research award. Her research focus is 'Lacrimal Gland and Ocular Adnexa', where she has a substantial body of original work. She is also an early-career India Alliance DBT-Wellcome Trust fellow for her work on lacrimal glands.

FOSTERING CHEMICAL SCIENCES (FCS) 2025		
December 02, 2025 (Tuesday)		
08:30-09:30	**REGISTRATION**	
09:30-10:30	**Inaugural Function**	
Session-I	**Chairperson**	Prof. Amitava Das
Technical Session-I		
10:30-10:45 IDL-1	**Speaker**: Prof. Santanu Bhattacharya, IISER Tirupati **Title:** TBA	
10:50-11:05 IDL-2	**Speaker**: Dr. Surya Prakash Singh, IICT Hyderabad **Title:** Development of energy harvesting molecules: From structure to function	
11:10-11:25 IF-I	**Speaker**: Prof. Arunan, Elangannan, IISc, Bangalore **Title:** Shock tube investigations reveal potential carrier for diffuse interstellar band λ5450	
11:25-12:00	**High Tea & Student/Scholars Discussion with Speakers**	
Session-II	**Chairpersons**	Prof. Amitava Das/Prof. S. P. Singh
Technical Session-II		
12:00-12:15 IF-II	**Speaker**: Prof. D. B. Ramachary, University of Hyderabad **Title:** Discovery of Sustainable Organocatalytic Reactions	
12:20-12:35 IF-III	**Speaker**: Prof. Subi George, JNCASR **Title:** Towards Life-Like Behavior in Supramolecular Polymers	
12:40-12:55 IF-IV	**Speaker**: Prof. S. K. Ghosh, IISER-Pune **Title:** Extraction Of Critical Minerals By Metal–Organic Frameworks (MOFs) And Related Advanced Porous Materials For a Sustainable Future	
13:00-13:15 IF-V	**Speaker**: Prof. Sundargopal Ghosh, IIT Chennai **Title:** Stabilization of Diboranes and Bn Rings (n = 3-6) on Transition Metal Templates	
13:20-13:35 IF-VI	**Speaker**: Prof. Partha Sarathi Mukherjee, IISc, Bangalore **Title:** Molecular Flasks	
13:35-15:00	**Lunch and Poster Presentation (P1-P50)**	
Session-III	**Chairpersons**	Prof. Amitava Das/Prof. J. P. Mittal
Technical Session-III		
15.00-15:15 IF-VII	**Speaker:** Prof. D. S. Rawat, Delhi University/Vice-Chancellor, Kumaun Univ., Nainital **Title:** Towards the End of Two Century Years of Suffering: The Phase II Human Clinical Trials and the Future of Parkinson's Care	
15:20-15:35 IF-VI	**Speaker**: Prof. BM Reddy, BITS Pilani, Hyderabad **Title:** Nanosized ceria-based catalysts for energy and environmental applications	
15:40-16:05 IYA-I	**Speaker:** Dr. Durga Prasada Hari, IISc, Bangalore **Title:** Carbene Mimics from Strained Rings	
16:10-16:25 IYA-II	**Speaker**: Dr Uttam Kumar Ghorai, Ramakrishna Mission Vidyamandira, Howrah **Title:** Electrochemical synthesis of green ammonia, green urea & nitric acid under ambient conditions: Fundamental and translational Components	
16:25-16:45	**Tea Break & Student/Scholars Discussion with Speakers**	
Session-IV	**Chairpersons**	Prof. Amitava Das/Prof. Subrata Ghosh
Technical Session-IV		
16:45-17:00 IYA-III	**Speaker**: Dr Indranath Chakraborty, Indian Institute of Technology Kharagpur **Title:** Precision Engineering of Nanoclusters: Advancing Structural and Functional	

	Properties
17:05-17:20 IAF-I	**Speaker**: Prof. S.S.V. Rama Sastry, IISER, Mohali **Title:** Cascade Transformations Promoted By Sulfoxonium Ylides For The Rapid Creation Of Skeletal Complexity
17:25-17:40 IAF-II	**Speaker**: Prof. Basker Sundararaju, IIT Kanpur **Title:** Evolution of Co(III)-Catalysis in Asymmetric C-H Bond Functionalizations
17:45-18:00 IAF-III	**Speaker**: Dr Dibyendu Das, IISER, Kolkata **Title:** Non-equilibrium self-assembly for living matter-like properties
17:45-18:30 F-XVI	**Panel Discussion: "**Future Challenges of Chemical Sciences: Academia and Industry" **Moderator:** Prof. Shrikant Kukreti and Prof. M. D. Milton **Panelist:** Dr. BVNBS Sarma, Sr. VP, Sai Life Sciences, Dr. G.S. Kapur, Advisor (R&D), GAIL
19:00	**Dinner**
Fostering Chemical Sciences	
December 3rd, 2025 (Wednesday)	
09:00-09:30	**REGISTRATION**
Session V	**Chairpersons** Prof. Rajeev Gupta & Prof. Rama Kant
Technical Session-V	
09:30-09:55 **IL-1**	**Speaker**: Prof. Anuj Sharma, IIT Roorkee **Title:** Radical-Based Transformative Routes to Carboxylic Acids
10:00-10:25 **IL-2**	**Speaker**: Prof. Swadhin Mandal, IISER Kolkata **Title:** Low-valent Phosphorus Compounds as Transition Metals
10:30-10:55 **IL-3**	**Speaker**: Prof. T. Punniyamurthy, IIT, Guwahati **Title:** TBA
10:55-11:20	**Tea Break & Student/Scholars Discussion with Speakers**
Session VI	**Chairpersons** Prof. R. Nagarajan/Prof. M. Nath
Technical Session-VI	
11:20-12:00 **PL**	**Speaker**: Prof. D. Basavaiah, University of Hyderabad **Title:** TBA
12:05-12:30 **IL-4**	**Speaker**: Prof. Nitin Patil, IISER Bhopal **Title:** Enantioselective Gold Redox Catalysis
12:35-13:00 **IL-5**	**Speaker**: Dr. Ravindra Kumar, CSIR-CDRI, Lucknow **Title:** Organo-catalysed Skeletal Editing Approach for the Synthesis of Azaborines and of BN-Isosteres via Wolff-type rearrangement
13:05-13:30 **IL-6**	**Speaker**: Dr. BVNBS Sarma **Title:** TBA
13:30-14:30	**Lunch and Poster Presentation (P51-P100)** **(Sponsored by Sai Life Sciences Ltd, Hyderabad)**
Session VII	**Chairpersons** Prof. K. C. Gupta and Prof. Parbati Biswas
Technical Session-VII	
14:30-14:55 **IL-7**	**Speaker**: Prof. Debayan Sarkar, IIT, Indore **Title:** Rise of Tribromide Tools – Precision Dearomatisation for 3D Molecular Frameworks

15:00-15:25 **IL-8**	**Speaker**: Dr. T. Saravanan, University of Hyderabad Title: Asymmetric β-Alkylation Enabled by EDA-Mediated Photobiocatalysis
15:30-15:55 **IL-9**	**Speaker**: Prof. Vandana Bhalla, GNDU, Amritsar **Title:** Understanding the Regulation of Self-assembly and Excited State Behaviour in Donor-Acceptor Systems
16:00-16:25 **IL-10**	**Speaker**: Dr. P. V. Srinivasa, Granules India Ltd, Hyderabad **Title:** A Concise Overview on API Selection Considering Economical and Eco-friendly Practices
16:30-16:55 **IL-11**	**Speaker**: Prof. E. Srinivasa, Central University of Rajasthan **Title:** **TBA**
17:00	***Valedictory Function***

Sectional Committee -III

Chemistry

Chair
Prof. Amitava Das, FNA

Amitava Das obtained his Ph.D. from Jadavpur University, Kolkata, in 1989, followed by postdoctoral research at the Universities of Birmingham and Bristol, UK. He began his independent career at CSIR–CSMCRI in 1993, later serving as its Director and Distinguished Professor of AcSIR until 2019. He was Chief Scientist at CSIR–NCL (2013–2016) and is currently Visiting Professor at IISER Kolkata, where he was Senior Professor (2020–2025). A Fellow of all three Indian Science Academies, he has received several honours, including the ANRF–J. C. Bose Fellowship and CRSI Bronze and Silver medals. His research focuses on supramolecular chemistry, biomolecular recognition, and nanostructured therapeutics. He is an academic editor of iScience.

Development of energy harvesting molecules: From structure to function

Surya Prakash Singh

CSIR-Indian Institute of Chemical Technology (IICT), Hyderabad, India
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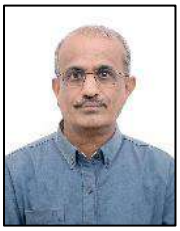
Energy is a crucial factor in driving social, economic, and industrial progress. Our daily energy consumption continues to rise gradually. In recent decades, rising energy demand has increased reliance on fossil fuels such as coal, petroleum and natural gas, releasing CO2 and contributing to global warming. Small organic molecules with suitable photophysical and electronic properties have garnered attention in advanced technology applications, especially in photonic devices such as dye-sensitized solar cells, organic solar cells, emissive displays like OLEDs; electronic materials such as organic semiconductors, and security printing. Organic photovoltaics are gaining popularity as a cost-effective, color-tunable, and mechanically flexible renewable energy technology. Numerous research endeavors aim to develop novel organic materials and enhance their efficiency and durability. Our research group is focussing on producing stable organic molecules for diverse applications. In the upcoming event, I will present our progress on developing hole-transport materials for perovskite solar cells. The presentation will commence with a brief introduction to solar cells, followed by an exploration of industrial applications and the commercialization potential of dye molecules.

Speaker's Profile

Dr. Surya Prakash Singh, is currently working as a Senior Principal Scientist at CSIR-Indian Institute of Chemical Technology (IICT), Hyderabad. He has been involved in the design and synthesis of materials and molecules for photonic devices. He has published over 250 research papers. BODIPY-based dyes for mitochondrial tracking developed by him have been commercialised by TCI (Japan). He is a recipient of several prestigious awards, like MRSI Medal, the CRSI-bronze Medal, Young Scientist Award, AVRA Young Scientist Award. Dr. Singh is a Fellow of the Telangana academy of sciences and Associate Fellow of the AP academy of sciences and INSA.

Shock tube investigations reveal potential carrier for diffuse interstellar band λ5450



Elangannan Arunan

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Astrophysical shocks can contribute to the chemical evolution of the interstellar medium. Only a few studies on the shock processing of cosmic analogues have been conducted so far. These have been done using the shock tube facilities established at the Indian Institute of Science, which has been extensively used in pyrolysis[1] and combustion[2] studies previously. Recently, we investigated the shock processing of coronene. This talk will highlight the results from shock tube experiments with post-shock analysis of the gaseous products and solid residues using various techniques coupled with molecular dynamics simulation.[3] Analysis of the emission spectrum indicates the presence of C_2 emission, a black-body radiation and a band around 540-550 nm. This band centered at 545 nm could originate from C_nH and it coincides with one of the bands in the diffused interstellar band (DIB) listed as λ5450.

Speaker's Profile

Prof. Elangannan Arunan had his BSc in Chemistry from The American College, Madurai and M.Sc. in Chemistry from IIT Madras. He did an M.Tech in Chemical Analysis from IIT Delhi before going to Kansas State University for his Ph. D. After a postdoctoral stint at the University of Illinois at Urbana-Champaign, he joined IIT Kanpur in November 1994. He moved to the Department of Inorganic and Physical Chemistry at the Indian Institute of Science in June 1997 where he is continuing as a professor now after serving as Chair from 2018-24. He built a pulsed nozzle Fourier transform microwave spectrometer, first and only one in India. Experimental results from his lab eventually led IUPAC to change the definition of hydrogen bond through a task group formed and chaired by him. In collaboration with Aerospace Engineering Department at IISc, he built shock tube facilities for both fundamental and applied research, of relevance to ISRO and DRDO

Discovery of Sustainable Organocatalytic Reactions

Dhevalapally B. Ramachary

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The discovery of *in situ* generated novel reactive primary catalytic species like enamines, iminium ions, dienamines, trienamines and aminoenynes from the reaction of variety of carbonyls with catalytic amount of chiral primary- or secondary amines or amino acids will be discussed. Their direct applications in a variety of selective green bond formations to furnish the chiral functionalized molecules, drugs, drug-like molecules, natural products, and pharmaceuticals will be discussed.

Speaker's Profile

Ramachary graduated with M.Sc. degree in School of Chemistry from University of Hyderabad and obtained Ph.D. in synthetic organic chemistry from Indian Institute of Science, Bangalore in 2001. He subsequently held postdoctoral position at the Scripps Research Institute for Catalysis, prior to joining University of Hyderabad in January 2005, where presently he is senior professor of organic chemistry.He is a recipient of many awards including Fellow of the National Academy of Sciences, Allahabad-2021, Fellow of the Royal Society of Chemistry, London-2020 and Fellow of Indian Academy of Sciences, Bangalore-2018. He has guided 22-PhD students, 14 PDFs and out of them, 5-PhD's got Eli Lilly & Company Asia Outstanding Thesis Awards 2011, 2012, 2013, 2014 and 2021. Prof. Ramachary serving as a reviewer for many national and international reputed journals and member in many committees of national funding body, DST, SERB. Prof. Ramachary published more than 125 research papers in both national and international reputed journals, two books on emerging organocatalysis area and few chemical reactions are named after him. Prof. Ramachary delivered more than 170 lectures in both national and international conferences.

Towards Life-Like Behavior in Supramolecular Polymers

Subi J. George

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Supramolecular polymers—dynamic, non-covalent analogues of conventional macromolecular polymers—have emerged as powerful platforms for the development of adaptive, responsive, and multifunctional soft materials. Despite significant progress, a key challenge remains: achieving precise spatial and temporal control over molecular organization to impart complex functionality. While recent advances in bio-inspired, kinetically regulated assembly strategies have opened exciting avenues, synthetic supramolecular systems still fall short of the intricacy and dynamic capabilities characteristic of biological matter.

Nature exemplifies the remarkable ability to self-organize, evolve, and perform sophisticated functions such as self-regulation, repair, and adaptive response. Mimicking such life-like features in synthetic materials could enable the creation of next-generation soft-materials capable of dynamic responsiveness, motility, and autonomous behavior. Achieving this, however, requires breakthroughs in multicomponent molecular organization, compartmentalized self-assembly, liquid–liquid phase separation, motility, oscillatory behaviors, and precise regulation of self-assembly in dynamic and crowded environments.

Driven by these challenges and opportunities, our laboratory is actively engaged in bridging the current gaps by designing supramolecular polymers that structurally mimic biological complexity and operate away from equilibrium, thereby exhibiting lifelike traits. This talk will present our recent efforts in this direction, from a chemist's perspective, highlighting how these materials are advancing toward the next frontier of adaptive soft materials.

Speaker's Profile

Subi George leads the Supramolecular Chemistry Group at the New Chemistry Unit, JNCASR, Bangalore, where he also serves as Dean (Faculty) and Associate Editor of Chemical Science (RSC). His research focuses on functional supramolecular polymers, living and non-equilibrium supramolecular polymerization, supramolecular chirality, and organic phosphors. He received the Shanti Swarup Bhatnagar Prize in Chemical Sciences (2020), the Swarnajayanti Fellowship (2017), and the CNR Rao National Prize (2021), among other recognitions. Elected Fellow of the Indian Academy of Sciences (2019) and NASI (2023), he was also honored with the G. D. Birla Award for Scientific Research in 2024

Extraction of critical minerals by metal–organic frameworks (MOFs) and related advanced porous materials for sustainable future

Sujit K. Ghosh

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Critical minerals (CMs) are those minerals that are essential for economic development and national security. In 2025 Indian government have launched the National Critical Mineral Mission (NCMM) to establish a robust framework for self-reliance in the critical mineral sector, and identified a list of 30 critical and strategic minerals. These are essential for the advancement of many sectors, including high-tech electronics, telecommunications, transport, and defence. Currently extraction or processing of CMs are happening in a few geographical locations in the world, which may lead to supply chain vulnerabilities and even disruption of supplies. For that there is an urgent need for development of sustainable and efficient extraction technologies of CMs in our country. Recycling of CMs from secondary sources such as e-waste, lithium-ion battery scrap, and end-of-life vehicle parts is also strongly encouraged with incentive scheme under the NCMM. Advanced function porous materials—like metal–organic frameworks (MOFs), related porous materials, have recently emerged as transformative platforms for efficient extraction technologies of different metal ions, due to their tuneable pore environments, high surface areas, and ion-exchange properties. In this lecture I will talk about some of the examples of MOFs and related porous materials, developed in our laboratory, which can efficiently extract some of the critical minerals from solution, demonstrating, potential use of the materials for extracting critical minerals from primary and secondary sources.

Speaker's Profile

Sujit is currently a Professor of Chemistry at IISER Pune, India. Before joining IISER in 2009 he did his postdoctoral work with this year's one of the Chemistry Nobel prize winners, Prof. Susumu Kitagawa, Japan. His research interest is metal–organic frameworks (MOFs) and related porous materials for extraction of critical minerals, sustainable environment and safe drinking water. He has published >175 papers with average IF ~8, with total citations > 18000 and h-index-68. Recently he got selected for "The Distinguished Lectureship Award" by the Chemical Society of Japan (CSJ), Friedrich Wilhelm Bessel Research Prize by the Humboldt Foundation, Germany.

Stabilization of Diboranes and Bn Rings (n = 3-6) on Transition Metal Templates

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The fascinating aspect of metallaborane chemistry is that several classic organometallic complexes that defined fundamental structural and bonding paradigms are mimicked by many isoelectronic metallaborane analogues. In this context, we have synthesized and structurally characterized a bimetallic diborane(4) which mimics Cotton's dimolybdenum-alkyne complex $[\{CpMo(CO)_2\}_2C_2H_2]$. Also, we have isolated the first classical diborane (5) $[B_2H_5]^-$, in which the sp^2-B center is stabilized by the electron donation from tantalum. Unlike carbon, boron does not usually form ring compounds due to its electron deficiency-driven affinity towards polyhedral geometries. Although the smaller B_3 and B_4-rings are mostly isolated as individual species, larger B_5 and B_6-rings are stabilized by transition metals, depending on the ring size and electronic requirements of the rings. For example, we have isolated the first examples of a nearly planar $[B_6H_6]$ unit, stabilized as a part of $[(Cp^*Ti)_2(\mu\text{-}\eta^6\text{:}\eta^6\text{-}B_6H_6)(\mu\text{-}H)_6]$, where significant electron delocalization was observed from the Ti–Ti bonding orbital to the μ-H atoms and B_6 skeleton. Furthermore, we have synthesized and structurally characterized tetraborane $[B_4H_8]^{2-}$, pentaborane $[B_5H_{10}]^-$ and hexaborane $[B_6H_{11}]^-$ ring stabilized by monometallic Os-templates in η^4, η^5, η^6-fashions which mimics $[C_4H_4]^{2-}$, $[C_5H_5]^-$, and $[C_6H_6]$ rings, respectively. The selection of transition metals mostly depends on their diffuse orbitals, valence electrons, and ring sizes, while the bridging hydrogens balanced the electron deficiency of the boron rings.

Speaker's Profile

Prof. Sundargopal Ghosh obtained his B.Sc. and M.Sc. degrees from the University of Calcutta, followed by Ph.D. from the Indian Institute of Technology Bombay in 1998. He then pursued postdoctoral research at University of Notre Dame, USA. His research focuses on the chemistry of transition metal-boron compounds. He has authored more than 300 scientific publications in leading international journals. Prof. Ghosh received the CRSI Bronze Medal and the Institute Research and Development Award (IRDA) from IIT Madras in 2014. He was an elected Fellow of the Indian Academy of Sciences (FASc, 2017), Fellow of the National Academy of Sciences (FNASc, 2017), and Fellow of the Indian National Science Academy (INSA). Over his career, Prof. Ghosh has guided 36 Ph.D. students, many of whom hold positions at reputed institutions in India and abroad.

Molecular Flasks

Partha Sarathi Mukherjee

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Chemical and physical properties of chemical entities in confined nanospace are expected to be different from their bulk behavior due to restricted motions. Such restricted motions along with other interaction/s may allow stabilization of unusual conformations of compounds in confined space of molecular cavity. Moreover, reactivity and reaction pathways in confined space may become different from traditional bulk reactions leading to the formation of unusual product/s. In this regard, chemists have been trying to design artificial molecular vessels to perform chemical reactions in their confined nanospace. My lecture will focus on the unusual behavior of photochromic spiropyrans in the confined cavities of molecular flasks that are made of Pd(II) and hydrophobic aromatic donors. Separation of hydrophobic aromatic isomers using a molecular flask by simple aqueous extraction will also be presented.

Speaker's Profile

Prof. Mukherjee is currently a professor of chemistry at IISc (Bangalore). He works on self-assembled discrete molecular architectures including their use in catalysis, sensing, biology, and light-harvesting. He has extensively used barrel shaped molecular architectures as molecular vessels for photocatalysis, separation of isomers, and chiral recognition. Prof. Mukherjee is a J. C. Bose fellow. He is a recipient of the NASI-SCOPUS young scientist award, INSA-Medal, S. S. Bhatnagar prize, TWAS young affiliateship and Swarnajayanti fellowship. He is an elected fellow of the TWAS, the Indian Academy of Sciences, and the INSA. He is currently serving as an Associate Editor of Inorganic Chemistry.

Towards the end of two century years of suffering: The Phase II human clinical trials and the future of Parkinson`s care

Diwan S Rawat

Vice Chancellor, Kumaun University
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To address the drug resistance issue and improve a drug molecule's ADME properties, the concept of molecular hybridization was put forward, wherein two or more distinct pharmacophores are covalently linked into a single molecule. This approach has resulted many drug candidates with improved activity profiles, and some of these compounds are in clinical trials. We have utilized this concept in designing antimalarial molecules, and later, a massive multi-institutional collaboration was started, and over 700 new molecules were studied for Nurr1 activation, a potential target for the Parkinson's disease model. Fifteen hit molecules were identified during this study. One of the molecule ATH 399A activates the Nurr1 enzyme, which is essential for the survival of the dopamine neurons, stops the aggregation of α-synuclein protein in the brain, and promotes autophagy demonstrating the potential of being a perfect drug candidate for Parkinson treatment. Systematic studies demonstrated that these compounds can cure the Parkinson-induced mice model at 5 mg/kg body weight without any toxicity. Phase I trials showed that ATH-399A was well tolerated with no major safety issues in any of the 76 participants and PK results support once a day dosing and the molecule has moved to phase II trials and two molecules are in pre-clinical stage of development, one for Lewis body dementia and other for autoimmune disease.

Speaker's Profile

Prof. Rawat is the Vice Chancellor of Kumaun University, Nainital. After obtaining his Ph.D. from Central Drug Research Institute, Lucknow and he worked with pharma industry followed by postdoctoral work from Indiana University and Purdue University, USA and joined Delhi University in 2003. He has published over 175 research papers, authored a book, the book was forwarded by Nobel Laureate Sir DHR Barton, he authored 7 book chapters, and 22 patents to his credit. His research work has been cited over 7850 times with impressive h-index of 52 and i-10 index of 139. Prof Rawat is the follow of INSA and NASI.

INSA New Fellow Lecture

Nanosized ceria-based catalysts for energy and environmental applications

Benjaram M. Reddy

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Environmental issues, including air pollution, water pollution, and the overconsumption of natural resources, continue to be among the greatest challenges facing humanity today. Recent advances in nanoscience and nanotechnology are playing a crucial role in addressing some of these challenges. The choice of material and its synthetic methodology ultimately determines the success or failure of a nanostructured material in its application, as its physicochemical properties are heavily influenced by the synthesis process. Ceria (CeO_2), an abundant rare-earth metal oxide, has garnered significant research interest recently due to its wide range of applications in environmental and energy-related fields. The importance of ceria comes from its notable Ce^{4+}/Ce^{3+} redox couple and excellent oxygen storage/release capacity (OSC). Ceria acts both as a promoter and as an active catalyst in three-way catalytic converters, reducing hazardous exhaust emissions. Additionally, the catalytic activity of ceria for soot combustion has recently been studied and proven to be a promising material. However, a major limitation of pure ceria is its poor thermal stability, which results in loss of surface area and OSC, leading to decreased catalytic performance. A key challenge is to develop efficient and thermally stable ceria–based catalysts that meet increasingly demanding requirements. Two promising strategies for improving CeO_2 properties are doping it with suitable rare-earth or transition metal ions and reducing ceria particle size into nanoscale. Our recent investigations, to be discussed in this presentation, have shown that incorporating an appropriate dopant into the nano-ceria matrix significantly boosts its redox properties and chemical reactivity.

Speaker's Profile

B.M. Reddy is a senior professor emeritus in the Department of Chemistry at BITS Pilani, Hyderabad Campus. He earned his PhD at CSIR-IICT in 1986 and served the same organisation in various capacities until 2017. Later, he was a DAE Raja Ramanna Fellow at the same institute. Reddy has received international fellowships from JSPS, DAAD, CNRS, Brain Pool, and NSF, allowing him to work across multiple countries. He has authored over 350 research articles, two books, five monographs, 13 book chapters, and 12 reviews, and holds eight patents. His Google Scholar h-index is 84 with over 21,200 citations. He has supervised 40 PhDs and more than 35 BTech/MTech/MSc dissertations. He serves on the editorial boards or as a guest editor for journals, including the Journal of CO2 Utilisation, Catalysis Today, Discover Catalysis, Industrial & Engineering Chemistry Research, and others. A special issue of Molecular Catalysis was published in his honour on his 60th birthday.
He has received various awards and honours, including CSIR Young Scientist Award and Catalysis Society of India (CSI) Young and Eminent Scientist Award, as well as an Associateship from TWAS. His accolades also include Sir C.V. Raman Fellowship from CSIR, Gold Medals from SMC and ABAP, as well as a Bronze Medal from CRSI. He has been an elected fellow of INSA, INAE, NASI, RSC, and Telangana Academy of Sciences (TAS). He has served as a Council Member of the International Association of Catalysis Societies and the Asia-Pacific Association of Catalysis Societies, and held positions including Honorary Secretary of CSI and Honorary Treasurer of TAS. His research focuses on catalysis and physical chemistry, with a special emphasis on emission control catalysts and CO2 utilization technologies.

INSA Associate Fellow Lecture

Evolution of Co (III)-Catalysis in Asymmetric C-H Bond Functionalizations

B. Sundararaju

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Since Murahashi's pioneering work on cobalt-catalyzed C-H bond carbonylation in 1955, the field of C-H bond functionalization has made significant strides, particularly with the development of low-valent cobalt systems. While the use of in situ-generated or isolated cobalt (III) catalysts for C-H activation was seldom explored until the independent studies by Matsunaga and Daugulis in 2014, recent advancements have shed light on the intricate coordination environment around cobalt and the mechanisms driving these catalytic cycles. In this talk, I will review the progress made over the past decade in Co (III)-catalyzed C-H bond functionalization, focusing on both mono- and bidentate directing groups, and the role of spectator ligands in the latter. I will also discuss how replacing these spectator ligands with external chiral ligands can induce chirality at the metal center through an enantio-determining C-H activation step, and how these factors impact the efficiency and selectivity of asymmetric transformations. Additionally, I will highlight our systematic efforts to replace Mn (II) with photocatalystsor oxygen as sole oxidants, thereby eliminating the need for stoichiometric metal oxidants in asymmetric C-H bond annulations using the Co/Salox catalytic system.

Speaker's Profile

Dr. Basker Sundararaju, born in Mettuppalayam, a small town in Tamil Nadu, earned his M.Sc. (2008) and Ph.D. (2011) from Université de Rennes, France, followed by an AvH postdoctoral fellowship with Prof. Alois Fürstner at the Max-Planck Institute (2011–2013). He joined IIT Kanpur in 2013, becoming Professor in 2022. His research focuses on base-metal catalysis using [Fe], [Co], and [Mn] systems for C–H activation, CO_2 valorization, and asymmetric synthesis. Author of 90 papers (H-index 41), he received awards including the Merck Young Scientist Award (2019), CRSI Bronze Medal and Fellow of Royal Society of Chemistry (2023) and now currently being elected for an INSA Associate Fellow (2025). He served as Associate Editor, J. Heterocyclic Chem. (2019–24) and early career advisory board member of ACS Catalysis (2018-20).

Non-equilibrium self-assembly for living matter-like properties

Dibyendu Das

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Life's soft and wet machinery arose from spatially confined assemblies of biomolecules capable of replication, integrated with metabolic reaction cycles that function far from equilibrium. By methodically synthesizing and integrating these key elements, i.e. replication, metabolism, and confinement under non-equilibrium conditions, we can begin to explore how chemically constructed systems might acquire life-like, evolving properties. This ambitious goal lies at the heart of systems chemistry. In this talk, I will outline recent insights into how reaction networks, self-reproduction, and compartmentalization can be brought together under non-equilibrium settings. I will also delve into the interplay between reaction dynamics and transient compartmentalization, and explore the development of self-replicating systems capable of sustained operation in far-from-equilibrium conditions.

Speaker's Profile

Dibyendu is an Associate Professor of Chemistry at IISER Kolkata. He earned his Ph.D. from IACS, India, postdoc at Emory University, USA. He leads an interdisciplinary lab on systems chemistry, chemical evolution, and adaptive materials, emphasising non-equilibrium self-assembly and peptide catalysis. He is awarded the Shanti Swarup Bhatnagar Award (RVP-YVSSB-2025) and Swarnajayanti award (2020), and elected Chair (2028) of the Gordon Research Conference on Systems Chemistry. Dr. Das was featured in "75 under 50 Scientists Shaping Today's India" by Vigyan Prasar.

INSA Associate Fellow Lecture

Cascade transformations promoted by sulfoxonium ylides for the rapid creation of skeletal complexity

S. S. V. Ramasastry

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The Corey-Chaykovsky reagent [dimethyloxosulfonium methylide (DOSM)] is typically employed for the preparation of cyclopropanes from electron-deficient olefins. However, we employed DOSM in an unconventional manner, as a nucleophilic trigger to initiate cascade reactions. This approach resulted in the formation of novel classes of fused- and spirocyclopropanes, generating multiple carbon-carbon bonds and stereocenters. We refer to this process as the interrupted Corey-Chaykovsky reaction (Figure 1). In my talk, I will describe how we entered this field serendipitously.

Speaker's Profile

Ramasastry obtained Ph.D. in Chemical Sciences in 2005 from the Department of Organic Chemistry, Indian Institute of Science, Bangalore (India), under the supervision of Prof. A. Srikrishna. He then pursued postdoctoral studies with Prof. Carlos F. Barbas, III, at The Scripps Research Institute, San Diego (USA). He joined the Department of Chemical Sciences, IISER Mohali, as an Assistant Professor in 2011. Since 2023, he has been a Professor in the same department. His research interests include the development of sustainable and atom economic reactions via organophosphine catalysis, palladium-catalyzed allylic alkylation reactions and cascade transformations employing sulfur ylides.

Carbene Mimics from Strained Rings

Durga Prasad Hari

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Ring-strain in organic molecules is a powerful driving force that promotes reactivity through strain-release, allowing the facile construction of a myriad of useful scaffolds via ring-opening or ring-expansion reactions. Carbene chemistry has been extensively studied, leading to numerous applications in organic synthesis, including X–H insertions (where X can be C, Si, N, O, etc.), cyclopropanations, ylide formations, and 1,2-migrations. Due to their high reactivity, carbenes are particularly well-suited for initiating cascade sequences, which results in the rapid generation of structural complexity. The most common method for generating carbenes involves highly reactive diazoalkanes, typically using metal catalysts or photoirradiation. Alternative precursors for carbenes include substituted triazoles or alkynes combined with pyridine *N*-oxides, often utilizing transition metal catalysts. Generating carbenes through the activation of C−C bonds presents significant advantages, as it offers unique opportunities for constructing the backbones of organic molecules. However, this process is challenging due to the inertness of C−C bonds and the lack of metal-carbon bond interactions. In this context, the ring strain energy in small organic molecules has been effectively utilized to promote the activation of these difficult C−C bonds. In this lecture, I will first discuss how we generate carbene mimics from bicyclo [1.1.0] butane using Rh-catalysis for the synthesis of skipped dienes. Next, I will present our approach to utilizing ring strain in [1.1.1] propellane to access carbenes for [2,3]-sigmatropic rearrangements and skeletal editing of ketones.

Speaker's Profile

D. P. Hari completed his M.Sc. at IIT Madras and earned his PhD from the University of Regensburg under the supervision of Prof. Burkhard Koenig. He was a postdoctoral fellow at EPFL with Prof. Jerome Waser and was a Marie Curie research fellow in the Aggarwal group at the University of Bristol. Since April 2021, he has been an Assistant Professor at IISc Bangalore. His research primarily focuses on discovering new reactivities of strained molecules. He has received several awards, including the INSA Young Associate Award, the Thieme Chemistry Award, the Infosys Young Investigator Award, and the IISc Award for Excellence in Teaching.

Electrochemical synthesis of green ammonia, green urea & nitric acid under ambient conditions: Fundamental and translational Components

U. K. Ghorai

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There are numerous varieties of fertilizers that primarily contain macronutrients such as nitrogen, phosphorus, and potassium. Fixed nitrogen frequently serves as the limiting factor for plant development, rendering the synthesis of nitrogen-based fertilizers—such as ammonia, nitrate, and urea—essential. In the present Indian scenario, the demand for these fertilizers is rapidly increasing due to agricultural expansion and food security needs. However, most of these fertilizers depend on imported raw materials and fossil fuels, leading to economic and environmental challenges. Hence, promoting important import substitutes chemicals like ammonia, urea, nano-fertilizers, and nitric acid is vital. India is emphasizing self-reliance (Atmanirbhar Bharat) by developing indigenous technologies for sustainable fertilizer production. The adoption of renewable energy-based chemical processes can significantly reduce carbon emissions, energy consumption, and import dependency, ensuring long-term agricultural productivity and environmental sustainability for the nation's growing population.

In our laboratory, we have developed sustainable electrocatalytic methods for producing green ammonia, green urea, and nitric acid under ambient conditions using metal phthalocyanine based electrocatalysts. These innovative processes are protected by appropriate intellectual property rights (IPR). Field trials for green ammonia and green urea synthesis have been successfully completed, demonstrating high efficiency and environmental sustainability. We have also completed technology transfer and licensing for pilot-scale green ammonia production in collaboration with a multinational company. Additionally, we have initiated technology licensing process for green urea production through CO_2 utilization in partnership with industry, supporting India's vision of clean, self-reliant, and energy-efficient chemical manufacturing.

Speaker's Profile

Dr. Uttam Kumar Ghorai is currently working as an Assistant Professor in Ramakrishna Mission Vidyamandira, Belur Math, India. He has made significant research contributions to the development of sustainable processes and products. The major emphasis of his research includes the synthesis of green ammonia, green urea, and nitric acid under ambient conditions using electrochemical pathways. He recently completed a technology licensing agreement for his electrocatalytic green ammonia synthesis process with a multinational company under royalty terms. His contribution to electrocatalytic CO2 capture and conversion to green urea technology aligns with the crucial contemporary challenge of carbon capture and utilization (CCU).

INSA Young Associate Lecture

Precision Engineering of Nanoclusters: Advancing Structural and Functional Properties

Indranath Chakraborty

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Atomically precise metal nanoclusters consist of a well-defined metal core and a ligand shell. Generally, the diversity in ligand types is rare for most NCs except for a few gold NCs (e.g., Au_{25}) reported so far. This is primarily because the ligand contributes significantly to determining the atomicity of the resulting NCs. Metal–ligand interactions during the NC formation are particular to individual metals and kinetic parameters used in the synthesis. For example, Ag_{25} NC was reported to be synthesized only with 2,4-dimethylbenzenethiol (DMBT), while Au_{25} NCs are reported with a wide variety of ligands, although both the NCs have identical crystal structures. Both secondary and primary ligands and their functionalities play a significant role in their optical properties, especially in photoluminescence. These examples indicate that NC's properties, like molecules, can be tunable via surface modification, ligand engineering, doping, or hybridization with other materials. This talk will explain how precision engineering will allow researchers to manipulate nanoclusters' structural and functional properties, such as stability, catalytic activity, and photoluminescence, increasing their usefulness in a wide variety of fields, including health care, electronics, and manufacturing.

Speaker's Profile

Prof. Indranath Chakraborty is an Assistant Professor at the School of Nano Science and Technology, Indian Institute of Technology Kharagpur. His research specializes in atomically precise nanomaterials, focusing on molecular-level synthesis, structure-property correlations, and applications in catalysis, sensing, and healthcare. His group pioneers the development of atomically precise metal nanoclusters and their nanohybrids to explore unique optical and catalytic properties. Prof. Chakraborty earned his PhD from IIT Madras and conducted postdoctoral research in the USA and Germany, including a fellowship from the Alexander von Humboldt Foundation. His achievements include the Malhotra Weikfield NanoScience Fellowship, the J.C. Bose Patent Award, and the IIT Kharagpur Faculty Excellence Award.

Annexure-V

Jawaharlal Nehru University, New Delhi

&

Indian National Science Academy, New Delhi

Organize

National Symposium

On

"ADVANCES IN MOLECULAR & CELLULAR BIOLOGY"

2 December 2025

on the occasion of

Celebration of Science Week at Delhi- 2025

&

INSA 91st Anniversary General Meeting

Venue: **Convention Center, Jawaharlal Nehru University**

Scientific Program

National Symposium on Advances in Molecular and Cellular Biology

December 2, 2025

Venue: Convention Centre, Jawaharlal Nehru University

Technical Program

	9:00 –10:00 AM	**Registration and Welcome Tea**	
Inaugural Session	10:00 – 11:30 AM	• Welcome Address by **Prof. Supriya Chakraborty,** Dean SLS • Opening Remarks by **Prof. Sanjay Puri,** Vice President, INSA • Address by **Prof. Rajendra Prasad,** Dean, FSET & Director, AIB, Amity University, Gurugram. • Address by **Prof. Santishree D. Pandit**, Vice Chancellor, JNU • Inaugural Address by the Chief Guest, **Prof. Shekhar C. Mande**, President-Elect, INSA, • Vote of thanks	
11:30 -12:00 AM		**High Tea**	
Technical Session I		**Chair** **Prof. Uday Bandyopadhyay** KNU, Asansol	**Co-Chair** **Dr. Prabodh Kumar Trivedi** CIMAP, Lucknow
12:00 -12:30 PM INSA-Distinguished Lecture		**Prof. Anand K Bachhawat** IISER, Mohali *'The Glutathione cycle: A new cycle for an old molecule'*	
12:30 - 1:00 PM INSA-Distinguished Lecture		**Dr. Dimple Notani** NCBS, Bengaluru '*Role of transcriptional enhancers in genome organization and gene regulation'*	
1:00 - 1:20 PM INSA New Fellow Lecture		**Dr. Sharmila A Bapat** NCCS, Pune *'Cellular and molecular heterogeneity in ovarian cancer: From cancer stem cells to personalized medicine and immunotherapy'*	
1:20 – 2:15 PM		**Networking Lunch**	

Technical Session II	**Chair** **Dr. Subhra Chakraborty** NIPGR, New Delhi	**Co-Chair** **Prof. Mohd. Zahid Ashraf** JMI, New Delhi
2:15 - 2:35 PM INSA New Fellow Lecture	**Dr. Chandrima Das** SINP, Kolkata *'Epigenetic reprogramming links extracellular matrix stiffness to immune signalling in cancer progression'*	
2:35 - 2:55 PM INSA New Fellow Lecture	**Dr. Jomon Joseph** NCCS, Pune *'Understanding the functions of annulate lamellae: An underexplored cell organelle'*	
2:55 - 3:15 PM INSA New Fellow Lecture	**Dr. Tapas Kumar Manna** IISER, Thiruvananthapuram *'Molecular drivers of mitotic chromosome segregation'*	
Technical Session III		
3:15 – 4:15 PM	**Poster Session**	
4:15 - 4:45 PM	**Networking Tea**	
Technical Session IV	**Chair** **Prof. Indranil Dasgupta** UDSC, New Delhi	**Co-Chair** **Prof. Samudrala Gourinath** JNU, New Delhi
4:45 - 5:05 PM INSA New Fellow Lecture	**Dr. Kalika Prasad** IISER, Pune *'Self-organized morphogenesis in plant regeneration'*	
5:05 – 5.25 PM INSA Associate Fellow Lecture	**Dr. Rajesh Ramchandran** IISER, Mohali *'HDACs regulate immune cell dynamics and ECM remodelling during appendage regeneration in zebrafish and axolotl'*	
5:25 – 5:45 PM INSA Young Associate Lecture	**Dr. Somlata** JMI, New Delhi *'Harnessing the unconventional molecules in parasitic signalling pathways for drug development in protozoan parasite Entamoeba histolytica'*	
Valedictory Session		
5:45 – 6:00	**Concluding Remarks**	

Sectional Committee -VII

Molecular and Cellular Biology

Chair
Prof. Uday Bandyopadhyay, FNA

Prof. Uday Bandyopadhyay is Vice Chancellor of Kazi Nazrul University. He was a former director of Bose Institute, former Professor, Academy of Scientific and Innovative Research (AcSIR), former Senior Principal Scientist, Division of Infectious Diseases and Immunology, CSIR-Indian Institute of Chemical Biology. Prof. Uday Bandyopadhyay has made significant contributions in the field of Infectious Diseases (Malaria), Chemical Biology, Drug discovery, Biochemical Pharmacology and Cell Biology.

The Glutathione cycle: A new cycle for an old molecule

Anand K. Bachhawat

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Glutathione is the most abundant sulfur-containing molecule in living cells. It carries out crucial functions in the cell that are important for health and disease. It is a tripeptide consisting of glutamate, cysteine and glycine with an unusual g-glutamyl linkage at its N-terminus. Glutathione was discovered over a century ago in 1888. Between 1920 to 1970, the structure, and metabolism (biosynthesis, degradation, transport) of glutathione were unravelled by many of the stalwarts of biochemistry of those years. And in 1969-70 Alton Meister who was at the forefront of glutathione research proposed the "g -glutamyl cycle" that was thought to capture the cycle of glutathione metabolism with a proposed role in amino acid transport. Ever since the cycle has been known in the field and in the literature. Thus, when we accidentally began work on glutathione in the late 1990s, it was thought that the biochemistry of glutathione, and its metabolism was completely known. We soon discovered that the 'degradation arc' of the cycle was wrong. We succeeded in identifying the first high affinity glutathione transporter as well as new enzymes in glutathione degradation. This eventually led us to propose a new cycle of glutathione metabolism, "The glutathione cycle" which we proposed should replace the previously known "g-glutamyl cycle" (proposed in 1969). A brief overview of our key findings, and a brief history into how such a wrong cycle of a key cellular metabolite has perpetuated will also be presented.

Speaker's Profile

Anand K Bachhawat is an Emeritus Professor at the Department of Biological sciences, IISER Mohali. He has completed his PhD in Biochemistry from Bose Institute, University of Calcutta, and post-doctoral research at the MGH Cancer Center- Harvard Medical School, Boston, USA and Carnegie Mellon University, Pittsburgh, USA before joining the Institute of Microbial Technology, Chandigarh. He moved to IISER Mohali in 2010. Dr Bachhawat's interests are largely in the area of metabolism with specific reference to sulphur, glutathione, redox and one-carbon metabolism

Role of transcriptional enhancers in and genome organization and gene regulation

Dimple Notani

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Genes are regulated by distal regulatory elements known as enhancers that exert their function on target genes by establishing looping with the promoter. Although discovered over forty years ago, the molecular mechanisms underlying enhancer functions still remain poorly understood. Recently, another layer of complexity has been uncovered by the discovery that in addition to widespread transcription of long non-coding RNAs (lncRNAs) in mammalian cells, bidirectional ncRNAs are transcribed on enhancers, and are thus referred to as enhancer RNAs (eRNAs). However, it has remained unclear whether these eRNAs are functional or merely a reflection of enhancer activation. Different roles of eRNAs in gene regulation are just emerging.
Investigations using Hi-C/5C technologies has revealed highly organized topologically associated domains (TADs) in chromosomes. These megabase sized regions are characterized by increased frequency (~2 fold) of interaction between loci within the TADs when compared to their interaction to loci located outside the confines of boundary elements. However, the defining principle behind these ordered structure is unknown. I will talk about some evidences indicating, the role of transcriptional enhancers and their eRNAs in such hierarchical chromatin organization.

Speaker's Profile

Precise regulation of gene transcription is central to development and homeostasis. Distal regulatory elements known as enhancers play a crucial role in gene regulation. Understanding of such functional enhancers is of paramount interest, as their malfunction is often associated with developmental disorders and diseases. My lab uses cutting-edge tools such as genome-wide NGS-based assays at bulk and single cell level, to sophisticated high-resolution microscopy, to unravel the functions of enhancers in gene transcription and genome organization. We have identified "mother enhancers" in the genome that play a key role in generating reproducible transcriptional programs upon cyclic/rhythmic signaling such as growth hormones. Our findings suggest that "mother enhancers' are universally present and play a critical role in dictating the transcriptional programs in metazoans. Combining the series of contemporary approaches, we aim to uncover the precise "Mother enhancer-based architectural code" defined by specific proteome, RNA and 4D-nuclear position of a gene, which dictates diverse transcriptional programs in metazoans. The proposed study will thus have broad impact on transcriptional control mechanisms in development and disease.

Epigenetic reprogramming links extracellular matrix stiffness to immune signalling in cancer progression

Chandrima Das[1,2]

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The epigenome functions as a critical regulator of cellular physiology through dynamic, reversible modifications that govern gene expression. Our laboratory investigates chromatin readers/effectors, which recognize specific epigenetic landscapes and regulate gene expression programs. Our findings demonstrate these proteins' pivotal roles in regulating cancer hallmarks, offering insights into tumor heterogeneity. The tumor microenvironment significantly influences cancer progression through interactions between resident cells and the extracellular matrix (ECM). We show that epigenetic regulators program ECM gene expression, thereby altering ECM stiffness leading to cell free DNA release from the exosomes of the cancer cells. Further, immune signalling pathways are also deregulated by the epigenetic factors directly impacting the metastatic potential of the cancer cells. Our research illuminates how specific chromatin readers interpret the epigenetic code in cancer, emerging as promising therapeutic targets for future interventions.

Speaker's Profile

The research focus of Dr. Chandrima Das' laboratory is to understand the link between the epigenome and cancer. Further she has made contributions in understanding the role of matrix remodelling and immune signalling pathways that directly impact cancer metastasis. She is a recipient of several prestigious research fellowships and awards including Swarna Jayanti Fellowship, CDRI-Award for Excellence in Drug Research in Life Science category, S. Ramachandran National Bioscience Award for Career Development. She is an Elected Fellow of The National Academy of Sciences (FNASc.), India. She is an active member of Asian-Forum of Chromosome-and-Chromatin-Biology and Asian-Epigenomics initiative of six-Asian countries.

Understanding the functions of annulate lamellae: An underexplored cell organelle

Jomon Joseph

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Annulate lamellae (AL) are specialized subdomains of the endoplasmic reticulum (ER) containing a distinct subset of nucleoporins (Nups). Although Nups are primarily known as components of nuclear pore complexes (NPCs), which mediate nucleo-cytoplasmic transport (NCT), the functional relevance of their presence at AL has remained largely unexplained. Our recent findings provide new insight into the biological roles of AL and the Nup358 nucleoporin that resides there. We show that AL physically associate with mRNP granules such as P-bodies. In this context, Nup358 acts as a scaffold that facilitates the pairing of microRNAs (miRNAs) with their target mRNAs, thereby influencing post-transcriptional gene regulation. In parallel, we have discovered that AL are positioned at ER-mitochondria contact sites (ERMCSs), which are essential for coordinating calcium signaling, mitochondrial metabolism, lipid exchange, and autophagy. We further demonstrate that Nup358 regulates ER–mitochondria connectivity through the mTORC2/Akt/GSK3β signaling axis, highlighting a functional link between NCT-associated proteins and organelle communication. Notably, disruptions in miRNA-mediated regulation, nucleo-cytoplasmic transport, and ERMCS function are all implicated in the development of neurodegenerative diseases and cancers. Therefore, our research reveals a previously unrecognized integration between RNA regulation and inter-organelle signaling mediated by AL and Nup358. These insights advance our understanding of fundamental cell biology and may inform new strategies for therapeutic intervention in disease contexts where these pathways are compromised.

Speaker's Profile

Dr. Jomon Joseph is a Scientist G at the National Centre for Cell Science (NCCS), Pune. He holds a Ph.D. in Biochemistry from the Indian Institute of Science and completed postdoctoral research at the NIH, USA. His research focuses on nucleoporins, annulate lamellae, ER–mitochondria contact sites, nucleo-cytoplasmic transport, and intercellular communication, particularly the roles of Nup358, Ran GTPase, and SUMOylation in mRNA regulation and signaling. His group has shown how annulate lamellae influence organelle interactions and cell metabolism. Dr. Joseph is an elected member of the Guha Research Conference and actively contributes to the Indian cell biology research community.

Molecular drivers of mitotic chromosome segregation

Tapas K. Manna

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Abnormal chromosome content in cells, termed as aneuploidy, primarily arises due to mis-segregation of sister chromatids during mitotic division and is a leading cause of cancer, birth defects and various developmental disorders. Altered regulation of spindle microtubule attachment with kinetochore, the supra-molecular protein complex assembled on the centromeres of chromosomes promotes this process. Effective coupling of chromosome movement with the dynamic microtubules is critical for the sister chromatids to segregate faithfully. Our research has unveiled that specialized microtubule-associated proteins (MAPs) regulate this coupling both spatially and temporally via interaction with specific kinetochore proteins. We have shown that EB1, a microtubule protein aberrantly expressed in cancers, facilitates chromosome segregation in human metaphase cells by stabilizing microtubule attachment of kinetochore protein complex, Ska via formation of extended microtubule-bound structures. Some MAPs associate with both kinetochores and centrosomes suggesting of their co-regulation presumably via microtubules. Our work has revealed that as the cells progress from early mitosis to metaphase, centrosome protein, Cytoskeleton Associated 5 (CKAP5), also known as ch-TOG (colonic hepatic -Tumor Overexpressed Gene), that is loaded onto microtubules once they start emanating from the mitotic centrosomes, stabilizes kinetochore association of a centromere-specific kinesin motor, CENP-E, whose function is to move the chromosomes from the centrosomal areas to the spindle midzone and align them at metaphase plate. Loss of this function results in premature silencing of spindle checkpoint and chromosome mis-segregation. Mechanistic insights of these key mitosis-regulating proteins that we have uncovered, may foster newer therapeutic strategies to develop in the future.

Speaker's Profile

Prof. Tapas Manna accomplished his PhD in Biochemistry from Bose Institute, Kolkata in 2004 and carried out his postdoctoral research at the University of California, Santa Barbara and then at the Univ. of Massachusetts Medical school, USA, where he identified regulators and mechanisms that govern microtubule dynamics and mitotic checkpoint in human cells. Soon after a short attachment with the Cancer Institute of University of South Alabama, he joined IISER Thiruvananthapuram in 2009 and is currently a Professor at the School of Biology of IISER Thiruvananthapuram. His research has been primarily focused on unraveling mechanisms that control chromosome segregation errors and centrosome amplification and their links to human diseases. He is a recipient of National Bioscience Award by DBT and is a fellow of National Academy of Sciences (NASI) and Indian National Science Academy (INSA).

Self-organized morphogenesis in plant regeneration

Kalika Prasad

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Our research group investigates the fundamental principles of self-organization in biological systems, using plant regeneration as a model to uncover how form and function re-emerge from disorder. We focus on the mechanics of morphogenesis—the process by which tissues and organs regenerate their structure. Morphogenesis unfolds through a delicate choreography of mechanical forces, cell geometry, and biochemical cues, including hormonal signals. Using *Arabidopsis thaliana* as a model, we examine both tissue culture–mediated and injury-induced regeneration to reveal how mechanical forces guide cellular self-organization. We discovered that shoot progenitors within undifferentiated callus tissues self-organize into functional meristems through a "stretch–compress" mechanism, where local compression and expansion reshape cell geometry and mechanical tension to sculpt the characteristic dome of the shoot meristem. Strikingly, a related "push–pull" mechanism operates during root tip regeneration, driving the convergence of cell files and reestablishment of the stem cell niche. Together, these findings illuminate how mechanochemical feedback and cell geometry orchestrate morphogenesis, offering a unified framework for understanding how plants rebuild themselves with exquisite precision.

Speaker's Profile

Kalika's group investigates the fundamental mechanisms underlying regeneration and developmental plasticity in plants. After earning his Ph.D. from the Indian Institute of Science, Bangalore, he pursued an EMBO postdoctoral fellowship at Utrecht University. His group at IISER Pune explores how mechanical, geometric and biochemical cues coordinate tissue regeneration. A Fellow of Indian Science Academies, INSA, IASc, and NASI, he serves on the Editorial Boards of Developmental Biology, Plant Communications and Journal of Genetics.

HDACs regulate immune cell dynamics and ECM remodelling during appendage regeneration in zebrafish and axolotl

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Vertebrates, such as zebrafish (*Danio rerio*) and axolotl (*Ambystoma mexicanum*), possess a remarkable tissue regenerative capacity that enables them to restore complex tissues, including the retina, spinal cord, tail, and limb. Deep injuries to their appendages induce epimorphic regeneration, resulting in the scar-free restoration of damaged organs. Zebrafish and axolotls regenerate appendages through cellular reprogramming, driven by a diverse range of genetic, epigenetic, and extracellular matrix (ECM) cues. Histone deacetylases (HDACs) regulate the chromatin state, thereby affecting the activation or suppression of gene programs during reprogramming. We examined the pre-amputation role of HDACs in appendage regeneration in zebrafish and axolotl. Pharmacological HDAC inhibition with Trichostatin A (TSA) led to excessive ECM deposition and altered the immune microenvironment, thereby impairing tissue regeneration. RNA-seq revealed a pro-inflammatory transcriptional milieu, which was phenocopied by bacterial lipopolysaccharide (LPS). Combined LPS/TSA treatment increased infiltration of pro-inflammatory $CD11b^{+}$ myeloid cells, promoted $CD4^{+}$ T-cell recruitment, and drove TGF-β-dependent collagen deposition. The LPS/TSA-induced regeneration block was rescued by the free-radical scavenger N-acetylcysteine. Conversely, blocking lymphocyte egress with FTY720 prevented regeneration, whereas Collagenase D rescued the TSA-mediated block. Collectively, our findings demonstrate that stringent HDAC-mediated control of immune cell trafficking and collagen deposition is crucial for the successful regeneration of appendages.

Speaker's Profile

Prof. Rajesh Ramachandran has been working on tissue regeneration since 2007, beginning with postdoctoral research at the University of Michigan in Ann Arbor. He joined IISER Mohali in 2012, where he continues to study retinal regeneration in zebrafish and established the axolotl as a model for limb and tissue regeneration. His group investigates how genetic and epigenetic regulators, as well as systemic conditions such as diabetes, shape regenerative outcomes. A central focus is identifying conserved cellular reprogramming signatures across species and tissues to form curative strategies for mammalian retinal blindness. He has published several peer-reviewed articles on regeneration.

Harnessing the unconventional molecules in parasitic signalling pathways for drug development in protozoan parasite E*ntamoeba histolytica*

Somlata

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Protozoan parasite *Entamoeba histolytica* causes amebiasis in humans through a coordinated role of motility, adhesion, cytolysis, and multiple endocytic processes leading to symptoms ranging from diarrhoea, dysentery to invasive forms. Pathogenesis begins when the parasite degrades host tissues via phagocytosis (ingestion of dead cells or debris) and trogocytosis ("nibbling/eating" live host cells) to ingest host material, leading to tissue damage and eventual ulceration. Although there have been overlap of molecules participating in phagocytosis and trogocytosis yet only an AGC family kinase is known to be involved in the trogocytosis exclusively. Along with other signalling events, Ca^{2+} dependent signalling has been shown to be important for the endocytic processes and pathogenesis as well. We are currently looking at unconventional CDPK Related Kinases (CRKs) expressed in the parasite which has not been investigated so far. These kinases present sequentially diverged CaM and Ca^{2+} binding sites in sequences, which were not reported before and indicate existence of a divergent signalling system present in the parasite which can be harnessed for drug development. It is also noteworthy, apart from phosphorylation events, membrane undergoes lots of remodelling during endocytic events by membrane remodelling proteins. We are currently focussed on putative I BAR class of protein which is sequentially diverged from proteins of other system yet displays biochemical characters typical of I BAR class of proteins. Overall, our research is trying to orchestrate the endocytic events that lead to pathogenesis and identify the druggable targets for developing anti amoebic agents.

Speaker's Profile

Dr. Somlata has completed her education from University of Delhi and Jawaharlal Nehru University. She has been working on understanding signalling pathway of protozoan parasite since 2005. Her lab is trying to build the signalling orchestra which leads to endocytosis by parasite involving kinases, actin remodelling and membrane remodelling. Her PhD work led to identification of a C2 domain kinase involved in initiation of phagocytosis by parasite E. histolytica and its detailed biochemical characterisation. Further, in post doctoral research she identified a kinase exclusively involved in trogocytosis by the parasite, which is first report of a kinase to be involved in trogocytosis. She is currently focussing on identifying inhibitors for kinases important in pathogenesis along with membrane remodelling. Her work has so far led to 5 grants by UGC, DBT and SERB along with DST Inspire faculty award in 2012 and INSA young scientist in 2016.

PRESIDENTIAL LECTURE

Presidential Lecture

Creating a Stable, Inclusive, Robust, and Sustainable Knowledge Ecosystem: Evolving Roles, Structure, and Processes of Academies at a Crossroads

Ashutosh Sharma
President, Indian National Science Academy
Bahadur Shah Zafar Marg, New Delhi

As the Indian National Science Academy (INSA) celebrates its 90th anniversary in 2025, it stands at a historic moment of reflection, reform, and renewal. The overarching challenges of our time and indeed for the future of humanity on Earth such as sustainable development and the rise of intelligent algorithms and machines, demand a fundamentally interdisciplinary and multidisciplinary approach. This approach requires the involvement of all stakeholders in science and society working with a clear and shared purpose. It necessitates transcending the silos of knowledge and fostering the massive democratization of science, integrating diverse perspectives on problems and solutions through the cultivation of inclusion, diversity, and equity. The evolution of an academy its structure, processes, membership, and activities must account for these powerful winds of change and embrace the willingness to understand and adapt to the exponential growth of knowledge and its impact.

INSA has been proactively working to promote inclusion and diversity in age, gender, areas of expertise, and its stakeholder base, thereby enhancing its range of connections and partnership activities. Over the past three years, INSA has entered a phase of transformation, actively reshaping its role to respond to emerging national and global needs. This period has been marked by the launch of new fellowship categories, the establishment of a Centre for Science, Technology & Innovation Policy, programs for leadership and capacity building, national efforts to enhance women's inclusion, and initiatives to connect science more closely with society. These efforts reflect a conscious shift from being primarily an academic institutional club to becoming a facilitator of innovation, policy thinking, and inclusive scientific leadership.

Key highlights from INSA's major initiatives and reforms undertaken during 2023–25:

1. **Improved Processes for Fellow Election**: These include clearer conflict-of-interest and confidentiality norms, enhanced recommendation letter requirements, an increase in the annual intake of fellows from 50 to 100, and making the elected numbers proportional to the nominations in each sectional committee.

2. **Reorganization of Sectional Committees**: This restructuring ensures that rapidly growing areas of science and technology (S&T), which are currently underrepresented, are adequately addressed.

3. **Diversity and Inclusion of Key Stakeholders**: Two new fellowship categories *Science in Translation* and *Science for Society* have been introduced to recognize leadership in using science to create socio-economic impact.

4. **Establishment of the Centre for Science, Technology, and Innovation Policy (CSTIP)**: CSTIP will focus on policy research, producing white papers, scholarly outputs, and advocating in critical areas of S&T.

5. **New Vice President Category Introduced for the Science Policy:** Earlier, the INSA Council operated with six Vice Presidents, each leading a distinct domain. In the new Council structure, a significant reform has been introduced with the creation of a new Vice President for Policy. Globally, national academies are expected to advise governments on critical science, technology, and innovation matters, and this new position aligns INSA with that international mandate.

6. The establishment of the CSTIP is the first major step in this direction. Together, the creation of the Vice President (Policy) portfolio and CSTIP positions INSA to become a stronger, more influential voice in shaping evidence-based policy for the nation.

7. **Age Diversity and Inclusion**: The introduction of *Associate Fellows* (under 50) and *Young Associates* (under 40) encourages early scouting, mentorship, and networking opportunities.

8. **Gender Diversity and Inclusion**: The *INSA Women's Association* (IWA) has been established to strengthen women's participation in science, leadership, mentorship, policy, and STEM advocacy.

9. **Creation of the Academic and Research Advancement Network of INSA (ARANI)**: This network aims to develop partnerships with universities, research institutions, R&D organizations, NGOs, start-ups, and policy think tanks, focusing on policy formulation, advice, workshops, conferences, and collaborations with INSA activities and fellowships.

10. **Capacity Building and Leadership Development**: INSA has launched structured programs such as the *LEADS (Leadership Development in Science & Technology)* Program, specialized workshops like *Navigating PhD and Beyond*, PAN-Indian sustainability workshops, and training initiatives on Environmental, Social, and Governance (ESG) frameworks with a focus on responsible research, sustainability, ethics, and science communication.

Additionally, the Academy is emerging as a facilitator of science-policy integration, organizing policy dialogues, research workshops, and collaborative initiatives with leading institutions such as IITs, IISERs, CSIR laboratories, DST, and global science bodies. These programs reflect INSA's commitment to engaging with a diverse stakeholder base in science and technology by recognizing both the creation and application of scientific knowledge, nurturing young talent, empowering

women scientists, and cultivating the next generation of science leaders. As INSA moves forward, its future will be defined not only by recognizing excellence in traditional fields of science but also by how effectively it encourages interdisciplinary collaboration, fosters emerging critical areas, and connects science with society, ethics, policy, and people. In doing so, INSA will continue to uphold the very spirit upon which it was founded: science in the service of the nation.

Speaker's Profile

Ashutosh Sharma is Institute Chair Professor at IIT Kanpur, President of the Indian National Science Academy (2023-25), Co-chair of S20/G20 and a former Secretary to the Government of India heading its Department of Science and Technology (January 2015- 2021). He was a Professor (1997-), and the Head (2003-05) of Chemical Engineering, and the founding Coordinator of Nanosciences Center and Advanced Imaging Center at the Indian Institute of Technology at Kanpur. Ashutosh received his PhD from the State University of New York at Buffalo (SUNYAB; 1988) working with Prof. Eli Ruckenstein—a recipient of the US Medal of Science, his MS from the Pennsylvania State University (1984) and B.Tech. from IIT Kanpur (1982). Ashutosh has had a broad international experience as a research faculty at SUNY Buffalo School of

Medicine (1988-90), visiting faculty at University of Texas at Austin, University of Western Ontario, University of Erlangen-Nuremberg and the World Class University Program of South Korea and as a Member of the European Research Commission. Ashutosh's research contributions are highly interdisciplinary, spanning a wide range in nanotechnology; thin polymer films; nanocomposites and devices in energy, health and environment; functional interfaces; micro/nano-mechanics of soft matter; nano-patterning and nanofabrication; colloid and interfacial engineering; biomaterials & biosurfaces; wetting and adhesion. He has published over 400 peer reviewed papers, filed over 15 patents, given over 200 keynote presentations and mentored a nanotechnology startup.

Ashutosh has been conferred with 'Padma Shri' by the Government of India for his groundbreaking contributions to nanoscience and nanotechnology. He is a recipient of numerous honors and awards including the inaugural Infosys Prize in Engineering and Computer Science, TWAS Science Prize of the World Academy of Sciences, Bessel Research Award of the Humboldt Foundation, J. C. Bose Fellowship, Bhatnagar Prize, Homi J. Bhabha Award of UGC, The Syed Husain Zaheer Medal of INSA, Distinguished Alumni Awards of IIT Kanpur and SUNY Buffalo, Life-time Achievement Award of the Indian Science Congress, UNESCO Medal for "Contribution to Development of Nanoscience and Nanotechnology", H.K. Firodia Award for Excellence in Science & Technology and Meghnad Saha Medal of INSA. He has also received nine D.Sc. honoris causa from universities in the USA and India. Ashutosh is an elected Fellow of The Indian National Science Academy, The Indian Academy of Sciences, The National Academy of Sciences, India and Indian National Academy of Engineering, The World Academy of Sciences (TWAS) and the Asia-Pacific Academy of Materials. He has also served on the Councils of the first two. He has been an associate editor of ACS Applied Materials and Interfaces, Proceedings of Indian National Science Academy and ASME Journal of Micro- and Nano-Manufacturing and has been on the editorial boards of several journals: Carbon; ACS Industrial and Engineering Chemistry Research; Current Science; Nanomaterials and Energy; Chemical Engineering Science; Journal of Colloid and Interface Science; Canadian Journal of Chemical Engineering and Indian Chemical Engineer. Ashutosh's other interests are in ancient history and philosophy, poetry, and art.

Science in Translation

Good Science Needs Good Data

Anand Deshpande

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India is on track to be among the world's top three economies, yet our scientific output does not reflect our scale or capability. In cancer research, diabetes research, and even social-science work with nano-entrepreneurs, we still depend heavily on Western research because we lack the high-quality, large-scale datasets needed for modern science. Jim Grey's "Fourth Paradigm" predicted this shift to data-intensive scientific discovery; with AI now central to research, the need for good data is even more urgent. Good AI needs good data. From my work with cancer and diabetes researchers, it is clear that building curated datasets in India is both essential and challenging. Our population diversity and the long-term nature of these diseases require data collected consistently across institutions, over many years, with discipline and agreed standards. Yet data creation is still treated as a side activity within short-duration projects. Scientists are rewarded for publications, not for building datasets. Funding structures rarely support shared, long-term data platforms. As a result, whatever data is collected remains narrow, fragmented, and inaccessible to the broader research community. The same gaps appear in the social sciences as well; the scale of our challenges demands much better data. In this talk, I will share my observations and argue that as India invests through ANRF and other national programmes, we must commit to building curated, long-duration data platforms that serve the entire scientific community. Astronomy shows what becomes possible when a field aligns around shared datasets and open access. If India wants to lead in science, we must start by investing in data—because good data powers good AI, and good AI will shape the future of discovery.

Speaker's Profile

Anand Deshpande is the Founder and Chairman of Persistent Systems, a global technology services company he established in 1990. His entrepreneurial journey transformed a small startup into an industry leader with a market capitalisation of nearly $10 billion and a workforce of 24,000 employees spanning 18 countries worldwide. Dr. Deshpande holds a B.Tech in Computer Science from llT Kharagpur and advanced degrees (M.S. and Ph.D.) in Computer Science from Indiana University, Bloomington. His alma maters have recognised his extraordinary contributions with the llT Kharagpur Distinguished Alumnus Award in 2012 and the Indiana University School of Informatics Career Achievement Award in 2007. A respected technology leader, Dr. Deshpande has been inducted as a Fellow of the Computer Society of India and the prestigious Indian National Academy of Engineering. He served as the Founding President of ACM India (Association for Computing Machinery) and was honoured with the ACM Presidential Award in 2024 for his significant contributions to computing. Dr. Deshpande's commitment to education is evident through his service as Chairman of several premier technical institutions, including llT Patna, lllT Allahabad, and VJTI Mumbai. His expertise was also leveraged at the national level as a part-time board member of UIDAI (Unique Identification Authority of India) from 2016 to 2022. His passion for entrepreneurship extends beyond his own success through two impactful initiatives. The deAsra Foundation, founded by Dr. Deshpande, has supported nearly 400,000 nano entrepreneurs across India, creating sustainable livelihoods and economic opportunities. Through Second Orbit, he has mentored and accelerated the growth of more than 1,000 companies, sharing his wealth of experience and business acumen. Currently, Dr. Deshpande serves as the co-chair of the Biotechnology Research Innovation Council (BRIC), where he is developing strategic programs to advance India's bioeconomy, bringing his technological expertise to the field of biotechnology innovation. Through his multifaceted contributions as a technology pioneer, institution builder, mentor, and thought leader, Anand Deshpande continues to shape India's digital future while creating global impact through innovation and entrepreneurship.

Radiopharmaceuticals for Nuclear Medicines

A. K. Mohanty

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At the heart of India's isotope program stands the Bhabha Atomic Research Centre Mumbai where the research reactors like Apsara-U and Dhruva produce a wide range of radioisotopesboth for cancer diagnosis and therapy. Radioisotopes such as Technetium-99m and Fluorine-18 (produced by medical cyclotron) are used in imaging organs and detecting diseases at an early stage. Isotopes like Iodine-131, Yttrium-90, and Lutetium-177 are used to treat thyroid, liver, prostate& neuroendocrine cancers, respectively, with precision. The talk will cover the Department of Atomic Energy (DAE)'s program on radioisotope productions using research reactors, accelerators and reprocessing of nuclear spent fuel. The high level waste generated from reprocessing the spent nuclear fuel discharged from the reactor contains many useful radioisotopes in significant quantities like Cs-137, Ru-106, Sr-90 as produced during the fission of U-235. DAE has developed reprocessing technologies to extract these radioactive fission products and has produced Brachytherapy plaque based on Ru-106 isotope for treatment of eye cancers and Cs-137 pencil for blood irradiation. Several important radioisotopes such as ^{18}F, ^{68}Ga and ^{201}Tl are produced using the Medical Cyclotron Facility at VECC, Kolkata. On an average 40,000 to 45,000 Ci of various radioisotopes are annually produced at Dhruva reactor to supply over 5000 consignments to more than 1900 user institutions in India and abroad on monthly basis including Ir-192 and Co-60. Still, we have to import several isotopes to meet the domestic demand. Now BARC is proposing a dedicated Isotope Producing Reactor which is expected to be the largest Isotope producing Reactor in the world in terms of volume of isotope production. It will fully meet country's demand and rest about 75% can be exported.

Speaker's Profile

Dr. A.K. Mohanty born in 1959 at Odisha is a well-known nuclear physicist, completed his bachelor's degree in 1979 from MPC College, Baripada and master's degree in Physics in 1981 from Ravesnshaw College, Cuttack which was at that time under Utkal University, Bhubaneswar. Dr. Mohanty graduated from the 26th batch of the BARC Training School and joined Nuclear Physics Division of Bhabha Atomic Research Centre in 1983 and got his PhD degree from Bombay University later on. He has taken over as Secretary, Department of Atomic Energy (DAE), Government of India, and Chairman of Atomic Energy Commission (AEC) in May 2023. Before his appointment as Secretary, DAE, Dr. Mohanty has held the position of Director of Bhabha Atomic Research Centre (BARC) from March 2019 to September 2023, Director of Saha Institute of Nuclear Physics (SINP), Kolkata from June 2015 to March 2019 and director of Physics group, BARC from July 2018 to March 2019. During the past four decades, Dr. Mohanty has worked in several areas of nuclear physics covering collision energy from sub-Coulomb barrier to relativistic regime. It includes experiment using Pelletron accelerator at TIFR, PHENIX and CMS experiments at Brookhaven National Laboratory (BNL), USA and CERN, Geneva respectively. Dr. Mohanty has held several honorary positions. To name a few, he served as Secretary and Member Secretary of BRNS Basic Science Committee from 2004-2010, General Secretary of India Physics Association (IPA) 2012-2016 and later on President of IPA 2018-2020, India-CMS Spokesperson (CMS Experiment at CERN Geneva) 2013-2015, Dean, Academic, Physical & Mathematical Sciences, BARC, Homi Bhabha National Institute. Dr. Mohanty has been recipient of several awards and recognitions during his illustrious career. Some of Dr. Mohanty' s awards and recognitions are Gold Medal in Graduation (1979, Radha Gobinda Trust, Mayurbhanj), Young Scientists Award of Indian Physical Society (IPS, Kolkata, 1988), Young Physicist Award by Indian National Science Academy (INSA, New Delhi 1991) and DAE Homi Bhabha Science & Technology Award (2001) by Department of Atomic Energy, Mumbai. He was also conferred the CERN Scientific Associate position at CERN, Geneva from 2002-2004 and thereafter again from 2010-2011. He has received Doctor of Science (Honoris Causa) from several Universities. Dr. Mohanty is a fellow of National Academy of Sciences and Indian National Academy of Engineering.

Science for Society

From rationality to relationality: rethinking the scientific temper in the 21st century

Naima Khatoon

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India's constitutional commitment to the development of a "scientific temper" was envisioned as a national ethos of critical inquiry and rational thought. Yet, in the complex, networked world of the twenty-first century, this vision requires profound renewal. A shift is proposed from a purely rational model of science to one grounded in relationality with an understanding that all knowledge arises from interconnection, mutual dependence, and ethical awareness. Rationality, when isolated from empathy and context, risks producing knowledge that is technically advanced but socially alienating. Drawing on the intersections of psychology, philosophy of science, and Indian epistemology, this approach explores how relational thinking can overcome the crisis of alienation by restoring the moral and cultural dimensions of inquiry. Compassion, dialogue, and rootedness are presented not as sentimental detours from objectivity but as scientific virtues that enhance understanding and resilience. Relational science emphasises shared cognition, cross-disciplinary dialogue, and ecological awareness as essential to human progress. In this framework, "Science for Society" becomes inseparable from the "Science of Society," an ecology of thought where rational precision and human sensitivity evolve together, reaffirming science as a profoundly moral and civilizational pursuit.

Speaker's Profile

Prof. Naima Khatoon, Vice-Chancellor of Aligarh Muslim University, is an eminent scholar, educationist, and psychologist whose leadership marks a historic milestone as the first woman to head the institution since its inception in 1920. A distinguished academic with decades of experience in teaching and research, she has made significant contributions to educational psychology, gender studies, and institutional development. Before becoming Vice-Chancellor, she served with distinction as Principal of the Women's College, AMU, where she strengthened academic standards, research culture, and women's leadership in higher education. Her intellectual work explores the intersections of spiritual psychology, cognition, ethics, and social responsibility, demonstrating how education and science can work together to nurture sustainable and humane futures.

Prof. Khatoon's vision of education combines moral insight with scientific temper by encouraging innovation rooted in compassion, inclusivity, and civic engagement. She has delivered numerous lectures in India and abroad on themes such as the psychology of trust in science, environmental consciousness, and the role of women in knowledge creation. Recipient of several awards and recognitions for her academic and administrative excellence, Prof. Khatoon continues to inspire a new generation of scholars to view knowledge not merely as accumulation, but as a transformative force for society and the nation.

Commercialisation of Indian Science is critical for India to achieve strategic autonomy in key technologies. Collaboration between Industry, Government, Academia is essential for this

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The global landscape is undergoing a profound transformation. Geopolitical alliances are being redrawn, economic borders are tightening and tariffs, technologies, and entire supply chains are being weaponized with impunity. In this New World Order, national sovereignty has become synonymous with technology sovereignty. India already has a stronger scientific and institutional base than many realise. Our leading institutions, particularly the IITs and IISc, now produce more postgraduate scholars than undergraduates. The scale and quality of R&D at these institutions has also risen sharply and we hear some great examples every day. But we now need Government, Industry and Academia to come together, restore the country's self confidence and faith in Indian Science and make India a key centre of critical technologies that the world needs. Government has made the first move by reducing the bureaucracy in Research and creating ANRF and the RDI Fund. Indian industry has significantly underinvested in R&D but it has the financial and organizational muscle to take cutting-edge research from lab to market. They must invest more in R&D, collaborate with academia, acquire or fund promising startups and place more faith in Indian science. Our startups are already showing the way. Creating a vibrant environment for Indian Science and Commercialisation of Indian technologies has been my focus for the last few years. This has involved advising different arms of government, brainstorming with like minded professionals in Industry and Academia, and deeply involving myself in the startup and investment ecosystem has been to take forward this goal.

Speaker's Profile

Mr. Saurabh Srivastava did his mechanical engineering from IIT Kanpur in 1968 and went on to pursue his master's degree at Harvard University. He started his career with IBM in the US and later worked at Tata Unisys in India before embarking on his entrepreneurial career. He co-founded and Chaired key institutions of modern India focussed on entrepreneurship: NASSCOM; Indian Venture Capital Association; TiE New Delhi NCR; Indian Angel Network. After working for IBM and Tata Unisys in the US and India, Mr. Srivastava became a highly successful serial entrepreneur , founding several successful IT companies. One was ranked amongst the top 20 Indian software companies and, post merger, listed as Xansa on the London Stock Exchange with revenues of approx. US $ 800 mill till it was acquired by Steria. He now Chairs Steria in India. Mr. Srivastava is a doyen of entrepreneurship and angel/VC investments. He has been involved in investing in around 100 start-ups and has personally mentored hundreds of entrepreneurs. He founded and chaired India's first private sector VC Fund- Infinity, which created companies like, India Bulls, India Games and Avendus. He was adjunct Professor of Entrepreneurship at IIT Bombay, on the board of Incubation Cell of IIT Delhi and is on the board of the Entrepreneurship/ Innovation Cell at IIT Kanpur. At the forefront of public service, constantly striving to help create a positive environment for startups and entrepreneurship in India, he has served on virtually every Committee set up by government to look at different aspects of startups and entrepreneurship in India : The National Innovation Council, SEBI Committee on Alternative Investment Funds, , Investment Committee of the Government's India Aspiration Fund of Funds Committee to Examine the Financial Structure of the MSME Sector, Bombay Stock Exchange Hi-Tech Advisory Panel ,Telecom Centre of Excellence and the National Expert Advisory Committee on Innovation, Incubation and Technology Entrepreneurship. Mr. Srivastava is a co-founder of Ashoka University and serves on the Advisory Boards of Imperial College Business School, London and Uttarakhand and Himachal Universities in India.

Achievements and Honors: *Padma Shri, Govt. of India, 2016. Distinguished Alumnus Award, IIT Kanpur, 1999. Lifetime Achievement Award, Dataquest, 2015. IT Excellence Award by the Prime Minister of India.*

Scaling Innovations: Transforming ideas to solutions impacting society

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Indias Science, Technology and Innovation policies since inception have given special impetus to building a strong scientific foundation, advancing scientific temper and integration of technology and innovation with the sustainable development missions. The emphasis has been on developing affordable and accessible products and technologies impacting society and addressing the national and global challenges. From the Space Mission to the Green Revolution, to the White revolution, to Polio eradication and then Biotech driven Bioeconomy, we have seen technology impacting all spheres of life from health to agriculture to climate change importantly targeting welfare of human kind. Science has continuously evolved and new emerging and disruptive technologies have given us the confidence of science solving major problems. The Pandemic war was won by humanity with a very well-articulated scientific response. From vaccines to diagnostics and other medical counter measures - new technology developed on an accelerated pace. We have today developed important Platform technologies and globally a very robust research and translational ecosystem has been built. We are now prepared for a rapid response to future emergencies. The importance of Science & Technology for delivering affordable innovative solutions to complex societal challenges was very well recognised by the world in the pandemic response. It is however important to remember that it is not just the pandemic or health priorities which need science led innovations to bring out innovative products, this is an urgent need in all sectors from agriculture to energy to industrial products. There are a number of new emerging and disruptive technologies which need special attention if we as a country have to cater to our societal needs and also make a global impact .Some key areas of focus are AI ,ML ,Big data, Precision Medicine and Agriculture ,Cell and regenerative medicine ,the Omics technologies ,synthetic biology etc to name a few which have the potential to deliver innovative solutions, allowing us to accomplish our Sustainable Development Goals specially, Food and Nutrition, Health for all, Clean energy and climate . It is therefore imperative that we focus on encouraging cutting edge discovery research ,innovative technology and process development for affordable products ,and create an enabling ecosystem which allows translational research to move across the value chain .This requires intense engagement between Academia ,industry, start ups and society .Science ,technology and innovation have clearly exhibited that these are the three pillars contributing to economic and societal growth and development to achieve the goals of a Sustainable Universe . .

Speaker's Profile

Dr Renu Swarup, is the Former Secretary, Department of Biotechnology (DBT), Government of India. Having served in Department of Biotechnology for over 30 years, she was also the Chairperson of Biotechnology Industry Research Assistance Council (BIRAC). She also held the Additional Charge of Secretary Department of Science &Technology for a short period. A PhD in Genetics and Plant Breeding, She did her Post Doctoral Research at The John Innes Centre, Norwich UK, Dr. Renu Swarup has been instrumental in the planning and implementation of some major National programmes. As a Science Manager issues related to policy planning and implementation were a part of her assignment. She was actively engaged in the formulation of National Biotechnology Vision and Strategy in 2001, 2007 and 2015and 2021. She was also a member of the Task Force on Women in Science constituted by the Scientific Advisory Committee to the Prime Minister. As the Secretary of Government of India, Department of Biotechnology, she led a Network of 16 Autonomous Research Institutes, 2 Public Sector Undertaking and a R&D Network of more than 5000 projects across more than 100 research institutes, Universities and Laboratories. In the recent COVID Pandemic situation she led the COVID Vaccine, Diagnostic and Genome sequencing Mission. The Public Sector BIRAC, for which she was the founding Managing Director and then Chairperson, had supported more than 10000 Startups and over 100 Incubators. She is a Fellow of the National Academy of Sciences (NASI) India, A Life Member of Trust for Advancement of Agricultural Sciences (TAAS) and a Member of the Organization for Women in Science for the Developing World (OWSD). She has received many awards, NASI PSheel Memorial Award, TWAS Regional Science Diplomacy Award, and the YB Chavan National Award 2021 for Public Service. She is currently the Vice Chair of the International Centre for Antimicrobial Resistance Solutions (ICARS) Copenhagen ,Denmark and also a Member of the Scientific Expert Group of the International Pandemic Preparedness Secretariat, Govt of UK, a Member of the Advisory Board of WHO for the National R&D Framework and the Advisory Board of the Hiroshima G7 Global Health Follow up initiative .She is a Member of the Board of Trustees of the M S Swaminathan Research Foundation ,and of the Board of Trustees of the Trust for Advancement of Agriculture Sciences. She is currently the Chair of the Governing Body of the Indian Association for Cultivation of Science, an Autonomous Institute of Department of Science &Technology, Govt of India and a Member of the Board of Governors of ICMR, AsCIR and IBEF. She was the Chair of the Niti Aayog Expert Committee on Emergency Response and Preparedness for Future Pandemics. She was a also a Member of the Rashtrapati Bhavan Visitors Award Committee and is also a member of the National Start up Advisory Council, Govt of India. She is a Chair of various committees of Niti Aayog, Ministry of Health and Family Welfare, ICMR ,Ministry of Textiles and State Governments of Uttar Pradesh and Madhya Pradesh .She is also a Member of many Committees of Office of PSA ,DST ,DPIIT and other Central Departments

Ecology-Inclusive Economy: A Challenge for Future Science and Technology

Anil Prakash Joshi
Himalayan Environmental Studies and Conservation Organization (HESCO)
Dehradun, Uttarakhand
E-mail : dranilpjoshi@gmail.com

Science needs to overcome Ecological crisis. Ecological crisis cannot be overlooked anymore. The past experience revealed that science and technology have been more focused on the development needs of various products, and are said to be responsible for the changes in the environmental behaviour, including Global warming and climate change. Current challenges cannot be understood and analysed without knowing the science of nature. This is the time we need to focus on nature-related science issues and solutions that can help to develop an ecology-inclusive economy. This is a well-known fact that the major challenge of the last decades has been devoted to addressing economic crises, and Science and Technology played a major role in overcoming the same. Ecological crisis is prevalent and pervasive now. It is time that we need to review role of our science, technology, and its products that do not match to nature's needs. We should target to discover knowledge related to the science of nature that can ultimately help us restore nature and overcome the ecological crisis. Thus, the ecology-inclusive economy can address both which hitherto were biased for economic growth.

Speaker's Profile :

Dr. Anil Prakash Joshi is an environmentalist, green activist, and the founder of Himalayan Environmental Studies and Conservation Organization (HESCO), a Dehradun -based voluntary organization. He has coined GEP (gross environmental product), an ecological growth measure parallel to GDP. GEP has been accepted as a growth measure by the state of Uttarakhand on 5 June 2021. Under the aegis of HESCO, Joshi promoted research and development of new environment-friendly technologies for the agricultural sector, tapping the local resources. He has authored over 100 research papers and ten books dealing with sustainable development of the Himalayas through various means.

His one of the major contributions has been to rejuvenate streams and springs. His tool to regenerate these water bodies have essentially been through understanding science of Nature. Today hundreds of springs and steams are recharged by various organizations through protocol develop by Dr. Joshi. Dr. Joshi has launched several social programmes, based on resource-based rural development, such as Women Technology Park, Technology Intervention for Mountain-Eco System, Ecological Food Mission in Mountain and Women's Initiative for Self Employment (WISE) and has been reported to be successful in providing the villages with water mills, composting pits, toilets, plan- based drugs and herbal pesticides and rainwater harvesting techniques.

Ashoka, the social entrepreneurial network, elected him as their Fellow in 1993. The Indian Science Congress awarded him the Jawaharlal Nehru Award in 1999 and The Week magazine selected him as the Man of the Year in 2002. The Government of India included him in the 2006 Republic Day Honours list for the civilian award of the Padma Shri and the same year, he received the Jamnalal Bajaj Award for his efforts in the application of science and technology for rural development. For his passionate contributions, Dr. Prakash has been awarded with Mother Teresa Memorial Award 2021, Passion Vista, Most Admired Global Indians Award 2021, Uttarakhand State Gaurav Samman, 2021, and Padma Bhushan Award, 2020.

Sumant Sinha

Chairman and Managing Director
ReNew Power Limited
E-mail: sumant@renew.com

Energy transition is India's defining national opportunity - that can propel an increasingly affluent, better skilled, younger, and aspirational India on the path to Viksit Bharat by 2047. As 2025 marks 15 years of Sumant Sinha founding ReNew, this speech highlights three core messages: 1) India has already begun capturing the economic gains of the energy transition - creating 1 million jobs, fostering entrepreneurship, and building competitiveness. But the real opportunity ahead is far greater: to scale self-reliance and innovation for a sustainable, prosperous future. 2) Science without commercialization and competitiveness is just expensive research. To truly lead, India must accelerate the commercialization of clean-tech innovations and leapfrog into next-generation technologies - with minimal dependence on China across the manufacturing ecosystem. This demands a robust investment framework and comprehensive industrial policy support to turn breakthroughs into scalable solutions. This is a $5 trillion opportunity for the next decade. 3) Today's right skill set for the clean energy transition is a blend: deep functional expertise and the ability to harness AI for maximum productivity. One without the other is incomplete—and increasingly irrelevant.

Speaker's Profile :

Sumant Sinha is the Founder, Chairman, and CEO of ReNew, one of India's largest clean energy companies. A global entrepreneur and internationally recognised thought leader on energy and climate change, Sumant founded ReNew in 2011 with a vision to drive a just and inclusive transition to net-zero energy. Under his leadership, ReNew has developed a diverse clean energy portfolio, including solar, wind, and battery solutions, with an overall pipeline of ~28 GW. The company offers comprehensive solutions across the entire decarbonisation spectrum, from clean energy to solar manufacturing to green fuels. Sumant co-chairs the World Economic Forum's Alliance of CEO Climate Leaders, the largest CEO-led alliance on climate change globally. Sumant is a Fellow of the Indian National Academy of Engineering and is also a member of the board of the US-India Strategic Partnership Forum (USISPF). Formerly, Sumant was the Chair of the board of the Rocky Mountain Institute (RMI), one of the world's foremost think tanks on the clean energy transition.

Sumant is a board member at IIT Delhi and has served on the boards of IIM Calcutta and Columbia University's School of International and Public Affairs (SIPA). He has been recognised as a distinguished alumnus by each of these institutions. He is the author of 'Fossil Free', a book focusing on India's clean energy transition. For his pioneering work, Sumant has been the recipient of several recognitions, including the Forbes Top 50 Climate Leaders 2025 and TIME100 Most Influential Climate Leaders 2024. Other notable recognitions include the 2022 USISPF Global Leadership Award, ET Energy's Chief Executive of the Year 2022, the Economic Times Entrepreneur of the Year Award 2018, and EY Entrepreneur of the Year 2017. He is the first Indian business leader to be recognised as an SDG pioneer by the United Nations.

Devi Prasad Shetty

Narayana Health, Bengaluru
Email: devishetty@hrudayalaya.com

Speaker's Profile :

Dr. Devi P. Shetty is a renowned cardiac surgeon, entrepreneur, and founder of Narayana Health, a large Indian hospital network. He is known for performing India's first neonatal heart surgery, implementing low-cost healthcare models like the Yashaswini micro-health insurance scheme, and earning the nickname "Henry Ford of Heart Surgery". His work focuses on making quality healthcare accessible and affordable, a strategy that has been studied globally. He is the Chairman and Senior Consultant Cardiac Surgeon at Narayana Health and has completed over 100,000 heart surgeries. He trained under the National Health Service in the UK and is also a Professor of International Health at the University of Minnesota Medical School. He is widely respected for his innovative approach to healthcare delivery, which has been recognized by institutions like Harvard and The Economist. He has received prestigious awards, including the Padma Bhushan, the third-highest civilian award in India. He has received honorary doctorates from the University of Mysore and the University of Minnesota.

Annexure-IX

New Fellows elected (*w.e.f.* 01.01.2026)
(Scrolls and Angavastram)

1. **Professor Elangannan Arunan**
   Indian Institute of Science, Bengaluru

2. **Professor Suddhasatwa Basu**
   Indian Institute of Technology-Delhi, New Delhi

3. **Professor Himender Bharti**
   Punjabi University, Patiala

4. **Dr Satya Sundar Bhattacharya**
   Tezpur University, Assam

5. **Professor Patrick D'Silva**
   Indian Institute of Science, Bengaluru

6. **Professor Benu Brata Das**
   Indian Association for the Cultivation of Science, Kolkata

7. **Professor Chandrima Das**
   Saha Institute of Nuclear Physics, Kolkata

8. **Professor Sarit Kumar Das**
   Indian Institute of Technology-Madras, Chennai

9. **Dr Anand S Deshpande**
   Chairman and Managing Director, Persistent Systems, Pune

10. **Professor Dipyaman Ganguly**
    Ashoka University, Sonipat

11. **Professor Subi Jacob George**
    Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru

12. **Professor Anish Ghosh**
    Tata Institute of Fundamental Research, Mumbai

13. **Professor Sujit Kumar Ghosh**
    Indian Institute of Science Education and Research, Pune

14. **Professor Sundargopal Ghosh**
    Indian Institute of Technology-Madras, Chennai

15. **Professor Gopalan Jagadeesh**
    Indian Institute of Science, Bengaluru

16. **Professor Mukesh Jain**
    Jawaharlal Nehru University, New Delhi

17. **Dr Jomon Joseph**
    National Centre for Cell Science, Pune

18. **Dr Anil P Joshi**
    Founder, Himalayan Environmental Studies and Conservation Organization, Dehradun

19. **Professor Suhas Sitaram Joshi**
    Indian Institute of Technology, Indore

20. **Professor Jayantee Kalita**
    Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow

21. **Professor Naima Khatoon**
    Vice-Chancellor, Aligarh Muslim University, Aligarh

22. **Dr Dhiraj Kumar**
    International Centre for Genetic Engineering and Biotechnology, New Delhi

23. **Dr Honnavalli Nagaraj Kumara**
    Salim Ali Centre for Ornithology and Natural History, Coimbatore

24. **Professor Meena Bhaskar Mahajan**
    The Institute of Mathematical Sciences, Chennai

25. **Professor Tapas Kumar Manna**
    Indian Institute of Science Education and Research, Thiruvananthapuram

26. **Professor Ujjwal Maulik**
    Jadavpur University, Kolkata

27. **Professor Rahul Mitra**
    Indian Institute of Technology, Kharagpur

28. **Dr Ajit K Mohanty**
    Secretary, Department of Atomic Energy, Mumbai

29. **Dr Tapan Kumar Mondal**
    ICAR-National Institute for Plant Biotechnology, New Delhi

30. **Professor Ashis Kumar Mukherjee**
    Institute of Advanced Study in Science and Technology, Guwahati

31. **Professor Partha Sarathi Mukherjee**
    Indian Institute of Science, Bengaluru

32. **Professor Prasanta Kumar Panigrahi**
    Siksha 'O' Anusandhan Deemed to be University, Bhubaneswar

33. **Professor N Parthasarathy**
    Pondicherry University, Puducherry

34. **Dr Kalika Prasad**
    Indian Institute of Science Education and Research, Pune

35. **Professor M Radhakrishna**
    Indian Institute of Technology-Bombay, Mumbai

36. **Professor Ravishankar Ramachandran**
    CSIR-Central Drug Research Institute, Lucknow

37. **Professor Dhevalapally B Ramachary**
    University of Hyderabad, Hyderabad

38. **Professor SA Rangwala**
    Raman Research Institute, Bengaluru

39. **Professor Diwan S Rawat**
    Kumaun University, Nainital

40. **Professor Samit Kumar Ray**
    Indian Institute of Technology, Kharagpur

41. **Professor BM Reddy**
    Birla Institute of Technology & Science Pilani, Hyderabad

42. **Professor Samir V Sawant**
    CSIR-National Botanical Research Institute, Lucknow

43. **Professor Pankaj Seth**
    National Brain Research Centre, Manesar

44. **Professor Shilpi Sharma**
    Indian Institute of Technology-Delhi, New Delhi

45. **Professor Aradhana Shrivastava**
    Bhabha Atomic Research Centre, Mumbai

46. **Dr Dheer Singh**
    ICAR-National Dairy Research Institute (Deemed University), Karnal

47. **Professor Jayant Kumar Singh**
    Indian Institute of Technology, Kanpur

48. **Professor Aninda Sinha**
    Indian Institute of Science, Bengaluru

49. **Professor Rajiv Sinha**
    Indian Institute of Technology, Kanpur

50. **Professor Binod Sreenivasan**
    Indian Institute of Science, Bengaluru

51. **Mr Saurabh Srivastava**
    Former Chairman of NASSCOM and Founder Chairman of Indian Angel Networks, New Delhi

52. **Professor RI Sujith**
    Indian Institute of Technology–Madras, Chennai

53. **Dr Renu Swarup**
    Former Secretary to Govt of India, Ministry of Science & Technology, New Delhi

54. **Dr Sudesh Kumar Yadav**
    CSIR-Institute of Himalayan Bioresource Technology, Palampur

New Foreign Fellow elected (*w.e.f.* 01.01.2026)

1. **Professor Bernard P Arulanandam**
   Tufts University, USA

2. **Professor BVR Chowdari**
   Nanyang Technological University, Singapore

3. **Professor CJ Joshi**
   University of California, Los Angeles, USA

4. **Professor Brajesh Kumar Singh**
   Western Sydney University, Australia

Annexure-X

INSA Young Associates
(recipient of certificate and Angavastram)

1. **Dr Chirodeep Bakli**
   Indian Institute of Technology, Kharagpur

2. Dr Prarabdh C. Badgujar
   National Institute of Food Technology, Entrepreneurship and Management, Sonipat

3. **Dr Indranath Chakraborty**
   Indian Institute of Technology, Kharagpur

4. **Dr Tanmoy Chakraborty**
   Indian Institute of Technology, Delhi

5. **Dr Amaranatha Reddy Devulapalli**
   Indian Institute of Information Technology, Design & Manufacturing, Kurnool

6. **Dr Uttam Kumar Ghorai**
   Ramakrishna Mission Vidyamandira, Belur Math, Howrah

7. **Dr Purvi Gupta**
   Indian Institute of Science, Bangalore

8. **Dr Durga Prasada Rao Hari**
   Indian Institute of Science, Bangalore

9. **Dr Kinjalk Lochan**
   Indian Institute of Science Education and Research, Mohali

10. **Dr Bhanu Prakash**
    Banaras Hindu University, Varanasi

11. **Dr Amiya Kumar Samal**
    Banaras Hindu University, Varanasi

12. **Dr Nitika Sandhu**
    Punjab Agricultural University, Ludhiana

13. **Dr Swati Singh**
    LV Prasad Eye Hospital, Hyderabad

14. **Dr Somlata**
    Multidisciplinary Centre for advanced Research and Studies, New Delhi

15. **Dr Rahul Srivastava**
    Indian Institute of Science Education and Research, Bhopal

16. **Dr Swati Tripathi**
    Birbal Sahni Institute of Palaeosciences, Lucknow

17. **Dr Mohit Verma**
    CSIR – Structural Engineering Research Center, Chennai

INSA Associate Fellows
(recipients of certificate and Angavastram)

1. **Dr Purushothaman C. Abhilash**
   Banaras Hindu University, Varanasi

2. **Professor Arpan Banerjee**
   National Brain Research Centre, Gurgaon

3. **Professor Suryasarathi Bose**
   Indian Institute of Science, Bangalore

4. **Dr Dibyendu Das**
   Indian Institute of Science Education and Research Kolkata, Mohanpur

5. **Dr Santosh Kumar Das**
   Indian Institute of Technology, Goa

6. **Dr Rajib Deb**
   ICAR-National Research Centre on Pig, Guwahati

7. **Professor Debangshu Dey**
   Jadavpur University, Kolkata

8. **Dr Suphiya Khan**
   Founder, Drumlins Water Technologies Pvt Ltd

9. **Dr Prashant Kumar**
   Space Applications Centre, ISRO, Ahmedabad

10. **Dr Charu Lata**
    CSIR-National Institute of Science Communication and Policy Research, New Delhi

11. **Professor Amit Mishra**
    Indian Institute of Technology, Jodhpur

12. **Dr Kutubuddin Ali Molla**
    ICAR-National Rice Research Institute, Odisha

13. **Dr Rajesh Ramachandran**
    Indian Institute of Science Education and Research, Mohali

14. **Professor Chandra Shekhar Sharma**
    Indian Institute of Technology Hyderabad, Kandi

15. **Professor Saurabh Kumar Shrivastava**
    Indian Institute of Science Education and Research, Bhopal

16. **Professor Sripada S. V. Rama Sastry**
    Indian Institute of Science Education and Research, Mohali

17. **Professor Basker Sundararaju**
    Indian Institute of Technology, Kanpur

18. **Dr Amit Tuli**
    CSIR-Institute of Microbial Technology, Chandigarh

INSA History of Science Young Associates
(recipients of certificate and Angavastram)

1. **Dr Amit Kumar Upadhyay**
   Banaras Hindu University, Varanasi

INSA Distinguished Lecture-1 Fellows
(recipients of Citations and Angavastram)

1. **Dr Dibyendu Chatterjee**
   ICAR National Rice Research Institute, Cuttack

2. **Dr Ved Vivek Datar**
   Indian Institute of Science, Bengaluru

3. **Dr Rakesh Kumar Pilania**
   Postgraduate Institute of Medical Education and Research, Chandigarh

4. **Professor Supriyo Mitra**
   Indian Institute of Science Education and Research, Kolkata

5. **Dr Sriparna Saha**
   Indian Institute of Technology, Patna

6. **Dr Surya Prakash Singh**
   CSIR-Indian Institute of Chemical Technology, Hyderabad

7. **Dr Mohit Tyagi**
   Bhabha Atomic Research Centre, Mumbai

INSA Distinguished Lecture-2 Fellows
(recipients of Citations and Angavastram)

1. **Professor SR Athreya**
   International Centre for Theoretical Sciences-TIFR, Bengaluru

2. **Professor Vinod Kumar**
   University of Delhi, Delhi

3. **Professor Jaikumar Radhakrishnan**
   ICTS- Tata Institute of Fundamental Research, Bengaluru

4. **Professor Ashoke Sen**
   International Centre for Theoretical Sciences-TIFR, Bengaluru

5. **Professor Ramanathan Sowdhamini**
   National Centre for Biological Sciences (TIFR), Bengaluru

Annexure-XI

National Symposium

on

General Biology & Mathematics

On the occasion of

Celebration of Science Week at Delhi - 2025

4th December 2025, Ashoka University

Celebration of Science Week at Delhi - 2025

General Biology & Mathematics

4th December 2025, Ashoka University

Schedule General Biology

Inaugural session (GN Ramachandran Hall)

10:00 – 10:15 Inauguration by Prof. Ashutosh Sharma (President, INSA)

10:15 – 10:30 Welcome speech by Prof. Somak Raychaudhury (Vice Chancellor, Ashoka University)

10:30 – 10:45 Address by Prof. Vijayraghavan (Chair, Science Advisory Council, Ashoka University)

10:45 – 11:00 Address by Prof. Gautam Menon (Dean Research, Ashoka University)

11:00 – 11:30 Tea break & Group Photo

Scientific talks (GN Ramachandran Hall)

11:30 – 11:50 Prof. Himender Bharti (Punjabi University, Patiala)

11:50 – 12:10 Prof. AK Mukherjee (IASST, Guwahati)

12:10 – 12:30 Dr. PC Abhilash (BHU, Varanasi)

12:30 – 12:50 Prof. N Parthasarathy (Pondicherry University, Kalapet)

12:50 – 13:10 Dr. Suphiya Khan (Shriram Institute for Industrial Research, Gurugram)

Celebration of Science Week at Delhi - 2025

General Biology & Mathematics

4th December 2025, Ashoka University

Schedule General Biology

13:10 – 13:30 Prof. Vinod Kumar (King George's Medical University, Lucknow)

13:30 – 14:30 Lunch

14:30 – 14:50 Dr. HN Kumara (SACON, Coimbatore)

14:50 – 15:10 Prof. Mewa Singh (University of Mysore)

15:10 – 15:30 Prof. Adam K. Chippindale (Queen's University, Kingston)

15:30 – 15:50 Prof. NG Prasad (IISER Mohali)

15:50 – 16:10 Dr. Anurag Agrawal (Ashoka University)

16:10 – 16:30 Tea break & Networking

16:30 – 17:00 Institute visit

Evening session (GN Ramachandran Hall)

17:00 – 18:00 Panel discussion (The Natural Language of Biology is Mathematics)

18:00 – 19:00 Networking break

19:00 – 21:00 Dinner

Celebration of Science Week at Delhi - 2025

General Biology & Mathematics

4th December 2025, Ashoka University

Schedule Mathematics

Inaugural session (GN Ramachandran Hall)

10:00 – 10:15 Inauguration by Prof. Ashutosh Sharma (President, INSA)

10:15 – 10:30 Welcome speech by Prof. Somak Raychaudhury (Vice Chancellor, Ashoka University)

10:30 – 10:45 Address by Prof. Vijayraghavan (Chair, Science Advisory Council, Ashoka University)

10:45 – 11:00 Address by Prof. Gautam Menon (Dean Research, Ashoka University)

11:00 – 11:30 Tea break & Group Photo

Scientific talks (Seminar Hall 007)

11:30 – 11:50 Prof. Meena Mahajan (IMSc, Chennai)

11:55 – 12:15 Dr. Ved Datar (IISc, Bengaluru)

12:20 – 12:40 Dr. Kumarjit Saha (Ashoka University, Sonipat)

12:45 – 13:05 Prof. Siva R Athreya (ICTS-TIFR, Bengaluru)

13:05 – 14:30 Lunch

Celebration of Science Week at Delhi - 2025

General Biology & Mathematics

4th December 2025, Ashoka University

Schedule Mathematics

14:30 – 14:50 Dr. Purvi Gupta (IISc, Bengaluru)

14:55 – 15:15 Prof. Saurabh K Srivastava (IISER Bhopal)

15:20 – 15:40 Dr. Sourav Ghosh (Ashoka University, Sonipat)

15:45 – 16:05 Prof. Anish Ghosh (TIFR, Mumbai)

16:10 – 16:30 Prof. Michael Batty (University College London)

16:30 – 17:00 Tea break & Networking

Evening session (GN Ramachandran Hall)

17:00 – 18:00 Panel discussion (The natural language of Biology is Mathematics)

18:00 – 19:00 Networking break

19:00 – 21:00 Dinner

Sectional Committee - I

Mathematics

Chair

Prof. C S Rajan, FNA

C S Rajan works in the areas of arithmetic geometry, automorphic forms and representation theory.

Co-evolution of Vertex Opinions and Edge Dynamics in Dense Random Graphs

Siva Athreya

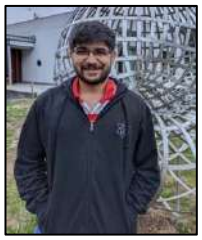
International Centre for Theoretical Science, TIFR-Bengaluru
Email: athreya@icts.res.in

A pressing challenge in network statistics lies in understanding systems with two simultaneous levels of dynamics: randomly evolving processes on randomly evolving networks locked in a feedback loop — a setting termed co-evolution that creates complex bi-directional interactions. We propose a voter model on a dynamically evolving dense coloured graph in which vertices can change opinions and edges can switch between being present or absent in a coupled way. We prove a complete mathematical description of a class of mutually coupled opinion dynamics and graph dynamics in the large-size limit. We show emergence of a form of homogenisation that manifests itself through a collapse of the joint dynamics onto a subset, where the vertex opinions homogenise while edge states evolve via stochastic flows governed by the overall opinion densities. We will also explore when consensus and polarisation may occur in the population. This is joint work with Frank den Hollander and Adrian Roellin.

Speaker's Profile

Siva Athreya is a Professor at International Centre for Theoretical Science, TIFR-Bengaluru. His research interests are in Stochastic Analysis, Random Graphs, Tree-valued Processes, Computational Epidemiology

On Yau's uniformization conjecture



Ved Datar

Indian Institute of Science, Bengaluru.
Email: vvdatar@iisc.ac.in

A central theme in differential geometry is that curvature imposes strong topological and analytic rigidity. In two dimensions, this principle is exemplified by the uniformization theorem: every simply connected Riemann surface is conformally equivalent to one of three model geometries — the round sphere, the flat complex plane, or the Poincaré disc. For non-compact surfaces, related theorems of Huber and Cohn–Vossen show that curvature controls the global conformal type. Yau's **Uniformization Conjecture** seeks to extend this geometric rigidity to higher dimensions. It asserts that any complete non-compact Kähler manifold with positive holomorphic bisectional curvature is biholomorphic to the complex Euclidean space $\mathbb{C}^n$. This statement, while superficially similar to the classical uniformization theorem, reflects deep interactions between curvature, complex structure, and global analysis. In this talk, I will present new results toward Yau's conjecture, establishing the conjectured uniformization for Kahler surfaces (complex dimension two) under natural geometric conditions. The main novelty in our approach is the use of complex Monge-Ampere equations to construct appropriate weight functions which are then used to obtain integral estimates on the square of the Ricci form. The main theorem then follows by combing these estimates with earlier work of Chen and Zhu.

Speaker's Profile

Ved Datar is an Associate Professor of Mathematics at the Indian Institute of Science, Bangalore. He works in complex differential geometry and geometric analysis, with contributions to the study of Kähler–Einstein metrics, curvature rigidity, and complex Monge–Ampère equations. After earning his PhD from Rutgers University under Jian Song, he held positions at the University of Notre Dame and UC Berkeley.

Constructing a Digital Twin for British Cities

Michael Batty

Centre for Advanced Spatial Analysis, University College London,
90 Tottenham Court Road, London W1T 4TJ, UK
Email: m.batty@ucl.ac.uk

My talk will outline how we are building a digital twin to simulate the location and growth of British cities so that we can assess the impact of changes in large scale infrastructure on the location of population, employment and new forms of transportation. My expertise lies in the development of simulation models to achieve this**.** Ever faster computers enable us to extend well-established land use transportation interaction (LUTI) models to systems of cities and regions composed of more and more locations and their spatial interactions. Here we build a platform, essentially a digital twin, for over 8000 urban places in Great Britain where we simulate flows between these locations using multi-modal transport models. We first present the model which links locations of employment to population through three transport modes, training and testing the model to reproduce the observed baseline. We then explore variants of the twin, partitioning the country into different spatial configurations at city, regional and national level. We are currently extending active travel in the model while using the platform to generate scenarios for assessing the impacts of new high-speed rail lines.

Speaker's Profile

Michael Batty is Bartlett Professor of Planning at University College London and Chair of the Centre for Advanced Spatial Analysis (CASA). He is a graduate of the University of Manchester in Town and Country Planning and of the University of Wales Institute of Science and Technology in Architecture where he was Professor of Town Planning and Dean of the School of Environmental Design in the 1980s. He was Director of the National Center for Geographic Information and Analysis (NCGIA) at SUNY-Buffalo from 1990 to 1995 before he set up CASA at UCL. He is a Fellow of the British Academy (FBA), Royal Society (FRS), Academy of Social Sciences (FAcSS), Royal Town Planning Institute (FRTPI), Chartered Institute of Logistics and Transport (FCILT), Royal Society of Arts (FRSA), and the Royal Geographical Society (FRGS).

Games, Strategies, and the Complexity of Proofs

Meena Bhaskar Mahajan

The Institute of Mathematical Sciences IMSc, Chennai
(A CI of Homi Bhabha National Institute, Mumbai)
Email: meena@imsc.res.in

There is a simple two-player game that captures the ease and the difficulty of computations that are limited to polynomial space. This game is played on a quantified Boolean formula (a QBF), and for any QBF, one of the players has a winning strategy. This talk describes ways to prove the truth-value of the QBF in some easy-to-check formats (proof systems), how this relates to winning strategies for the appropriate player, and how lower bounds can be established.

Speaker's profile

Meena Mahajan is a professor at The Institute of Mathematical Sciences (HBNI), Chennai. An alumna of IIT Bombay (CSE BTech and MTech) and IIT Madras (PhD), her interests span most of theoretical computer science. Her research focusses primarily on understanding the limits of efficient computation, and encompasses many aspects of complexity theory, including Boolean function complexity, algebraic circuits, and proof complexity. Meena is a Fellow of the Indian Academy of Sciences, and of the Indian National Science Academy (w.e.f. 2026), and a recipient of the J C Bose National Fellowship (2024-2029). She served on the ICM Structure Committee during 2023-2024.

An ergodic perspective on number theory

Anish Ghosh

Tata Institute of Fundamental Research, Mumbai
Email: ghosh@math.tifr.res.in

Ergodic theory is the mathematical study of chaotic systems. Somewhat surprisingly, it has close connections with number theory. I will illustrate these connections through the example of some recent progress on the study of continued fraction expansions of typical numbers.

Speaker's Profile

Anish Ghosh is a Professor of Mathematics at TIFR and is currently Dean of the School of Mathematics. His research interests are in the ergodic theory of group actions on homogeneous spaces and interactions with number theory and geometry.

On the bilinear Bochner-Riesz problem

Saurabh Kumar Shrivastava

Department of Mathematics, Indian Institute of Science Education and Research, Bhopal, India.
Email: saurabhk@iiserb.ac.in

The convergence of Fourier series of functions in Lebesgue function spaces is a classical problem in Euclidean harmonic analysis. This problem motivates the study of Fourier multipliers in general. Among the vast class of Fourier multipliers, the Bochner-Riesz multipliers are of particular interest. They provide us with a suitable alternative to the convergence of Fourier series. Despite being one of the central problems in harmonic analysis for the past several decades, the Bochner-Riesz conjecture in dimensions larger or equal to THREE remains one of the most challenging open problems in the subject. This along with some of the recent developments in harmonic analysis in the theory of bilinear multipliers, motivates us to study the bilinear Bochner-Riesz problem. The Fourier analytic methods and their interplay with the geometry of spheres play crucial roles in the study of Bochner-Riesz multipliers. In this lecture, we shall discuss some of the recent developments on the bilinear Bochner-Riesz problem.

Speaker's Profile

I did my Ph.D. from IIT Kanpur. I joined the Department of Mathematics at IISER Bhopal as Assistant Professor in the year 2012. Currently, I am working at the same department as Professor. My research interests fall in the broad areas of Euclidean Harmonic Analysis and Discrete Harmonic Analysis.

On the isotropicity of rationally convex immersions

Purvi Gupta

Indian Institute of Science, Bengaluru.
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A compact set $\mathbb{C}^n$is said to be rationally convex if its complement in $\mathbb{C}^n$is a union of complex hypersurfaces. Rational convexity endows a compact set with a Runge-type approximation property. A wider interest in rational convexity stems from some known symplectic characterizations of rational convexity for certain kinds of compact sets. For instance, a result by Duval--Sibony (1995) says that a compact totally real submanifold of $\mathbb{C}^n$is rationally convex if and only if it is isotropic with respect to a Kähler form on $\mathbb{C}^n$. Such a characterization is lacking in the case of totally real immersions in $\mathbb{C}^n$. In this talk, we will survey the known results in this setting. Eventually, we will focus on the case of maximally totally real (i.e., *n*-dimensional) immersions that admit only transverse double points.

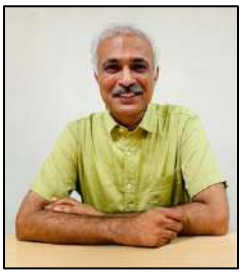
Speaker's Profile

Purvi Gupta is an Assistant Professor at the Indian Institute of Science, Bangalore. She obtained her Ph.D. from the University of Michigan, Ann Arbor, and spent her postdoctoral years at the University of Western Ontario, Canada, and Rutgers University, New Jersey. Her primary area of research is several complex variables, within which she studies convexity properties of real submanifolds, polyhedral approximations of convex-type domains, and holomorphic function spaces with reproducing kernels.

Sectional Committee -VI

General Biology

Chair
Prof. N.G. Prasad, FNA



Prof. Prasad is a Professor of Biology at IISER Mohali. My research is in evolutionary genetics, with particular focus on sexual selection and genomic conflict between the sexes, life-history evolution, and evolutionary ecology of immunity. He is a Fellow of the Indian National Science Academy (INSA) and the Indian Academy of Sciences (IAS), and a recipient of the Sastra-Obaid Siddiqi Award for Life Sciences (2025). At IISER Mohali, he teaches and mentors at all levels and have supervised several Ph.D., master's, and undergraduate theses. He has served in various academic and administrative roles, including Dean of Students, Dean of International Relations and Outreach, and Chairperson of the Joint Admissions Committee of IISERs. He currently chairs the National Committee for the International Union of Biological Sciences at INSA, was also a founding member and Secretary of the Indian Society of Evolutionary Biologists.

Timing shapes survival: seasonal strategies in latitudinal migrants

Vinod Kumar

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Timed biological processes are the product of internal timers operating at circadian (Latin: *circa* = about; *dies* = day) and circannual (Latin: *circa* = about; *annum* = year) bases and interacting with the external *Zeitgebers* (*zeit* = time, *geber* = giver; or time cue), e.g. photoperiod, temperature, and/ or food availability. For a seasonal events like the reproduction and migration, for example, the circannual timer sets the temporal window for the seasonal life-history state (LHS) during the year, and the circadian timer regulates the physiological preparedness for exhibition of appropriate biological response characteristics. This seems challenging for millions of songbirds that follow rigid seasonal schedules, with migrations in spring and autumn placed before and after the reproductive period, respectively, and differing in several aspects including the context, the direction of changes in photoperiod and temperature. I aim to highlight clock-controlled adaptive strategies that migrants possibly employ during their non-migratory and migratory LHSs twice-a-year. This brief presentation will be based on research in my laboratory on two Palearctic-Indian migratory songbirds, the blackheaded bunting (*Emberiza melanocephala*) and redheaded bunting (*Emberiza bruniceps*).

Speaker's Profile

Professor Vinod Kumar with over four decades of research and teaching experience, including 7 years in institution abroad, superannuated as Senior Professor from University of Delhi. Currently, he is an INSA Senior Scientist in King George's Medical University, Lucknow. He received several recognitions, including Fellowships from Indian National Science Academy (FNA), Royal Society of Biology (FRSB), International Ornithology Union (FIOU). A recipient of Aschoff Ruler Prize, highest distinctions in Chronobiology, he has published >230 research publications, edited/ authored books, guest edited journal issues, established state-of-art research facilities, and trained a generation of scientists serving in institutions in India and abroad.

Natural History of Himalayan Ants

Himender Bharti

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The natural history of an organism serves as a window into its life history, ecological interactions, and broader evolutionary context. Unfortunately, natural history observations have declined in prominence within contemporary scientific research. As a result, we are losing a significant body of information that cannot be replicated through laboratory-centric approaches. The Himalayan mountain, one of the most biodiverse and ecologically complex mountain systems in the world, harbors a remarkable diversity of ants. Himalayan ants exhibit extraordinary ecological adaptability and life history patterns. Understanding their natural history is crucial, as it provides insights into their ecological and evolutionary responses to extreme environments, their roles in ecosystem functioning, and their interactions among themselves and other organisms as well. These ants occupy distinct elevational zones across Himalaya, adapting to a wide range of envirinmental conditions. Adaptation to high-altitude stress has led to the evolution of diverse strategies and traits, including parasitic interactions, polygyny, polydomy, and heterodynamic life cycles. The Himalayan ant lineages represent relic forms with plesiomorphic features, differing considerably from their Palaearctic counterparts. The biogeography, degree of endemism, and evolutionary relationships suggest that the diversification of these ants is closely linked to the geological uplift and origin of the Himalayan mountain system. Thus, understanding the natural history of Himalayan ants is vital to uncovering how life evolves and adapts under extreme environmental pressures. These findings stand as a reminder that field biology remains indispensable for unraveling the intricate patterns and processes that shape the natural world.

Speaker's Profile

Dr. Bharti pioneered the work on Ant systematics in India, combining molecular with classical methods, has extended the scope of systematics research beyond traditional taxonomy to life-history, ecology, and evolutionary interpretations. He discovered more than 100 new species. Expounded the Natural history of high-altitude Himalayan ants, life history patterns, details of immature stages and morphological adaptations. Elucidated the phylogeographic patterns of lineages, defining lineage splitting and evolutionary relationships using molecular phylogenetic methods. The holistic approach for species delineation includes morphology, ecology and molecular markers. He established Natural History Collection of Indian Ants, which includes about 1000 ant species from India and other countries: a treasure trove for future naturalists/scientists.

Connecting the Conservation Science and Conservation: A tale of lion-tails from the Western Ghats

H. N. Kumara

Salim Ali Centre for Ornithology and Natural History, Tamil Nadu
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The evergreen forests between the Sharavathi and Aghanashini River were found to be home to one of the largest populations of lion-tailed macaque *Macaca silenus* – the northernmost population of its range, which was notified as the "Aghanashini Lion-tailed Macaque Conservation Reserve" encompassing 298.93 km². In the last two decades, population size remained the same, but group size got reduced while the number of groups increased and expanded their range. The food resource list, especially of plant resources and their preference, provided a list of plants for the restoration of the degrading habitat in the landscape. Local people's livelihood also depends on the Non-timber Forest Products, which are also part of the macaque's diet, leading to high overlap in resource use by macaque and people, affecting the availability of resources for macaques and their diet. The expansion of agriculture and the exploitation of firewood from these forests led to the degradation of evergreen forests into lesser forest types. Although the primates are not hunted here, but high hunting pressure on other mammals is prevalent in the entire Sharavathi River valley and adjoining lion-tailed macaque habitat. Now, the Conservation Reserve has been merged with the existing sanctuary at south of the river and notified as the 'Sharavathi Lion-tailed Macaque Sanctuary' for better management, and many initiatives have been taken for the conservation of lion-tailed macaques.

Speaker's Profile

H. N. Kumara obtained his PhD from the University of Mysore for his study "An Ecological Assessment of Mammals in Non-sanctuary Areas of Karnataka". He identified the potential populations for many lesser-known species and played a role in strengthening the Protected Area network. He studied the adaptation of lion-tailed macaque to the changing habitat, documented the male influx, infanticide, and female transfer in bonnet macaque, distribution of lorises, elephants in South Bengal, impact of windmills on animals in Karnataka, animals of the burrows, and macaques of the islands. He has over 150 publications. After his PhD, he was in NIAS as a Young Scientist, joined SACON in 2010 and is currently Principal Scientist.

Application of Snake Venom-Inspired Custom Peptides against Pesticide-Induced Neurodegeneration

Ashis Kumar Mukherjee[1,2,3*]

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[2]*Microbial Biotechnology and Protein Research Laboratory, Department of Molecular Biology and Biotechnology, School of Sciences, Tezpur University, Tezpur, Assam, India*
[3]*Faculty of Science, Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, UP, India*
Email: akm@tezu.ernet.in

Neurodegenerative disorders (ND) pose significant challenges due to the progressive loss of neurons, which is influenced by oxidative stress and mitochondrial dysfunction. This study presents a computational analysis of two novel synthetic peptides, Tribeca-neuropeptide (TNP) and Heptadeca-neuropeptide (HNP), which are derived from snake venom nerve growth factors. Silico studies indicated a substantial interaction with the human TrkA receptor, which is essential for neuronal growth and survival. In vitro validation subsequently confirmed the binding affinity of the compound to TrkA receptors in rat pheochromocytoma PC-12 cells, promoting neuritogenesis and reducing paraquat-induced cellular toxicity. The peptides demonstrated no adverse reactions in both in vitro and in vivo assessments. Functional proteomic analyses identified metabolic pathways regulated by these peptides, which provide neuroprotection against paraquat (PT)-induced neuronal damage. Transcriptomic and qRT-PCR analyses demonstrated a reversal in the expression patterns of oxidative stress-related genes in PC-12 cells that were pre-treated with TNP and HNP. The in vivo protective mechanisms of these custom peptides against paraquat-induced neurodegeneration in the *Caenorhabditis elegans* model were elucidated. CPs inhibit PT binding to the CAM-1 receptor, thereby preventing increased ROS production and mitochondrial dysfunction. They significantly inhibit PT-induced degeneration of dopaminergic neurons and aggregation of alpha-synuclein, characteristic features of Parkinson's disease, in transgenic *C. elegans* strains. Transcriptomic and functional proteomics reveal that CPs can inhibit gene expression alterations linked to oxidative stress and apoptosis. In a murine model, CPs effectively repair PT-induced damage without eliciting toxicity or inflammatory responses. These findings highlight the neuroprotective potential of CPs.

Speaker's Profile

Prof. Mukherjee is the Director of the DST Institute of Advanced Study in Science and Technology, Guwahati. His research interests include the proteomic analysis of snake venom, the pharmacological reassessment of medicinal plants used in snakebite treatment, the quality assessment of commercial antivenoms, and the discovery of new drugs from snake venom. He has received 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 IAS, Bangalore; NAS, Prayagraj; INSA, NAMS, New Delhi; Royal Society of Biology, UK; Royal Society of Chemistry, UK; and West Bengal Academy of Science and Technology, Kolkata. He has guided 20 PhD students, published more than 190 peer-reviewed research articles. He is also a member of the DBT, ICMR, and WHO task force on preventing and treating snakebite envenoming.

Long-term ecological research for biodiversity conservation and sustainable resource use

N. Parthasarathy

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Large-scale plant diversity inventories in Western and Eastern Ghats, Coromandel Coast tropical dry evergreen forest and Andamans generated metadata on tree and liana diversity. Plot sizes ranged from 0.1 to 30ha, while most of them were one-hectare plots. Tree diversity totaled 680 species and 47,500 individuals in 96ha. Re-inventory of these plots revealed the cumulative impact of natural and anthropogenic disturbances in three to thirty-year interval in different sites. Tree density declined by 30 to 46 per cent over decades in sites experiencing forest disturbance, whereas in undisturbed forests density increased marginally. Tree turnover rates were faster in dry evergreen than in wet evergreen forests. Liana diversity totaled 237 species and 61,789 stems in 110ha of various peninsular Indian forests. Interestingly, in contrast to declining tree density, liana density increased over decades in many tropical dry evergreen forests, a trend similar to many other global tropical forests. The metadata of tree and liana diversity were contributed to Global Tree Database (GTD) and Global Liana Database (GLD), to analyze patterns of plant diversity and carbon stocks and address them in relation to various environmental drivers. Notably, metadata analysis revealed the extent of continental-level high endemism and how native diversity maintenance buffers against the severity of tree invasions. Research on plant functional traits and plant-animal interactions provides insight into forest functional ecology of endangering tropical dry evergreen forest. Long-term plant species abundance data and changes over decades provide valuable information on species recruitment, guiding effective biodiversity conservation and sustainable utilization of bioresources.

Speaker's Profile

Dr. N. Parthasarathy, served as professor over three decades in Department of Ecology and Environmental Sciences, Pondicherry University and retired in June 2024. He obtained his M.Sc. and Ph.D. from University of Madras. Served as HOD and Dean, School of Life Sciences. Guided 19 Ph.Ds. He was awarded FNASc. in 2013. Published 142 research papers and published four books. He is Life Member of 6 professional societies, Served as associated editor in Tropical Conservation Science and Tropical Ecology. He was an invitee of American and European government for Global biodiversity research programs at University of California and ETH, Zurich, Switzerland.

An Evolutionary Battle of the Sexes: Arms Race or Arm Wrestle?

Adam Chippindale

Queen's University, Kingston, Canada
Email: adam.chippindale@queensu.ca

Females and males are caught in an evolutionary battle that cannot be won; famously "there's just too much fraternizing with the enemy". The conflict is played out in two distinct dynamics. First, adaptations by one sex to assert control over reproduction may illicit counter-adaptations in the other; an evolutionary "chase" or "arms race". Second, shared traits may be pulled in different directions by selection; an "arm wrestle" created by genetic constraints. In this talk, I will focus on examples from nature and results from three decades of experimental investigation of sexual conflict with laboratory evolution in the fruit fly, *Drosophila*, showing evidence for both processes. I will argue that sexual conflict has profound implications for topics as diverse as the origin of species and human psychosocial disorders.

Speaker's Profile

Adam Chippindale is a professor of Evolutionary Genetics at Queen's University in Canada whose research is focused on the evolution of development, reproduction and ageing. A special interest is sex differences and the kinds of evolutionary processes that can create them or leave them mired in conflict within the genome.

Restoring degraded lands for the UN Sustainable Development Goals

P. C. Abhilash

Institute of Environment & Sustainable Development, Banaras Hindu University, Varanasi 221005, UP, India
Email: pca.iesd@bhu.ac.in

Restoring degraded land is essential for human development because land is a vital life-support system that helps achieve several UN Sustainable Development Goals (UN-SDGs). However, over 33% of the global land is degraded, impacting the livelihoods of billions worldwide. According to the Food and Agriculture Organization of the United Nations, over 30% of India's land is degraded, which negatively impacts biodiversity and agricultural production. Therefore, restoring marginal and degraded land is crucial for regaining ecosystem services and fulfilling international commitments, such as the Bonn Challenge and the UN Decade of Ecosystem Restoration. The present work describes innovative strategies, including the use of multi-purpose plant species, bio-residues, and bioinoculants, as a low-input approach for restoring marginal and degraded land in India. The study also highlights the importance of various biophysical indicators for ecological profiling and sustainability analysis of degraded or polluted land, along with adaptive, climate-resilient, and sustainable agricultural practices to improve soil, crop health, and productivity in the drylands of eastern UP, thereby supporting the achievement of the UN-SDGs at the local level.

Speaker's Profile

P.C. Abhilash is an Associate Professor of Sustainability Science at the Institute of Environment and Sustainable Development, BHU. He was the founding Chair of the Agroecosystem Specialist Group of the IUCN. His research focuses on exploring ecological solutions to achieve the UN-SDGs at the local level. He is the founding Editor-in-Chief of Anthropocene Science and Executive Editor of Tropical Ecology. He has received prestigious awards, including the INSA Medal for Young Scientists, the NASI-Platinum Jubilee Young Scientist, the ICAR-Lal Bahadur Shastri Young Scientist Award, and the HIYOSHI Young Ecologist Award. He is an elected Fellow of NASI and NAAS, India

The Art and Science of Commercialisation: Bridging Science, Academia, Industry and Society

Suphiya Khan
Deputy Director, Shriram Institute for Industrial Research, Gurugram, Prof at Banasthali (On lien); Founder and Director Drumlins Water Technologies Pvt Ltd.
Email: suphiyakhan@gmail.com; ksuphiya@banasthali.in

The journey from scientific discovery to societal impact is rarely linear. While universities serve as engines of discovery, and startups or spinouts as vehicles of innovation, the transition from laboratory breakthroughs to market-ready products is fraught with obstacles. Academic spinouts, in particular, face unique challenges distinct from traditional startups — ranging from technology transfer, funding, and regulatory barriers to cultural gaps between academia and industry. This talk will reflect on the landscape of Academic entrepreneurship by giving case study of Drumlins Water Technologies Pvt Ltd— the challenges of founding and scaling a startup, the barriers faced by women in STEM and female founders, and the critical importance of mentorship, leadership, and inclusivity in shaping sustainable innovation. It will also highlight the successful scale-up of Zinc Removal and Recovery Technology from bench experiments to industrial deployment, demonstrating how scientific precision, materials innovation, and cross-sector collaboration can deliver tangible environmental and economic impact. Today, **Drumlins Water Technologies' solutions are undergoing validation across multiple sites in different states**, addressing critical challenges of **fluoride, zinc, and heavy metal contamination** in drinking water. The company's evolution from a university research initiative at **Banasthali Vidyapith** to a **recognised deep-tech startup** exemplifies how academia-driven ventures can translate rigorous scientific innovation into scalable, real-world impact. Equally, it will emphasise how successful commercialisation requires an alignment between science, academia, industry, business, and society, ensuring that innovations are not only technically sound but also economically viable and socially relevant. By bridging these domains, commercialisation emerges not only as an economic driver but also as a powerful Science-to-Society missions

Speaker's Profile

Prof. Khan is an accomplished scientist, academic leader, and bioentrepreneur with over 23 years of experience in teaching, research, and innovation. She serves as the Deputy Director at the Shriram Institute for Industrial Research, and as Professor at Banasthali Vidyapith, where she established the Centre for Excellence on Water and Energy. A CRISP Oxford Fellow, INSA Associate Fellow, and SERB POWER Fellow, Prof. Khan is widely recognised for her pioneering work in nanobiotechnology, fluoride remediation, and sustainable water purification technologies. She is the Founder of Drumlins Water Technologies Pvt. Ltd., a startup dedicated to developing affordable and energy-efficient water treatment solutions that have been patented and successfully commercialised. Her leadership has attracted significant funding from DST, DBT, MHRD, and UGC for cutting-edge projects in water innovation. She is a recipient of the NASI-Reliance Platinum Jubilee Award, the Women Transforming India Award by NITI Aayog, and the Wonder Women in STEM Award. Her vision integrates research, innovation, and entrepreneurship, bridging science, industry, and society to drive sustainable development and transformative impact.

Celebration of Science Week 2025

INSA-IARI National Seminar
STEM to STEAM

Agricultural Sciences

4th December 2025,
ICAR-IARI

Celebration of Science Week at Delhi – 2025

Agricultural Sciences

INSA-IARI National Seminar
STEM to STEAM

4th December 2025, ICAR-IARI

PROGRAM

9:00–9:30 AM	***Registration***
9:30–10:30 AM	***Inaugural Session*** Chairperson: Director, IARI
	TEA BREAK
11:00 – 1:30 PM	***Presentation by INSA Agricultural Science Awardees*** *[(13+2min) each].* **Chairperson**: Dr. Snehalata Pareek, ICGEB (Sectional Committee X) ***Opening Remarks by Chair*** **Speakers - INSA Fellows** 1. Dr. SS Bhattacharya, Tezpur University 2. Prof. Mukesh Jain, Jawaharlal Nehru University 3. Dr. T.K. Mandal, ICAR-National Institute for Plant Biotechnology 4. Prof. S.V. Sawant, CSIR-National Botanical Research Institute 5. Prof. Shilpi Sharma, Indian Institute of Technology - Delhi 6. Dr. Dheer Singh, ICAR-National Dairy Research Institute 7. Dr. S.K. Yadav, CSIR-Institute of Himalayan Bioresource Technology **Speaker - INSA Foreign Fellow** 8. Prof. Brajesh Singh, Western Sydney University

Celebration of Science Week at Delhi – 2025

Agricultural Sciences

National Seminar STEM to STEAM

4th December 2025, ICAR-IARI

PROGRAM

11:00 – 1:30 PM

Speaker - INSA Distinguished Lecture 1

9. Dr. Dibyendu Chatterjee, ICAR-National Rice Research Institute

Speaker - INSA Distinguished Lecture 2

10. Prof. Paramjit Khurana, Delhi University

LUNCH BREAK

2:30 – 3:30 PM
Session – 1

INSA Young Associates *[(13+2 min) each]*

Chairperson: Sectional Committee X

Speakers

1. Dr. Nitika Sandhu, Panjab Agricultural University
2. Dr. Prarabdh Chandrakant Badgujar, National Institute of Food and Technology, Entrepreneurship and Management
3. Dr. Bhanu Prakash, Banaras Hindu University

3:30 – 4:30 PM
Session – 2

INSA Associate Fellows *[(13+2 min) each]*

Speakers

1. Dr. Kutubuddin Ali Molla, ICAR-National Rice Research Institute
2. Dr. Charu Lata, CSIR-National Institute of Science Communication & Policy Research
3. Dr. Rajib Deb, ICAR-National Research center on Pig

4:30 – 5:15 PM

Concluding remarks

Followed by group photograph & high tea

Chairperson: Dean & Joint Director Education, IARI

Sectional Committee -X
Agricultural Sciences

Chair
Dr. Sneh Lata Singla-Pareek, FNA

Dr. Sneh Lata Singla-Pareek, Group Leader at ICGEB, New Delhi, is a distinguished scientist in Plant Stress Biology and Agricultural Biotechnology. With a Ph.D. from the University of Delhi and visiting fellowships at institutions like the University of North Carolina, Cornell University, and UC Davis, she has made ground-breaking contributions to understanding the abiotic stress tolerance mechanisms and enhancing rice crop yield. Her research has led to the development of high-performing, stress-resilient rice varieties, earning recognition from the seed industry. She has successfully led multiple national and international research projects and has coordinated a Centre of Excellence and bi-national research programs. She has published over 200 research articles and 45 book chapters. A globally recognized expert, she has received numerous awards, including the NAAS Fellowship-2025, SERB-POWER Fellowship, J.C. Bose Gold Medal, DBT-BIRAC Innovator Award, and the Innovative Young Biotechnologist Award. She is a Fellow of INSA and NASI and has been featured in Stanford University's list of the world's top 2% scientists for the three consecutive years. Beyond her research, Dr. Singla-Pareek actively involved in mentoring graduate students and trains professionals from neighboring countries, fostering scientific talent and collaboration in plant biotechnology.

INSA Distinguished Lecture

Plant genomics for climate resilient crops

Paramjit Khurana

Department of Plant Molecular Biology, University of Delhi South Campus, New Delhi, India
Email: param@genomeindia.org

Climate change and abiotic stress affects agriculture and crop production adversely. Wheat is a temperate crop and prone to various abiotic stresses. Tolerance to heat stress is a complex phenomenon and controlled by multiple genes. Heat tolerance related gene transcripts were identified based on their putative functions and validated by cDNA macroarray and northern/RT-PCR analysis in wheat. A common response to high temperature stress is the synthesis of Heat Shock Proteins (HSPs). HSP encoding genes are found to be under the control of Heat Shock Factors (HSF), transcription factors that regulate the expression of HSP genes. For spike photosynthesis genome-wide transcriptome exploration revealed the awn showing high expression of genes involved in photosynthesis as compared to other photosynthetic organs in spike including spike, lemma and palea. *A. tauschii* suffered less inhibition of photosystem II efficiency and net photosynthetic rate (Pn). Although *A. tauschii* showed nearly complete recovery of PSII, the adverse effect was more pronounced in A. *speltoides*. Functional characterization of additional transcription factors from Triticum aestivum was undertaken, namely TaZnF and TaMADS. The wheat bZIP displays temporal and varietal specific regulation and its overexpression showed enhanced tolerance to salinity, drought and heat stress. TaZnF expression was upregulated under high temperature, salinity, drought and cold stress. In addition, characterization of a heat stress inducible Myo-inositol-1-Phosphate Synthase (TaMIPS) gene from wheat (*Triticum aestivum*) has been undertaken in the T2 generation overexpression lines. The discovery of novel genes, determination of their expression pattern in response to abiotic stress and an improved understanding of their roles in stress adaptation (obtained by functional genomics) will provide the basis of effective engineering strategies leading to greater stress tolerance and management in agriculture. Thus, with the advent of genomics, a new era of plant sciences is beginning which helps not only in gene discovery and functional analysis of novel genes, but also aid in mining efficient alleles for introgression in desired plants for crop improvement and generation of agriproduct diversification.

Speaker's Profile

Professor Paramjit Khurana has contributed extensively in the area of Seri biotechnology and Wheat Biotechnology. In wheat, a systems biology approach has been used to investigate the molecular mechanisms regulating auxin-induced somatic embryogenesis. She has done pioneering work on genetic transformation of wheat and mulberry. The development of wheat transgenics over-expressing potato proteinase inhibitor gene conferred tolerance against the Cereal Cyst Nematode in T. durum, and that of HVA1 over-expression imparted tolerance towards salinity and drought in T. aestivum. Doubled haploid technology to produce transgenics to avoid segregation of introduced traits in wheat has been successfully demonstrated by her group. Transgenics in mulberry have been raised for drought, salinity and biotic stress with HVA1 and osmotin genes, respectively, and transferred to the Central Sericulture Research & Training Institute (CSRTI) at Mysore, and University of Agricultural Sciences (UAS), Bangalore, for field evaluation. In addition, she has also done excellent work on lipopolysaccharide (LPS)-mediated cellular recognition during legume-Rhizobium symbiosis and cell-to-cell communication by use of impermeant macromolecules in living cells. She sequenced the complete chloroplast genome and nuclear of mulberry, and was actively associated with sequencing of rice, tomato and wheat genomes as part of the International Genome Sequencing Conso

Advanced techniques for climate change monitoring in lowland rice using eddy covariance

Dibyendu Chatterjee

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Mass and energy exchange was studied in lowland flooded rice–rice ecology at ICAR–Central Rice Research Institute, Cuttack, Odisha, using the eddy covariance technique. Mass exchange, including net ecosystem carbon dioxide exchange (NEE), net ecosystem methane exchange (NEME) and water vapour flux was measured during dry and wet cropping seasons and the respective fallow periods. In both cropping seasons, the flooded rice paddy acted as a net CO 2 sink (negative NEE) from the vegetative to early maturity stage. The NEE decreased gradually from the vegetative phase to maximum tillering, then increased slightly during flowering until harvest. The Q10 model is the most appropriate for partitioning NEE into gross primary productivity and ecosystem respiration, compared to the rectangular hyperbolic method. The NEME was higher from active tillering to panicle initiation stages and was controlled by air and soil temperatures, standing water and radiation. Parameters such as actual evapotranspiration and crop coefficients, calculated from eddy covariance data, can be used to improve crop water requirements and irrigation management. Among the energy fluxes, latent heat flux dominates over sensible heat flux in flooded rice ecology. During the fallow seasons, a higher proportion of available heat flux is partitioned into sensible heat due to reduced soil moisture content. Energy balance closure was evaluated using ordinary least squares, energy balance ratio and residual heat flux (RHF), with RHF proving to be the most effective estimation method. On average, RHF was 10.3–12.0% higher in the wet season compared to the dry season. The energy balance in paddy fields shows a greater imbalance during the rainy season, as energy is advected in the fresh rainwater.

Speaker's Profile

Dr. Chatterjee is currently working as a Senior Scientist (Soil Science) at ICAR-Central Rice Research Institute, Cuttack. He did his graduation from BCKV, Mohanpur; Masters from GBPUAT, Pantnagar and PhD from IARI, New Delhi. He achieved 1st rank in ASRB-ARS and joined ICAR RCNEH, Nagaland Centre in 2011. He was awarded NEWS fellowship and visited UKCEH, Edinburgh and INRA, Paris in 2018. Dr. Chatterjee's research focused on monitoring climate change using eddy covariance and adaptation and mitigation strategies using nitrogen management. He is a member of several academies and societies, including Associate of NAAS and WAST, member of INYAS and NASI, and life member and young scientist awardee of ISCA, CMSI and ISSS. He has published more than 65 research papers in reputed journals.

Essential role of soil biodiversity in food, environmental and human health security

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Soil biodiversity provides key ecosystem functions including primary productivity, climate regulation and nutrient cycling. Similarly, crop-associated microbiota, which are mainly recruited from soils, play critical role in the provision of vital host functions including nutrient absorption, provisions of key phytohormones, metabolites, and resilience against biotic (e.g. pathogens and pests) and abiotic (e.g. drought, heatwave) disturbances. Soil biodiversity also plays direct role in plant and human health via reducing exposure to pathogens, supressing antibiotic resistance gene transfer, and degrading harmful chemicals pollutants from the environments. This presentation will provide overview, empirical data and maps in direct evidence for 1. linkage between soil biodiversity and ecosystem functions including food production at local to global scales, 2. current and future global distribution of pathogens, and 3. critical role of soil biodiversity in supressing pathogens. The presentation will argue that effective conservation policies of soil biodiversity is integral to improve outcomes for food and environmental security and human health.

Speaker's Profile

Brajesh is a Disguised Professor of Soil biology, at Hawkesbury Institute for the Environment, Western Sydney University. Through his fundamental research, he identifies the quantitative relationships between soil biodiversity and ecosystem/ host functions and how natural/anthropogenic pressures such climate change affect this. His applied research harnesses the knowledge gained in fundamental research to improve agriculture productivity, restoration success and environmental sustainability. Outcomes from his research have informed multiple policy decisions at national and international levels, and he is currently working with multiple government and inter-governmental bodies including as a member of UN- FAO's Intergovernmental Panel on Soil and the Chair of FAO- International Network on Soil Biodiversity (FAO-NETSOB).

Prof Singh has published ~ 340 scientific papers and these have been cited >57,000 times with h' index of 107. He is a Fellow of many academies including the Australian Academy of Science.

Soil health and livelihood centric research: A journey towards sustainable development

SS Bhattacharya

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Soils are valuable natural resources and play a significant role in meeting the UN Sustainable Development Goals (SDG). Soil health management and restoration of the depleted soil organic C pool are reliable strategies to mitigate Climate Change and desertification. On the other hand, solid waste utilization as organic fertilizers is a useful proposition to reduce the waste-load in cities, which can substitute the chemical fertilizers in agricultural soils. In these contexts, vermicomposting, composting, and microbe mediated technologies are effective options. This deliberation would reveal major research outcomes on vermicomposting and biofertilizer technologies. Various industrial and urban wastes can be treated and sanitized through vermicomposting into valuable manures and eventually can be utilized for cultivation. As such, the earthworm mediated system is far more efficient than conventional composting techniques regarding enrichment of the finished product. Interestingly, our research exhibited the unique potential of earthworms in removing toxic heavy metals from waste materials through some novel metal binding proteins in their intestines. We have also explored earthworm gut environment and formulated microbial inoculums that has immense potential as prolific biofertilizers for the farming communities. This talk would showcase innovative waste valorization techniques, utilizing earthworm microbial consortia, enable the detoxification of industrial residues and lignocellulosic waste without pre-treatment, exemplifying sustainable waste-to-wealth practices. Moreover, our research on emerging contaminants, including pharmaceuticals and pesticides, emphasizes strategies to mitigate environmental risks, aligning with SDG 6. Overall, our holistic approach integrates biological innovation with sustainability, offering impactful solutions for environmental protection, food security, and climate resilience.

Speaker's Profile

Dr. Satya Sundar Bhattacharya, Professor and Head of the Soil and Agro-Bioengineering Laboratory, Department of Environmental Science, Tezpur University, leads research on plant bioactivity under environmental stress, waste management, soil health, nano-fertilizers, and earthworm microbiology. He has guided 10 Ph.D. scholars and published over 100 papers, books, and chapters, with 80 in high-impact journals (h-index: 38 Google Scholar, 35 Scopus). He holds an Indian patent (2020) on a novel soil conditioner, licensed for use. A former Research Professor at Hanyang University, Korea, he collaborates with Örebro University, Sweden, and received the GYTI Award (2018) and NASI Fellowship (2024).

Integrated multi-omics approaches for climate-smart future crops

Mukesh Jain

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Recent advances in multi-omics approaches have accelerated gene discovery and understanding the molecular basis of important agronomic traits for undertaking translational research. I shall illustrate the use of high-throughput multi-omics technologies in generation of genomic resources and connecting genes and genomic variations to agronomic traits giving examples from a non-model (chickpea) crop plant. We sequenced the genome/transcriptome of chickpea to reveal the gene space, gene regulatory networks and genetic variations associated with important agronomic traits. A comprehensive analysis of transcriptome dynamics during seed development and under drought stress in chickpea cultivars with contrasting seed size and drought response identified a significant proportion of the genes exhibiting cultivar-specific expression patterns. The transcriptional changes in cell cycle, endoreduplication, carbohydrate metabolism and hormone signal transduction pathways were found to determine seed size/weight in the chickpea cultivars. Further, we revealed the regulation of candidate genes via differential DNA methylation and non-coding RNAs. A comprehensive gene expression atlas was developed and demonstrated its applications in functional genomic studies and candidate gene discovery. Our studies provide insights into the molecular signatures and regulatory mechanisms governing key agronomic traits and will surely facilitate various areas of functional and translational genomics research in crop plants for sustainable agriculture and ensure food security.

Speaker's Profile

Dr. Mukesh Jain is currently serving as a Professor at the School of Computational & Integrative Sciences, Jawaharlal Nehru University, New Delhi. He has worked extensively in the areas of Plant Genomics, Biotechnology and Computational Biology, and published more than 140 articles in international journals of high repute with an h-index of 60 and >16000 citations. Prof. Jain is one of the pioneers of next-generation genomics research in plant sciences in India. In addition to the development of several high-value public web resources, his group has made significant contributions in understanding the molecular mechanisms underlying abiotic stress responses and seed development in crop plants. For his outstanding scientific contributions, Prof. Jain has been honored with several awards and Fellowships of the National Academies. Prof. Jain's current research interests include understanding epigenetic and chromatin-level regulation of agronomic traits using integrated multi-omics, single-cell genomics, and systems biology approaches.

Sustainable use of *Oryza glaberrima* and wild species *Oryza coarctata* for management of salinity stress of rice

TK Mondal

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Wild species are excellent reservoirs of important genes, many a times that are not found in cultivated gene pool. Canonically rice plant is salt sensitive though few genotypes are salinity tolerant which have been extensively used as donor in salinity breeding program of rice. Thus there is a need to discover alternative favourable alleles/genes that give better salinity tolerant. *Oryza coarctata* is a wild species that can grow up to maximum EC value of 65 ECe (electrical conductivity) dS/m^2. It is mainly found in the coastal region of South Asian countries. Unfortunately, the conventional crossing of this plant is not very successful with rice. Thus, to find out the cause of low breeding success as well as salinity tolerant mechanisms, we did cytogenetic, genomics, transcriptomics and metabolomics study of this species. While decoding the nuclear genome along with transcriptomic studies gave several novel salt tolerant genes, metabolomics study indicated allantoin a key compound that might be responsible for its salinity tolerance. Further transgenic Arabidopsis plant with over expressed allantoin biosynthesis gene indicated that it renders salinity stress through some hormonal pathways. African rice *Oryza graberrima* though low yielder yet grow under human neglects. We have found out novel salinity tolerant genes from this species and utilized for developing the coastal salinity tolerant rice variety. A details account of our research finding of this species related to these two species will be delivered in my talk.

Speaker's Profile

Dr. Mondal is a Principal Scientist at ICAR-NIPB, New Delhi and working on pre-breeding of rice, wild species of rice and tea genomics. He has decoded the genome of Indian tea and wild species of rice (Oryza coarctata). He is the recipient of several scientific awards including the fellows of NASI, NAAS, ISPGB, Indian Botanical Society, PTCA. Guided 11 Ph. D. students including one Nigerian student. He helped to create to 2 self-help groups and mentored a farmer's organization of Sundarbans, West Bengal to get the Genome savior Award-2016. He is Editors of 4 journals and members of several scientific committee. He has written three Books and has more than 100 research papers. He has, 5 copy rights, filed 4 Indian patents and registered 12 germplasm at NBPGR. Some of his elite lines of rice under varietal trail for salinity tolerant.

Innovating cotton research for augmenting yield and quality

S. V. Sawant

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The epidermal cells of cotton ovules that commit to developing fibres provide an intriguing model for studying genetics and epigenetics, which is also a focus of my laboratory. We have demonstrated that cotton histone deacetylase 5 (HDA5) plays a positive role in regulating cotton fibre development. Inhibiting histone acetylase activity through treatment with Anacardic acid (AA), a p300/PCAF inhibitor, in in-vitro ovule cultures promotes the development of cotton fibbers. Transcriptome and ChIP-seq analyses have revealed that AA enhances fibber yield by increasing the expression of genes in the auxin pathway while suppressing the expression of cell cycle genes. Furthermore, foliar application of AA on developing flowers and bolls significantly improved cotton yield across multiple genotypes and locations. Multi-location AICRP trials conducted over two years confirmed a yield enhancement of 5-30% in cotton, leading to technology development and commercialization.Another major challenge in cotton hybrid production is the reliance on hand emasculation or ms5ms6-based genetic male sterility systems. Male sterility and fertility restoration are crucial for successful F1 seed production. We have developed a novel reversible male sterility strategy achieved through the spatiotemporal modulation of anther tapetum degeneration. This provides a controllable and efficient approach for harnessing hybrid vigour in cotton. Additionally, we generated large-scale genomic resources and re-sequenced 320 *Gossypium hirsutum* genotypes, identifying over 3.2 million SNPs and Indels. Genome-wide association studies (GWAS) identified more than 250 significant markers associated with key traits, including fiber yield and quality, stress tolerance, plant architecture, and flowering time. These high-quality polymorphic SNPs and trait-associated markers were utilized to develop a 120K cotton SNP chip, facilitating molecular-assisted breeding and association-based mapping for agronomically important traits in cotton.

Speaker's Profile

Dr Sawant works as the Chief Scientist at CSIR-NBRI, Lucknow, and his group has made significant contributions to cotton research. The lab's research focuses on transcriptional regulation and epigenetic mechanisms of fiber development. His group is utilising innovative technologies and genomic resources to enhance cotton for improved lint yield and quality. His group identified Anacardic acid as a novel growth-promoting molecule that enhances cotton fibre yield and quality. This innovation has been granted a US patent, and the technology is now commercialised. The 120K cotton SNP Chip has been developed for marker-assisted breeding in cotton varieties, and the Chip has been licensed. Dr Sawant's lab developed a novel reversible male sterility strategy for the development of F_1 cotton hybrids.

Plant microbiome engineering for climate resilient agriculture

Shilpi Sharma

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A crop's productivity is an outcome of the multitude of interactions between the plant, soil and its environment. The plant is no longer considered an individual entity, but is a part of a holobiont, with indispensable association with the microbiome. The plant microbiome contributes to the plant's fitness by various mechanisms. The rhizosphere is a special zone surrounding the plant roots, harbouring a huge microbial diversity that is recruited by the plant. To address the challenges faced by agriculture worldwide, viz. increasing population and deterioration arable land (due to climate change), plant growth promoting rhizobacteria (PGPR) have been employed for enhancing soil fertility and crop productivity since decades.

However, amendment with PGPR suffers from various limitations including the compromised efficacy and survival of the introduced strains under field conditions. Engineering the rhizosphere microbiome to enhance plant's fitness and resilience has emerged as a promising approach to agricultural sustainability. The group's success stories in rhizosphere engineering by top-down and bottom-up approaches, and their translation from lab to field, will be presented. Case studies will be discussed wherein an in depth understanding of soil-plant-microbiome nexus has been gained, followed by harnessing the microbiome for stress mitigation using different model crops.

Speaker's Profile

Shilpi Sharma is a Chair Professor at Department of Biochemical Engineering and Biotechnology, at IIT Delhi. An alumnus of the Department of Botany, BHU, she completed her Ph.D. from Ludwig Maximilian University, Germany, followed by postdoc at the Helmholtz Centre, Munich. She is an environmental microbiologist tailoring plant-microbe interactions for attaining Food Security and Agricultural Sustainability. She has authored >120 international publications and 20 chapters. She has been bestowed upon several coveted awards by the Indian Botanical Society, AMI, BRSI, and "She is: 75 Women in STEAM", an honour conferred by Government of India and British High Commission. She is the inaugural winner of the TATA Transformation Prize in Food Security, and Exemplary Women Leadership award, IIT Delhi. She is also the Fellow of the National Academy of Sciences.

From Genes to Farmers' Doorsteps: Molecular Innovations Empowering India's Dairy Value Chain

Dheer Singh

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Dairy value chain in India, the world's top milk producer for more than two decades, is a solution to nation's food insecurity. However, certain intricate problems in dairy production, processing, quality and safety as well as public health, limit the competitiveness of dairy value chain to a global level. Particularly, reproductive problems such as late maturity, accurate estrus and ovulation identification, abortion, retention of placenta, uterine infections and mastitis cause huge economic losses nearly Rs. 40-50,000 crores annually. Our efforts in translational and basic research provided innovative and simple solutions to these problems. For instance, the molecular endocrinology of buffalo aromatase, the key gene in estrogen biosynthesis, was explored. Further, we developed Buffalo Salivascope, a simple salivary fern pattern-based estrus identification method and a peptide based nanobiosensor strip for ovulation prediction at farmers' doorsteps. Similarly, LAMP colour reactions were developed for detecting *Ureaplasma diversum* for screening dairy animals with sub-clinical uterine diseases, and to identify xenobiotics in milk samples. To make dairy industry further remunerative, we recognized the emerging value-added components of milk, milk extracellular vesicles (mEVs) and delineated their molecular repertoire. Effective therapeutic and delivery potential of mEVs was also demonstrated by encapsulating mEVs either with miRNA or curcumin or antibiotics, for treating mastitis, in cancer cell lines and in vivo bioavailability studies. These integrated molecular, and mEVs based innovations collectively demonstrate a transformative potential to strengthen India's dairy value chain with direct translational impact at farmer, industry and public health levels.

Speaker's Profile

Dr. Dheer Singh, Director and Vice-Chancellor, ICAR-National Dairy Research Institute, Karnal, is a distinguished biochemist, Fellow of National Academy of Sciences (FNASc) and Fellow of National Academy of Agricultural Sciences, India. He significantly contributed to resolving buffalo reproductive problems by delineating the buffalo Cyp19A1 gene molecular biology and developing proofs of concept for ovulation prediction and field-applicable methods for estrus detection to increase conception rate and profitable buffalo rearing. He also characterized milk exosomes and demonstrated their potential as delivery vehicles for neutraceuticals and drugs. He published more than 100 research papers in reputed national and international journals.

Plant metabolic engineering and bioprocess technology for value addition

SK Yadav

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We have significantly contributed in the areas of biotechnology and metabolic engineering for crop improvement and bioprocess technology for the production of value-added products. Understood the caffeine metabolic pathway in tea with respect to seasonal and developmental conditions. Developed low-caffeine *Kangra jat* tea and seed less/ low-seeded fruits through gene silencing. Provided first evidence of epigenetic regulation of flavonoid biosynthesis and antioxidant pathway during salinity stress, molecular regulation of steviol glycosides in stevia, glyoxalase pathway and its role in providing stress tolerance to crop plants. Molecular insights into the picroside biosynthetic pathway have suggested that PkGPPS.SSU interacts with two PkGGPPS to form heteromeric GPPS in *Picrorhiza kurrooa*. We have developed nanoformulations of plant bioactives catechins, picrorhiza, stevioside, betulin, etc. to improve their efficacy, stability and bioavailability. Also developed edible coatings from waste biomass for shelf-life enhancement of fruits and vegetables, an economical process for extraction of pectin from black carrot pomace and identified an ethanol tolerant microbial strain for acetic acid production from biomass. An efficient process has also been developed for the production of bacterial cellulose. A direct process has been developed for recovery of nano-silica and lignin from paddy straw and bagasse agro-waste. Processes have been developed for the synthesis of high-value and low-calorie rare sugars like D-tagatose, D- ribose, D-talose and functional molecules.

Speaker's Profile

He has contributed significantly in the area of biotechnology and bioprocessing for crop improvement and production of value-added molecules. He has already published more than 220 research papers, 19 patents, 4 books, 38000 citations, 65 h-index. He is fellow of INSA, NASI, NAAS, RSB. He is recipient of National Bioscience Award, NASI-Reliance Industries Platinum Jubilee Award, and "Recognition Award' by NAAS. He is an Honorary Member of PTCA. He has also been conferred INSA-YSA, 2008; NASI-Platinum Jubilee YSA, 2009; CSIR-YSA, 2010; NAAS-Associate, 2013; Prof. Hira Lal Chakravarty Memorial Award of ISCA, 2012-2013; Haryana Yuva Vigyan Ratna Award, Haryana Govt., 2011-12.

Genome wide profiling and functional characterization studies reveal role of PGPR-responsive miRNAs in drought stress tolerance in plants

Charu Lata

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Pseudomonas putida strain MTCC5279 (RA), a plant growth promoting rhizobacteria improves plant growth and development and stress tolerance by colonizing their root surface. Further, along with several stress responsive genes, microRNAs are also well known for their crucial involvement in drought stress response. Considering the above, identification and expression profiling of small RNAs in chickpea roots was carried in the presence of P. putida RA inoculation under drought stress through high-throughput sequencing. A total of 923 conserved and 216 novel miRNAs from all four libraries were identified. 431 and 332 conserved miRNAs; and 60 and 39 novel miRNAs were found to be differentially expressed in RA and drought with RA-inoculated plants, respectively. At-miR393a-5p in Arabidopsis thaliana homologous system was functionally characterised for its role in growth and development. Our results indicated that At-miR393a-5p overexpressing Arabidopsis exhibited diverse plant growth and development attributes, such as increased shoot length, primary root length, biomass, number of lateral branches and number of siliques as compared to the Col-0 wild type plants. Additionally, all the overexpressing lines have improved water status, cell membrane integrity, proline accumulation and super oxide dismutase activity under drought stress. Another study revealed that RA-responsive Car-miR166 plays beneficial stress-mitigating roles under drought in transgenic Arabidopsis and chickpea plants. The results reported that the transgenic lines showed a positive interaction of miR166 with PGPR, resulting in drought stress mitigation and better plant survival in harsh drought conditions, paving the way for further characterization and utilization of miRNAs in crop improvement programmes.

Speaker's Profile

Dr Charu Lata is Principal Scientist and Associate Professor (AcSIR) at CSIR-NIScPR, New Delhi. Dr Lata pursued Ph.D. from NIPGR (JNU) in foxtail millet genomics. Later, she joined ICAR-NIPB as INSPIRE Faculty Fellow, and then as a Scientist at CSIR-NBRI, Lucknow. She moved to CSIR-NIScPR, New Delhi in 2019. Her research interest has been in the field of crop improvements especially abiotic stress responses and tolerance in crop plants. She has primarily focused in the research areas pertaining to the elucidation of mechanisms regulating abiotic stress tolerance in legumes and cereal crops through transcriptomics, small RNA profiling, and functional characterization studies. Dr Lata is also a recipient of several prestigious awards and honours.

Addressing livestock health and food safety using cutting edge molecular tools

Rajib Deb

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The livestock sector plays a pivotal role in strengthening India's economy by contributing significantly to food security, rural livelihood, and agricultural sustainability. Ensuring the health of livestock is critical for enhancing productivity, profitability, and the overall safety of animal-derived foods. Food safety, particularly in livestock products such as milk and meat, remains a major concern due to issues like adulteration and contamination, which not only pose serious risks to public health but also raise concerns related to religious taboos. Rapid and accurate disease diagnosis is a cornerstone of livestock health management, enabling timely intervention and effective disease control. The application of advanced molecular diagnostic tools offers unprecedented precision and speed in detecting major bacterial and viral pathogens affecting livestock. Moreover, vaccination remains the most reliable strategy for disease prevention; hence, the development of indigenous vaccines using local pathogen isolates is essential for achieving region-specific protection. This presentation will highlight recent advancements in molecular approaches for livestock disease diagnosis and species- specific food adulteration detection. Efforts toward the development of an indigenous vaccine candidate against Indian isolates of porcine viral diseases will be discussed, along with insights into host–pathogen interactions in emerging diseases like African swine fever. These innovative molecular interventions promise to revolutionize livestock health management and food safety assurance, aligning with the goal of sustainable agriculture in India.

Speaker's Profile

Dr Rajib Deb, PhD at present working as Senior Scientist at ICAR-National Research Centre on Pig, Guwahati, Assam. Currently his area of research is on the area of piggery health sector emphasizing on development of molecular diagnostic tools, vaccine candidates, understanding the host-pathogen interaction and immunological criteria associated with viral pathogenesis in the line of development of successful therapeutic gadgets and antimicrobial resistant.

Integrating genomics and biotechnology for climate-resilient and resource-efficient direct-seeded rice systems

Nitika Sandhu

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Direct Seeded Rice (DSR) is emerging as a transformative solution to address the urgent challenges of groundwater depletion, labour scarcity, methane emissions, and production stagnation in rice-based systems. However, its large-scale adoption is constrained by poor seedling emergence under deep sowing, early-stage abiotic stress tolerance, iron deficiency, and weed competition. My research integrates genomics-driven breeding, high-throughput phenotyping, and advanced molecular tools such as QTL mapping, genome wide association studies, genomic selection, haplotype-based selection, and CRISPR/Cas9-led functional gene validation to develop climate-resilient, resource-efficient rice cultivars tailored for DSR ecosystems. Significant progress has been made in dissecting genomic regions associated with traits improving adaptation of rice under DSR. Traits include anaerobic germination, early seedling vigor, early and uniform germination from deep sowing depth, mesocotyl elongation, submergence, flood and drought tolerance, root traits improving nutrient uptake, grain yield under DSR, weed competitiveness, herbicide tolerance, lodging resistance, grain quality, and biotic stress tolerance/resistance. Elite introgression and pre-breeding lines have been developed and field-evaluated across multi-locations in India, demonstrating enhanced establishment, nutrient-use efficiency, and yield stability under water-deficit, direct-seeded conditions. Beyond this, the research emphasizes translation to farmer fields through marker-assisted selection, trait-based varietal pipelines, and farmer-centric validation. Ongoing efforts include genome editing for seedling vigor, herbicide tolerance and the development of AI-enabled predictive tools for stress diagnostics and agronomic decision support. This integrated genomics-to-field pathway aims to accelerate the deployment of next-generation DSR rice cultivars, positioning India as global leaders in climate-smart, sustainable rice intensification.

Speaker's Profile

Dr. Nitika Sandhu is a molecular geneticist specializing in direct-seeded rice (DSR). Her pioneering research in next-generation sequencing-based trait mapping has identified 17 QTLs associated with enhanced DSR adaptation, now applied in genomics-assisted breeding programs for developing climate-resilient rice varieties. As an early-career researcher, she has published 55 research papers in reputed international journals, 14 book chapters, and one book, and has registered eight DSR-adapted breeding lines with NBPGR and eight gene sequences with NCBI. She has secured five national and one international research project from DBT/DST (India) and UKRI (UK), respectively, contributing significantly to rice improvement and sustainable agriculture.

Innovative products/processes and solutions for Indian food industry & consumers

Prarabdh C. Badgujar

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To offer curcumin in easy, convenient, daily use food format, two novel nutraceutical products: 'curcumin functionalized/fortified cream powder and milk powder' were developed. Instant liquid cream and curcumin latte/milk can be reconstituted which revealed high sensory acceptability. Effect of processing conditions on powder functionalities, particle size, morphology, curcumin bioavailability, fluorescence, anti-cancer properties and cytotoxicity were studied. Results showed that CP and MP had significantly higher yield (85 and 81.3%). TEM confirmed curcumin particles to be in the nano-scale (50–250nm) compared to initial 2000nm curcumin size. In-vitro simulated digestion followed by Caco-2 cells uptake showed significantly high (CP: 95.01%; MP: 89.7%) curcumin bioavailability. CP and MP exhibited potent anticancer activity (100-2700µg/mL) by significantly inhibiting hepatic cancer (HepG2) cells with no cytotoxicity (MTT assay). Further, almond protein hydrolysate powder (APHP) was developed from almond meal through enzymatic hydrolysis using alcalase. APHP had all essential amino acids with 92.05mg BCAA/g protein and 0.44 PDCAAS score. APHP was shown to have significant immunostimulatory activity at 900 mg/kg bw in mice model wherein it had significantly high lymphocyte proliferation, NK cell activity (YAC-1 cells), peritoneal macrophage phagocytosis and IL-6 & IL-10 levels compared to the control; it also neutralized delayed type hypersensitivity (DTH) reaction induced by DNCB. APHP shown to be fortified (15%) in pea protein-based supplement with favourable sensory profiling. A low-cost meat storage structure requiring no direct electricity was developed using PCM to ensure hygienic meat for Indian consumers. Spoilage, pathogenic microbes were 1000 times less than FSSAI limits & meat is safe from physical contaminants: dust, flies.

Speaker's Profile

Dr. Prarabdh C. Badgujar is a Associate Professor at Dept. of Food Science and Technology, National Institute of Food Technology Entrepreneurship and Management, Kundli (NIFTEM-K), Sonipat, Haryana. His research areas include food toxicology and efficacy studies; Nutraceuticals & functional foods formulations; Protein hydrolysates & Bioactive peptides. He has handled research projects worth 5.2 Crore till date and has transferred 2 technologies to the Industries. He has received 4 Indian patents & 2 copyrights 58 published papers with 1520 citations & h-index of 22. He has guided 4 Ph.D., 27 Master's students. He is recipient of DST-INSPIRE Fellowship, Summer Research Fellowship by IAS, Bangalore, International fellowships by JICA, Govt of Japan & 'MASHAV Scholarship' by Govt. of Israel.

Phytochemicals in food safety and sustainability

Bhanu Prakash

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Food safety is one of the critical components of global food sustainability and well aligned with United Nations Sustainable Development Goals (SDGs), particularly SDG 2 (zero hunger) and SDG 3 (good health and well-being). Fungal contamination in agri-food commodities is one of the major causes of food spoilage linked with breaching the food safety and security leads to fatal disease and negatively affects the trades. Among different storage fungi, Aspergillus flavus and its associated toxin (aflatoxin B 1) have been considered as the most resilient fungi and mycotoxin in agricultural food commodities. In this talk, I shall present a brief overview on our research work, how the integration of recent techno-scientific innovation especially mathematical modeling, omics approaches and nanotechnology could be used to formulate the novel phytochemicals-based antifungal agents to combat the fungal spoilage, aflatoxin B 1 contamination and emergence of resistance, and to achieve the global food safety and sustainability.

Speaker's Profile

Dr. Bhanu Prakash is currently working as an Associate Professor of Botany at Department of Botany, Banaras Hindu University, Varanasi. His group has explored the preservative and functional characterization of plant-based chemicals. Given his scientific contributions, he has received several prestigious awards such as

- *Associates (2020): National Academy of Agricultural Sciences (NAAS-New Delhi), India.*
- *NASI-Young Scientist Platinum Jubilee Award (2017): The National Academy of Sciences,*
- *(NASI), India.*
- *Elected Life member MNASc (2018), National Academy of Science (NASI), Prayagraj, Uttar Pradesh, India.*
- *Prof Gurcharan Singh Bains Award (2021) Association of Food Scientists & Technologists (Mysore, Karnataka, India).*

Indigenous Next-generation Precision genome editing tools for crop improvement

Kutubuddin Ali Molla

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Genome editing has revolutionized modern biosciences and biotechnology by enabling targeted and precise modification of genetic sequences. While CRISPR–Cas9 and Cas12a systems have become the cornerstone of genome engineering in eukaryotes, their commercial application in India remains limited due to intellectual property (IP) constraints. To address this, our laboratory at ICAR–CRRI focuses on developing indigenous and IP-free genome editing tools for plant research and crop improvement. Moving beyond conventional CRISPR platforms, I will introduce a transposon-associated TnpB system—a compact, programmable, and next- generation genome editor that our group has successfully established for eukaryotic genome editing. In parallel, we are advancing base editing and prime editing technologies to achieve single-nucleotide substitutions and precise, small DNA insertions or deletions without inducing double-strand breaks or requiring donor templates. Drawing from our ongoing research, I will present case studies on (i) base- edited rice with enhanced resistance to major diseases, and (ii) prime-edited rice lines carrying a C4-like phosphoenolpyruvate carboxylase (PEPC) variant that exhibits early flowering and improved photosynthetic efficiency. We further discovered that these prime-edited lines are enriched in zinc, iron, and protein (ZIP) in grains—marking a significant step toward achieving biofortification and nutritional security goals. The presentation will conclude with a brief outlook on our latest efforts to integrate AI-generated proteins in the rational design and optimization of novel genome editors.

Speaker's Profile

Dr. Kutubuddin Molla is a Senior Scientist at ICAR–National Rice Research Institute, Cuttack, India, specializing in genome editing for crop improvement. A Ph.D. from the University of Calcutta and a Fulbright Postdoctoral Fellow at Penn State University, he has developed indigenous genome editing tools, including a compact TnpB system, base editors, and prime editors. His innovations are used in over 35 laboratories worldwide. Dr. Molla has received several honors, including the INSA Medal for Young Scientist (2020) and INSA Associate Fellowship (2025). He was recently selected as a 'Next Generation Leader' for the Asilomar 50th Anniversary Summit, USA.

IIT Delhi

National Seminar

Sectional Committee: PHYSICS

On the occasion of

Celebration of Science Week at Delhi – 2025

Date: 4th December 2025

Celebration of Science Week at Delhi – 2025

Program Schedule

Sectional Committee (SC): II (Physics)

SC Chair: Professor Tanusri Saha-Dasgupta

Venue: IIT Delhi

Date: 4th December 2025

Reporting time at Venue: 9:30 AM

Name	**Address**	**Title**	**Time**
Professor Tanusri Saha-Dasgupta	S. N. Bose National Centre for Basic Sciences, Kolkata	Opening remarks	9:45-10:00
Professor Ashoke Sen	International Centre for Theoretical Sciences (ICTS)- TIFR Survey No. 151, Shivakote Hesaraghatta Hobli Bengaluru 560089	String theory	10:00-10:20
Professor Chandrashekhar Janardan Joshi	1432, Beckwith Ave, Los Angeles, CA 90049, USA.	Race to Develop Particle Accelerators for Particle physics in the 21st Century	10:20-10:40
Professor Anjan Barman	Senior Professor & Dean (Faculty) Department of Condensed Matter Physics and Material Sciences SN Bose National Centre for Basic Sciences, Block-JD, Sector-III, Salt Lake, Kolkata-700106	Magnetic Texture Controlled Ultrafast Spin Dynamics in Engineered Magnetic Nanostructures	10:40-11:00
Tea (11:00-11:30)			
Professor P K Panigrahi	Director, Center for Quantum Science and Technology, ITER, Siksha 'O' Anusandhan University Bhubaneswar-751030	Wave-particle duality in double slit experiment and beyond	11:30-11:50
Professor S A Rangwala	Professor II, Raman Research Institute, CV Raman Avenue Sadashivanagar Bengaluru-560080	Observing Symmetry and its Transitions with Trapped Ion Clusters	11:50-12:10
Professor Aradhana Shrivastava	Head, Nuclear Physics Division Bhabha Atomic Research Centre, Trombay, Mumbai-400085	Nuclear Physics towards the limit of stability	12:10-12:30
Shri Nadir Godrej	Chairman and MD Godrej Industries	Scientific Innovation in the Godrej Industries Group	12:30-12:50
Lunch (12:50-14:00)			

Professor Aninda Sinha	Centre for High Energy Physics Indian Institute of Science CV Raman Avenue Bengaluru-560012	The quantum life of pi	14:00-14:20
Professor Raghunathan Srianand	Director, Inter-University Centre for Astronomy and Astrophysics (IUCAA), Post Bag 4, Ganeshkhind, Pune-411007	Physics of young galaxies in the early universe	14:20-14:40
Professor B. V. R Chowdari	Senior Executive Director of the Materials Research Society of Singapore and Adjunct Professor of Materials Science and Engineering at NUS and NTU; 3 Jubilee Road, Singapore 128527.	Physics and Chemistry of Materials for Energy Storage Applications	14:40-15:00
Dr Mohit Tyagi	Scientific Officer (G) & Associate Prof., HBNI Crystal Technology Section Technical Physics Division Bhabha Atomic Research Centre, Trombay, Mumbai-400085	A journey from raw material to nuclear radiation detector based on single crystal scintillators	15:00-15:20
Dr Santosh K. Das	Associate Professor, Indian Institute of Technology Goa.	Probing electromagnetic fields in high-energy heavy-ion collisions through heavy quarks	15:20-15-40
Dr Kinjalk Lochan	Associate Professor, Indian Institute of Science Education and Research Mohali, Mohali.	Bringing the Unruh Effect to the fore	15:40-16:00
Dr Rahul Srivastava	Associate Professor, Indian Institute of Science Education and Research Bhopal, Bhopal.	Searching for the Ghosts of Nature	16:00-16:20
Professor Jürgen Hartmut Eckert	Director, Erich Schmid Institute of Materials Science, Austrian Academy of Sciences, Jahnstraße 12, 8700 Leoben, Austria.	Tailoring structure and properties of metastable alloys	16:20-16:40 (pre-recorded)
Tea (16:40 – 17:00)			

Contact: Rajendra S. Dhaka, 9711019605 (rsdhaka@physics.iitd.ac.in)

Sectional Committee -II

Physics

Chair
Prof. Tanushree Saha Dasgupta, FNA

Works in area of computational materials physics. Fellow of American Physical Society, The word academy of sciences, Indian National Science Academy, Indian Academy of Sciences, National Academy of Sciences, India and West Bengal Academy of Sciences. Currently Senior Professor and Director at S. N. Bose Centre.

Scientific Innovation in the Godrej Industries Group

Nadir Godrej

Chairman and MD Godrej Industries
Email nb.godrej@godrejinds.com

A detailed discussion on various research initiatives, over the years, that helped the group grow steadily and contribute to humanity. Research in animal feeds, agrochemicals, oleochemicals and specialty chemicals are discussed. The importance of Green Chemistry and environmental sustainability is discussed.

Speaker's Profile

Nadir Godrej is the Chairperson of Godrej Industries Group and the Chairperson and Managing Director of Godrej Industries. He received a B. S. degree in Chemical Engineering in 1973 from the Massachusetts Institute of Technology, and an M.S. in Chemical Engineering in 1974 from Stanford University. He also earned an MBA from Harvard Business School in 1976. Since 1977, he has served as a Director of Godrej Soaps Limited and has played a critical role in developing the animal feed, agricultural inputs, and chemicals businesses of Godrej Industries Group. He has also been very active in research and holds several patents in the field of agricultural chemicals and surfactants. In 2001, Godrej Soaps Limited was renamed Godrej Industries, and he was appointed Managing Director. He is also the Chairperson of Godrej Agrovet and a Director of Godrej Properties, both subsidiaries of Godrej Industries Group. Additionally, he serves on the boards of Godrej Consumer Products, Astec Life Sciences Limited and other group companies.

He has been actively engaged in various industry associations, including CLFMA (Compound Livestock Feed Manufacturers Association of India), ICC (Indian Chemical Council) [erstwhile ICMA (Indian Chemical Manufacturers Association)], and OTAI (Oil Technologists' Association of India). He also engages closely with the Harvard Business School and MIT Alumni Associations in India. He currently serves as the President of the Alliance Française de Bombay, and is a Member of the CII (Confederation of Indian Industry) National Council, having previously chaired the CII National Committee on Chemicals.

Mr. Godrej has been honored with numerous prestigious awards in India and internationally for his exceptional contributions to business, sustainability, and society. Recently, he was awarded an Honoris Causa degree by Bennett University, Times Group, and earlier this year received the Vivekananda International Relations Peace Award. In February 2025, he was honoured with the D.Sc. (Honoris Causa) from Institute of Chemical Technology. In 2023, he was recognized with the Hurun Award for Most Respected Indian Industrialist of the Year and the Game Changer Felicitation at the India Gulf Business Summit for redefining sustainability in business. He has also been conferred honorary doctorates by XIM University, Bhubaneswar, acknowledging his impact on industry and society.

His accolades include the Chevalier de Légion d'Honneur, Lifetime Achievement Awards from CLFMA of India, Indian Chemical Council, AILBIEA, and the Society Achievers "Pride of India Honour" for his contributions to entrepreneurship, sustainability, and philanthropy. Other notable recognitions include the Green Business Titan Award by JSW & The Times of India, the King Husein Global Business & Intercultural Peace Award, and the Qimpro Platinum Standard in Business Medal.

Mr. Godrej's illustrious career continues to inspire through his unwavering commitment to sustainability, business excellence, and societal progress. Science, linguistics, swimming and poetry; author of "Life and Other Poems" & "Nadir Godrej The Poet", a collection of English and French poems. Mr Godrej is known to make speeches in verse!

Uniqueness of string theory

Ashoke Sen

International Centre for Theoretical Sciences (ICTS)- TIFR, Bengaluru
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String theory has many manifestations that differ in the number of compact dimensions as well as the shapes and sizes of these compact dimensions. I shall discuss in what sense these different manifestations should be regarded as part of the same theory.

Speaker's Profile

Ashoke Sen is renowned for his pioneering contributions to string theory and quantum field theory. Born in 1956, he is a professor at the International Centre for Theoretical Sciences in Bengaluru, India. Sen's major achievements include: Foundational work on S-duality and strong–weak coupling dualities in string theory. The discovery of Sen's conjectures on tachyon condensation, which advanced understanding of unstable D-branes. Contributions to black hole entropy calculations and string field theory. He has received numerous honors, including the Breakthough Prize in Fundamental Physics (2012), Padma Bhushan (2013) and Dirac Medal (2014).

A journey from raw material to nuclear radiation detector based on single crystal scintillators

Mohit Tyagi

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Although, Roentgen got the Nobel Prize for first finding of radiation about 120 years ago, but the crucial element of this pivotal discovery was the observation of glow on fluorescent screen. Since then, the application of scintillating materials is continuously increasing in medical and nuclear industry, basic research, homeland security etc. This ongoing increment in demands has need of the finding of novel scintillating crystals having required and improved performance characteristics. Further, the advancement in material synthesis and purity refinement techniques along with the state of art sensors and data acquisition systems have provided another dimension in this field. However, the discovery of alternative crystals and the improvement of existing scintillators' performances require a systematic and integrated multi-disciplinary approach. It can be achieved only when the researchers, experts in diverse fields, work altogether along with the end-users of the devices. In this talk, along with the general view of selecting an appropriate scintillator for a particular application and a systematic approach for adequately addressing various issues in the development of advanced scintillators will be presented with a few examples. The current interest in finding promising scintillators for neutron detection and pulse shape discrimination will be also discussed. The scintillation mechanism, which has gained interest in the last decade only, to address some unresolved issues and a few current and less explored problems would be also presented.

Speaker's Profile

Dr. Mohit Tyagi joined Crystal Technology Section, Bhabha Atomic Research Centre in 2005. He completed his M.Sc. Physics from CCS University Meerut and Ph.D. from HBNI, Mumbai and Post-Doc from University of Tennessee, USA. He visited Kyungpook National University in 2019 as a Brainpool fellow. He is working on the growth and characterization of single crystal scintillators for nuclear radiation detection. Along with the responsibility of developing nuclear radiation detector, He is member secretary of Basic Science committee of Board of Research in Nuclear Sciences. He is a recipient of the highest award of the Department of Atomic Energy (DAE) Homi Bhabha Manpatra-2024. His work has been recognised by various other awards including 'DAE Group Achievement- 2013', 'DAE Young Applied Scientist -2014', 'IACG Young Crystal Grower-2015', 'Nucleonix best researcher -2015', 'Indian Physical Society Young Physicist-2016' , DAE SSPS Young Achiever Award 2017, 'NASI Young Scientist -2017' , DAE Scientific & Technical Excellence Award 2020, INSA- Distinguished lecture 2025 etc." He is Young Associate of Maharashtra Science Academy and Member of Indian Young Academy of Science (INYAS-INSA) and National Academy of science (NASI)".

Physics and Chemistry of Materials for Energy Storage Applications

B.V.R. Chowdari[1,2,3]

[1]*Materials Research Society of Singapore,* [2]*National University of Singapore,*[3] *Nanyang Technological University Singapore*
Email: chowdari@mrs.org.sg

The interdisciplinary nature of materials science with focus on the role of physics and chemistry for potential applications to global challenges is presented. The work done in my research group on Lithium-ion Batteries for Energy Storage applications is used as an example. The strategy adopted for improving the performance of the Lithium-ion Batteries through extensive research on synthesis, characterization, and optimization of novel electrode materials is highlighted with specific examples.

Speaker's Profile

Prof. B.V.R. Chowdari is a Materials Scientist. His research focuses on Lithium-ion Batteries for Energy Storage devices. He received Ph.D. degree from IIT Kanpur; Doctor of Literature (Honoris Causa) from Mangalore University, and Doctor of Science (Honoris Causa) from K.L. University. He served as the President of International Union of Materials Research Societies and Director of India-Connect Program at NUS and NTU. Currently, he is a Foreign Fellow of the NASI, Fellow of the SNAS, Vice-President of APAM, Member of the Executive Board of the AASSA, and President Emeritus & Senior Executive Director of Materials Research Society of Singapore.

Tailoring structure and properties of metastable alloys

J. H. Eckert [1,2]

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[2] *Department of Materials Science, Technical University of Leoben, Jahnstraße 12, A-8700 Leoben, Austria*
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Metastable metallic alloys with hierarchical microstructure and combination of different phases can yield unique properties rendering them attractive for a variety of structural and functional applications. Such heterogeneous microstructures can combine the properties of their constitutive phases and allow property optimization through precise control of volume fractions and length-scale of the respective phases.

With respect to structural applications, one major goal is to achieve favourable combinations of high strength, good ductility and toughness by preventing shear localization. For this purpose, concepts of creating heterogeneous materials with different type and length-scale of phases have been followed to control the mechanical properties by proper alloy and microstructure design. Similarly, hybrid hierarchical microstructures can also generate new materials with improved performance.

Recent developments along this line will be outlined for different types of metallic alloys to illustrate how structural and functional properties can be tuned by appropriate phase and microstructure control. The resulting structures will be described for selected materials, and the mechanisms responsible for their mechanical behaviour will be discussed. Consideration of the challenges for the use of amorphous / nanostructured materials in engineering applications, as well as a discussion of the possible solutions, will also be addressed.

Speaker's Profile

Jürgen Eckert is Director of the Erich Schmid Institute (ESI) of Materials Science of the Austrian Academy of Sciences and Chair Professor of Materials Physics at Technical University of Leoben, Austria. His main research interests are materials physics, metastable materials as well as design and synthesis of advanced high performance nanostructured materials for structural and functional applications. He is author of more than 1400 scientific papers and holds 24 patents in the areas of materials science and processing technology. He received numerous honors and awards, and is a member of several Scientific Academies.

Race to Develop Particle Accelerators for Particle physics in the 21st Century

Chandrashekhar J. Joshi

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High Energy particle accelerators have been the principal instrument of discovery of subatomic particles in the 20th century. This trend will likely continue if higher and higher center of mass energy lepton/hadron colliders can be built at a lower cost per GeV addition of energy. The capital cost of the collider is reduced by increasing the accelerating gradient whereas the operating cost is reduced by improving their wall plug efficiency. For the past 4 decades we have been working on a plasma-based linear accelerator that simultaneously increases the accelerating gradient and efficiency by more than 3 orders of magnitudes compared with the current radio frequency linear machines. We power our plasma accelerator by using high current, ultra-relativistic particle beams or ultra-short, PW-class laser pulses rather than RF as in conventional accelerators. When such tightly focused drive beams propagate through a column of ionized gas (plasma), they excite a disturbance that is nothing more than a space charge density wave that has electric field components that are both accelerating (longitudinal) and focusing (transverse). Unfortunately, the wakes are mesoscopic (sub mm diameter and m long) and transient (lifetime of tens of picoseconds). Nonetheless, ingenious schemes have been developed to inject and accelerate charge using such wakes and extract a significant fraction of the energy from the wake. Our latest results will be described.

Speaker's Profile

Professor Chan Joshi (UCLA) is a distinguished professor and holds the Mukund Padmanabhan Endowed Chair in Research Excellence . He is the founder of the experimental field of Plasma-based accelerators. He has received the Maxwell prize of the APS Alfven prize of the EPS and Marie Curie prize of the IEEE. In 2014 he was elected to the National Academy of Engineering.

Magnetic Texture Controlled Ultrafast Spin Dynamics in Engineered Magnetic Nanostructures

Anjan Barman

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Engineered magnetic nanostructures will form important building blocks for next-generation spintronics and externally controlled spin textures offer new opportunities for novel spin-based device fabrication [1]. The optimization of these devices demands understanding and control of ultrafast spin dynamics as well as spin-wave propagation. Here, we will discuss femtosecond laser-induced ultrafast magnetization dynamics controlled by domain-wall origami in $[Co/Pt]_{22}$ multilayer. Depending on the underlying domain landscape, the spin-transport-driven magnetization dynamics shows a transition from ultrafast demagnetization to an anomalous transient magnetization enhancement (TME) via a state where both TME and demagnetization coexist in the system [2]. Thereby, the study reveals an extrinsic channel for the modulation of spin transport, which will introduce a route for the development of magnetic spin-texture-driven ultrafast spintronics devices. Furthermore, we will discuss the development of on-demand magnonic nanochannels by periodically tailoring perpendicular magnetic anisotropy using an electric field. Brillouin light scattering measurement revealed magnonic bands, consisting of two spin-wave frequency modes, along with a bandgap under the application of moderate gate voltage, which can be switched off by withdrawing the voltage. The anticrossing between these two modes gives rise to the observed magnonic bandgap [3]. This study will lead to on-chip parallel data communication and processing.

1. B. Pfau et al., Nat. Commun. **3**, 1100 (2012).
2. A. K. Mondal et al. ACS Nano **18**, 16914 (2024).
3. S. Choudhury et al. Sci. Adv. **6**, eaba5457 (2020).

Speaker's Profile

Professor Anjan Barman, Senior Professor at the S. N. Bose National Centre for Basic Sciences, received his Ph.D. from IACS, Jadavpur University in 1999. He held postdoctoral positions in Israel, the UK and the USA, and served as faculty at the University of South Carolina and IIT Delhi. A world leader in ultrafast spin dynamics, magnonics and spintronics, he pioneered all-optical spin control, spin-waves, hybrid and quantum magnonics, spin-orbitronics and strain-controlled magneto-elastic devices. He has published around 280 articles/books, supervised about 100 researchers, including 35 Ph.D. students and is a Fellow of IASc and IOP (UK).

Wave-particle duality in double slit experiment and beyond

P.K. Panigrahi

1. India Institute of Science Education and Research, Kolkata, Mohanpur, West Bengal, 741246 2. Siksha 'O' Anusandhan University, Bhubaneswar, Odisha, 751030
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Starting from Thomas Young the double slit experiment has played a key role in establishing the wave nature of light. In quantum theory, understanding of wave particle duality and the collapse of the wave function during measurement process have been illustrated through the double slit experiment. Coherence of light lies characterizes the interference phenomenon measured through visibility as is well known detecting the light trajectory in a given slit leads to vanishing of the interference pattern yielding which path information and therefore the particle nature of light. Investigation of general multi slit scenario leads to an exact triality condition involving wave-particle nature and entanglement. We illustrate a surprising manifestation of entanglement and recent experimental investigation demonstrating this exact triality condition.

Speaker's Profile

Prof. Prasanta K. Panigrahi is presently director of Center for Quantum Science and Technology (CQST), SOA university and emeritus professor at IISER Kolkata. He has served as a faculty at University of Hyderabad, Physical Research Laboratory and at IISER Kolkata. He did his doctoral degree at university of Rochester in theoretical physics with postdoctoral experiences from University of Illinois and University of Montreal. His research interest lies in quantum information, quantum computing, nonlinear dynamics, many-body physics and data analysis. He is a fellow of National Academy of Science, India and Gujrat Science Academy.

Observing Symmetry and its Transitions with Trapped Ion Clusters

S. A. Rangwala

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Trapped ions, when laser cooled, crystalize in their minimum configuration, which combines the effect of external trap potential and their ion-ion interactions. They change morphologies when the trap potential is altered, which express as change in the structure of the cluster. The intriguing thing is that the ions are well separated and so can be imaged using a camera. The unit cell size of the clusters also permit very accurate computation of their structures which show near perfect agreement with the experiment. In this talk I will show images of the various structures of the clusters, as the potential imposed by the end cap ion trap is deformed. The transition of clusters from one configuration to another can be imaged and the structural transitions in these unit cell objects can be measured and quantified. Both displacive and reconstructive transitions are observed, the order parameter for the transitions can be rigorously arrived at and astonishingly, even a triple point is observed [1].

References

[1] Akhil Ayyadevara, Anand Prakash, Shovan Dutta, Arun Paramekanti, S. A. Rangwala, arXiv:2505.16378v3 [physics.atom-ph] https://doi.org/10.48550/arXiv.2505.16378

Speaker's Profile

Sadiq Rangwala, an experimental atomic, molecular and optical physicist, is presently a professor at the Raman Research Institute (RRI), Bangalore. He works with ultracold and trapped atoms, ions, molecules and studies interactions between them, using precision laser systems and quantum optics techniques. Atom-cavity QED studies are an important part of his scientific palette. He has received the Shanti Swarup Bhatnagar Award in Physics, the IPA P.K. Iyengar Award for Experimental Physics and is fellow of the Indian Academy of Sciences.

Nuclear Physics towards the limit of stability

Aradhana Shrivastava

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Nuclear physics seeks to understand the fundamental nature of strongly interacting matter and the mechanisms that govern nuclear reactions from the earliest stages of the universe to present-day stellar environments. Much of our current understanding of nuclear structure and reactions arises from studies of low-energy interactions using particle beams produced by heavy ion accelerators. Recent advances in accelerator technology, coupled with state-of-the-art detection systems and data analysis techniques, have enabled the exploration of novel reaction mechanisms and exotic nuclear structures across a wide range of nuclei—both near and far from the line of stability.
This talk will highlight recent progress and emerging excitement in the field, with particular emphasis on nuclear fusion–fission processes involving both stable and weakly bound nuclei at energies deep below the Coulomb barrier. These studies, conducted using innovative experimental approaches, provide a sensitive testing ground for understanding quantum tunneling, coupling of collective excitations, and breakup effects that strongly influence barrier penetration probabilities. The results also have important implications for modelling astrophysical reaction rates that govern the synthesis of light and medium-mass elements in stellar and explosive environments.
In addition, the talk will outline future research directions and upcoming accelerator facilities in India aimed at advancing front-line studies in nuclear physics.

Speaker's Profile

Dr. Shrivastava is currently serving as Head, Nuclear Physics Division, BARC and Senior Professor of HBNI. She is recipient Homi Bhabha Science & Technology award, DAE Scientific & Technical Excellence Award and DAE Group Achievement Award. She has served as General Secretary of Indian Physics Association. She served as a member of the drafting group for Mega-Science Vision 2035 document, written on initiative by the Office of the Principal Scientific Advisor to the Government of India. She is Member of the Standing Advisory Group on Nuclear Applications of IAEA. Member of Technical program committee for the Physical Sciences of ANRF, for Advanced Research Grant. She is Fellow of the National Academy of Sciences, India.

The quantum life of pi

Aninda Sinha
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I will present an infinite number of new formulas for pi that originated from considerations in quantum field theory and string theory. This line of research was motivated by re-examining the historical origins of string theory, but rooted in modern understanding of quantum field theory. The hope is to generalize the string framework in an attempt to bootstrap it to nature. The resulting series for pi includes in a limit, the famous Madhava series. I will conclude my talk by discussing the famous Ramanujan 1/pi series and their connection with physics.

Speaker's Profile

Aninda Sinha is a theoretical physicist at the Centre for High Energy Physics, IISc, Bangalore and a Quantum Horizons Alberta senior fellow at the University of Calgary, Canada. His research interest is in quantum field theory, string theory, cosmology and quantum computing. He was awarded the 2015 Swarnajayanti fellowship, 2016 ICTP Prize, 2019 Shanti Swarup Bhatnagar Prize, 2024 Indian Academy of Sciences Fellowship, 2025 Wolfram Innovator Award and 2026 INSA fellowship.

Probing electromagnetic fields in high-energy heavy-ion collisions through heavy quarks

Santosh K. Das
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One of the primary objectives of experiments at the Relativistic Heavy Ion Collider (RHIC) and the Large Hadron Collider (LHC) is to create a novel state of matter called the quark–gluon plasma through the collision of heavy ions. This state of matter is believed to resemble the conditions of the early Universe just microseconds after the Big Bang. In non-central heavy-ion collisions, extremely strong magnetic fields are generated, primarily due to the motion of spectator charges. The magnetic field can reach magnitudes of around 10^{19} Gauss, several orders of magnitude larger than those estimated at the surface of magnetars. As the spectators move away, the rapid decay of the magnetic field induces intense electric fields, making heavy-ion collisions a unique environment to study QCD matter under extreme electromagnetic conditions. Heavy quarks, produced in the early stages of the collision and acting as non-equilibrium probes, provide a powerful tool to probe these fields. Our results show that the electromagnetic fields induce a significantly larger directed flow for charm quarks compared to light quarks, making the splitting between the directed flow of charm and anti-charm quarks a distinct signature of the produced electromagnetic field. Consequently, the directed flow of heavy mesons has been measured experimentally at both RHIC and the LHC.

Speaker's Profile

Dr. Santosh Kumar Das earned his Ph.D. in high-energy nuclear physics from the Variable Energy Cyclotron Center, Kolkata, in 2012. He worked as a postdoctoral researcher at the University of Catania, Italy, from 2013 to 2017. From December 2017 to June 2018, he served as an Associate Professor at the University of Lanzhou, China. In 2018, Dr. Das joined IIT Goa as an Assistant Professor and is currently an Associate Professor at IIT Goa.

Bringing the Unruh Effect to the fore

Kinjalk Lochan

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Email: kinjalk@iisermohali.ac.in

The union of Quantum Field theory with the General theory of Relativity provides many remarkable and counter-intuitive theoretical results such as non covariance of the status of particles for different observers. The concept of particle creation due to motion of observers is beautifuly captured in the famous *Unruh effect* which posets that the vacuum of inertial observers appears thermally populated to accelerating ones. This central idea resonates in many prominent predictions such as the Hawking radiation from black holes, creation of particles from vacuum in Schwinger effect, initial seeding of the galaxies in the early universe, as well. Despite being of much theoretical prominence, these effects have never been realized experimentallly or obsevationally due to the extremely demanding conditions they need e.g. an atom needs to be accelerated to ~ 10^20 times the acceleration due to gravity to feel thermality of 10 K. In the recent set of works we study the field conditions which can ease out the extreme requirement of witnessing the Unruh effect in an experimental run. We argue that by appropriately tailoring the density of modes of the quantum field and invoking mechanisms like spontaneous and stimulated emissions or superradiance, the requisite acceleration scales can be brought down to much lower accelerations ~ 10^6 times the earth's gravity, or even smaller. The results from our studies appear encouraging and capable of potentially bringing the Unruh thermality to the realm of experimental verification in near future.

Speaker's Profile

Kinjalk Lochan is an Associate Professor at the Indian Institute of Science Education and Research (IISER), Mohali. He did his PhD in 2013 under the supervision of Prof. T. P. Singh at TIFR, Mumbai. Subsequently he worked with (Late) Prof. T. Padmanabhan at IUCAA Pune, and Prof. S. Shankarnarayanan at IISER Trivandrum during his post doctoral tenures. In Dec 2016 he joined IISER Mohali as DST INSPIRE Faculty and then worked as an Assistant Professor in July 2018-Dec 2023. His research primarily spans the area of quantum theory and gravity. He has been working on the topics of Black hole radiation, quantum fields in cosmology and quantum field theoretic effects in non inertial settings. For his research contributions, he was conferred N.R. Sen award by the Indian Association of General Relativity and Gravitation (IAGRG) in 2022.

Searching for the Ghosts of Nature

Rahul Srivastava

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The Standard Model of particle physics has been an extraordinarily successful theory, yet it fails to address several fundamental phenomena such as neutrino oscillations and the existence of dark matter. These "ghosts of nature" are particles elusive to high energy colliders like the LHC, but can leave detectable imprints in low energy precision experiments and cosmological observations which we aim to explore. In this talk I will discuss the recent advances in modelling and analyzing data of the current state of the art experiments. By leveraging a broad array of terrestrial experiments such as Coherent Elastic Neutrino-Nucleus Scattering (CEvNS), Elastic Neutrino-Electron Scattering (EvES), dark matter direct detection experiments (like XENONnT, LZ and PandaX-4T), I aim to discuss the novel experimental searches for these ghost particles. I will also briefly discuss the complementary constraints provided by cosmological observables such as the effective number of relativistic species (Neff) in the early Universe.

Speaker's Profile

Dr. Rahul Srivastava did his schooling from his hometown of Gorakhpur in Uttar Pradesh. After school he joined Gorakhpur University for his Bachelor of Science, followed by Master of Science from Banaras Hindu University, Varanasi. He then joined Centre for High Energy Physics, Indian Institute of Science, Bangalore for his PhD which he completed in 2012. During his PhD he worked on non-commutative and non-local field theories. After PhD, Dr. Srivastava joined The Institute of Mathematical Sciences, Chennai as a Post Doctoral Fellow where he remained till Jan2013. This was followed by a short stint as Post Doctoral Fellow in Physical Research Laboratory, Ahmedabad till Nov 2016. Dr. Srivastava subsequently joined Instituto de Fisica Corpuscular, Valencia, Spain as Post Doctoral Fellow for the duration Nov2016-Oct2019. He joined Physics Department, Indian Institute of Science Education and Research - Bhopal (IISER-Bhopal) as Assistant Professor in Nov2019. He is currently working in IISER-Bhopal as Associate Professor. Dr. Srivastava has worked on a number of topics beyond the Standard Model of Particle (BSM) Physics, with particular focus on Neutrino and Dark Matter physics. His current research interests include model building and phenomenological analysis of neutrino mass generation and mixing mechanisms, dark matter model building and analyzing phenomenological signatures for BSM physics, particularly in low energy (sub-GeV) terrestrial experiments and cosmological probes.

Annexure-XVII

SRMIST AT 40 A LEGACY UNFOLDS | ACCREDITED BY NAAC GRADE A++

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)
DELHI-NCR CAMPUS, GHAZIABAD (U.P.)

Celebration of Science Week at Delhi-2025

Sectional Committee - V

Engineering & Technology

SRM Institute of Science and Technology
Delhi NCR Campus, Ghaziabad
Uttar Pradesh

Celebration of Science Week at Delhi-2025

Inaugural Ceremony

Programme Schedule

09:30AM	**Invocation**
09:32AM	**Lamp Lighting and Saraswati Vandana**
09:35AM	**Felicitation of Guests**
09:40 AM	**Welcome Address by** **Prof. Dhowmya Bhatt** **Dean IQAC, SRMIST, Delhi-NCR Campus, Ghaziabad**
09:45AM	**Address by** **Prof. R. P. Mahapatra** **Dean, SRMIST, Delhi-NCR Campus, Ghaziabad**
09:50AM	**Address by** **Dr. S. Viswanathan** **Director, SRMIST, Delhi-NCR Campus, Ghaziabad**
09:55 AM	**Special Address by Guest of Honour** **Prof. Indranil Manna** **Vice President** **Indian National Science Academy**
10:05AM	**Keynote Address by Guest of Distinction** **Dr. Raj K. Shirumalla** **Mission Director** **National Biopharma Mission, BIRAC**
10:15 AM	**Presidential Address by Chief Guest** **Prof. Ashutosh Sharma** **President** **Indian National Science Academy**
10:25 AM	**Declaring the event open**

Date: 4th December 2025 **Time:** 9:30 AM **Venue:** Dr. Sarvepalli Radha Krishnan Hall

KeyNote Sessions
on
Engineering & Technology
(Sectional Committee V)

Minute to Minute Programme

Venue: John McCarthy Seminar Hall (Ground Floor- Academic Block)

Session Chair: Professor Yogesh M Joshi
Mr. & Mrs. Gian Singh Bindra Chair, IIT, Kanpur

10:40 AM Prof. Ujjwal Maulik
Jadavpur University, Kolkata

11:00 AM Prof. Jagadeesh Gopalan
Indian Institute of Science, Bangalore

11:20 AM Tea Break

Session Chair: Prof. Suhas S Joshi, IIT Indore

11:40 AM Prof. Jaikumar Radhakrishnan
International Centre for Theoretical Sciences (ICTS-TIFR)

12:00 PM Prof. Chandra Shekhar Sharma
Indian Institute of Technology, Hyderabad

12:20 PM Prof. Sami Erol Gelenbe
Polish Academy of Sciences, Paris

12:40 PM Lunch Break

Session Chair: Prof. Rahul Mitra IIT Kharagpur

02:00 PM Prof. Suddhasatwa Basu
Indian Institute of Technology, Delhi

02:20 PM Prof. Sarit K. Das
Indian Institute of Technology, Madras

Session Chair: Prof. Yogesh M Joshi, IIT Kanpur

03:00 PM Prof. Subhash S. Joshi
Indian Institute of Technology, Indore

03:20 PM Prof. Rahul Mitra
Indian Institute of Technology, Kharagpur

KeyNote Sessions
on
Engineering & Technology
(Sectional Committee V)

Minute to Minute Programme

Venue: Ada Lovelace Seminar Hall (Ground Floor)

Session Chair: Prof. Jayant K Singh, IIT Kanpur

10:40 AM Prof. Sriparna Saha
Indian Institute of Technology, Patna

11:00 AM Prof. Debangshu Dey
Jadavpur University, Kolkata

11:20 AM Tea Break

Session Chair Chair: Prof. Sarit K. Das, IIT Madras

11:40 AM Prof. Jayant K. Singh
Indian Institute of Technology, Kanpur

12:00 PM Prof. R. I. Sujith
Indian Institute of Technology, Madras

12:20 PM Dr. Mohit Verma
CSIR – Structural Engineering Research Center, Chennai

12:40 PM Lunch Break

Session Chair: Prof. Mohit Verma, CSIR – SERC, Chennai

02:00 PM Dr. Tanmoy Chakraborty
Indian Institute of Technology, Delhi

02:20 PM Dr. D. Amaranatha Reddy
IIIT, Design & Manufacturing, Kurnool

Session Chair: Prof. Chandra Shekhar Sharma

02:40 PM Dr. Chirodeep Bakli
Indian Institute of Technology, Kharagpur

03:00 PM Prof. Samit K. Ray
Indian Institute of Technology, Kharagpur

03:20 PM Prof. Tarun Kant
Indian Institute of Technology, Powai, Mumbai

SRMIST AT 40 A LEGACY UNFOLDS

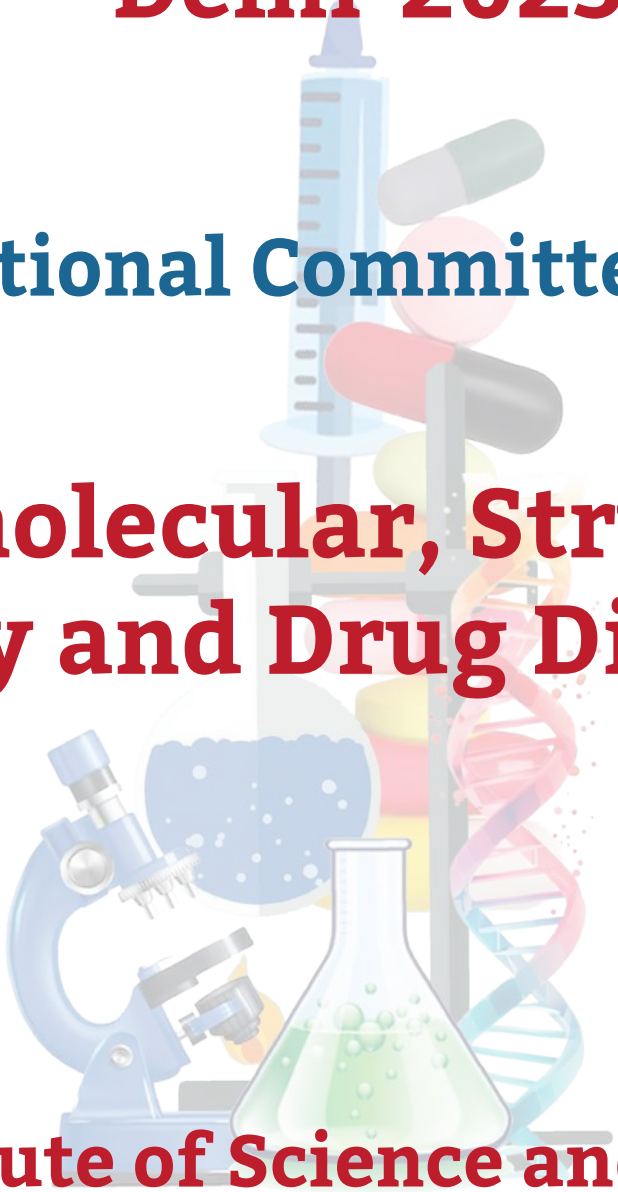
ACCREDITED BY NAAC GRADE A++

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)
DELHI-NCR CAMPUS, GHAZIABAD (U.P.)

Celebration of Science Week at Delhi-2025

Sectional Committee - VIII

Biomolecular, Structural Biology and Drug Discovery



SRM Institute of Science and Technology
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Celebration of Science Week at Delhi-2025

Inaugural Ceremony

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10:15 AM	**Presidential Address by Chief Guest** **Prof. Ashutosh Sharma** **President** **Indian National Science Academy**
10:25 AM	**Declaring the event open**

Date: 4th December 2025 **Time:** 9:30 AM **Venue:** Dr. Sarvepalli Radha Krishnan Hall

KeyNote Sessions
on
Biomolecular, Structural Biology and Drug Discovery
(Sectional Committee VIII)

Minute to Minute Programme

Venue: Peter F Drucker Hall (first Floor - Academic Block)

Session Chair: Dr Rajendra Prasad Roy, Dean, Regional Centre for Biotechnology NCR Biotech Science Cluster, Faridabad-Gurugram

10:45 AM	**Prof. Shantanu Chowdhury** **CSIR-Institute of Genomics and Integrative Biology, New Delhi,**
11:10 AM	**Prof. Patrick D'Silva** **Indian Institute of Science, Bangalore**
11:35 AM	**Tea Break**
11:50 AM	**Prof. Benu Brata Das** **Indian Association for the Cultivation of Science, Kolkata**
12:15 PM	**Prof. Timir Tripathi** **North-Eastern Hill University, Shillong**
12:40 PM	**Lunch Break**
02:00 PM	**Prof. R. Sowdhamini** **National Centre for Biological Sciences (TIFR), Bangalore**
02:25 PM	**Prof. Ravishankar Ramachandran** **CSIR-Central Drug Research Institute, Lucknow**

Sectional Committee -V

Engineering and Technology

Chair
Prof. Yogesh M Joshi, FNA

Dr. Yogesh Joshi earned his B.E. from Pune University in 1996 and his Ph.D. in Chemical Engineering from the National Chemical Laboratory Pune and the Indian Institute of Technology Bombay in 2001. He then joined the Benjamin Levich Institute in New York for post-doctoral studies. In 2004, Dr. Joshi joined the Department of Chemical Engineering at the Indian Institute of Technology Kanpur, where he is currently the Sir J C Bose National Fellow and Mr. and Mrs. Gian Singh Bindra Chair Professor. His research interests include the rheology of complex fluids, soft matter, interfacial science and engineering, clay dispersions, and polymer science and engineering. He is a senior editor of Langmuir and serves on the editorial advisory boards of Physics of Fluids, Journal of Rheology, and Rheologica Acta. Dr. Joshi received the prestigious Shanti Swarup Bhatnagar award in Engineering Sciences in 2015. He is an elected fellow of the Society of Rheology (US), the Indian National Science Academy, the Indian National Academy of Engineering, and the National Academy of Sciences, India.

Limitations for quantum search by circuits of limited quantum depth

Jaikumar Radhakrishnan

International Centre for Theoretical Sciences (ICTS-TIFR)
Bengaluru
E-mail :*jaikumar.radhakrishnan@gmail.com*

We consider algorithms for quantum search with limited quantum depth, that is, algorithms where all the registers are measured after every k queries to the oracle. We provide an information-theoretic proof that any such algorithm to find a marked element in a database with n elements requires Omega(n/k) queries. The lower bound will be obtained by combining considerations of quantum fidelity with a chain rule for Hellinger distance due to TS Jayram. The lower bound itself is not new: it was established by Hamoudi, Liu and Sinha (2023) using sophisticated and more generally applicable machinery that they developed for studying noisy circuits for collision finding. (This is based on unpublished joint work with Rohit Sarma Sarkar.)

Speaker's Profile

Jaikumar Radhakrishnan is a theoretical computer scientist with research interests in complexity theory, randomness and computation, quantum information and computation, combinatorics, and information theory. Radhakrishnan obtained his BTech in Computer Science and Engineering from IIT Kharagpur in 1985, and his PhD in Computer Science from Rutgers University, NJ, USA, in 1991. He joined the Tata Institute of Fundamental Research in 1991; in 2024 he moved to the International Centre for Theoretical Sciences (ICTS-TIFR), Bengaluru, where he is currently a Distinguished Professor.

From Benchmarks to Models: Building the Foundation for Inclusive AI in Indian Languages

Sriparna Saha

Department of Computer Science and Engineering, Indian Institute of Technology Patna, India
Email: sriparna@iitp.ac.in

Benchmarking large and multimodal language models across cultural, multilingual, and healthcare domains is a pressing need. Before deploying these models, it is vital to understand their robustness across diverse tasks. My research began with evaluating AI systems' understanding of India's cultural and linguistic diversity, leading to the creation of two major benchmarks: SANSKRITI and DRISHTIKON. SANSKRITI comprises over 21,000 curated question–answer pairs across 28 states and 8 union territories to assess cultural competence, while DRISHTIKON includes 64,000 text–image pairs in 15 Indian languages, enabling culturally grounded multimodal evaluation. These benchmarks revealed the underrepresentation of Indian languages and contexts in AI, motivating expansion into new domains. CultSportQA evaluates AI reasoning in traditional sports across 60 countries, promoting culturally aware global reasoning. M3LS, the largest multilingual multimodal summarization dataset spanning 20 languages, supports standardized evaluation of summarization from text and images. COSMMIC integrates articles, images, and reader comments for comment-aware summarization in nine major Indian languages. Collectively, these resources advance inclusive, context-aware, and culturally competent AI evaluation. Building on these, we are developing Small Language Models (SLMs) tailored for Indian languages and culturally grounded tasks. In healthcare, we built a small domain-specific model for veterinary medicine, trained with pretraining, fine-tuning, and safety alignment. Complementing this, M3Retrieve offers a multimodal medical retrieval benchmark with 1.2 million documents and 164K queries, and a multilingual trust benchmark spans 15 languages and 18 tasks. Together, these efforts aim to make generative AI robust, reliable, and inclusive for culturally rich and healthcare applications.

Speaker's Profile

Dr. Sriparna Saha received her M.Tech. and Ph.D. degrees in Computer Science from the Indian Statistical Institute, Kolkata. She is currently an Associate Professor in the Department of Computer Science and Engineering, Indian Institute of Technology Patna. Her research interests span natural language processing, generative AI and multimodal learning. Dr. Saha has received numerous recognitions, including the INSA Young Associate (2024), NASI Young Scientist Platinum Jubilee Award, Fulbright-Nehru Fellowship, and the Humboldt Research Fellowship. She has also received multiple Best Paper Awards at prestigious international venues and serves on the editorial boards of several IEEE and ACM Transactions journals.

Hybrid materials as electrode and electrolyte materials for conversion devices

Suddhasatwa Basu

Department of Chemical Engineering,
Indian Institute of Technology Delhi, New Delhi 110016
Email: sbasu@iitd.ac.in

Developing a low-cost effective, readily available, highly efficient electrocatalyst and electrolyte are essential to produce clean and sustainable energy through electrochemical energy storage and conversion devices. The *bi*-functionalized Fe, Co, Ni phosphonates based electrocatalysts have been used for overall water splitting in an alkaline medium due to its higher surface area with microporous channel and the synergistic effect of the highly active metal oxyhydroxide component on the pore wall leading to lower activation overpotentials [Electrochim Acta, 2022 416, 140277]. A 3d-printed membraneless microfluidic electrolyzer (μE) is developed with 1 A/cm^2 current density at 2.4 V [Chem. Eng. J., 2023, 452 (3), 139433]. Further, polyanionic compound, e.g, $Na_3V_2(PO_4)_2F_3$ (NVPF), which suffers from the intrinsic drawbacks of poor electronic conductivity, limited reversible capacity, and severe volume alterations during intercalation-deintercalation cycling in Na-ion battery, is coated with boron doped carbon (BDC) to bring synergistic contribution of morphology and surface modulation on the electrochemical activity of NVPF/BDC electrode. In another example, a protective layer ZIF 8 based MOF on the zinc anode has proven to be an effective approach for aqueous zinc-ion batteries slowing down dendrite formation. We have worked on development of all solid-state cobalt free Li-ion battery in collaboration with Bar-Ilan University, which is based on $LiNiO_2$ (LNO) cathode coated with $LiAlZnO_2$ (LAZO) protective layer of 4 nm thickness along with argyrodite solid electrolyte which is safe and durable [3]. LAZO@LNO-based ASSLB deliverred a high specific capacity of 4.65 mAh·cm^{-2} (184.48 mAh·g^{-1}) and 4.14 mAh·cm^{-2} (159.5 mAh·g^{-1}) with a good capacity retention of 81.46% after 60 cycles and 70.31% after 200 cycles at a current density of 0.454 mAcm^{-2} and 0.934 mAcm^{-2}, respectively [[Nat Nanotech, 2024, 19, 208–218]. Further, Nd-based perovskites $Nd_{0.67}Sr_{0.33}Co_{0.8}Fe_{0.2}O_{3-\delta}$ (NSCF) have been developed as an efficient IT-SOFC cathode, which exhibits outstanding power densities of 1.52 W/cm² at 700°C [Small, 2025, 21, 240896].

Speaker's Profile

Prof. Suddhasatwa Basu completed Ph.D./MS in Chemical Engineering from Indian Institute of Science, Bangalore. He holds FIPI Chair Professor on Clean Energy at IIT Delhi. Earlier, He was the Director of CSIR-Institute of Minerals & Materials Technology, Bhubaneswar. He has vast work experience on development of materials for energy conversion and storage devices, e.g., Hydrogen & Fuel Cells Technologies and Li-/Na- Ion Battery, Electrosynthesis. He has published more than 290 articles in high impact journals with H-index 56, 10 granted patents and 6 filed, and 2 technologies transferred to industries. He is a Fellow of Indian National Science Academy (designated), National Academy of Science of India, Indian National Academy of Engineering, Royal Society of Chemistry UK and received Fulbright fellowship, Herdillia Award, Dr A. V. Rama Rao Foundation's Research Award, SMC Gold Medal, MSRI Medal.

Rising from ashes like the phoenix, nanofluids: providing breakthroughs in thermal management and beyond

Sarit K Das

Indian Institute of Technology Madras
Email:skdas@iitm.ac.in

At the beginning of the millennium, Nanofluids, which are dilute suspensions of nanoparticles in Newtonian liquids came with a huge promise in the arena of thermal management technologies. The relentless miniaturization and increasing power densities of electronic devices pose significant thermal management challenges. Nanofluids were seen as a significant emerging technological innovation to tackle these challenges. However, some controversies regarding stability and the quantum of property enhancement had put breaks on its progress towards full potential of its usage. In reality, the above discrepancy arises from the lack of standardization in the method of preparation. Of late, Nanofluids have made a strong comeback proving its decisive edge over usual cooling fluids in as diverse fields as cooling of electronics, Battery Thermal Management Systems (BTMS), and even hyperthermia treatments for tumor ablation. This lecture traces this development and also demonstrates the application of Nanofluids in a particular case of processing electronic material. Nanofluids, engineered by dispersing nanoparticles such as hBN in unique Deep Eutectic Solvents (DES), exhibit superior thermal properties. Furthermore, innovative geometries, such as mini-channel heat sinks with optimized flow features, can further enhance heat dissipation by promoting efficient heat transfer mechanisms. Choosing the right cooling method with environmental consideration is mandatory in the current global warming scenario. The current organic solvents replacing the presently used harmful engineering fluids will reduce the global warming potential (GWP) rating.

Speaker's Profile

Prof. Sarit K. Das, Institute Professor at IIT Madras and first V. Balakrishnan Chair occupant, is a former Director of IIT Ropar. A leading expert in nanofluids, his research spans thermo-fluidics, BTMS, fuel cells, and bio-microfluidics. He is a Fellow of NASI, INAE, Humboldt Foundation, Asian Union of Thermal Sciences and Engineering (AUTSE), and a JC Bose awardee. A Peabody Professor at the Massachusetts Institute of Technology (2011), he received the India Citation Award (2012) and IIT Madras Lifetime Achievement Award. He is an associate editor of Heat Transfer Engineering. He received the Lifetime Achievement Award from IIT Madras.

Shocking - Yet True…

G. Jagadeesh

Department of Aerospace Engineering , Indian Institute of Science
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Email:jaggie@iisc.ac.in

The phenomenon of "Shock Waves" has been historically associated with aerospace engineering and in particular with supersonic flight. Shock waves appear in nature, when different elements in a fluid approach one another with a velocity higher than the local speed of sound. These waves are also generated if massive energy dissipation takes place within ultra-short time in events like explosions. A number of methodologies/facilities to generate shock waves of requisite strength have been designed and indigenously built in the Laboratory for Hypersonic and Shockwave Research (LHSR) in Indian Institute of Science (IISc), Bangalore. Over the years, these facilities have facilitated very interesting interdisciplinary research programmes in IISc with participation of several faculty members from physics, chemistry, biology and materials engineering. Some of the novel techniques that will be discussed in this talk includes retractable aero-spikes, smart coatings, forward facing jets and concentrated energy deposition for reducing the aerodynamic drag around vehicles flying at hypersonic speeds. Concurrently, utilizing the remarkable ability of shock waves to instantaneously enhance the pressure and temperature in the propagating medium, several innovative shock-wave assisted techniques have been developed in LHSR. These include non-intrusive needleless vaccine delivery, cell transformation, Wound healing in diabetic patients, bio-film destruction, polyphenol enrichment in tea, metal texture modification, and preservative impregnation in bamboo. A broad overview of the recent Transdisciplinary shock wave science and technology development activities at LHSR will be presented in this lecture.

Speaker's Profile

Prof. Gopalan Jagadeesh is a Senior Professor in the Department of Aerospace Engineering, and the Founder Chairman of Centre of Excellence in Hypersonics, in IISc, Bangaluru. He mentors many start-ups formed with equity participation from IISc to commercialize several of his discoveries related to shock waves and allied areas. Prof. Jagadeesh is one of the leading researchers in Hypersonic Aerothermodynamics and shock wave propagation in complex fluids. He has published extensively in addition to holding 25 patents on various discoveries related to Shock Waves and hypersonic flow control. He is currently the President of the International Shock Wave Institute, Sendai, Japan. He is a Fellow of the prestigious Royal Aeronautical Society (UK), Indian Academy of Sciences, National Academy of Sciences and National Academy of Engineering. Prof. Jagadeesh is very passionate about spreading scientific temper especially among rural high school/college students in India and has interacted with over 600,000 till date.

INSA New Fellow Lecture

Designing Durable Liquid-Infused Surfaces for Liquid Food Packaging

Suhas S Joshi[a,b]

[a] Department of Mechanical Engineering, Indian Institute of Technology Bombay, Mumbai 400 076, India, [b] Department of Mechanical Engineering, Indian Institute of Technology Indore, Indore 453 552, India

Adhesion of sticky liquid foods such as honey, ketchup, and yoghurt to packaging surfaces leads to product wastage and poses challenges in cleaning and recycling. Bio-inspired by the Nepenthes pitcher plant, Liquid-Infused Surfaces (LIS) offer a practical solution to minimize residue through a stable, immiscible lubricant film entrapped within textured cavities. However, the durability of LIS depends strongly on texture geometry and lubricant properties. Flow-based simulations across four cavity shapes identified the rectangular cavity as the most robust geometry for lubricant retention under shear in laminar flows, exhibiting minimal depletion across viscosity ratios ($0.2 \leq \mu_r \leq 1.0$) and Reynolds numbers ($100 \leq Re \leq 1000$). Under low-frequency oscillations (0.1–10 Hz) representing transport vibrations, stability improved for denser lubricants and more viscous external liquids, while oscillation amplitude showed negligible influence. The findings were experimentally validated on stainless-steel substrates textured with femtosecond-laser 2D pillars bearing LIPSS and infused with silicone oils of 5 cSt, 20 cSt, and 100 cSt. Results with honey (Newtonian) and four shear-thinning foods: mango juice, cold coffee, ketchup, and yoghurt, showed low critical sliding angles (<32°). Increasing lubricant viscosity systematically enhanced durability; higher-viscosity LIS shed more drops with minimal residue after repeated cycles, while immersion tests confirmed sustained repellency and lubricant retention. Overall, rectangular-cavity LIS with viscous lubricants provide a robust and scalable design for sustainable food packaging and open pathways for large-scale applications in cosmetic and pharmaceutical containers.

Speaker's Profile

Dr. Suhas Joshi is currently the Director, IIT Indore. He is a Fellow of the Indian National Academy of Engineering (INAE), the National Academy of Sciences of India (NASI), and The American Society of Mechanical Engineers (ASME). Prior to joining IIT Indore as the Director in Jan 2022, at IIT Bombay, Dr. Joshi was Rahul Bajaj Chair Professor (2014-22). He also served as the Dean of Alumni and Corporate Relations (2018-22) and the Head of Mechanical Engineering Department (2014-17). Dr. Joshi obtained his Ph.D. from IIT Bombay in 1997 and worked with Engineering Research Centre of Tata Motors, Pune before joining IIT Bombay as a faculty member in 1999. Dr. Joshi was a Research Affiliate at Georgia Tech, USA while pursuing post-doctoral research supported by BOYSCAST Fellowship of Govt. of India in 2002. He was a Visiting Faculty at the University of Illinois at Urbana-Champaign, USA during 2005-06. During 2009-14, he spearheaded establishment of 'National Centre for Aerospace Innovation and Research (NCAIR)', at IIT Bombay as its founding Principal Investigator. The centre was an industrial consortium mainly supported by Govt. of India and The Boeing Company. Dr. Joshi's research work involves improving the productivity and quality of multi- scale machining processes through physics-based modelling. He has undertaken over 35 research, consultancy, and infrastructure development projects sponsored by aerospace, nuclear, defence organizations and industries. Dr. Joshi has several editorial assignments with prestigious international journals during all these years. Dr Joshi received Dr. P. K. Patwardhan Technology Development award (2008) and Best Faculty award of Mechanical Engineering Department (2007) at IIT Bombay. Dr. Joshi has supervised 4 post-doctoral and 24 doctoral students. He is currently guiding 2 Ph.D. students. He also has supervised more than 120 masters' dissertations. Dr. Joshi has around 360 publications including over 210 in refereed international journals.

Artificial Intelligence and Machine Learning for Healthcare Systems

Ujjwal Mauliks

Department of Computer Science and Engineering
Jadavpur University
Kolkata-700032

In this lecture, first the fundamental, current trends and challenges in Artificial Intelligence (AI) and Machine Learning (ML) will be discussed. The basic concept of supervised, unsupervised and Deep Learning (DL) algorithms will be presented. We will also learn the utility of explainable and trusted AI. In the second part of the lecture, we will present how advance ML techniques and Graph Algorithms can be used to build better healthcare system. In this regard, we will demonstrate the use of DL as well as Graph Neural Network (GNN). We will also discuss the challenges faced by a newly developed startup in this domain. Finally, we will conclude by presenting the future advancement of AI and ML.

Speaker's Profile

Dr. Ujjwal Maulik is a Professor in the Dept. of Comp. Sc. and Engineering., Jadavpur University since 2004. He was also the former Head of the same Department. Dr. Maulik has worked in many universities and research laboratories around the world as visiting Professor/ Scientists. including USA, Germany, France, Australia, China, Italy, Poland and Slovenia. He is the Fellow of INAE, NASI, IAPR, AAIA, IEEE. He has also received Humboldt Fellowship, Germany and Senior Associateship of ICTP, Italy. His research interest include Machine Learning, Pattern Analysis, Data Science, Bioinformatics, Multi-objective Optimization, Social Networking, IoT and Autonomous Car. In these areas he has published ten books, more than three hundred fifty papers, mentoring several start-ups, filed several patents and already guided twenty five doctoral students.

Mechanical behavior and oxidation resistance of materials tailored for ultra-high temperature aerospace applications

Rahul Mitra

Department of Metallurgical and Materials Engineering
Indian Institute of Technology Kharagpur, Kharagpur 721302, West Bengal
Email: rahul@metal.iitkgp.ac.in

The rapid technological growth of aerospace sector in recent years has driven the development of materials for use under extreme environments at temperatures beyond the limit of nickel based superalloys. In this context, molybdenum (Mo) and niobium (Nb) silicide based refractory intermetallic alloys as well as the carbon fibre reinforced silicon carbide (C_f-SiC) composites are considered candidate materials to increase the operating temperatures of aero-engines, whereas the ZrB_2-SiC based ceramic composites are attractive for potential applications in nose-cones and leading edges of hypersonic vehicles. These materials are designed to retain strength and resist environmental degradation at high temperature, as well as exhibit adequate fracture toughness at room temperature. Ductile phase toughened Mo-Si-B and Nb-Si alloys are found to exhibit impressive strength retention along with high temperature oxidation resistance, with significant improvement caused by suitable alloying additions. The oxidation resistance of both Mo-Si-B alloys and ZrB_2-SiC composites is contributed by formation of a self-healing borosilicate glass scale. In ZrB_2-based composites, 20 vol% SiC reinforcement leads to an optimum resistance to oxidation, thermal shock and ablation, while the fracture toughness remains poor. The C_f-SiC composites designed with Si-B-C modified matrix and weak interphase of multi-layered $(PyC\text{-}SiC)_n$ exhibits increase in strength with temperature along with improved fracture toughness and damage tolerant behavior due to crack bridging by partially debonded fibres. Enhanced ablation resistance without compromising the damage tolerance is obtained in hybrid C_f-ZrB_2-SiC composites processed by infiltrating ZrB_2-SiC slurry into C-fibre preforms. Selected experimental results along with the involved mechanisms will be discussed.

Speaker's Profile

Prof. Rahul Mitra is a Professor of Metallurgical and Materials Engineering at IIT Kharagpur, where he joined after serving as scientist at DMRL, Hyderabad during 1993-2002. He received B.Tech (Hons.) in Metallurgical Engineering from IIT Kharagpur in 1988 and Ph.D. from Northwestern University, USA in 1992. His research is primarily focused on refractory intermetallic alloys and ceramic-matrix composites for ultra-high temperature applications. He has authored/co-authored 220 journal papers, 13 book-chapters, and 2 books. He is fellow of INAE, NASI, IIM and EMSI, while his awards include MRSI Medal, Metallurgist of the Year, GD Birla Gold Medal, and Faculty Excellence award.

Emerging Semiconductor Heterostructures for Optoelectronic and Neuromorphic Devices

Samit K Ray

Department of Physics, Indian Institute of Technology Kharagpur, Kharagpur-721302, India
email: physkr@phy.iitkgp.ac.in

We shall discuss the characteristics of 2D materials and perovskite nanocrystals based hybrid heterostructures for optical and neuromorphic devices. We noted a significant improvement in hot carrier relaxation dynamics, with a larger bi-exciton redshift in Cu-doped $CsPbI_3$ nanocrystals, leading to higher intraband recombination time. Hybrid heterostructures comprising of zero-dimensional perovskite nanocrystals having excellent photosensitive characteristics offer the possibility to achieve next generation optoelectronic devices with superior functionalities. This has been demonstrated through giant photo-amplification in highly stable α-$CsPbI_3$ NCs on layered WS_2 mixed-dimensional heterostructures photo-FET with asymmetric contacts. Utilizing the superior luminescence properties and high colour purity of inorganic perovskite nanocrystals, we reported the fabrication of colour-saturated $CsPbBr_{3-x}I_x$ (x=0-3)/ZnO heterojunctions based white light emitting diodes on a flexible platform. We shall also discuss the doping-induced transition from positive to negative photo-conductance effect in perovskite nanocrystals, expanding their potential for both excitatory and inhibitory optical synapse applications. The optical responses of perovskite nanocrystals provide an opportunity towards developing low power brain-like cognitive systems. Our results highlight the potential of 2D and perovskite hybrid heterostructures for emerging optoelectronic and neuromorphic devices, paving the way for on-chip and energy-efficient computing hardware systems.

Speaker's Profile

Prof. Samit K. Ray is a Chair Professor in the Department of Physics, IIT Kharagpur. He has previously served as the Director S. N. Bose National Centre for Basic Sciences, Kolkata, Dean (Post-graduate & Research Studies) and Head, Physics at IIT Kharagpur. His research interests are in the area of semiconductor nanostructures, quantum technology, and nanophotonic devices. He is an elected fellow of the Indian Academy of Sciences, National Academy of Sciences India, Indian National Academy of Engineering, and is the recipient of INSA Young Scientist Award, UGC Homi Bhabha Award, MRSI Superconductivity & Materials Science Senior Award etc.

Accelerated material discovery: Integrating AI/ML and molecular simulations

Jayant K Singh

Om Prakash Gautam Chair Professor, Department of Chemical Engineering, Indian Institute of Technology Kanpur
Email: jayantks@iitk.ac.in

Artificial intelligence (AI) and machine learning are transforming computational materials discovery, opening new pathways for designing materials for gas separation, CO_2 capture, and conversion. From single-atom catalysts and transition metal carbides to MXenes and advanced membranes, AI-driven insights are accelerating progress at the intersection of energy transition and digital innovation.

This talk will highlight proof-of-concept examples of AI in materials discovery. I will first discuss how AI enables the design of 2D crystalline materials—such as MXenes and single-atom catalysts—for hydrogen generation and CO_2 capture. I will then address the challenges of extending these methods to 3D crystalline materials for gas separation and outline strategies to overcome them. Finally, I will introduce the concept of inverse design for discovering novel materials.

Speaker's Profile

Prof. Jayant K. Singh is the Om Prakash Gautam Chair Professor in the Department of Chemical Engineering at IIT Kanpur. He earned his B.Tech. from IIT Kanpur and his M.S. and Ph.D. from SUNY Buffalo, USA. Founder of Prescience Insilico, he has authored over 200 papers and holds seven patents. A recipient of the INAE-SERB Abdul Kalam Technology Innovation National Fellowship, NASI-Reliance Platinum Award, and SERB STAR Award, he is an elected fellow of all four national academies of India. He currently serves as Associate Editor of Chemical Engineering Communications and on advisory boards of multiple ACS journals.

Complex system approach to investigate and mitigate thermoacoustic instability in turbulent combustors

R.I. Sujith

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Thermoacoustic instability is a catastrophic phenomenon where ruinously large amplitude oscillations of sound are established in jet engines and rockets. Such large-amplitude sound emerges as a result of the feedback between the combustion processes and sound waves in the combustor. Traditionally, a linear framework has been used to study thermoacoustic instability. In contrast, we view thermoacoustic system in a turbulent combustor as a complex system where several nonlinear feedback processes are involved, resulting in the emergence of a variety of intriguing dynamical states. We discuss recent discoveries including different types of transitions leading to thermoacoustic instability. Further, we discuss how our discoveries based on complex system theory are translated to technologies for prognosis and mitigation.

Speaker's Profile

Sujith received his B. Tech from IIT Madras and M. S. (1990) & Ph. D. (1994), from the Georgia Institute of Technology. He is currently an Institute Professor and D. Srinivasan Chair Professor at IITM. He was the founding Editor-in-Chief of the International Journal of Spray and Combustion Dynamics. He is an International Member of the US National Academy of Engineering, a Distinguished Fellow of the International Institute of Acoustics and Vibration and a fellow of the Combustion Institute, INAE, IASc and Ambassador of TU Munich. Sujith's research interests are in the areas of thermoacoustic instability and complex systems theory.

From Earth to Mars: Pioneering Metal-Carbon Dioxide (Metal-CO2) Battery Solutions for a Greener Tomorrow

Chandra Shekhar Sharma

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As climate change intensifies, energy solutions for Earth have become crucial towards a sustainable future. Metal-carbon dioxide (CO_2) batteries offer a transformative approach, converting CO_2 into usable energy while addressing carbon management and reducing emissions. Beyond Earth, these batteries hold significant potential for Mars, where CO_2 is abundant (95 %) providing essential power for future colonies, supporting habitats and life support systems. By harnessing the in-situ resources of Mars, metal-CO_2 batteries could enable sustainable living on the Red Planet. However, its practical implementation faces challenges, including low cyclability, high overpotentials, and poor reversibility due to the thermodynamic stability of discharge products like Li_2CO_3 and amorphous carbon. Our work addresses these challenges by developing unique catalysts including carbon, transition metals, composite nanoparticles. These catalysts enhance the CO_2 reduction and therefore the cyclability of the system. Their bifunctional catalytic behavior helps reduce the activation energy required for the decomposition of the Li_2CO_3 and amorphous carbon, resulting in enhanced reversibility. Benefitting from this, we were able to achieve a cycle life of ~200 cycles at the current density of 500 mA g^{-1} for a limited capacity of 500 mAh g^{-1} along with an operational time exceeding 600 hours. Additionally, we explored translating the system from lithium to the more abundant sodium and potassium metals, paving the way for future sustainable energy solutions.

Speaker's Profile

Prof. Chandra Shekhar Sharma earned his Ph.D. from IIT Kanpur in 2010 and has been with IIT Hyderabad since then, where he currently serves as the Head of the Department of Chemical Engineering. He has also served as Dean (Sponsored Research & Consultancy) at the institute. A recipient of the prestigious Swarna Jayanti Fellowship and an Associate Fellow of the Indian National Science Academy (INSA), Prof. Sharma has authored over 170 research publications and holds several granted patents. He has supervised 19 Ph.D. scholars in diverse areas such as energy storage systems, gas sensors, and drug delivery. His research group is actively engaged in developing advanced battery chemistries—including metal-CO_2, metal-sulfur, and dual-carbon systems—along with nature-inspired functional surfaces towards an eco-friendly, sustainable future.

CdS Photocatalysts for Visible-Light Hydrogen Evolution: Challenges, Strategies and Future Prospects

D. Amaranatha Reddy

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Hydrogen (H_2) is widely recognized as a clean and sustainable energy carrier for future carbon-neutral societies. Among various H_2 production approaches, photocatalytic water splitting driven by solar energy is highly attractive due to its low cost, environmental friendliness, and abundant sunlight. Cadmium sulfide (CdS) is one of the most promising visible-light-responsive photocatalysts because of its suitable bandgap (~2.4 eV), strong absorption in the visible region, and favourable conduction band position for proton reduction. However, pristine CdS still faces several major challenges, including photo-corrosion, fast electron–hole recombination, and limited surface active sites, which restrict its practical hydrogen evolution efficiency and stability. To overcome these drawbacks, significant research efforts have focused on designing heterojunctions, co-catalyst loading, defect engineering, morphology control, and surface passivation strategies. Coupling CdS with materials such as MoS_2, g-C_3N_4, graphene derivatives, nickel phosphides (Ni_2P), or noble metals can effectively enhance charge separation and improve redox kinetics. Similarly, introducing oxygen/sulfur vacancies and synthesizing nanostructures including nanorods, quantum dots, and hollow spheres has shown remarkable improvement in light harvesting and catalytic performance.

In this talk, we will highlight the recent progress of CdS-based photocatalyst systems for hydrogen fuel production, discuss structure–property relationships and charge transfer mechanisms, and summarize current challenges and future research directions toward scalable, stable, and non-sacrificial system development.

Speaker's Profile

Dr. D. Amaranatha Reddy is an Associate Professor in the Department of Sciences (Physics) at IIITDM Kurnool, Andhra Pradesh. He received his PhD in 2013 from Sri Venkateswara University, Tirupati, and worked as a researcher at Yonsei University and Pusan National University, South Korea, from 2013–2020. His research interests include nanoscale materials for solar fuels (hydrogen production), photocatalytic water purification, CO_2 conversion, and energy storage devices such as solar cells, supercapacitors, and batteries. He has published 130 research papers and currently leads seven funded research projects worth ₹1.7 crore from agencies like SERB, DRDO, APSCHE, UGC-DAE, etc.

Nanostructured Pathways for Sustainable Energy Future

Chirodeep Bakli

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Nanoscale innovations are central to the transition toward a sustainable future, offering enhancements in the efficiency, durability, and adaptability of energy systems. These innovations emerge from an intricate interplay of interfacial physics, molecular transport and energy conversion processes across multiple scales. A combination of experiments, molecular simulations, and data-driven analysis provides a research pathway to establish design principles for controlling wettability, entropy, and heat flow dynamics at the nanoscale. At the fluid-solid interface, wettability-modulated transport, coupled with enthalpic-entropic decomposition analyses, reveals the complex relationship between nanoscale ordering, resultant fluid transport, and energy dissipation. These insights play a vital role in numerous applications, ranging from desalination and oil-water separation to moisture capture and nanoscale transport, where interfacial forces dictate transport and selectivity. These fundamental molecular insights converge to inform the design of nanostructured materials and interfaces for sustainable energy systems, ultimately leading to real, functional systems. This interfacial control transitions into the applied domain of sustainable energy materials, particularly engineered substrates for enhanced transport, low-cost filtration/separation and thermal regulation via passive cooling. These applications, spanning confined nanofluidic channels to macroscale thermal management systems, underscore that molecular-level control of interfacial phenomena can effectively translate into enhanced macroscale energy efficiency. The integration of radiative and evaporative cooling strategies, photovoltaic performance enhancement, and selective separation processes establishes a unified framework that integrates material design with thermodynamics and molecular insights. Collectively, these developments advance the foundation for sustainable, adaptive, and energy-resilient technologies.

Speaker's Profile

Dr. Chirodeep Bakli is an Associate Professor in the School of Energy Science and Engineering at IIT Kharagpur. He has published over 60 papers in leading journals, including Physical Review Letters, Nano Letters, Nanoscale, and Physics of Fluids. His research integrates micro/nanoscale fluid mechanics, interfacial transport, and energy conversion to advance thermal management, energy harvesting, and fluidic diagnostics. Renowned for his work on wettability, electrokinetic flows, and smart surface design, he bridges molecular-scale insights with sustainable energy applications. A senior IEEE member and recipient of the Faculty Excellence Award, he serves on editorial boards and mentors interdisciplinary teams.

Towards Designing Efficient, Adoptable and Interpretable Large Language Models

Tanmay Chakraborty

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Despite the superior performance demonstrated by Large Language Models across numerous applications involving natural languages, their high computational cost, energy consumption, and limited accessibility underscore the need for efficient, interpretable, and adaptable language models (LMs). This talk highlights methods to develop economical and interpretable LMs that rival their larger counterparts in performance without significant computational requirements. Our research emphasizes three key dimensions: economical resource usage, adaptability to diverse and low-resource tasks, and enhanced interpretability. Techniques like competitive knowledge distillation, leveraging student-teacher dynamics, and activation sparsity in manifold-preserving transformers demonstrate significant efficiency gains without compromising performance. We formulate novel decomposer components for LMs for modularizing problem decomposition and solution generation, allowing smaller models to excel in complex reasoning tasks. We also propose innovative prompt construction and alignment strategies that boost in-context knowledge adaptation in low-resource settings for SLMs. Our findings demonstrate that small LMs can achieve scalability, interpretability, and adaptability, paving the way for broader and sustainable AI accessibility.

Speaker's Profile

Tanmoy Chakraborty is a Rajiv Khemani Young Faculty Chair Professor in AI and an Associate Professor in the Dept. of Electrical Engineering and the School of AI at IIT Delhi. His research primarily focuses on building economical, adaptable and interpretable language models for social good. He served as the DAAD visiting professor at MPI Saarbrucken, PECFAR visiting professor at TU Munich and Humboldt visiting professor at TU Darmstadt. Tanmoy has received numerous recognitions, including the Indian National Academic of Science Young Associate, Ramanujan Fellowship, ACL '23 Outstanding Paper Award, IJCAI'23 AI for Social Good Award, and several faculty awards from industries like Microsoft, Google, LinkedIn, JP Morgan, and Adobe. He has authored two textbooks -- "Social Network Analysis" and "Introduction to Large Language Models". Tanmoy earned his PhD from IIT Kharagpur in 2015 as a Google PhD Scholar.

Real-Time Hybrid Simulation for Dynamic Response Evaluation of Complex Engineering Systems

Mohit Verma

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Experiments are fundamental to validating scientific theories and hypotheses, providing insights into the intricate phenomena observed in nature. In structural engineering, dynamic behaviour is often studied using quasi-static, pseudodynamic and shake table testing methods. While these methods are widely used, they each have notable limitations. Real-Time Hybrid Simulation (RTHS) is an innovative experimental technique that overcomes the challenges of classical techniques. By combining the physical testing of selected structural components with numerical simulation of the remaining system, RTHS provides a more accurate and economical means of studying complex dynamic behaviour. This approach enables researchers to focus on the critical or poorly understood components of a structure while leveraging computational models for the rest, offering a comprehensive understanding of system dynamics. To enhance the stability and practical implementation of RTHS, a novel impedance matching approach was developed. This method simplifies control design and improves the robustness of real-time coupling between physical and numerical substructures. The developed RTHS framework has been successfully applied to validate vibration control strategies for wind turbines under dynamic loading. It has also been extended to evaluate the performance of elastomeric isolation systems subjected to combined thermal and seismic effects, advancing the experimental investigation of multi-hazard scenarios. These efforts have significantly broadened the applicability of RTHS across diverse engineering domains establishing it as a powerful tool for performance-based design and parametric studies.

Speaker's Profile

Dr. Mohit Verma is currently a Principal Scientist at the Advanced Seismic Testing and Research Laboratory, CSIR-SERC. His research interests include dynamic testing methods, control design for hybrid testing, and active vibration control of structures. He is a recipient of the prestigious Fulbright–Nehru Doctoral and Professional Research Fellowship and the IEI Young Engineer Award in the Civil Engineering Division. Dr. Verma conducted his postdoctoral research at the Precision Mechatronics Laboratory, Université libre de Bruxelles (ULB), Belgium, and at the University at Buffalo, New York, USA.

Sectional Committee VIII

(Biomolecular, Structural Biology and Drug Discovery)

Chair
Dr. Rajendra Prasad Roy, FNA

RP Roy works in the area of protein science and engineering, and has authored several research papers and patents. Dr Roy is a recipient of the National Bioscience Award for Career Development and JC Bose National Fellowship. He is an elected Fellow of all the three major Science Academies of India.
Dr Roy holds a PhD degree from the Indian Institute of Science Bangalore, and is currently the Dean of the Regional Centre for Biotechnology, Faridabad.

From Protein Structures to Medicinal Plants: A smooth continuum

R. Sowdhamini

National Centre for Biological Sciences (TIFR) Bangalore
Email: mini@ncbs.res.in

Our laboratory has been interested in relationships amongst protein domains where evolutionary divergences may be large, but there are strong similarities in the overall shape and biological function. We proposed structural motifs as constraints to drive computational searches in sequence space. We next built phylogenetic trees to describe these evolutionary variations. This helped us to ask various questions like – is there a common evolutionary ancestor for protein domains that cluster together? Can we extrapolate common biological function whenever protein domains co-cluster? Where do functionally important residues reside? In the process, we chose to study medicinal plants where abundant information is present on evolutionary divergence of enzymatic domains. We chose plants like Tulsi to perform genome assembly and I will share our experiences. Finally, I will also present our more recent study of transcriptome of Aparajitha or Sankapushpi where different biosynthetic enzymes and their tissue localisations could be analysed.

Speaker's Profile

Sowdhamini is a Senior Professor in National Centre for Biological Sciences since 1998. She received her basic degree and Masters in Chemistry. She worked on fold prediction and protein domains during her postdoctoral tenure in Prof Tom Blundell's laboratory in University of Cambridge. Broad research interests in Dr. Sowdhamini's laboratory in NCBS have been in the analysis of protein structural similarities and distant relationships amongst proteins. Sowdhamini was a Wellcome Trust Senior Research Fellow and DBT career fellow. She is a Fellow of Indian National Science Association and Indian Academy of Sciences. She holds a JC Bose Fellowship.

Molecular interplay between FG-Nup98 and Tau through phase separation and co-condensation in Alzheimer's Disease

Timir Tripathi

Professor, Molecular and Structural Biophysics Laboratory, Department of Zoology, School of Life Sciences, North-Eastern Hill University, Shillong-793022, India
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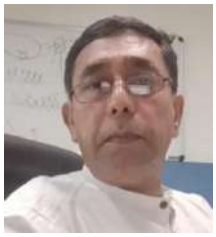
Aberrant aggregation of the microtubule-associated protein tau is a defining feature of several neurodegenerative diseases. Recent evidence indicates that monomeric tau interacts with the FG-repeat domain of Nup98, a component of the nuclear pore complex, thereby compromising nuclear membrane integrity and disrupting nucleocytoplasmic transport. These observations suggest that tau–FG-Nup98 interactions precede tau aggregation, yet whether and how these proteins undergo liquid–liquid phase separation (LLPS) prior to oligomerization remains unknown. Here, we integrate in vitro assays, microscopy analyses, and multiscale simulations to elucidate the molecular basis of tau–FG-Nup98 coassembly. Droplet assays, fluorescence recovery after photobleaching, and high-resolution microscopy reveal that tau and FG-Nup98 form heterotypic condensates whose material properties and architectures depend on stoichiometry. These condensates range from homogeneously mixed droplets to nested assemblies with distinct internal organization. Molecular docking and atomistic simulations identify intrinsically disordered interface regions that stabilize co-condensates through a dynamic network of weak, multivalent interactions. These findings establish a mechanistic framework connecting tau LLPS with impaired nucleocytoplasmic transport and suggest that modulating FG-Nup98 phase behaviour could mitigate tau-mediated neurodegeneration.

Speaker's Profile

Prof. Timir Tripathi, Professor of Molecular Biology at NEHU, Shillong, earned his Ph.D. from JNU, New Delhi, while working at CDRI, Lucknow. He previously served as the Regional Director of IGNOU, Kohima, Nagaland. His research focuses on protein-substrate interactions, conformational dynamics, intrinsically disordered proteins in neurodegenerative diseases, and drug-target proteins from Fasciola gigantica. With 150+ publications and 9 books, he serves as Senior Editor of Critical Insights in Biophysics, Editor of the International Journal of Biological Macromolecules (Elsevier), Associate Editor of PLOS Neglected Tropical Diseases, Advisory Board Member of FEBS Letters, and is on the editorial boards of several other leading international journals.

Indian Breast Cancer Genome Atlas: Predicts Cancer Recurrence in Indian patients



Shantanu Chowdhury

Integrative and Functional Biology Unit, CSIR-Institute of Genomics and Integrative Biology, New Delhi, India and Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, India
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The CSIR supported multi-centre program is making genomic profiles ~1000 breast cancer patient tumors (and matched normal tissue), with follow-up to characterize potential genomic signature(s) associated with response to therapy. Data from the study comprise whole genome sequencing at relatively high depth, transcriptome and epigenome sequencing. Overall the program seeks to not only create India-specific cancer genomic resources, but also aid in identifying actionable molecular signatures of clinical significance. In about 3.5 years, the program has built a network of more than 12 primary hospitals across India, and profiled 800+ breast tumors along with clinical follow up. Interesting trends in molecular attributes of Indian breast cancers are emerging that promise early prediction of potential recurrence.

Speaker's Profile

Shantanu Chowdhury is a professor at the CSIR-Institute of Genomics and Integrative Biology in Delhi. His research interests include understanding mechanisms behind telomerase control and telomere function. Fundamental work from his group on how non-duplex DNA structures impact our understanding of biological mechanisms are widely followed. He currently leads a consortium of more than 100 doctors, data scientists and biologists for a program that is constructing the first-ever Genome Atlas of Indian Breast Cancers. In 2012, Shantanu received the Shanti Swarup Bhatnagar Award in Biological Sciences. He is Fellow of the Indian Academies and former Senior Fellow of the DBT / Wellcome Trust India Alliance.

Understanding the role of PARK7/DJ-1 Family Proteins in Parkinson Disease Progression.

Patrick D'Silva

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Parkinson's disease (PD) is among the most prevalent neurodegenerative disorders, and its progression is hallmarked by elevated metabolic stress with the accumulation of toxic reactive carbonyl species (RCS) generated in various biochemical pathways, particularly Methylglyoxal (MG) and Glyoxal (GO). Both MG and GO extensively modify and damage cellular macromolecules, causing genetic mutations, DNA breaks, protein aggregation, and organelle dysfunction. Emerging research findings suggest that human DJ-1/*PARK7*, a genetic determinant of PD, may regulate diverse stress conditions and have a protective effect on mitochondrial integrity. However, the molecular insights into how DJ-1 regulates mitochondrial health in PD are still enigmatic.

To investigate this, we utilized *Saccharomyces cerevisiae* as a model organism, which contains four DJ-1 homologs that share similar properties with human DJ-1. Our study highlights that yeast DJ-1 orthologs function as novel enzymes involved in the preferential scavenging of glyoxal and methylglyoxal, toxic metabolites, and genotoxic agents. Their collective loss stimulates chronic glycation of the proteome and nucleic acids, leading to a spectrum of genetic mutations in both nuclear and mitochondrial genomes. In addition, RNA glycation significantly lowered mRNA translational efficiency in the absence of DJ-1 paralogs. Moreover, the DJ-1 paralogs efficiently repair severely glycated macromolecules derived from carbonyl modifications. Under RCS stress conditions, the DJ-1 paralogs redistribute into mitochondria and attenuate the glycation of mitochondrial proteins and mtDNA. They also preserve functional mitochondria and protect the integrity of the genome. Our research findings provide an early lead in understanding how mutations in DJ-1 paralogs are involved in the PD-progression.

Speaker's Profile

Prof. PATRICK D'SILVA Completed Ph.D. from the Department of Biotechnology, IIT-Mumbai (2000), and postdoctoral studies at the University of Wisconsin-Madison, Biochemistry department. Currently Professor at department of Biochemistry, Indian Institute of Science, Bangalore, India. mportant Awards/Recognitions: Fellow of all 3 academies (NASI, IAS, INSA), Swarnajayanthi fellow, Sir. C.V. Raman Karnataka State Science award, Life Sciences Karnataka, State, CDRI-award for Excellence in Drug Research under Biological Sciences, Lady Tata Memorial Trust-award, Wellcome Trust Senior fellow, American Heart Association foundation fellow, Birla Science award, National Bioscience award from DBT. He has authored over 50 publications (Nature Communications, Angewandte Chemie, JACS, eLife).

Decoding Disease: How Trapped Topoisomerase-DNA Breaks Lead to Genomic Instability

Benu Brata Das

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DNA Topoisomerase 1 (Top1) is a vital enzyme that maintains genomic integrity by resolving DNA supercoiling during replication and transcription. However, Top1 can become cytotoxic when it forms stable cleavage complexes (Top1cc) on DNA, especially in response to anticancer drugs such as camptothecin (CPT) and its clinically approved derivatives, which are used to treat solid tumors including colon, lung, and ovarian cancers. Cells employ sophisticated DNA repair mechanisms to counteract these toxic lesions. A central component of this repair pathway is Tyrosyl-DNA Phosphodiesterase 1 (TDP1), which removes trapped Top1 from DNA in both nuclear and mitochondrial compartments. The activities of TDP1 and associated repair factors are tightly regulated by post-translational modifications (PTMs), which control their function, localization, and interactions. Our research has uncovered that Cyclin-Dependent Kinase 1 (CDK1), along with Protein Arginine Methyltransferase 5 (PRMT5) and Poly(ADP-ribose) Polymerase 1 (PARP1), plays a critical role in modulating the DNA damage response to Top1cc. Together, these regulators orchestrate a finely tuned network essential for effective repair of Top1-induced DNA breaks and maintenance of genome stability, offering promising targets for cancer therapy.

Speaker's Profile

Prof. Benu Brata Das is a Senior Professor at the School of Biological Sciences, Indian Association for the Cultivation of Science (IACS), Kolkata. A leading molecular biologist, his research focuses on DNA repair, mitochondrial genome maintenance, and cancer biology, providing key insights into genome stability and therapeutic innovation. He obtained his Ph.D. (2006) from the Indian Institute of Chemical Biology (IICB) and pursued postdoctoral training (2006–2012) at the National Cancer Institute (NCI), NIH, USA, where he received the NIH Fellows Award for Research Excellence in 2010 and 2011. Prof. Das's pioneering discoveries on DNA topoisomerase I (Top1) and Tyrosyl-DNA phosphodiesterase 1 (TDP1) have identified crucial mechanisms and novel therapeutic targets for cancer and neurodegenerative diseases. His numerous accolades include the DBT-National Bioscience Award (2019), ICMR Award for Basic and Translational Oncology Research (2020), and election as a Fellow of National Academy of Science, India (FNASc) (2020) Indian Academy of Sciences (FASc) (2025). Wellcome Trust India Alliance fellow 2013.

Novel Mechanisms of AP-Site Recognition and Repair in DNA and mRNA: Insights from *Mycobacterium tuberculosis*

Ravishankar Ramachandran

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Apurinic/apyrimidinic (AP) sites represent critical lesions in both DNA and RNA, posing significant threats to genomic and transcriptomic integrity. In *Mycobacterium tuberculosis* (MTB), efficient recognition and repair of AP sites are vital for bacterial survival under oxidative and UV stress conditions. This talk will explore our seminal findings on the distinct mechanisms governing AP-site repair in DNA and mRNA, focusing on the roles of the class II AP-endonuclease/3'-5' exonuclease (XthA) and the ribosomal protein Rps3 respectively. XthA engages with NAD+-dependent DNA ligase A (LigA) and the ß-Clamp to form a BERosome to counter futile cleavage and ligation cycles in Base Excision Repair, ensuring robust DNA repair. In contrast, Rps3 exhibits a novel AP-endoribonuclease activity, recognizing and cleaving AP sites in mRNA via its conserved 130RR131 motif within the 30S ribosome's mRNA entry tunnel. High-resolution Cryo-EM structures reveal cleaved mRNA products and a hyper-rotated 30S ribosome conformation, facilitating downstream processing by ribosome quality control factors. Knockdown studies in MTB H37Ra further underscore Rps3's protective role against stress-induced mRNA damage. By comparing these mechanisms, this talk will highlight the sophisticated surveillance systems in MTB that safeguard nucleic acid integrity, offering insights into bacterial stress response and potential therapeutic targets and strategies.

Speaker's Profile

Prof. Ravishankar Ramachandran is a Chief Scientist at the CSIR-Central Drug Research Institute (CDRI), Lucknow. He holds a Ph.D. from the Indian Institute of Science, Bangalore and subsequently received the Alexander von Humboldt Fellowship to work with Prof. Robert Huber at Max Planck Institute for Biochemistry, Germany. At CSIR-CDRI, he has made ground-breaking contributions to structural biology and drug discovery, particularly in understanding molecular mechanisms underlying mycobacterial nucleic acid repair. His work on drug-repurposing has led to pioneering Phase III clinical trials of Umifenovir, an antiviral drug for COVID-19, and has advanced therapeutic strategies against tuberculosis, and Chronic myeloid leukemia.

Annexure-XIX

INYAS: From a Decade of Excellence to a Future of Possibilities

Dr. Nishant Chakravorty
Chairperson, INYAS
Associate Professor, IIT Kharagpur

The Indian National Young Academy of Science (INYAS) has been actively shaping the landscape of science outreach and public engagement ever since its inception in December 2014. As the country's only academy representing young scientists, it has steadily facilitated conversations across research communities, industry, and policy circles, always guided by its belief that science must ultimately serve society.

In the past decade, INYAS has hosted a vibrant mix of symposiums, conferences, workshops, and training programmes across India. Last year's celebration of its ten-year journey marked not just a milestone, but the start of a new phase filled with fresh ideas and renewed enthusiasm. With more than 2,000 people participating from India and abroad, its activities have reached classrooms, research labs, universities, and even remote rural clusters—showcasing both the reach of its efforts and the sincerity of its mission. The three flagship programmes—RuSETUP, PRAYOJAN, and WiSDom—have naturally grown into the pillars of INYAS's work. RuSETUP, continues to strengthening science learning in under-resourced areas through hands-on activities and field-level capacity building. PRAYOJAN 2025 helped young scientists navigate the often-confusing paths across research, academia, and industry by opening doors and offering mentorship when it mattered most. WiSDom, on the other hand, keeps the spotlight on gender equity by celebrating women scientists and helping create a more supportive ecosystem for women researchers. Together, these initiatives highlight the academy's commitment to an inclusive, fair, and nurturing scientific environment.

Alongside these efforts, INYAS has put considerable energy into capacity-building programmes that train young researchers in grant writing, effective science communication, and modern research techniques. Its outreach work with schools and rural communities has also helped spark curiosity, build awareness, and encourage sustainable practices at the ground level.

INYAS's presence has grown internationally as well. Co-hosting the 2025 Global Young Academy Annual General Meeting and the International Conference of Young Scientists (in partnership with IIT Hyderabad, GYA, and INSA), taking a leadership role in the Network of Asia-Pacific Young Academies (NAYA), and joining the InterAcademy Partnership (IAP) as a Young Affiliate have all strengthened India's voice in global scientific conversations.

Recently, the academy concluded its mid-year meeting and technical symposium, "Advances in Science and Technology for Sustainable Future (ASTSF-2025)," held from 18–20 September 2025 at Vellore Institute of Technology. The event brought together sessions on climate science, agriculture, healthcare, clean energy, and materials research, along with panel discussions that explored how young scientists can contribute to governance and strengthen collaboration between industry and academia.

Speaker Profile:

Dr. Nishant Chakravorty (MBBS, M. Med Sci and Tech, PhD, FRSB), Associate Professor at IIT Kharagpur, currently serves as the Chairperson of INYAS. He is a physician-scientist by training and leads the Regenerative Medicine lab at School of Medical Science and Technology, IIT Kharagpur. He was selected as a Young Physician Leader in 2021 by IAP to represent India. He serves as an Editorial Board member for several prestigious international journals including Nature Scientific Reports, PLOSONE, The Nucleus, Molecular Biology Reports. Other notable achievements include, the Outstanding Doctoral Thesis Award - Executive Dean’s Commendation Award from Science and Engineering Faculty, QUT, Australia and the prestigious Institute Silver Medal from IIT Kharagpur.

Annexure-XX

Celebration of Science Week at Delhi 2025
91st INSA Anniversary General Meeting
2nd - 5th December 2025

INSA Women Associate (IWA) Induction and Presentation

Date: December 05, 2025
Venue: Miranda House College

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Induction Ceremony: Tentative Schedule
Venue: Mini Audi, Miranda House

Time	Session
09:00 – 09:30	Registration
09:30 – 09:35	Lamp Lightening
09:35 – 09:40	Welcome Address by **Dr Bijayalaxmi Nanda, Principal Miranda House**
09:40 – 09:45	Address by **Dr V M Tiwari, Vice President- INSA**
09:45 – 09:55	Presidential Address by **Prof Ashutosh Sharma, President INSA**
09 -55 – 10:10	Presentation by **Prof Nishant Chakravorty, Chair INYAS**
10:10 – 10:45	**Induction of IWA members**
10:45 – 10:50	Vote of Thanks by **Sh. Sunil Zokarkar, DED-I, INSA**
10:50 – 11:20	**Tea/Coffee Break**

Celebration of Science Week at Delhi 2025
91st INSA Anniversary General Meeting
2nd - 5th December 2025

Presentation by IWA members

Venue: Mini Audi/ Seminar Hall, Miranda House

Time	Venue-I (Mini Audi)	Venue-II (Seminar Hall)
11:20 – 11:30	Aparajita Bhattacharya	Darshana Joshi
11:30 – 11:40	Barnita Banerjee	Nidhi Pant
11:40 – 11:50	E.V. Soniya	Bineesha Payattati
11:50 – 12:00	Jhimli Bhattacharyya	Rupa Vasudevan
12:00 – 12:10	Kiranmai Nayani	K. Rajeshwari
12:10 – 12:20	Prajakta Dandekar Jain	Nusrat Sanghamitra
12:20 – 12:30	Veda Krishnan	Alka Sharma
12:30 – 12:40	Riffat John	Anita Gupta
12:40 – 12:50	Sarika Jalan	Dipti Kakkar Thukral
12:50 – 13:00	Sharmistha Banerjee	Ekta Kapoor
13:00 – 13:10	Shobha Shukla	Smita Mishra
13:10 – 13:20	Tharamani C. Nagaiah	Nisha Mendiratta
13:20 – 13:30	Vandana Nanal	Rashmi Sharma
13:30 – 13:40	Sheffali Gulati	Neetu Garg
13:40 – 13:50	Sujata Mohanty	Subi Chaturvedi
13:50 – 14:00	Uma Dhawan	Deeksha Gupta
14:00 – 14:45	**LUNCH**	
14:45 - 14:55	Tessy Thomas	
14:55 – 15:05	Preeti Parashar	
15:05 – 15:15	Geethavani Rayasam	
15:15 – 15:25	Anupama Singh	
15:25 – 15:40	Poster competition award ceremony and Valedictory session	
15:40 – 16:00	**Tea/Coffee Break**	
16:00 – 17:30	IWA meeting at Mini Audi, Miranda House	

Annexure-XXI

Celebration of Science Week
Delhi 2025

WOMEN IN STEM

91st INSA Anniversary

2nd - 5th December 2025

IWA, an INSA initiative

Abstract Book

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Miranda House
UNIVERSITY OF DELHI

MESSAGE BY PRINCIPAL MIRANDA HOUSE

PROF. BIJAYALAXMI NANDA
Principal
Miranda House
University of Delhi
New Delhi

It is a matter of great honour that Miranda House, University of Delhi, is a hosting partner for the upcoming INSA Science Week, to be held in Delhi from 2–5 December 2025. As part of this national celebration of scientific education, Miranda House is privileged to host the Induction Ceremony of the newly introduced INSA Women Associates on 5 December 2025. This new vertical of INSA is a landmark initiative aimed at recognizing, encouraging, and amplifying the contributions of outstanding women scientists across the country.

The INSA Science Week provides a vibrant platform for dialogue, collaboration, and inspiration across diverse scientific disciplines. Participants—ranging from faculty members and researchers to students—will have the opportunity to engage with eminent scientists and interact with transformative ideas shaping the future of scientific research in India. The inclusion of the Induction Ceremony of the INSA Women Associates adds a powerful dimension to this celebration, underscoring the academy's commitment to gender equity and the creation of a more inclusive scientific ecosystem.

This collective celebration of science gains further depth through the participation of esteemed academic and research institutions, each contributing unique strengths, perspectives, and innovations. As we come together for this significant event, we are reminded of the responsibility shared by the scientific community to nurture talent, promote innovation, and strengthen collaborative networks that support meaningful scientific advancement.

I applaud the efforts of the organizing teams at INSA and Miranda House for curating this important programme and creating a space where scientists, educators, and students can connect, exchange ideas, and build a foundation for future breakthroughs. Hosting the INSA Women Associates Induction Ceremony at Miranda House aligns seamlessly with our institution's legacy of empowering women and fostering excellence in science.

On behalf of Miranda House, I extend my warmest wishes for a successful and inspiring INSA Science Week. May this gathering of brilliant minds lead to fresh insights, impactful collaborations, and collective progress in the pursuit of scientific knowledge.
With warm regards,

Professor Bijayalaxmi Nanda
Principal
Miranda House
University of Delhi
New Delhi

MESSAGE BY INSA PRESIDENT

PROF. ASHUTOSH SHARMA
President
Indian National Science
Academy Bahadur Shah Zafar Marg
New Delhi

The year 2025 marks a moment of exciting transformation for the Indian National Science Academy (INSA). Building on the Academy's long-standing commitment to excellence, INSA has reimagined its traditional Annual General Meeting as a week-long Celebration of Science to be held from 2–5 December 2025 across leading Delhi–NCR institutions, including Indian Institute of Technology Delhi, Jawaharlal Nehru University, Ashoka University Sonipat, Amity University Noida, University of Delhi, ICAR-Indian Agricultural Research Institute, Miranda House DU, and SRM-Institute of Science and Technology Ghaziabad. This step, moving the AGM beyond a single campus and into a city-wide Science Week, is an important institutional reform intended to broaden public engagement, strengthen university–academy partnerships, and bring science closer to society.

The programme has been thoughtfully designed to showcase the full spectrum of scientific endeavour in India. It combines the core elements of the AGM: the Council Meeting, the residential Address, the induction of newly elected Fellows, and the felicitation of outgoing Council members with an expanded series of sectional meetings, distinguished lectures, and public-facing events. These activities will take place across partner institutions and will feature lectures and presentations by newly elected Fellows, INSA Young Associates, Associate Fellows, the History of Science Young Associate, and the INSA Women Associates. The event will also include sessions highlighting science in translation and science for society. We view this Celebration of Science as more than a logistical change: it is a deliberate effort to democratize the Academy's outreach and to invite a wider community of students, educators, policy- makers, industry partners, and the general public into conversations about the impact of science on national development. By decentralizing the AGM and situating sessions at multiple universities and research institutes, we hope to foster fresh collaborations, engage diverse audiences, and inspire the next generation of scientists. I warmly invite all members of India's scientific community and all those who value science-led progress to participate in the

Celebration of Science. Together we will celebrate achievements, reflect on the evolving role of science in society, and renew our commitment to evidence-informed policy and inclusive scientific endeavour. May this week reinforce INSA's mission of nurturing excellence, broadening engagement, and advancing the role of science for the public good.

With warm regards,
Professor Ashutosh Sharma
President
Indian National Science Academy

MESSAGE BY INSA EXECUTIVE DIRECTOR

Dr Brajesh Pandey
Executive Director
Indian National Science Academy
Bahadur Shah Zafar Marg
New Delhi

This year, for the first time, the Academy's Annual General Meeting will expand into a four-day *Celebration of Science*, from December 2 to 5, 2025, hosted across major institutions in the Delhi–NCR region. Partner campuses include IIT Delhi, Jawaharlal Nehru University, Ashoka University, Amity University, University of Delhi, ICAR-IARI, Miranda House, and SRM-IST Ghaziabad. This city-wide initiative is a key institutional effort aimed at deepening public engagement, strengthening collaboration with universities, and fostering closer connections between science and society.

The Celebration will integrate the AGM's core functions—Council Meeting, Presidential Address, induction of Fellows, and recognition of outgoing members—while offering an expanded programme of sectional meetings, distinguished lectures, and events for broader audiences. Newly elected Fellows, INSA Young Associates, Associate Fellows, and INSA Women Associates will present their work, along with sessions focused on science for society and science in translation. More than a logistical change, this initiative aims to open the Academy's doors to students, educators, policymakers, industry professionals, and the public, fostering meaningful dialogue and collaboration. By dispersing activities across multiple institutions, we aim to inspire young minds, foster partnerships, and promote science-led national progress.We warmly invite the scientific community and all supporters of evidence-based development to participate in this Celebration of Science and join us in reaffirming INSA's mission—excellence, inclusion, and science for public good.

With warm regards,
Dr Brajesh Pandey
Executive Director
Indian National Science Academy

Aparajita Bhattacharya
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Leadership through Architecture: from Specification to Silicon

Abstract

From powering 99% of the world's smartphones to advancing into data centers and high performance computing, Arm architecture has become a foundational pillar of the modern digital world. Behind this global impact lies a journey rooted in collaboration, resilience, and a shared vision—one that closely parallels my own professional path and the remarkable rise of Arm India.

I began my career as a young engineer at Arm's small Austin Design Center, contributing to the development of the first high-performance Arm CPU—technology that helped spark the smartphone revolution. A few years later, I moved to the fledgling India Design Center, then a modest group of junior but highly motivated engineers, determined to build capability and earn trust across the global organization.

Since then, Arm India has evolved into a vital hub of innovation and leadership. I have had the privilege of growing alongside it—starting as an engineer, helping to establish the Architecture and Technology group in India, and now leading the global engineering team within Arm's Architecture group. We contribute to the evolution of the Arm architecture, define specifications to ensure clarity and consistency, and develop verification solutions that help our partners implement the architecture correctly and confidently.

In this talk, I will reflect on how Arm's architectural vision—and Arm India's evolution—intertwine with my own journey. I will share insights into building trusted technology at global scale, and what it means to lead a worldwide organization from within the vibrant technology landscape of India.

Barnita Banerjee
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Productivity and Monsoon: Are they linked in Bay of Bengal?

Abstract

The Quaternary Period is an important interval in geological records as it marks many large amplitude and high-frequency oscillations which might have affected various biological parameters and terrigenous inputs in the bay. However, limited work has been carried out to study the monsoonal variation during Mid Pleistocene Transition (MPT) and post MPT and its effect on productivity with respect to change in glacial cycle. Here, we present an integrated study of organic– inorganic geochemistry and micropaleontology from western Bay of Bengal (IODP U1446, offshore Mahanadi basin) ~1.3 Ma to decipher productivity changes.

Overall, productivity proxies show a shift towards higher values post MPT. The variability in the productivity proxies shows that stronger Indian monsoon post MPT created stronger stratification during interglacials leading to lower biological productivity in the region. The stronger glacial post MPT induced convective mixing resulting in high nutrients and also the glacial monsoonal event owing to Southern Hemispheric (SH) forcing further added nutrients to the study site enhancing productivity in the glacial period. The high glacial-interglacial variability was the primary factor responsible for the shift in marine productivity across the MPT.

Dr. E V Soniya
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Understanding Quick Wilt Resistance in Black Pepper: Insights from Molecular and Rhizobiome Studies

Abstract

Black pepper (*Piper nigrum* L.), known as the "King of Spices," is economically significant in India but is severely affected by quick wilt disease caused by *Phytophthora capsici*. To explore the molecular basis of this plant–pathogen interaction, we analyzed disease-responsive genes and regulatory small RNAs such as tRNA-derived fragments, rRNA-derived small RNAs, and long non-coding RNAs. As developing stable resistance in cultivated black pepper is challenging, examining beneficial root-associated microbes pursued a sustainable, farmer-friendly approach. Comparative rhizobiome profiling of a susceptible cultivar and its naturally resistant wild relative, *Piper colubrinum*, using 16S rRNA amplicon sequencing and shotgun metagenomics, revealed clear differences in bacterial diversity. Notably, *P. colubrinum* possessed a higher abundance of known biocontrol taxa. These findings suggest that harnessing beneficial microbiomes offers a promising, environmentally safe strategy for managing quick wilt disease.

In parallel, studies were conducted on Type III polyketide synthases (PKSs) from *Aegle marmelos*, *Phyllanthus emblica*, and *Zingiber officinale*. Notably, work on *A. marmelos* led to the identification and functional characterization of a PKS responsible for quinolone biosynthesis. Structural analysis of this enzyme uncovered previously unrecognized catalytic features that govern the formation of pharmacologically important secondary metabolites, providing new insights into PKS-mediated natural product biosynthesis.

Jhimli Bhattacharyya
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Thermodynamic insights into nucleic acid binding of phytochemicals

Abstract

For decades, the phenomenon of plant-derived small molecules binding to DNA has grown in interest. Many of such phytochemicals belong to the indole alkaloid group with effective medicinal properties. Nucleic acids (mainly DNA) are the main molecular target of many of these ligands because of their vast pharmaceutical applications. Transcription or replication may be impacted by these interactions, which may ultimately result in apoptotic cell death. Here, we describe the DNA binding interactions of several bioactive indole alkaloid compounds, such as yohimbine, harmane, ajmalicine, etc, with a special emphasis on their thermodynamic aspects. Calorimetric, multi-spectroscopic and molecular modelling techniques have been employed under physiological conditions, to estimate the binding thermodynamics. The Scatchard plot analyses using the McGhee-von Hipple method revealed non-cooperative binding and affinities in the range of 10^5- 10^6 M^{-1}, either with 1:1 or 1:2 stoichiometry. Thermodynamic analyses suggested spontaneous, exothermic binding, favored by negative enthalpy and positive entropy changes in most of the cases. The interaction between the phytochemical and DNA was majorly governed by non polyelectrolytic forces. The results of iodide quenching, urea denaturation assay, dye displacement, circular dichroism and *in silico* molecular docking, revealed the groove binding natures of all the ligands (under investigation, towards DNAs). Both biophysical and computational methods were used to validate the groove binding mechanism. The thermodynamic profile and structural features discussed here could help create new DNA targeted treatments with reduced side effects and increased efficacy.

N. Kiranmai
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Towards the sustainable synthesis of active pharmaceutical ingredients (APIs) for affordable healthcare

Abstract

Organic chemistry research involves development of new and more efficient reactions and catalysts, recreating complex molecules found in nature such as bioactive compounds in the lab, with a wide range of applications in medicine, materials science, and energy. Organic Chemistry has undergone transformations beyond the imagination of the early chemists: the functional properties and complexity have been the two driving factors in choosing targets for synthetic organic chemists. The primary demands of academia have been to "somehow" reach the target molecule whereas the industry demands were mostly on the scalability and adaptability for mass production at the lowest cost possible. The pharma and agro industries, with large volumes of effluents and by-products, have got criticism from the masses while the products have changed the way we live including the quality of life. To overcome this criticism and also to minimize the adverse impacts on the environment, the experimental organic chemistry has begun a new innings following quality by design in industry and ideal synthesis in academic efforts. Our group has been engaged both in academia driven work and industry related projects and realised the contrast in approaches. A mixed strategy satisfying the demands of academia, industry and environment is adapted and our learnings will be shared. Herein, we present an overview of recent developments in the synthesis of few bioactive/API molecules.

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From 2D to 3D: Functional Spheroid Models Shaping the Future of Anti-Cancer Drug Development

Abstract

This study presents a 3D lung cancer spheroid model that closely mimics the tumour microenvironment for more reliable cancer research. Lung adenocarcinoma, one of the most common and deadly cancers, requires better models to test new therapies. The 3D spheroids were created to replicate tumour growth, necrosis, and drug response. Cellular assays provided insights into mechanisms of tumour progression and metastasis as well as confirmed apoptosis in spheroids treated with anticancer agents. Additionally, the presence of hypoxia and EMT-related markers, as well as the angiogenic potential observed in the spheroids highlighted the relevance of these assays for consideration by the regulatory agencies as alternative-to-animal tools for evaluation of newer anti-cancer agents.

Veda Krishnan
ICAR-Indian Agricultural Research Institute (IARI), NewDelhi,
vedakrishnan@iari.res.in

Nutritional Biochemistry, Functional Foods, and Agri-ResearchLeadership

Abstract

Advances in nutritional biochemistry and functional food research are central to addressing global challenges of malnutrition, metabolic disorders, and micronutrient deficiencies. Food Matrix Lab's body of work exemplifies this integrationbyexploring the molecular dynamics of food matrices, bioactive compounds, and nutrient bioavailability to inform next-generation agri-derived innovations. The research spans metabolic pathway engineering, glycemic response modeling, and characterization of phytochemicals and micronutrients across cereals, legumes, and mushrooms. Through interdisciplinary leadership, Food Matrix Lab, bridges fundamental science with translational outputs, contributing to commercialized technologies, improved crop nutritional profiles, and nutraceutical development. The efforts highlight the critical role of agri-research leadership in shaping sustainable, health-focused food systems for emerging global needs.

R. John
Plant Molecular Biology Lab, Department of Botany, University of Kashmir,
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Molecular Basis of Cold Hardiness: Lessons from Himalayan Plants for Crop Improvement

Abstract

Plants inhabiting the Kashmir Himalayan region exhibit remarkable resilience to extreme environmental stresses, providing a unique opportunity to unravel the molecular and physiological mechanisms underlying stress tolerance. Our research focuses on dissecting these adaptive strategies using an integrated multi-omics framework that combines genomics, transcriptomics, proteomics, metabolomics, and physiological analyses. We investigate a range of Himalayan high
altitude species along with *Brassica rapa*, *Brassica oleracea*, and diverse maize germplasm to understand how cold, light, and other abiotic factors regulate growth, development, and reproductive transitions. A major component of our work examines flower development in *Brassica rapa*, where we have identified key temperature- and light-responsive proteins associated with floral initiation and morphogenesis.

In collaboration with ICGEB, the Indian Institute of Maize Research, Delhi University (South Campus), SKAUST, and international partners through Indo-German and Indo-US initiatives, we integrate fundamental molecular insights with applied breeding strategies. Current research efforts focus on identifying and validating the functional alleles that govern cold tolerance through QTL mapping, GWAS, haplotyping, and CRISPR/Cas9-based genome editing. By leveraging natural and doubled-haploid maize populations derived from crosses between the cold-resilient Gurez Local and elite cultivars, we aim to develop pre-breeding lines suitable for temperate and high
altitude agro-climatic regions.

Additionally, our work explores plant adaptation across altitudinal gradients to link ecological traits with molecular signatures of stress resilience. Overall, this research advances our understanding of cold tolerance mechanisms and aims to translate Himalayan plant hardiness into climate-smart crop improvement, contributing to sustainable agriculture in cold and marginal environments.

Sarika Jalan
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A world of higher-order interactions: Beyond pairwise

Abstract

Many real-world systems—from social groups to neural circuits—depend on interactions that happen in groups rather than just pairs. My research shows how these higher-order interactions fundamentally change the way collective behaviour emerges, spreads, and stabilizes. By looking at groups as the basic units of interaction, we uncover hidden phenomena that traditional network models miss. A key result of my work is the revelation of a nontrivial finite-size scaling in higher-order dynamical systems, where critical thresholds and stability regimes depend sensitively on network size. Higher-order coupling introduces size dependent nonlinear corrections that persist even beyond the mesoscopic scale. This discovery helps explain why experiments, simulations, and real-world systems often do not match predictions that assume infinitely large networks.

Prof. Sharmistha Banerjee
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Many Lives, Many Masters: Cellular Heterogeneity in Regulation of Human Immunodeficiency Virus-1 Infection Cycle

Abstract

Human Immunodeficiency Virus-1 (HIV-1) primarily targets immune cells, including T lymphocytes, macrophages, and dendritic cells; however, it can also infect glial, neuronal, and astrocytic cells during chronic infection. These cell types support variable viral replication; brain cells, such as astrocytes (reservoirs), permit minimal proliferation, whereas CD4+T lymphocytes are more productive. Characterizing reservoirs is vital, as they sustain HIV-1 persistence and rebound viremia, complicating therapy and cure efforts. We investigate cell specific factors and mechanisms that regulate HIV-1 persistence, driving latency, rapid spread, or abortive infection. We specifically study nucleocytoplasmic trafficking of viral components and analyze molecular distinctions to advance understanding of HIV biology, guiding therapeutic strategies (PLOSONE-2013; Retrovirology-2014; JMB-2020; Viruses-2021; FEBS-J-2022; JVI-2023; Front.Immunol-2024; Traffic-2025).

One of our recent discoveries elucidates that HIV-1 Tat interferes with a host protein, hnRNPA2, to disrupt RNA splicing in CD4+T-lymphocytes, but not in astrocytes. This change affects the production and movement of viral RNA, influencing virus titers, positioning hnRNPs as novel antiviral factors. We also discovered that new virus particles pick up different host proteins depending on the cell they come from, which changes the infectivity of the emerging viruses. For example, viruses from CD4+T-lymphocytes package Importin β-1, which helps them enter the nucleus and infect new cells. However, if Importin β-1 is already present in high amounts, it can block HIV replication after the virus has integrated into the genome. This dual functionality highlights the dynamic conflicts between host defense and viral adaptation, providing novel insights into intrinsic innate immune mechanisms.

Tharamani C. Nagaiah
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Designing greener energy conversion system for a sustainable future

Abstract

Global energy requirements are touching new meridians with the gradual advancement in the living standards and the day-by-day growing world population. This necessitates the exploration to seek for greener and sustainable energy reservoir systems which ought to be environmentally agreeable for such an intriguing purpose. Electrochemical energy conversion and storage devices offer some most alluring aptitudes for providing clean energy. To name a few of these include fuel cells, rechargeable metal

air/peroxide batteries and HCl/ H_2S electrolysis and likewise.[1,2] Oxygen being central to the processes in these devices, a lot of attention has been focused upon the study of oxygen chemistry in terms of oxygen reduction reaction (ORR) and also Hydrogen evolution reaction (HER) and thence to the melioration of the associated electrocatalysts. In the past decade research has depicted tremendous improvement towards the betterment of fuel cells/metal-air/peroxide batteries/hydrogen production in its legions of shortcomings or corrigible features.[3,4] But still an infinite pursuit towards the exploration of effective, sturdy and energy efficient catalysts continues. The talk addresses,

• several strategies pursued to replace noble-metal free electrocatalysts for ORR/HER. • Zn based batteries

• visualization of local electrocatalytic activity by SECM.

Keywords: ORR, HER, electrocatalyst, Zn based batteries, SECM

Prof. Vandana Nanal
Tata Institute of Fundamental Research, Mumbai

Is neutrino its own antiparticle?

Abstract

The nuclear beta decay revealed the existence of neutrino more than eight decades ago, but the neutrino still continues to be a puzzle waiting to be unravelled. The mass and nature of neutrinos play an important role in physics beyond the standard model. At present, neutrinoless double beta decay (NDBD) is perhaps the only experiment that can tell us whether or not the neutrino is its own antiparticle. Given the significance of the NDBD, there is a widespread interest worldwide employing a variety of novel techniques. This talk will present a brief report of ongoing and proposed NDBD experiments and will highlight Indian efforts towards the feasibility study of search for NDBD in 124Sn.

Professor Sheffali Gulati
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Understanding autism spectrum disorder: Pathophysiology and current research insights

Abstract

Autism Spectrum Disorder (ASD) is a multifactorial neurodevelopmental condition marked by deficits in social communication, restricted interests, and repetitive behaviours. Its pathogenesis involves complex interactions among genetic, epigenetic, environmental, and neurobiological factors that disrupt brain development and neural connectivity. Genetically, ASD arises from rare and common variants, CNVs, and de novo mutations in genes like SHANK3, CHD8, and NRXN1. Aberrant DNA methylation adds to its variability, while global genomic studies are uncovering pathogenic mechanisms and clinical correlations. Neurodevelopmental abnormalities include disrupted neurogenesis, faulty neuronal migration, excitatory-inhibitory imbalance, and impaired synaptic pruning. Neuroimaging reveals atypical brain connectivity, early overgrowth, and volumetric changes in the frontal and temporal lobes, cerebellum, and corpus callosum, offering potential diagnostic biomarkers. Environmental factors such as maternal infections, advanced parental age, valproate exposure, toxins, and nutrient deficiencies increase ASD risk through inflammatory and epigenetic mechanisms, while neuroinflammation and microglial activation impair synaptic development. Common comorbidities include intellectual disability, epilepsy, ADHD, sleep and psychiatric disorders, and metabolic or endocrine dysfunctions, underscoring the need for multidisciplinary care. Biomarkers like oxidative stress indicators, AGEs, heavy metals, and mitochondrial dysfunction aid early detection. Management is focussed on early behavioural therapy, complemented by gene therapy, probiotics, dietary changes, TMS, and pharmacological approaches. AI-driven diagnostic tools, digital platforms, and community-based therapies enhance early screening and personalized care. Integrating genetic, environmental, and metabolic insights through large-scale, longitudinal research will advance precision medicine, early intervention, and global ASD management.

Mohanty Sujata
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Regenerating Hope, Celebrating Science: Stem Cells Unleashed

Abstract

Regenerative medicine and stem cell research offer significant promise for the treatment of a wide range of degenerative diseases, providing potential solutions for tissue repair and cellular regeneration. Stem cells can build every tissue in the human body, and hence have great potential for future therapeutic uses in tissue regeneration and repair. They have the ability of unlimited self-renewal to produce progeny the same as the originating cell and the ability to differentiate into a specialized adult cell type. With the increase in incidences of disease related to the cornea, skin, bone, heart, and liver tissue, there is an emerging need to develop an off-the-shelf alternate approach as a part of regenerative tissue engineering to help in tissue regeneration.

Mesenchymal stem cells (MSCs) are a promising therapeutic tool in regenerative medicine due to their multipotency, immunomodulatory properties, and ability to secrete extracellular vesicles (EVs) that facilitate tissue repair and regeneration. MSCs exhibit added advantages: secretion of a variety of tropic factors, maintaining natural microenvironment, highly proliferative, improved survival and anti-inflammatory properties, better response to cellular signals, facilitate vascularization *in vivo,* and exhibit enhanced regeneration potential. Additionally, they produce extracellular vesicles (EVs), and a multitude of cytokines and growth factors that suppress immune responses that allow allogenic MSCs to be used for tissue regeneration.

In skin tissue regeneration, MSCs and their EVs have shown promising results in promoting wound healing, reducing scar formation, and enhancing epithelialization and angiogenesis. In ocular injuries, MSCs have been demonstrated to promote corneal epithelial regeneration and reduce inflammation, offering a potential therapeutic avenue for treating corneal injuries and

dry eye disease. Additionally, MSC-derived EVs play a pivotal role in tissue engineering, where they contribute to the enhancement of scaffold-based tissue regeneration. Notable clinical trials have investigated the use of MSCs & their EVs in the treatment of chronic wounds, corneal injury, and cartilage defects, demonstrating their potential to improve healing and functional recovery. While the clinical evidence is promising, further large-scale, well-controlled trials are necessary to establish optimal protocols for EV-based therapies. With ongoing advancements and a deeper understanding of their mechanisms, EV-based therapies have the potential to revolutionize the treatment of various medical conditions, pushing the boundaries of current clinical practices and offering new hope for patients.

Keywords: Mesenchymal Stem Cell, Extracellular vesicles, Regeneration

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Epigenetic insights into neurodegeneration: Role of 5-hydroxymethylcytosine in REM sleep deprivation

Abstract

Rapid eye movement sleep deprivation (REMSD) induces stress that disrupts normal brain function, leading to significant neurological defects and cognitive dysfunction, similar to those observed in neurodegenerative and behavioral disorders like Alzheimer's disease (AD) and Amyotrophic lateral sclerosis (ALS). Although these conditions are multifactorial and result from complex interactions between genetic and environmental factors, the specific mechanisms by which sleep deprivation, especially REMSD, contributes to neurodegeneration remain largely unclear and insufficiently explored. 5-hydroxymethylcytosine (5-hmC), one of the various epigenetic mechanisms, has gained attention for its role in the regulation of gene expression within the central nervous system (CNS). Although 5-hmC is highly enriched in the brain, its specific involvement in sleep deprivation-related neurodegeneration remains largely unexplored.

Using hMeDIP sequencing, we have identified significant genome-wide alterations in 5-hmC patterns within the brain tissue of REMSD rats. These differentially hydroxymethylated regions are associated with genes related to neuronal development, memory, learning, neurotransmission, synapse and cognitive functioning, processes commonly disrupted in neurodegeneration. Notably, several of these affected genes encode RNA-binding proteins (RBPs) that are known for their pathological roles in neurodegenerative disorders. The co-occurrence of 5-hmC alterations with dysregulated expression and aggregation of RBPs suggests a mechanistic link between sleep loss and neurodegeneration. Collectively, our findings highlight the interplay between an altered DNA hydroxymethylation landscape and RBP dysfunction in REMSD-associated neurodegeneration.

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Science, Strategy, and Stewardship: Shaping Leadership for a Viksit Bharat

Abstract

As India advances towards the vision of *Viksit Bharat*, science, technology, and innovation must become the foundation of this national transformation. Achieving this goal calls for leadership that blends scientific excellence, strategic foresight, and social stewardship. This lecture explores how India can cultivate a new generation of leaders who drive discovery, foster collaboration, and ensure that science serves as a catalyst for both national development and global good.

Central to this transformation is a strong partnership between industry and academia, where ideas are translated into impact through co-created research, applied innovation, and commercialisation of indigenous technologies. This collaborative approach bridges the gap between knowledge and implementation, positioning India as a global hub for responsible and sustainable innovation.

Inclusive innovation must also remain a cornerstone of progress. Expanding access to scientific opportunities, empowering marginalised communities, and increasing women's participation in STEM are essential steps in ensuring that technological advancement benefits every segment of society.

Leadership within the scientific ecosystem must evolve from competition to collaboration, from hierarchy to mentorship, and from ambition to stewardship. By nurturing integrity, empathy, and curiosity alongside intellect, India can foster leaders capable of building sustainable solutions that address global challenges.

In this journey from vision to realisation, science must anchor national strategy, and leadership must embody stewardship. Only through this integration can India shape a *Viksit Bharat* that is scientifically strong, socially inclusive, and globally respected.

Research Focus

This lecture focuses on the intersection of science, leadership, and innovation policy in shaping India's journey toward becoming a developed nation. It examines structural and cultural shifts required within scientific and academic institutions to foster collaboration, ethical leadership, and inclusivity.

Keywords : Science policy; innovation leadership; Viksit Bharat; inclusive innovation; STEM participation; industry–academia collaboration; sustainable development

Preeti Parashar
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Quantum Resource Theories

I will give an overview of quantum resource theories emphasizing their role in quantum foundations and technologies.

Dr D. Joshi
Co-founder and CEO, VigyanShaala International

Finding Your Tribe and Shaping the Future Together

Abstract

Science and technology have given humanity extraordinary power. But, the true question is not what the world can do, it is what kind of world we choose to build. As we stand at the crossroads of climate change, inequality, and rapid technological transformation, the challenge before us is as moral as it is scientific.

In this talk, Dr Darshana Joshi invites young minds, especially women in STEM, to dream beyond individual success, to see themselves as co-architects of a shared sustainable future. She will introduce the '3I Approach – Inclusive, Innovative, and Interdisciplinary' as a framework for solving the complex challenges of our time, from climate resilience to equitable access to technology. Drawing on her journey from a Delhi government school to the University of Cambridge, and on VigyanShaala's work empowering thousands of young women in STEM across India, she explores how "finding your tribe" can spark courage, collaboration, and purpose.

Dr Joshi will challenge the audience to push boundaries and then push them a little more as they envision science not just as a tool for progress, but as a shared language of empathy, justice, and hope.

Because the only thing bigger than where you will be in five years is where the world will be and together, we can shape it for the better.

Dr. Rupa Vasudevan
Chancellor & Founder, Bharatiya Engineering Science and Technology Innovation University (BESTIU), Andhra Pradesh, India

Reimagining the Indian HEI as a Global Node

Abstract

Indian higher education is rapidly evolving into a global node—an open, networked ecosystem where learners, researchers, and industry collaborate to co-create knowledge across borders.

Future-ready HEIs will adopt co-creator and co-learner models while leveraging AI-driven personalised learning pathways, advancing the concept of an "omniversity" that transcends geographical boundaries.

BESTIU's "Living Lab" and "Innovation Immersions" exemplify how technology, local innovation, and global engagement can enable experiential, cross-border learning. By aligning skills with emerging job markets through agile, industry-responsive frameworks, Indian universities can transform into transnational hubs shaping talent, research, and solutions for a rapidly changing world.

Dr. K. Rajeshwari
Bioklone Biotech Private Limited, Unit 14 and 15, Golden Jubilee Biotech Park for Women Society, Inside SIPCOT IT Park, Siruseri,Chennai- 603103
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A journey of two decades: Building an enterprise for antibodies

Abstract

Bioklone Biotech Private Limited, founded in 2006, is a Contract Research Organization that specializes in the development of customized antibodies and assays. It has over 500 clients across various sectors including academia, R&D divisions of hospitals, diagnostic and pharma companies, in India and abroad. Bioklone has successfully developed custom antibodies to over 1000 antigens including proteins, peptides, polysaccharides, drugs, small molecules and whole cells. The company offers end-to-end services, including peptide designing, expression and purification of recombinant proteins, development of antibodies in rabbits and mice, purification and labelling of antibodies and development of assays for the antibody users. Bioklone has vast experience in the development of pharmacokinetic (PK) and anti-drug antibody (ADA) assays for study and assessment of new biosimilars and drug candidates as well as in vitro assays using cell-lines to study cell viability/proliferation.

The key to Bioklone's success is its scientific and innovative approach in the execution of all the projects. This has been possible because of the experienced technical team at Bioklone, which pays attention to finer details and executes the projects with unerring precision. Bioklone's antibodies and services have been cited in several international publications. The company is known as a reliable antibody partner who is vested in the success of its projects. Despite the struggles and challenges in antibody development and validation, Bioklone continuously strives to adhere to its commitment and quality, even if it has to go the extra mile.

Dr. Nusrat J M Sanghamitra
Founder & CEO, CyGenica Limited, *nusrat@cygenica.com*

Delivering Hope: Getting RNA Medicines to the Right Place in the Cell

Abstract

Every disease begins with a message inside our cells that has gone off script. Those messages are written in RNA - the quick notes that tell a cell what to make and when. Traditional drugs often act from the outside, easing symptoms but missing the source. RNA medicines are different: they can correct the faulty message itself, opening doors to problems long considered "undruggable" and bringing fresh hope to patients.

The hurdle is the last mile. RNA is delicate. If it doesn't reach the right spot inside the cell, it won't help. Think of delivery as the difference between a letter and a letter that actually reaches the right address.

In this talk, I'll share a simple, visual story of GEENIE™ - a tiny protein helper we're building to act like a courteous guide, protecting RNA on the journey and walking it past cellular barriers to the place where it can work. This kind of precision could mean smaller doses, fewer side effects, and real options for hard problems in the brain, in the eye, where today's tools often fall short.

Beyond experiments, this work is a story of curiosity, compassion, and courage - bridging cell biology, chemistry, and protein engineering, and linking teams across India and Ireland. I invite students to pursue meaningful questions, speak across disciplines, and persist until science becomes care. Breakthroughs don't end at discovery; they begin when we deliver healing, responsibly and at the right place - leaving a legacy of lives made better.

Dipti Kakkar Thukral
Institute of Nuclear Medicine and Allied Sciences(INMAS),DRDO
Former Adviser, Anusandhan National Foundation (ANRF), New Delhi

Role of women scientists in shaping the future of women in STEM in India

Abstract

Women scientists in India have played a transformative role in shaping the country's scientific landscape and in advancing opportunities for future generations of women in STEM. Their contributions span cutting-edge research, leadership in national laboratories, policy formulation, innovation-driven entrepreneurship, and impactful mentoring. This talk highlights the multifaceted influence of women scientists—from pioneering figures who laid the foundation for women's participation in science to contemporary leaders driving India's progress in frontier areas such as Nanotechnology, biotechnology, space science, artificial intelligence, and environmental sustainability.

Despite persistent structural and societal barriers, women scientists have continually challenged norms, expanded representation, and championed more inclusive scientific ecosystems. Their leadership has strengthened national programs supporting women's careers, including targeted fellowships, re-entry grants, flexible working environments, and mentorship. Through community engagement, science communication and advocacy, they have also inspired young girls to pursue scientific paths, bridging gaps in aspiration and access.

The talk examines key initiatives and success stories that showcase how women scientists contribute not only through their scientific achievements but also through systemic change—promoting gender equity, supporting interdisciplinary collaboration, and shaping policy frameworks that ensure sustained participation of women in STEM. By reflecting on their journeys, challenges, and strategies for empowerment, the session aims to envision a future where women's talent and leadership form an essential pillar of India's scientific growth. Ultimately, the role of women scientists extends beyond personal accomplishment; it catalyzes a more inclusive, innovative, and resilient scientific ecosystem for India's future.

Dr. Alka Sharma
Additional Director General
Extramural Research
Indian Council of Medical Research
Ministry of Health and Family Welfare

Cell and Gene Therapy: *Futuristic Therapies* Opportunities, Challenges, and the Road Ahead

Abstract

Gene therapy offers an innovative and transformative approach for development of cutting-edge therapies for various diseases including genetic disorders, cancers, and autoimmune diseases. Globally, several transformative cell and gene therapies are being developed. In India, cell and gene therapy interventions are moving forward at a fast pace due to the increased ability to initiate and carry out novel cutting-edge research. Overall aim is to develop these therapies affordable in India. Clinical trials of gene therapy in humans have shown some success in treating certain diseases such as severe combined immune deficiency, Hemophilia, retinitis pigmentosa and Leukemia. In Hemophilia, gene therapy aims to provide the body with the ability to produce the clotting factor that patients are lacking which would be useful in reducing the need for blood transfusion for maintaining Facto-VIII levels. Cellular therapy such as CAR-T therapy exemplifies how immune engineering can convert a patient's immune system into a precise anti-cancer weapon. Indigenous CAR-T therapies in academic-industry partnership have also been developed in India that would help in reducing the cost by several fold. However, developing cost effective models for scale-up; manufacturing; evolving regulatory pathways; and long-term follow up frameworks require strengthened institutional support. Several challenges need to be addressed before full scale advantage of these technologies can be made available to the patients. Some of them includes: safely and off-target effects; affordability; infrastructure/facility for indigenous largemanufacturing for clinical trial material generation; development of scalable process, globally accepted clinical trial protocols and product/cell banks. Monogenic disorders are likely first targets for widespread gene therapy

rollout.Academic-hospital integration strengthens clinical translation. This would also be required appropriate regulatory framework, investment, and manufacturing scale-up.

Smita Mishra

Rewriting the Code of Responsibility: From Business to AI to Planet

Abstract

As the world is working towards concluding COP30 and the 2030 Sustainable Development Goals (SDGs) deadline, a quiet revolution is underway — one that is not just about technology or policy, but about responsibility.

This talk explores how responsibility is emerging as the new currency of trust — across businesses, investors, and intelligent machines. From responsible business practices that measure impact beyond profit, to responsible AI that thinks ethically, to responsible investors who steer capital toward sustainability — we are witnessing the formation of a new ecosystem where value meets values.

• How AI can be a force for good — if built on fairness, transparency, and inclusivity.
• Why ESG and SDGs are not corporate buzzwords but design principles for the next generation of entrepreneurs.
• How responsible investing is reshaping the global economy and redefining growth.
• What COP30 and the global stock take mean for young innovators entering this decade of action.

Through the lens of Fandoro Technologies, we'll reimagine how AI, finance, and sustainability can converge to create not just smart enterprises — but wise ones.

The talk invites students to think of themselves not as future employees or founders, but as architects of responsible intelligence — where every idea, code, and company contributes to a regenerative, inclusive, and sustainable planet.

Dr. Nisha Mendiratta
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Building an Inclusive and Sustainable STI Ecosystem at the Grassroots

Abstract

Science, Technology and Innovation (STI) at the grassroots level plays a transformative role in addressing local challenges, enhancing livelihoods, and fostering inclusive development. By leveraging local knowledge systems alongside scientific and technological advances, grassroots innovations can offer sustainable solutions in areas such as agriculture, health, energy, water management, and climate resilience. A strong STI ecosystem at this level not only empowers communities but also strengthens national innovation capacity by ensuring that technological progress reaches the last mile.

The evolving STI landscape in India increasingly demands a collaborative approach—bringing together government agencies, academia, industry, startups, and local communities. Such convergence enables the co-creation and deployment of context-specific technologies, fosters entrepreneurship, and accelerates technology diffusion. Emerging technologies such as artificial intelligence, drones, and biotechnology are reshaping the innovation ecosystem, creating new opportunities for problem-solving and scaling grassroots innovations through digital platforms and data-driven decision-making.

The way forward lies in building stronger institutional linkages between central and state systems, promoting participatory innovation models, and enhancing the capacity of State S&T Councils and local innovation hubs. Policy coherence, sustained funding, and inclusive frameworks that integrate science with social needs will be key to realizing an equitable and resilient STI ecosystem—one that transforms grassroots ingenuity into scalable, sustainable national progress.

Evaluating the Optimized Use of TiO_2 Nanoparticles in Promoting Microalgal Growth of *Chlorella* and *Scenedesmus* Species: Current Findings and Future Perspectives

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Abstract

Nanoparticles with a very less in diameter shows distinctive physicochemical properties and large surface area that confer significant advantages for applications in medical, biotechnology, microbiology, pharmaceutics and chemistry, engineering, inexpensive catalyst, cytotoxicity study. Titanium dioxide (TiO_2 NPs) nanoparticles are widely studied due to their notable optical and photocatalytic characteristics. However, their influence on microalgal physiology beyond toxicity has not been well studied until now. The present study investigates the effects of different concentration of TiO_2 nanoparticles from 0 to 5 µL on the growth of two microalgal species, *Chlorella* sp. and *Scenedesmus* sp., commonly used in remediation of polluted water bodies like Yamuna. Over a 15-day culture period, *Scenedesmus* sp. showed maximum growth under nanoparticle-free control medium and growth gradually decreasing as TiO_2 concentrations increased. However, *Chlorella* sp. shown in a growth as concentration-increase, achieving maximal optical density at 3 to 5 µL TiO_2, signifying a stimulatory effect at moderate to elevated nanoparticle levels. These divergent, species-specific responses highlight the potential for modifying TiO_2 nanoparticle dosages to increase microalgal growth and thereby enhance the phycoremediation efficiency. Subsequent investigations will focus on the integration of TiO_2 nanoparticle-mediated growth promotion within algal-based wastewater treatment systems to optimize contaminant removal.

Keywords: *Chlorella* sp., nanoparticle, phycoremediation, *Scenedesmus* sp, Titanium dioxide

Effect of Different Concentrations of Amoxicillin on Pollen Germination and Pollen Tube Elongation of *Catharanthus roseus*

Ananya Rawat[a] , Sakshi Sejal[a]

Prof. Saloni Bahri[a]*, Prof. Madhu Bajaj[a], Dr.Somdutta Sinha Roy[a] and Dr. Jyoti Arora[a]

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Abstract

Environmental contamination by pharmaceutical antibiotics has become an emerging ecological concern, yet their specific effects on early plant reproductive processes remain insufficiently explored. This study examined how varying concentrations of amoxicillin influence pollen germination and pollen tube elongation in *Catharanthus roseus*, a medicinally valuable species with dependable in-vitro pollen viability. Fresh pollen grains were exposed to graded amoxicillin solutions prepared in Brewbaker and Kwack medium and germination percentage along with pollen tube length were quantified using microscopy and micrometry to capture dose-dependent responses. The results showed a clear concentration-linked decline : control pollen exhibited robust germination and long, healthy tubes; low concentrations caused minimal or no inhibition; moderate concentrations significantly reduced germination and tube growth; and high concentrations led to strong suppression and many ungerminated grains. These patterns suggest that amoxicillin disrupts membrane stability and early developmental pathways, revealing its potential to impair plant reproduction under pharmaceutical pollution. Overall, the study highlights a pressing need to monitor antibiotic contaminants in urban and agricultural ecosystems, as even routinely used drugs may exert subtle but impactful effects on plant health and ecological balance.

Keywords : Amoxicillin, Pollen Germination, Pollen Tube Elongation, *Catharanthus roseus*, Brewbaker and Kwack Medium

Phytoremediation potential of *Lemna minor* in Removing Cationic and Anionic Synthetic Dyes: An Integrative Research Review

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Abstract

The textile industry is one of the largest contributors to water pollution. It releases effluents containing synthetic dyes, heavy metals, and other toxic compounds. Their complex aromatic structures make the synthetic dyes resistant to degradation. Conventional treatment methods like flocculation, adsorption, photolysis and membrane filtration are effective, but they are expensive and often create secondary pollution in the form of sludge. Because of these limitations, phytoremediation has become an eco-friendly alternative for dye removal. Phytoremediation utilizes the natural pollutant-removal capacity of plants. It has gained prominence as a viable green technology. Among aquatic macrophytes, Duckweed (*Lemna minor*) is a free-floating macrophyte found in fresh water and sewage, is an ideal candidate in wastewater treatment due to its higher growth rate and proven ability to absorb various pollutants, heavy metals, and organic compounds. This integrative review utilizes findings from recent studies (2020-2025) to evaluate the phytoremediation potential of *L. minor* for removing structurally distinct cationic and anionic textile dyes. A systematic literature search was conducted across scientific databases like ScienceDirect, Scopus, SpringerLink, and Google Scholar which reveals that *L. minor* shows higher removal efficiency for cationic dyes as compared to anionic dyes due to strong electrostatic attraction between positively charged dye molecules and negatively charged plant surfaces. Various mechanisms like biosorption onto root surfaces, rhizofiltration, phytostabilization and the gathering of metals into plant tissues that were identified. Despite strong laboratory-scale evidence, key research gaps still persist. The interactions within a mixed-dye system can be antagonistic or synergistic, and these effects are poorly understood for *Lemna minor*. In order to proceed to the next step of practical application future research on the topic will be more focused on validation at a pilot scale, studying plant-microbe interactions, developing multispecies phytoremediation approaches and carrying out the mechanisms by using mixtures of dyes. Overall, *Lemna minor* stands out as an eco-friendly, low-cost, and large-scale candidate for phytoremediation, which can significantly help in resolving dye pollution issues in underdeveloped areas with no or poor wastewater treatment facilities.

Endosperm Balance Number: Driver of Seed Success

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Abstract

Seed development in flowering plants depends on the correct balance of maternal and paternal genomes in the endosperm, controlled by the Endosperm Balance Number, EBN. This balance is essential for viable seed formation, yet the developmental effects of EBN variation across species remain underexplored. This study aims to examine how differences in EBN influence endosperm development, seed viability, and hybrid success, and to evaluate whether EBN can guide the selection of compatible parents in breeding programs. A structured literature review was conducted using peer reviewed studies from 1990 to 2025 that reported EBN values, genome ratios, and developmental outcomes in interspecific and interploidy crosses. Across studies, balanced EBN ratios supported normal endosperm cellularization, nutrient distribution, and embryo growth. In contrast, mismatched EBN caused abnormal or delayed endosperm development, reduced seed size, and frequent seed abortion. These findings highlight EBN as a major driver of seed success and a practical tool for predicting hybrid compatibility. Understanding EBN diversity can help breeders avoid post-zygotic barriers and improve seed-based crop improvement strategies.

Keywords: Endosperm Balance Number, seed development, genomic ratio, hybridization barriers, plant breeding

In-Silico ADMET Analysis & Pharmacological Profiling of *Emilia sonchifolia*

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Abstract

Emilia sonchifolia is a widely used medicinal herb known for its anti-inflammatory, antimicrobial, and wound-healing properties, yet its phytochemical mechanisms remain scientifically underexplored. This study establishes the first integrated in-silico workflow to evaluate the plant's phytochemicals through ADMET screening, target prediction, molecular docking, and pathway mapping. A total of 82 reported compounds were catalogued from literature, and γ-muurolene, a sesquiterpene hydrocarbon, was selected as a representative model to demonstrate the computational pipeline. ADMET analysis indicated favourable drug-likeness, while pharmacophore-based target prediction and docking helped identify potential protein interactions and biological pathways. This approach provides a systematic foundation for understanding the bioactive potential of *E. sonchifolia* phytochemicals and supports future prioritization of compounds for experimental validation.

Keywords*: Emilia sonchifolia*, γ-Muurolene, ADMET, Molecular Docking, Pathway Mapping

The potential of organic farming in agroecosystem: It's future prospects and Challenges

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Abstract

This review explores the potential of organic farming in agro-ecosystems, acknowledging its role in improving soil health and biodiversity, while confronting significant challenges such as often lower yields (15-25% reduction) and climate stress. Global organic cultivation has expanded significantly, indicating a rising demand for environmentally friendly food. Emerging solutions, including the use of climate-resilient cultivars and bio-inputs like microbial consortia and biofertilizers, show potential to address nutrient limitations and enhance plant resilience. However, the combined impact of these integrated approaches is not well understood, which represents a key research gap. The study emphasizes that integrating stress-tolerant cultivars with effective, locally sourced bio-inputs could enhance productivity, soil health, and resilience in organic systems, suggesting a crucial pathway for long-term sustainability that requires further multi-location field validation.

Keywords: Organic farming, climate-resilient cultivars, bio-inputs, soil health, sustainability, agroecosystems.

Exploring Stress Memory in *Arabidopsis thaliana* Through Transcriptomics: Differential Gene Expression, Core Network Structure, and Epigenetic Signatures

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Abstract

Drought severely limits global crop productivity, yet the mechanisms by which plants coordinate early stress responses and retain stress memory remain poorly understood. We analyzed the *Arabidopsis thaliana* drought dataset GSE80744 from NCBI GEO, comparing control plants with 3-day (early) and 9-day (late) drought treatments using GEO2R ($|\log_2 FC| \geq 1$, $p \leq 0.05$). Analysis revealed that early drought predominantly induced lipid-transfer proteins, glycine-rich proteins, and cell-wall enzymes (XTH3). In contrast, prolonged drought activated strong ABA- and defense-associated genes, including RAB18, LEA29/46, ACD6, and PDF1.2A, along with repression of several ERF transcription factors. The top 40 significant DEGs were integrated into STRING to generate a Minimal Stress Network, revealing a tightly connected module linking transcriptional regulators (ERF016/017/018, DREB1F), ABA/LEA nodes, defense genes, and structural components. Reports suggest that several key hubs—such as DREB1F, RD29A, AZI1, and PDF1.2 family genes—undergo chromatin modifications during repeated drought, indicating their potential roles as epigenetic stress-memory candidates. This analysis establishes a connection between phased transcriptomic responses with network structure and provides a framework for the development of a quantitative Memory Index in future.

Keywords: Drought, Differential Gene Expression, Transcriptomics, STRING Network, Stress Memory, Epigenetics

Baseline Assessment of Carbon Storage across Vegetation types in an Urban Institutional Landscape

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Abstract

Institutional green spaces contribute meaningfully to local climate regulation, yet their vegetation-specific carbon storage remains largely unquantified. Since different species vary in size, growth patterns, and biomass, establishing baseline information is essential for understanding their role in CO_2 mitigation and for guiding climate-responsive ecological planning. The primary objective of this study is to establish an initial baseline understanding of how different tree species within an institutional landscape contribute to carbon storage and CO_2 uptake. This involves documenting the existing vegetation structure and exploring early patterns in species-wise carbon values using non-destructive measurements and modelling tools. The study aims to generate foundational data that can support future, more detailed analyses of biomass, soil organic carbon, and overall carbon sequestration potential as the work progresses. Tree parameters including species identity, diameter at breast height (DBH), height, canopy width, and overall condition were recorded. These measurements were analysed through the i-Tree Eco model to estimate preliminary CO_2 uptake and early carbon storage patterns. Further integration of shrub biomass, lawn dry matter, and soil organic carbon is planned. Initial patterns indicate that larger-girth, mature species such as *Ficus*, *Pongamia pinnata*, and *Eucalyptus* form the dominant early carbon pool, while fast-growing species like *Cassia fistula* and *Mangifera indica* show higher annual uptake despite moderate biomass. Continued analysis is expected to produce a comprehensive, component-wise carbon budget for the institutional landscape.

Keywords: Carbon storage; CO_2 sequestration; institutional vegetation; i-Tree Eco model; allometric traits; DBH; species-specific carbon uptake; baseline assessment.

Biochar-based microbial seed coating to alleviate drought stress in medicinally important *Tithonia diversifolia*

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Abstract

Drought stress poses a significant threat to global agricultural productivity, with nearly 70% of global land area projected to experience declining soil moisture by 2025. In 2023, approximately 48% of global land experienced at least one month of extreme drought conditions, threatening food security and medicinal plant cultivation worldwide. *Tithonia diversifolia* (Mexican sunflower), valued for its anti-inflammatory, antimalarial, antidiabetic, and antioxidant properties, requires innovative cultivation strategies to enhance resilience under water scarcity. This study explores biochar-based microbial seed coating as a sustainable approach to alleviate drought stress in *T. diversifolia* cultivation.

Biochar seed coating enhances seed germination, stand establishment, and plant growth under water-deficit conditions through multiple mechanisms. The porous biochar structure improves soil water retention, nutrient availability, and creates favorable microhabitats for beneficial microorganisms, while microbial inoculants enhance root development and stress-responsive gene expression. Recent evidence demonstrates that biochar coating promotes photosynthetic performance, stabilizes chloroplast ultrastructure, and maintains reactive oxygen species homeostasis under drought stress. For *T. diversifolia*, which typically requires 1,000-2,000 mm annual rainfall but tolerates 700-2,500 mm, this technique offers potential to expand cultivation into marginal lands while maintaining medicinal compound production. Integration of plant growth-promoting rhizobacteria (PRPR) with biochar carriers have reported enhanced nutrient uptake by 39% for nitrogen, 31% for phosphorus, and 34% for potassium under water-deficit conditions. This innovative approach represents a scalable strategy for enhancing *T. diversifolia* cultivation resilience against drought stress.

Keywords: Drought Stress, Biochar, PGPR, *T. diversifolia*

Apomictic reproduction: Is it opportunity or failure?

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Abstract

Sexual reproduction is the norm in flowering plants, but apomixis which is asexual seed formation without fertilization offers an alternative pathway. It can produce genetically identical offspring, ensuring trait stability across generations. However, the absence of genetic recombination raises questions about adaptability and long-term viability. Understanding apomixis has immense potential in agriculture for fixing hybrid vigor and reducing seed costs. It will address the question- Does apomictic reproduction represent an evolutionary advantage (opportunity) or a limitation (failure) for plant species and agriculture? The hypothesis states that apomixis serves as an opportunity rather than a failure, offering stability and efficiency for agricultural systems, though it may limit genetic diversity in natural populations. It is a literature -based review. Sources are Peer-reviewed journals, scientific databases (PubMed, Google scholar, etc.), and reports from 2000-2025. Apomictic reproduction is more of an opportunity than a failure, especially in the context of sustainable agriculture and food security. Future research should focus on transferring apomictic traits into crop species and managing the genetic stability-diversity balance.

Keywords: Apomixis, asexual reproduction, parthenogenesis, hybrid seed, plant breeding, genetic stability.

The Phytoremediation power of *Eichhornia crassipes*: A case study at the Yamuna – Najafgarh confluence

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Abstract

The Yamuna River is a critical freshwater resource in northern India, supporting urban, agricultural, and industrial needs. However, rapid urban expansion and uncontrolled discharge of untreated sewage and industrial effluents—especially through the Najafgarh drain have resulted in significant ecological degradation and water quality deterioration. This study explores the phytoremediation potential of *Eichhornia crassipes* (water hyacinth) to mitigate Pollution in this region. Water from the Najafgarh drain section was treated with *E. crassipes* across three replicates over a 7-day period. Changes in physicochemical parameters were monitored on Days 0, 2nd, 5th, and 7th, including pH, electrical conductivity, total dissolved solids, salinity, chloride, acidity, alkalinity, dissolved oxygen (DO), and biological oxygen demand (BOD). Results showed notable reductions in BOD, electrical conductivity, salinity, and total dissolved solids, along with a marked increase in dissolved oxygen. The pH tended towards neutrality, and both acidity and alkalinity levels decreased, indicating improved buffering. These findings demonstrate that *E.crassipes* is an effective, low-cost phytoremediation agent for reducing pollution in urban aquatic ecosystems.

Keywords: *Eichhornia crassipes*, phytoremediation, Yamuna River, Najafgarh drain, water pollution, aquatic macrophytes, water quality, dissolved oxygen

In *Silico* analysis of Plant Secondary Metabolites in Enhancing Symbiotic Association between *Lotus japonicus* and *Bradyrhizobium* nodulation genes through Molecular Docking and ADMET Profiling

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Abstract

This study investigates secondary metabolites from *Lotus japonicus* including flavonoids such as daidzein and isoflavonoids as chemical signals that enhance its symbiosis with *Bradyrhizobium*. Molecular docking was used to evaluate their binding affinity to key nodulation proteins (NodD and NodZ), while ADMET profiling assessed stability, safety, and bioactivity. Several metabolites showed strong binding energies and favorable interactions with nodulation proteins, indicating potential to enhance early plant bacteria signaling. Most compounds also displayed good absorption and low predicted toxicity. These findings highlight promising natural metabolites that may promote nod gene activation and strengthen nitrogen-fixing symbiosis, supporting future experimental and sustainable agricultural applications.

Keywords: *Lotus japonicus*, Bradyrhizobium, secondary metabolites, flavonoids, isoflavonoids, NodD, NodZ, molecular docking, ADMET profiling, nodulation, nitrogen fixation, plant–microbe interaction, sustainable agriculture.

Development of Plant-Based Alginate Beads as a Slow-Release Larvicidal System Against Mosquito Larvae

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Abstract

Mosquito-borne diseases remain a serious health threat, and most widely used larvicides either impose environmental hazards or develop resistance over time. Plant-based compounds are safer alternatives, but most research depends upon crude extracts that degrade rapidly in water and are not easy to store for a longer period of time. This study investigates the feasibility of using alginate beads as carriers for plant bioactive molecules to slowly release them and thus render them useful in field applications in mosquito control. Beads were prepared by a simple ionotropic gelation method using sodium alginate and calcium chloride. Blank beads were first prepared to normalize the shape, firmness, and stability of the beads in water. Subsequently, plant extractloaded beads were prepared by the same method and studied for integrity and release pattern over 24 hours. The extract-loaded beads released their contents slowly while maintaining their shapes, indicating that the formulation works as a slow-release system. These initial observations seem to indicate that alginate beads may provide an eco-friendly alternative to chemical larvicides with better stability. Further bioassays with mosquito larvae will help determine their actual effectiveness and possible use at the community level for mosquito control.

Keywords: Alginate beads, mosquito larvae, plant-based larvicide, slow release, eco-friendly vector control

Pollen Germination as a Bioindicator of Herbicide-Induced Ecotoxicity

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Abstract

Herbicides are common in modern agriculture, but they increasingly threaten the reproductive processes of non-target plants. However, pollen toxicity is rarely considered in regulatory risk assessments. This review looks at in vitro pollen germination and tube growth as quick and cost-effective bioindicators of herbicide-induced toxicity. The goals are to (i) summarize the effects of commonly used herbicides, (ii) identify dose-dependent and species-specific toxicity patterns, and (iii) evaluate the use of pollen assays for early-warning ecotoxicological screening. A literature-based approach combined peer-reviewed studies that report quantitative germination or tube growth responses after herbicide exposure. The findings show that glyphosate, 2,4-D, metolachlor, and pelargonic acid significantly reduce pollen viability and tube growth in a concentration-dependent way. They often cause metabolic disruption, ROS imbalance, and morphological issues like swelling or rupture. Species sensitivity differs; for instance, pelargonic acid is more toxic than glyphosate in hazel pollen, while glyphosate caused around 66% viability loss in *Rosa acicularis*. These similar responses emphasize pollen's high sensitivity to chemical stress and support its inclusion in environmental risk assessments to improve the detection of sub-lethal impacts from herbicides and encourage sustainable farming practices.

Keywords: Pollen germination; Herbicide toxicity; Pollen tube growth; Bioindicator

Horticultural Expansion and Its Ecological Impacts on Forest and Endemic Species in the Eastern Himalayas

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Abstract

The Eastern Himalayas host exceptional biodiversity, yet expanding agriculture and horticulture in Arunachal Pradesh have intensified ecological pressure. In the Siang basin, covering Upper and East Siang, forests and secondary vegetation are increasingly converted into orchards under schemes such as the Kiwi Mission 2025–35. This study examines how these transitions affected forest integrity and endemic-species habitats from 1985 to 2025. Multi-temporal Landsat and Sentinel imagery were analysed in QGIS and Google Earth Engine to generate NDVI and NDWI indices for assessing changes in vegetation greenness and surface-water conditions, supported by policy documents and published literature. The assessment shows reduced vegetation cover and water stability in valley and foothill zones where horticulture has intensified. Forest thinning and edge expansion near road corridors and terraces indicate rising fragmentation. Endemic species such as *Rhododendron arunachalense* and *Michelia punduana* now persist in interior forest patches bordering orchard areas. State records note horticulture expanding to nearly 165,000 hectares by 2023, reflecting strong policy momentum but growing ecological strain. Horticultural growth improves livelihoods but lowers biodiversity resilience and watershed stability. Integrated land-use planning with biodiversity zoning, agroforestry buffers, and watershed-based management is needed to maintain ecological balance in the region.

Keywords: Upper Siang, East Siang, horticultural expansion, endemic species, NDVI, Eastern Himalayas, forest fragmentation

Evaluating the Effect of Herbicide on Root Meristem in Plant

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Abstract

Root meristems are highly sensitive area due to their continuous and active cell division, making them effective indicator of chemical toxicity. Herbicides, mostly used for weed management, often interfere with the cellular process in non-target plant tissue. This review collect and analyze literature focused on the cytotoxic and genotoxic responses of root meristem cell- mainly in *Allium cepa* and *Vicia faba*, widely used cytogenetic model plants. Across multiple studies, herbicide treatment has been shown to slow down the cell division, causing chromosomal defect including stickiness, chromosome bridges and lagging chromosome etc. These disruptions collectively impair the meristem organization and root growth. Studies have shown that combination of herbicides can produce even more toxic effect compared to a single herbicide. Overall, the review highlights chromosomal aberration and altered mitotic index as reliable indicator of herbicide toxicity, emphasizing the broader environmental implications of herbicide use.

Keywords:

Herbicide toxicity, root meristem, mitotic index, chromosomal aberration, cytotoxicity, genotoxicity.

Hidden Reproductive Toxicity of Herbicides: herbicides do not just affect weeds- they silently weaken the next generation of plants

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Abstract

Herbicides are essential in modern agriculture, but their subtle effects on plant reproduction often go unnoticed. This review examines how commonly used herbicides influence key stages of pollen biology, including pollen viability, germination, tube elongation, and subsequent fertilization. Findings from multiple plant species reveal that even low herbicide doses can slow pollen germination, alter tube structure, disrupt cellular processes, and ultimately reduce fertilization success and seed formation. These impacts frequently occur before visible damage appears on leaves or stems, showing that herbicides can cause hidden reproductive stress. The review further highlights differences in species sensitivity and the importance of exposure timing. By focusing on these reproductive responses, this work emphasizes the need for better evaluation of herbicide safety to support sustainable crop production and protect plant biodiversity.

Keywords: Herbicides, Pollen Biology, Pollen Tube Growth, Fertilization, Reproductive Toxicity, Plant Physiology, Crop Sustainability

Iron Oxide Nanocomposites: A Promising Catalyst for Dye Degradation

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Abstract

Due to fast growing industrialisation in textiles and other fields, the use of synthetic dyes and organic pollutants have increased a lot. To treat the dye contaminated waste water (10-200 mg/L of dye) is the most challenging task because of its significant impact on the environment and the traditional methods available are not that efficient. This study focuses on finding a cost-effective alternative for this problem providing environmental and industrial benefits. In recent years, Iron oxide nanoparticles have gathered so much attention because of their exceptional physiochemical properties such as superparamagnetism, higher surface to volume ratio, surface area and feasible magnetic separation, which makes them applicable in various fields. This research work outlines the synthesis of iron oxide nanoparticles through co-precipitation, employing various capping agents at different concentrations and temperatures with NaOH as the base. The nanoparticles were further combined with carbon ash obtained from natural precursors (Musaparadisiaca, Saccharum officinarum, and Mangifera indica) to synthesize nanocomposites. The iron nanocomposites were characterized by UV-Visible spectroscopy, XRD and FTIR analysis giving absorbance in the 250-380 nm range and band gap energies between 2.15 eV and 3.92 eV using tauc's plot. The formed composites result in approximately 95% visual degradation (in 5 minutes) of toxic dyes methylene blue and eosine. Overall, this study shows iron nanocomposites as potential agents for efficient dye degradation, indicating their application for water purification.

Keywords: Coprecipitation, Nanocomposite, Superparamagnetism, Organic pollutants, Iron oxide nanoparticles

Inhibition of STAT3 in the JAK-STAT pathway of atopic dermatitis: molecular docking of Desrhamnosyl acteoside from Foxglove as a potential inhibitor

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Abstract

Atopic Dermatitis (AD) is a chronic inflammatory skin disorder characterized by intense itching, redness and inflammation in the skin. AD is primarily mediated through the JAK-STAT signaling pathway. Among the key transcription factors, Signal Transducer and Activator of Transcription 3 (STAT3) plays a crucial role in AD pathogenesis, including immune cell differentiation (Th1, Th2, Th17/Th22), skin barrier integrity, and the perception of itch. Current treatment for AD such as immunosuppressants and corticosteroids is associated with major side effects with prolonged use and this highlights the need for safer, plant-based alternatives. In this study, molecular docking was performed to evaluate the binding affinity of Desrhamnosyl Acteoside, a phenylethanoid glycoside derived from the herb Foxglove (Digitalis purpurae), against the STAT3 protein. The 3D structure of STAT3 (PDB ID: 6SMB) was retrieved from the RCSB Protein Data Bank, and molecular docking was carried out using Schrödinger's Maestro software to analyse ligand-receptor interactions. Desrhamnosyl Acteoside demonstrated a good docking score, indicating significant inhibitory potential against STAT3 protein. These findings suggest that Desrhamnosyl Acteoside could serve as a natural STAT3 inhibitor and a promising lead compound for developing novel drugs against AD.

Keywords: Atopic Dermatitis, Foxglove, JAK-STAT pathway, STAT3, Desrhamnosyl Acteoside

A Detailed Study on $NiCeFeO_4$ Trimetallic Nanoparticles: Synthesis, Characterization and Practical Relevance

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Abstract

Ni-Fe-Ce trimetallic oxide nanoparticles were synthesized via top- down (solid state method) and bottom- up (co-precipitation method, pechini method) approaches. The Ni-Fe-Ce ternary metal oxide nanoparticle offers exceptional efficiency, owing to iron's redox flexibility, nickel's enhanced electrical conductivity and cerium's oxygen-vacancy-driven oxidation activity. The prepared nanoparticles are extensively researched for their roles in hydrogen evolution reaction, fuel cells, and dye degradation due to their high surface area, enhanced electron transfer capabilities, and remarkable stability. The prepared nanoparticles were characterized by XRD, UV, FTIR, FESEM, BET, VSM techniques.

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Keywords: trimetal oxide, oxidation activity, nanoparticles, dye degradation, co-precipitation, pechini method

Click Chemistry 2.0: When Chemistry Clicks with Code

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Abstract

Click chemistry, as first articulated by Kolb, Finn, and Sharpless (2001), has revolutionized synthetic design and synthesis methodology through modularity, reliability, and efficiency under mild and sustainable conditions. In recent years, these same qualities like orthogonality, rule-based reactivity, and high predictability have made click reactions ideal models for computational exploration and potential advance's investigation. This poster presents the evolution of click chemistry with the accelerating capabilities of artificial intelligence (AI) and data-driven computation.

By mapping the algorithmic nature of click transformations into reaction databases, machine learning models can learn from consistent input–output relationships. These can thus forecast optimal conditions, design orthogonal ligation systems, and predict novel click-like transformations. AI-assisted retrosynthesis planners and neural network predictors, trained on click-based datasets, also have demonstrated increasing success in generating chemically valid and sustainable synthetic routes. Such computational frameworks not only enhance reproducibility but also support green chemistry goals by minimizing experimental redundancy, waste, and energy consumption.

This combination of chemistry and computation redefines the discovery process itself by going from intuition-led to data-informed exploration. As predictive models continue to evolve, the frontier of click chemistry expands toward autonomous laboratories capable of guided, modular synthesis supporting green chemistry vision. The study reflects how computational chemistry and AI can transform "click" from a methodology into a work where chemistry not only clicks in the flask but also computes in the cloud.

Keywords: Click chemistry, Artificial intelligence, Computational synthesis, Machine learning, Retrosynthesis, Green chemistry, Predictive modelling

Thermodynamic and Spectroscopic Investigation of Molecular Interactions in N-Methylacetamide(NMA) + Polyethylene Glycol (PEG 200/300/400) Binary Mixtures

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Abstract

The molecular interactions in N-methylacetamide (NMA) + polyethylene glycol (PEG) mixtures are studied from the measurements of the densities, ρ and speeds of sound, u of NMA + PEG 200, PEG 300 and PEG 400 mixtures across the entire range of composition at temperatures, T/K = (293.15–323.15) and pressure, p = 100 kPa. The excess parameters, viz., excess molar volume, excess isentropic compressibility, excess intermolecular free length and excess acoustic impedance were calculated from the measured data.These parameters have been interpreted in terms of molecular interactions in these systems. Also, the FT-IR spectra of pure NMA, PEG and near equimolar NMA + PEG mixture were recorded and examined to substantiate the nature and extent of prevailing inter- molecular interactions, speeds of sound, u of NMA + PEG 200, PEG 300 and PEG 400 mixtures across the entire range of composition at temperatures, T/K = (293.15–323.15) and pressure, p = 100 kPa.

Keywords: N-methylacetamide; polyethylene glycol; excess molar volume; isentropic compressibility; excess intermolecular free length; excess acoustic impedance FT-IR.

Synthesis, Characterization and Potential Application of Mn dioxide nanoparticles

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Abstract

Manganese dioxide nanoparticles were synthesized by the co-precipitation method using various capping agents, including L-glutamic acid, L-cysteine, sodium borohydride, Ascorbic acid, and sodium citrate as stabilizing agents. The concentration of these used capping agents significantly impacts the nanoparticles properties, such as size, shape, and surface chemistry. The synthesized nanoparticles were characterized using X-ray diffraction (XRD), which revealed a crystalline structure and confirmed the successful synthesis of nanoparticles. The optical properties were studied using UV-visible spectroscopy, which showed band gap energy between 2.82-4.59 eV. The synthesized nanoparticles demonstrated excellent photocatalytic activity with methylene blue and Eosin degradation within 15 and 20 minutes, respectively. The nanoparticles might have a high surface area, crystallinity, and an energy-band gap, contributing to their enhanced catalytic performance. These nanoparticles and their nanocomposites can be used in the treatment of textile dye industry wastewater, which leads towards environmental sustainability.

Keywords: Manganese dioxide nanoparticles, capping agents, X-ray diffraction (XRD), band gap energy between2.82-4.59eV, photocatalytic activity, treatment of textile dye industry wastewater.

Green Corrosion Inhibition Using Hibiscus Flower Extract for Mild Steel in Acidic Medium

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Abstract

Corrosion of mild steel is a significant challenge in industries such as construction and manufacturing, particularly when exposed to acidic environments during processes like acid pickling. While conventional synthetic inhibitors effectively mitigate this issue, their inherent toxicity, high cost, and non-biodegradability pose serious environmental and health risks. This study investigates the efficacy of *Hibiscus rosa-sinensis* (China rose) flower extract as a sustainable, eco-friendly "green" corrosion inhibitor for mild steel in a 1M hydrochloric acid (HCl) medium.

The aqueous extract was prepared from dried hibiscus petals and tested at varying concentrations (1%, 3%, and 5% v/v) using the gravimetric (weight loss) method at room temperature over a 4 hour immersion period. Experimental results demonstrated that the *Hibiscus* flower extract significantly retards the corrosion rate of mild steel. The inhibition efficiency was found to be concentration-dependent, increasing with the amount of extract added, and achieving a maximum efficiency of approximately 85–90% at a 5% concentration. Visual inspection of surface morphology confirmed that mild steel samples treated with the extract exhibited a smoother surface with significantly less rust compared to uninhibited samples.

The study attributes this protective effect to the presence of phytochemicals such as flavonoids, anthocyanins, and phenolic acids within the extract. These organic compounds adsorb onto the metal surface, donating electrons to the vacant d-orbitals of iron atoms to form a stable, protective film that blocks corrosive agents. In conclusion, *Hibiscus rosa-sinensis* extract serves as a highly effective, biodegradable, and cost-efficient alternative to hazardous synthetic inhibitors for industrial applications.

Keywords: Green corrosion inhibitor, *Hibiscus rosa-sinensis*, Mild steel, Adsorption, Weight loss method, Eco-friendly.

Catalysis for Climate Solutions Bridging Chemistry and Environmental Stewardship

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Abstract

Climate change and escalating environmental degradation have intensified the global demand for scientifically driven, scalable climate solutions. Catalysis—long established as the foundation of chemical transformation—has emerged as a transformative technology capable of addressing some of the most urgent environmental challenges. This study examines recent advances in organocatalysis, photocatalysis, and electrocatalysis (2020–2025), highlighting their potential to reshape modern industries through sustainable reaction pathways, reduced activation energies, and eco-friendly synthesis routes. Catalytic systems now enable metal-free organic transformations, low-temperature industrial processes, and the conversion of greenhouse gases into valuable fuels and chemicals, thereby contributing directly to reduced global emissions and circular carbon utilization. A significant emphasis is placed on catalytic CO_2 capture and conversion technologies, which facilitate the transformation of atmospheric CO_2 into methanol, formic acid, syngas, and other industrially relevant products. Furthermore, photocatalytic and electrocatalytic water splitting show promise in enabling large-scale green hydrogen production, a cornerstone of future clean-energy systems. These innovations collectively demonstrate how catalysis can support a shift toward low-carbon industries while maintaining economic feasibility.The societal relevance of catalytic science is particularly evident in regions experiencing severe air pollution, such as Delhi, where particulate matter ($PM_{2.5}$ and PM_{10}), nitrogen oxides, volatile organic compounds, and carbonaceous emissions consistently exceed safe limits. Advanced catalytic converters, selective catalytic reduction units, photocatalytic air-purifying surfaces, and catalyst-assisted biomass-to-energy systems offer practical pathways to reducing emissions from transport, industrial operations, and combustion sources—three of the primary contributors to Delhi's air-quality crisis. Moreover, next-generation catalysts capable of decomposing NO_x and VOCs in real time present promising avenues for urban air purification. By uniting fundamental chemistry with environmental responsibility, catalysis emerges as a cornerstone of climate action. Its integration into energy production, industrial reform, pollution control, and CO_2 valorization underscores its central role in creating a sustainable and resilient future. The findings emphasize that catalytic innovation is not merely a scientific advancement but a critical strategy for combating climate change and improving air quality in rapidly urbanizing environments like Delhi.

Keywords: Catalysis, Climate Change Mitigation, Organocatalysis, Photocatalysis, Electrocatalysis, CO_2 Conversion, Green Hydrogen, Air Pollution, Delhi Pollution, Sustainable Chemistry, Environmental Catalysis, Green Technology

Green Luminescent Nanomaterials: A sustainable route for Anti-counterfeiting Inks

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Abstract

Counterfeiting of currency, goods and commercial products continues to be a persistent global challenge that threatens economic security. There by intensifying the demands for advanced, cost-effective, sustainable, and security materials. The earlier used traditional security inks often rely on toxic metals or synthetic kind of dyes which are unstable and less fluorescent.

Recent progress in the eco-friendly synthesis strategies, including cost-eUective biomass-derived precursors, also solvent-free methods, and low-energy processes which reduce global and atmosphere impact while enhancing emission stability. The photophysical mechanisms behind the purpose is their strong green luminescence, including those defect-state emission, the surface passivation, and the ligand-induced quantum eUects. Fluorescent nanomaterials, such as carbon quantum dots, doped metal oxides, oUer unique optical properties that serves as invisible with verifiable security features, good for secure labeling and authentication of currency notes. This review briefs the key materials, mechanisms and the potential of Luminescent nanomaterials for scalable smart anti- counterfeiting technologies with the real world applications, highlighting how nanomaterials can serve as reliable tools against forgery.

Keywords: Counterfeiting, sustainable, Fluorescent, carbon quantum dots, labeling, Luminescent, nanomaterials

The Strategic Periodic Table: How rare earth elements shape Sustainability, Technology and Global Policy

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Abstract

Rare earth elements (REEs) — the 15 lanthanides plus scandium and yttrium — are critical enablers for modern technologies from electric vehicles and wind turbines to smartphones and defence systems. Their unique electronic configuration (4f orbitals) gives rise to magnetism, luminescence and catalytic behaviour, making them indispensable to high-performance applications. Yet while REEs are abundant geologically, economically viable mining, separation chemistry and global supply-chain control are highly concentrated. In 2024, global production of REO (rare earth oxides) reached ~ 390,000 t, of which China produced ~ 270,000 t (~ 69% of global output). The combination of high technological demand, chemical processing complexity and geopolitical concentration makes REEs a strategic material bridging chemistry, policy and sustainability. The global political economy of REEs is shaped by highly uneven extraction and especially processing capacities. Over the past two decades, policy measures, low-cost processing investments, and regulatory environments concentrated refining and value-addition in a small number of producing states, producing supply-chain chokepoints and episodic market shocks when export policies or trade frictions escalated. These dynamics have driven recent national strategies (stockpiles, alliance building, and domestic processing investments) and regulatory efforts to classify REEs as "critical minerals" central to economic security. The geopolitics of REEs therefore emerges from an interplay of geology, process chemistry, and trade policy — where laboratory-scale separations and refining steps have direct diplomatic consequences.

Art in the Uncanny Valley: An Analysis of Ethical Conflict in AI-Generated Media

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Abstract

Artificial Intelligence (AI) tools such as Midjourney and DALL·E have reshaped digital art creation by enabling seamless synthesis of human imagination and algorithmic computation. However, this rapid expansion of AI-generated media has intensified debates around authenticity, artistic integrity, and copyright ethics. A major source of conflict arises from "style scraping," where prompts mimic copyrighted or culturally distinct visual styles such as Ghibli-style or Anime-style. This study investigates the prevalence and patterns of ethical concerns surrounding AI-generated artwork, using a dataset of 500 images and social-media metadata from trending "Ghibli-style" posts. After preprocessing and TF-IDF prompt analysis, correlation and pattern-detection techniques were applied to identify which prompts, platforms, and content types most frequently trigger ethical dilemmas. Results show that 48.2% of AI-generated posts were flagged for ethical concerns, with style-specific prompts showing the strongest correlation to accusations of plagiarism and misuse of artistic labour. Instagram emerged as the most conflict-intensive platform, reflecting active public discourse around ownership and artistic originality. These findings highlight the growing tension between AI creativity and ethical boundaries in digital art spaces, underscoring the need for clearer frameworks on authorship, artistic rights, and responsible AI-art practices.

Keywords: AI-generated art, ethical conflict, style scraping, Ghibli-style prompts, digital originality, plagiarism.

Comparison between Different Machine Learning Algorithms for Diabetes Prediction

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Abstract

Diabetes or diabetes mellitus is an incurable metabolic disease that is characterized by abnormal rises in blood sugar levels(hyperglycemia) due to insufficient insulin production in the body or the body's inability to use insulin effectively. It is a global health concern; The recent report of the International Diabetes Federation (IDF) Diabetes Atlas (2025) says that 11.1% (589 million) of the adult population has diabetes. And by 2050, 1 out of every 8 adults, i.e., approximately 853 million adults, will suffer from diabetes, which shows an increase of 46% from current numbers.

Given that it is an incurable disease, both its early prediction and identification are necessary. This research focuses on the prediction of diabetes using the Pima Indian Diabetes dataset. This paper aims to compare the performance of different machine learning algorithms, including Random Forest, XGBoost, Support Vector Machine (SVM), K-Nearest Neighbors (KNN), and Naïve Bayes (NB), on the Pima Indians Diabetes Dataset, to observe which algorithm works the best to predict diabetes. The algorithms are compared and evaluated on the basis of various evaluation metrics, including accuracy, precision, recall, F1-score, and confusion matrix, which are used to assess the models' predictive power. The results of this study provided insights into the best-performing model for diabetes. It was observed that among all the models, XGBoost and SVM achieved the highest accuracy, followed closely by Random Forest and KNN. Considering overall balance across all metrics and AUC, XGBoost stood out, with a high F1-score, recall, and AUC, indicating better handling of class imbalance.

Keywords: Diabetes, Machine Learning, Pima Indian Diabetes Dataset, Feature Selection, Predictive Modeling.

Computational Prediction of Phytochemicals Binding Using Machine Learning and Deep Learning Methods

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Abstract

Accurately predicting phytochemical–protein binding affinity is essential for advancing plant-based drug discovery, yet major challenges persist due to limited experimental datasets and the inherently complex nature of molecular interactions. To address these limitations, this study employs a hybrid AI-based framework that integrates molecular fingerprints, physicochemical descriptors, and protein-sequence features to model phytochemical–target binding. A combination of machine learning algorithms and deep learning techniques, including Graph Neural Networks (GNNs), was used to evaluate binding interactions. The predictive models achieved high performance with an AUC of 0.94 and an R^2 value of 0.78, further validated through Leave-One-Protein-Out cross-validation to ensure robustness across unseen protein targets. Model interpretability using SHAP analysis identified critical contributors such as Topological Polar Surface Area (TPSA), LogP, and GRAVY index as key determinants of binding affinity. The computational results were further supported by protein pocket visualization, confirming complementary ligand–receptor interactions. These findings highlight the potential of the proposed AI-driven pipeline as a reliable and interpretable tool for large-scale phytochemical screening and early-stage drug discovery.

Keywords: Phytochemicals, Binding Affinity, Machine Learning, Graph Neural Networks, SHAP Analysis, Protein–Ligand Interaction.

Dynamic Relationship Between Bitcoin and Gold in INR : Evidence from Rolling Correlation and Portfolio Analysis

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Abstract

Bitcoin and Gold are two assets increasingly compared for their roles in portfolio diversification and crisis protection. For Indian investors, however, their behavior can differ substantially once prices are evaluated in INR terms, making it important to understand how global shocks and currency movements shape their relationship. This study investigates the dynamic linkage between Bitcoin and Gold from 2016–2025 using daily USD prices converted to INR through date-wise USD/INR exchange rates. Rolling correlation analysis, volatility measures, tail-risk estimation (95% VaR and CVaR), and event-wise segmentation were performed to capture time-varying co-movement across four global regimes: Pre-COVID, COVID-19, War–Inflation, and Recovery.

The results show that Bitcoin–Gold correlation is not stable and shifts markedly with macroeconomic conditions. Correlation peaks during the COVID period, while weakening in recovery phases, indicating alternating phases of diversification and co-movement. Volatility comparison reveals that Bitcoin is substantially riskier in INR terms, with annualized volatility ranging from 22% to 138%, compared to Gold's 9% to 38%. Tail-risk metrics further highlight deeper downside exposure for Bitcoin. Portfolio simulations demonstrate that moderate Bitcoin exposure (20–30% allocation) yields the highest Sharpe ratio, suggesting that Bitcoin adds value only when used in controlled proportions alongside Gold.

These findings provide INR-specific evidence that Gold continues to act as the more stable risk-hedge for Indian investors, while Bitcoin enhances returns when markets stabilize. The study contributes a currency-adjusted perspective on Bitcoin–Gold dynamics and offers practical insights for constructing balanced portfolios under varying global macroeconomic conditions.

Keywords: Bitcoin, Gold, INR returns, Rolling correlation, Risk analysis, Portfolio diversification.

Enhancing Heart Disease Prediction Using Chi-Square Feature Selection and SMOTE-ENN Balancing: A Comparative Study of Machine Learning and Deep Learning Models

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Abstract

Heart disease remains one of the leading causes of morbidity and mortality worldwide, emphasizing the need for reliable and interpretable predictive tools in clinical decision-making. In this study, the Cleveland Heart Disease dataset was utilized to investigate whether simple machine learning models, when paired with robust preprocessing techniques, can perform comparably to more complex deep learning architectures. Feature selection was conducted using the Chi-Square test, and class imbalance was addressed through the SMOTE-ENN hybrid resampling technique. Subsequently, models including Logistic Regression, Decision Tree, Random Forest, and a Deep Learning network were trained and evaluated under multiple preprocessing configurations to analyze their predictive capabilities. The results demonstrate that well-designed and transparent machine learning models can achieve predictive performance on par with deep learning methods, while offering superior interpretability and ease of deployment in healthcare environments. These findings highlight the potential of simpler, explainable models as practical and efficient tools for heart disease prediction.

Keywords: Heart Disease Prediction, Chi-Square Feature Selection, SMOTE-ENN, Machine Learning, Deep Learning, Model Interpretability.

From Well-being to Wellness:analyzing happiness index and life expectancy of india vs globally

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Abstract

This study investigates the relationship between the Happiness Index and Life Expectancy in India. It compares these trends with global patterns from 2005 to 2024. Special attention is given to the impact of COVID-19. While many associate happiness with wealth or comfort, the Happiness Index emphasizes deeper factors. These include social trust, mental well-being, and a sense of purpose. India consistently ranks lower than the top five countries. This highlights that economic growth alone does not guarantee overall well-being. Data from the World Happiness Report is used. It includes 2,199 observations across 13 key variables. Random Forest Regressor and feature selection techniques are applied. These identify the factors most strongly influencing happiness and life expectancy. The analysis reveals that GDP per capita and life expectancy are the most significant predictors of happiness. Social support also has a strong effect. Generosity and perceptions of corruption have minimal impact. Conversely, happiness emerges as the strongest predictor of life expectancy. Economic stability and social support further support this relationship. The study finds that COVID-19 caused a sharp decline in India's happiness. Recovery has remained slow compared to global leaders. These findings highlight the importance of psychosocial factors. They are critical alongside economic development in enhancing well-being. The results can inform policy strategies aimed at improving life quality in India.

A study of m-Kannan contraction

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Abstract

Fixed point theory plays a central role in nonlinear analysis and applied mathematics. The Banach contraction principle guarantees a unique fixed point for contractive mappings on complete metric spaces, and its generalization by Kannan (1968) removed the requirement of continuity. However, it remains unclear whether similar results hold when iterates of a mapping satisfy Kannan-type conditions. This study addresses this theoretical gap by examining generalized contractions under relaxed assumptions. The main goal of this work is to study and analyse *m*-Kannan contractions. Our work will focus on finding conditions under which these map- pings possess unique fixed point. In our research work, we use analytical methods based on complete metric space and iterative sequences are analysed to show convergence under *m*-Kannan conditions, and we provide examples to confirm that results for both continuous and discontinuous cases. The proposed *m*-Kannan contraction generalizes the classical Kannan contraction ($m = 1$). Under *k*-continuity, the mapping admits a unique fixed point, with convergence from any initial point. Without continuity, the iterative sequence converges to a unique limit, which may not be a fixed point. We provide an example to show that the *m*-Kannan class is strictly larger than the Kannan class and includes discontinuous mappings. This study extends Kannan's fixed point theorem by developing the *m*-Kannan framework, demonstrating that continuity is a sufficient but not necessary condition for the existence of fixed points. The results broaden the understanding of contraction-type mappings and open new avenues for exploring non-continuous operators within fixed point theory.

Keywords: Kannan contraction, Banach contraction, iterates, k-continuity, m-Kannan contraction.

Numerical Solution of one-dimensional Burger's Equation using Hopf -Cole Transformation and Crank-Nicolson scheme

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Abstract

Various phenomena that exist in the real life such as modeling traffic flow, analysing gas dynamics and shock waves, cancer modeling, cosmology, etc. can be represented or studied using Burger's Equation. Understanding Burger's Equation can help us bridge the gap that exist between mathematical and physical significance. Burger's Equation is a fundamental non-linear partial differential equation that models the balance between non-linear convection and diffusion term. The objective of the research is to obtain the numerical solution of the solve the one space dimensional Burger's Equation. We first solved the Burgers equation using Hopf Cole Transformation which transforms the non-linear Burger's Equation into linear heat equation. The transformed heat equation is solved using Crank Nicolson Discretization scheme, yielding a system of algebraic equations. Further the Burgers equation is solved using Crank-Nicolson scheme without Hopf Cole transformation. The numerical results from both are compared with analytical solution for different values of viscosity. The efficiency analysis is done based on the asymptotic analysis and running time of the program with different grid sizes.

Keywords: Burger's Equation, Hopf Cole Transformation, Crank Nicolson, Absolute Error.

Solving Multiobjective Optimization Problem via Scalarization

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Abstract

Studying multiobjective optimization problems is very important as many real world problems involve objectives which are conflicting in nature. So, we need to create a balance between various conflicting objectives to arrive at the best or optimal solution in some appropriate sense because if there exists a solution that optimizes all the objectives simultaneously then we would have obtained an ideal solution. But quite often, it happens that improvement of one objective results in a loss of another leading to an unlikely existence of an ideal solution. The objective of this study is to solve the multiobjective optimization problem. In this research work, we will be solving a given multiobjective optimization problem by converting it into a single-objective problem i.e. A scalar problem which is much easier to solve as compared to a given complex problem. That's why we call it solving a multiobjective problem via a scalarization approach. For a single real valued function, it is easy to find out an optimal value as real values are easily comparable. In contrast to this, the space R^n, $n \geq 2$, for example, is not an ordered space unless we define an appropriate partial order for comparing its elements.

Keywords: Optimization, Multiobjective Programming, Scalarization

On some irreducibility criteria of a polynomial having integer coefficients

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Abstract

The problem of finding an irreducibility of a polynomial with integer coefficient fascinated several mathematicians. Some well-known classical irreducibility criteria are Eisenstein's irreducibility criterion, Mod p (p is prime) irreducibility criterion and reducibility test for 2- and 3-degree polynomials etc. Proceeding in the same direction, we study an irreducibility criterion of a polynomial f(x) with integer coefficients via prime p. More precisely, if we express p in base 10 as $p = a_m 10^m + a_{m-1}10^{m-1} + ... + a_1 10 + a_0$, then the polynomial $f(x) = a_m x^m + a_{m-1}x^{m-1} + ... + a_1 x + a_0$ is irreducible in $Z[x]$. Now for a fix b(t) in $F_q[t]$, where F_q is a finite field and q is a prime power, the above result can be generalized, if for a given irreducible polynomial p(t) in $F_q[t]$. we write $p(t) = a_m(t)b(t)^m + ... + a_1(t)b(t) + a_0(t)$, then the polynomial $f(x) = a_m(t)x^m + ... + a_1(t)x + a_0(t)$ is irreducible in $F_q[t, x]$.

Keywords: Polynomial, Irreducibility, Field.

Decoding E-Shopping Choices: Statistical Insights on Sales Sensitivity and Subscription Trends

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Abstract

This research analyses the way in which seasonal sales strategies and subscription-based models influence the digital buying habits of young Indian consumers. In regard to this, a questionnaire was circulated, and data were collected from people aged 18-24 in June 2024 in order to get valuable insights into the role of promotional sales strategies on consumer decision-making. The reliability analysis of the study confirms the strength of the data, which reveals that online shopping is the preferred mode of purchase among participants, with a majority of them reporting that they will postpone purchases until the sales period and subscribe to at least one digital service. The correlation analysis highlights some important key trends: Consumers who favour discounts don't generally show platform loyalty; transparent practices encourage peer review; and loyalty incentives, though present, have only a moderate impact, and that too in the fashion sector only. Although saving money is a motivator, it is not the only one leading to the switching of services. Other non-monetary factors, such as trust, ease of use, and personalization, also have a big role in shaping consumer preferences. Businesses can therefore strengthen their long-term relationships with young consumers by adopting transparent policies and timely execution of seasonal campaigns.

Keywords: Consumer Behaviour, Online Shopping, Seasonal Trends, Subscription-based Models, Correlation Analysis

Approximation by integral form of the operators involving Miller-Lee polynomials

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Abstract

In the year 2021, Sucu introduced a sequence of Stancu type operators including generalized Brenke polynomials. He studied some approximation properties of the operators. There are several integral modifications of well-known operators like Bernstein, Baskakov and Szász operators that are developed and studied. In the present article, we introduce the two integral modifications of the operators given by Sucu based on Baskakov basis function and Szász basis function. First, we estimate moments of these operators and establish some approximation properties for our integral type operators in terms of first and second modulus of continuity and asymptotic formulae for these operators. We extend the class of functions from continuous to integrable and we employ the software 'Mathematica' in order to carry out various computations involved.

Keywords: Baskakov basis function, Szász basis function, Modulus of continuity, asymptotic formulae.

Sensitivity analysis in optimization

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Abstract

In practice, most of the parameters involved in optimization models are rarely fixed. Sometimes the cost fluctuates, sometimes the availability of resources changes, and sometimes the external conditions, like market demand, change. Re-solving an optimization problem from scratch each time these parameters change is impractical. Therefore, sensitivity analysis helps to determine how much variation an optimal solution can tolerate, making optimization more practical and reliable. The study will dwell on developing the understanding of sensitivity analysis in both LPP and NLP settings and how it aids in making better decisions. The goal of this dissertation is to analyze how changes in model parameters affect optimal solutions. Precisely, the research investigates sensitivity analysis in Linear Programming through the variation of cost coefficients and resource availability, after which an extension is made to Nonlinear Programming via Quadratic Programming Problems (QPP). We solve a Linear Programming Problem by the Simplex Method and then perform sensitivity analysis by varying systematically: i) cost coefficients (c_j) and ii) resource availability values (b), interpreting the changes that result in the optimum value, shadow prices, and feasible region. An example is used for the purpose of illustrating these changes.

Next, the Quadratic Programming Problem is considered and solved graphically by contour plots and representation of the feasible region. Then, sensitivity is applied by changing parameters in the quadratic objective function to see how the optimal point shifts. For the linear case, the results indicate that the optimal solution remains stable within certain ranges of allowable changes in cost coefficients and resource levels, beyond which the basis changes and production decisions adjust accordingly. The quadratic model is different, with parameter variations affecting the objective function and resulting in more complicated shifts in the position of the optimum. Graphical analysis can dramatically demonstrate how nonlinear models differ in the way that they respond to changes in parameters. The work emphasizes the practical relevance of sensitivity analysis as a means to investigate the robustness of optimization models. Both LPP and QPP analyses have shown how variation in parameters affects decision-making and allows decision-makers to make necessary changes in strategies without completely resolving the model. Generally, sensitivity analysis provides greater flexibility and credibility to the application of optimization in real-life uncertain scenarios.

Keywords: Optimization, Sensitivity Analysis, Linear Programming, Nonlinear Programming, Quadratic Programming Problems.

TOPSIS analysis for prioritising online learning platforms

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Abstract

With the rapid expansion of online learning platforms, it has become increasingly challenging for students to choose the best platform that aligns with their educational needs. This paper aims to prioritise the online learning platforms as per student needs and requirements. The study uses four key criteria, namely, ease of use, variety of courses, cost, and reputation of instructors. The MCDM technique, the TOPSIS method, is used to rank various alternatives based on their distance from the ideal best or ideal worst solution. The findings highlight the objectivity and transparency of the MCDA-TOPSIS approach in comparing alternatives and provide valuable insights into the relative strengths and weaknesses of each platform. This study assists students in making informed decisions and choosing a platform suitable for their study needs.

Keywords: Multicriteria decision making, Online learning platform, TOPSIS method, student needs, Criteria weights.

Learning With Errors (LWE)

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Abstract

The Learning With Errors (LWE) problem is one of the central hardness assumptions in modern cryptography. Introduced by Oded Regev in 2005, it has since become a cornerstone for constructing cryptographic primitives that are believed to be secure even against quantum computers. The LWE problem generalizes the classical Learning Parity with Noise (LPN) problem and captures the difficulty of solving systems of noisy linear equations over finite fields. To summarize the fundamentals of LWE and its role in developing secure, quantum-resistant cryptographic systems. The study reviews LWE's mathematical structure, noise model, hardness reductions to lattice problems, and its use in key cryptographic schemes such as encryption and signatures.

Keywords: Learning With Errors (LWE), lattice-based cryptography, post-quantum cryptography, hardness assumptions, cryptographic primitives, noise distribution, lattice problems, quantum-resistant security.

A Study on Screen Time Usage of Adolescents

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Abstract

In today's world, where education and everyday life are increasingly digital, screen time has become a normal part of adolescents' routines. While being constantly connected offers many benefits, it also raises important questions about the impact on young people's physical health, mental wellbeing, sleep, and social interactions. Despite these concerns, there is still a lack of detailed research in the Indian context that looks at how screen time relates to various personal, behavioral, and health factors all at once, especially for adolescents navigating life in a rapidly digitalizing society. The study aims to explore how the amount of daily screen time relates to various factors such as adolescents' demographic background, their patterns of device and internet use, lifestyle habits, and selected aspects of physical and mental health. The study uses a structured Google Forms survey shared with adolescents to collect information on demographics, parents' education, device types, internet access, phone usage habits, favorite apps, and Wi-Fi quality. It also asks about stress and anxiety related to screen time, eye strain, muscle pain, break habits, multitasking, screen-time controls, effects on concentration, sleep duration, physical activity, and BMI. The gathered data will be analyzed using descriptive and inferential statistics to explore links between screen time and these factors.

Keywords: Adolescents, Screen time, Mental health, Lifestyle behaviours, Digital habits.

Optimized Workforce Scheduling via Integer Linear Programming

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Abstract

Service industries, particularly call centers, face a critical challenge in minimizing operational costs while guaranteeing service level consistency against dynamically fluctuating demand. This research addresses the scheduling problem in managing a multi-skilled workforce: the necessity of trading off the lower cost of single-skill specialist agents against the greater operational flexibility and coverage provided by higher-cost multi (cross)-trained agents. The study aims to develop an integer linear programming model and apply a deterministic optimization framework to find the optimal assignment of three agent types, across two 8-hour shifts to minimize the total daily labour cost. This must be achieved while rigidly satisfying four non-negotiable minimum staffing demands for two skills during two distinct, overlapping time periods. We are using an Integer Linear Programming (ILP) model, a standard technique in Operations Research. The formulation includes six integer decision variables $x_{j,k}$ representing the count of each agent type on each of the two available 8-hour shifts. The objective function minimizes cost, factoring in the wage difference (₹160 vs. ₹200 per shift). The model is constrained by four linear inequalities, ensuring sufficient skilled coverage for the required staff levels. The model is designed to be solved computationally using the Branch and Bound algorithm. The optimal solution yielded a strategic hybrid staffing mix that utilized a necessary quantity of cross-trained agents in the overlapping shift period. This optimized approach resulted in cost saving and reduction in overstaffing. The optimal solution yielded a strategic hybrid staffing mix that utilized a necessary quantity of cross-trained agent.

Keywords: Branch and Bound, Cost Optimization, Integer Linear Programming, Optimization, Shift Scheduling Problem.

Phenomenological Modelling of Deuteron – A Lennard-Jones Potential Approach

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Abstract

Understanding nucleon-nucleon interactions at low energies has long been an active area of research in nuclear physics. While nucleons are composed of quarks at a more fundamental level, the calculational complexity associated with treating quark-quark interactions at low energies necessitates using alternative approaches for probing nuclear interactions. One of the most popular strategies towards studying nuclear systems is to adopt or construct phenomenological potential models, an approach which has proved to be considerably successful over the years in various contexts.

In this work, we consider the simplest of all nuclear systems, the Deuteron, a unique, loosely-bound system with just one proton and one neutron, which makes a wonderful test case to understand nucleon-nucleon interactions through phenomenological modelling. Furthermore, the knowledge of the Deuteron wavefunction is useful for an assessment of its polarization characteristics, as well as the determination of scattering amplitudes/transition amplitudes in nuclear reactions involving a Deuteron. Thus, such problems have previously been explored through various phenomenological models for nucleon-nucleon interaction in the literature, such as a Radial Potential Well, Woods-Saxon Potential, Reid Potentials, Argonne Potential, Morse Potential, and H ¨ulth´en Potential. In the present work, we develop a new phenomenological model with as few free parameters as possible, to describe the proton-nucleon interaction in a Deuteron. The key idea underlying this work is the common knowledge that the short range nuclear forces are attractive for some distance, but also have a repulsive core for inter-nucleon separation smaller than a certain optimal distance. This behavior is in-principle similar to the behavior of inter-molecular forces. Motivated by this similarity, we mathematically model this behavior by attempting a phenomenological potential from the Lennard-Jones family of potentials, which is commonly used in molecular dynamics, with $V(r) = \frac{A}{r^m} - \frac{B}{r^n}$ with m > n.

Besides the commonly used "12-6" variant of the Lennard-Jones Potential, we also adopt other phenomenological models from this family, especially the "8-2" Lennard-Jones Potential, which is also found to work reasonably well. We solve the Schr ¨odinger equation for the Deuteron with the said potentials, numerically using the finite-difference method. Key physical properties of the Deuteron, such as its Binding Energy, are extracted directly, while other attributes like the most probable radius (r_{mp}) , which may be taken as an estimate of the size of the Deuteron, and its root mean square radius (r_{rms}), are calculated with the aid of the computed Deuteron wavefunction, and verified against the experimentally known values for the

same, as well as against model-dependent calculations for the same within various other phenomenological models mentioned before. The results are resoundingly positive, as we find that our "8-2" Lennard-Jones Potential successfully generates the experimentally known Deuteron Binding Energy of 2.22 MeV, and gives a size estimate (through r_{mp}) as 1.96 fm, which is within 0.15% of the known size. This excellent agreement establishes that our model is firmly well-placed within the family of phenomenological models for the Deuteron.This work shows that nuclear interactions in this simple two-body system can be approximated using the Lennard–Jones family of potentials, and illustrates how the knowledge of the nature of nuclear forces can help us build an intuitive two/three-parameter pheonomenological model, which approximately reproduces the Deuteron attributes known experimentally from scattering studies, as well as from more evolved low-energy nuclear phenomenological models.

A Peek into Early Universe: GRB Calibration with Artificial Neural Network (ANN) on Hubble and Pantheon+ Data

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Abstract

Understanding the late-time expansion history of the Universe is a cornerstone of modern cosmology. The Hubble parameter, *H(z)*, encapsulates the rate of cosmic expansion as a function of redshift, serving as a direct probe of dark energy dynamics and deviations from the ΛCDM model. However, most determinations of *H(z)* rely on parametric assumptions such as specific forms of the dark energy equation of state that may bias the inferred expansion history. To avoid this, non-parametric reconstruction techniques have become increasingly important. This study presents a comparative reconstruction of the Hubble parameter using Gaussian Process (GP) regression and Artificial Neural Networks (ANNs), focusing on the ability of each method to capture ne-scale structure and uncertainty in the observational data.

The objective of this work is twofold: first, to evaluate how well GPs and ANNs can reconstruct *H(z)* from sparse and noisy observational datasets without imposing a cosmological model; and second, to quantify the robustness and interpretability of these reconstructions in the presence of observational uncertainties. Specifically, we seek to assess whether machine-learning-based approaches such as ANNs can complement or outperform kernel-based GP regression in capturing non-linear trends in *H(z)*.

The methodology involves reconstructing *H(z)* from a compilation of current observational data, including cosmic chronometers (differential age method) and baryon acoustic oscillation (BAO) measurements, spanning $0 < z < 2$. For the Gaussian Process reconstruction, we employ a squared-exponential kernel with hyperparameters optimized through maximization of the marginal likelihood. The GP inherently provides smooth functional interpolation with uncertainty estimates that depend on data density and noise level. In contrast, the ANN reconstruction is implemented using a fully connected feed-forward network with multiple hidden layers and non- linear activations (ELU and ReLU). The network is trained via backpropagation using mean squared error loss and regularized using dropout and early stopping to prevent overfitting. Bootstrap re-sampling is employed to estimate uncertainty bands around the ANN predictions, allowing a direct comparison with GP condence intervals.

The results show that both GP and ANN reconstructions reproduce the expected monotonic increase of *H(z)* with redshift and are broadly consistent with ΛCDM predictions within 1σ confidence regions. The GP provides smooth, conservative estimates with well-behaved uncertainties, but tends to underfit regions with rapid changes due to its kernel rigidity. The ANN, on the other hand, captures subtle non-linear features in the data, potentially indicating local deviations in the reconstructed expansion rate. However, its uncertainty quantication derived from bootstrapping rather than intrinsic Bayesian variance - is broader and less

structured. Quantitatively, both methods yield present-day Hubble constants H0 consistent with current observational bounds, with ANNs slightly favoring higher H_0 values than GPs.

In conclusion, Gaussian Processes remain the most statistically transparent and stable approach for non-parametric cosmological reconstructions, particularly when uncertainty estimation is critical. Nevertheless, Artificial Neural Networks demonstrate strong potential for detecting non-trivial patterns in sparse cosmological data when properly regularized and ensemble-averaged. A hybrid framework combining the interpretability of GP priors with the expressive power of neural networks may represent the next step toward robust, model-independent inference of the cosmic expansion history.

Sol-Gel Derived MoS_2 Thin Films for Sensitive Bilirubin Biosensing

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Abstract

Bilirubin is an important biomarker used to evaluate liver function. The abnormal levels often indicate liver disorders such as jaundice, hepatitis, and other metabolic complications. Early and accurate detection of bilirubin is essential for timely medical intervention, which can significantly improve treatment outcomes and reduce the risk of severe health complications. Electrochemical biosensors offer a promising solution due to their high sensitivity, low cost, ease of fabrication, and potential for real-time, point-of-care monitoring. In this work, MoS_2 thin films were synthesized using a simple and cost-effective sol-gel method, followed by deposition on Pt/Si substrates through spin coating under optimized processing conditions. The films were further treated with thermal annealing to enhance their structural and electrical properties. Characterization techniques such as X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and UV-Visible spectroscopy confirmed the successful formation of crystalline MoS_2 with strong Mo–S bonding and an optical band gap of 1.2 eV. The electrochemical behaviour of the films was investigated for bilirubin detection using cyclic voltammetry (CV) and differential pulse voltammetry (DPV). The results showed that the films exhibit excellent sensitivity and selectivity toward bilirubin, highlighting their potential for accurate and efficient biosensing applications. Overall, this study demonstrates that sol-gel derived MoS_2 thin films provide a stable, reproducible, and cost-effective platform for bilirubin biosensors. These findings contribute to the development of compact and real-time diagnostic devices that can be used in healthcare for early disease detection and improved patient care.

Keywords: MoS_2 thin films; Biosensor; Bilirubin detection.

Photometric and Kinematic Study of Open Cluster using Gaussian Mixture Model (Melotte 111)

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Abstract

Open Clusters are often regarded as a laboratory for stellar evolution; stars in these clusters have similar ages and metallicities as they are formed through the same molecular cloud; the only major difference between them is their stellar mass. The simplest way to find an Open Cluster is by looking for star overdensities in the night sky, supplemented with a color–magnitude diagram. This study focuses on Melotte 111 (Coma Berenices), aiming to determine accurate membership probabilities, analyze cluster kinematics, and constrain its age and metallicity using Gaia DR3 photometric and astrometric data. Melotte 111 is a prominent celestial gathering located within the constellation Coma Berenices, renowned for its proximity to our Sun, at a distance of approximately 87 parsecs, located at approximately RA = 12h 23m, Dec = $+26^{\circ}$. We used photometric data from Gaia DR3 to determine the membership of the Cluster. A variety of machine learning models can be used; we applied the Gaussian Mixture Model (GMM) using parallax, proper motion in RA (pmRA), and proper motion in DEC as discriminating parameters. Reddening and extinction corrections were performed for the photometric dataset, followed by isochrone fitting to derive cluster physical parameters. We have applied this model to 8 other Open Clusters (OCs), with varying ages (log age 7.555 to 8.91) and distances (275.5 pc to 7004 pc), and compared our results for these clusters for different methods, and investigated the efficiency of this model for identifying the member stars in the cluster. For Melotte 111 we obtained pmRA = −11.0275 mas/yr and pmDEC = −8.36989 mas/yr, log age = 8.87506 and Metallicity $Z \approx 0.02$. Similarly, we have obtained the result for other clusters as well. However, the model showed reduced efficiency for distant clusters or those with low stellar density due to weaker dynamical contrast with surrounding field stars. The refined parameters will aid in understanding the early dynamical evolution of nearby clusters and calibrating stellar models. These results contribute to broader efforts in mapping the local Galactic environment and can be extended to other young clusters.

Enhanced Conductivity and Flexibility in Polyaniline-Based Thermoelectric Energy Harvesters: A Comprehensive Study

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Abstract

Organic polymer-based thermoelectric energy harvesters have garnered significant attention from both scientists and industry as a means to address the growing demand for renewable energy in the current era of climate change in a cost-effective way. In this context, the present study explores a range of PAni based composites and compares their performance with the goal of achieving a higher Seebeck coefficient, higher electrical conductivity and lower thermal conductivity. More than 15 PAni-based composite formulations were investigated, including varying concentrations of PEDOT:PSS (20, 30, 50%), conductive fillers (MWCNTs), different substrates (glass, pellet, PVDF), and compatibility with different solvents (DMSO, DMF), to determine the most suitable composition for flexible thermoelectric energy harvesters. Consequently, a thin and flexible thermoelectric film was developed via in-situ polymerization of polyaniline (PAni) combined with multi-walled carbon nanotubes (MWCNTs) in a PVDF matrix. The film demonstrated a stable voltage output and a distinct Seebeck coefficient of 556μV/K (PAni/PVDF) under a moderate temperature gradient when tested using a custom thermoelectric setup. Its excellent mechanical strength, lightweight nature, and reliable thermoelectric performance highlight its promise for application in wearable, flexible, and self-powered energy-harvesting devices.

Development of Low - Cost Biofilter for Laundry Wastewater for Safe Reuse

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Abstract

Rapid urbanization and growing population in India have increased the water scarcity. About 72% of sewage that is being left untreated contributes to surface and groundwater pollution. Laundry wastewater (LWW), contributes 21% of total domestic greywater and contains high levels of detergents, surfactants and organic pollutants, whose direct discharge is environmentally harmful. Centralized treatment systems are efficient but they are often energy intensive, expensive, and unsuitable for decentralized applications. The purpose of this study is to develop a low cost, household – level biofilter using locally available materials – gravel, sand and neem seed shells for treatment and reuse of LWW which aligns with SDG 6.3 (Improve water quality, wastewater treatment and safe reuse). Neem seed shell is an efficient adsorbent and it is a waste product in neem oil industry, sand and gravel enabling physical filtration and biofilm forms on them which helps in breakdown of organic matter present in greywater. Key parameters to be analysed are pH, temperature, chemical oxygen demand (COD), biological oxygen demand (BOD) etc. Based on previous findings and literature, it suggests that proposed system can reduce up to 70% COD and BOD with 70-80% surfactant adsorption, resulting in treated effluent suitable for non -potable uses like floor cleaning, cleaning stairs and corridors. The system is eco- friendly, affordable and easy to maintain, offering a suitable alternative for decentralized greywater management. This biofilter will potentially help achieve SDG 6.3 by treating LWW so it can be safely reused.

Keywords: SDG, Laundry wastewater, Greywater, Biofilter, Neem seed shell, Adsorbent

ARID4B: A Multifunctional Chromatin Regulator of Cancer and Reproduction

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Abstract

ARID4B (AT-Rich Interactive Domain-containing protein 4B) is a chromatin-associated transcriptional regulator belonging to the ARID protein family. Structurally, ARID4B contains an ARID DNA-binding domain, chromosomal domains, and coiled-coil motifs that mediate protein–protein interactions. It also possesses a unique interdigitated double Tudor domain (HTD) that binds directly to DNA through charge-based interactions, explaining its role in chromatin remodeling and gene regulation. These structural regions enable ARID4B to recognize specific DNA sequences and histone modifications, allowing it to regulate chromatin organization and transcriptional activity as part of the mSIN3A–HDAC1/2 corepressor complex.

Functionally, ARID4B has crucial regulatory roles in stem cell differentiation, epigenetic regulation, gene expression, embryonic development, and reproduction. In embryonic stem cells, its loss disrupts the balance between active and repressive histone marks, affecting developmental signaling and gene expression. In cancer biology, ARID4B exhibits context-dependent behavior—promoting tumor growth in PTEN-deficient prostate cancer via activation of PI3K pathway genes—and is also implicated in glioma, breast, and liver cancers. In reproduction, ARID4B functions as an androgen receptor coactivator in Sertoli cells, regulating genes essential for spermatogenesis, germ cell survival, and testicular structure. Overall, ARID4B is a multifunctional chromatin regulator vital for normal developmental and reproductive processes.

The Multifaceted Role of PUM1 in Post-Transcriptional Regulation and Oncogenic Signaling

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Abstract

PUM1 is a member of the evolutionarily conserved Pumilio family of RNA-binding proteins, Pumilio (Pum)/FBF family (PUF), which has emerged as a key regulator of post-transcriptional gene expression with profound implications in cancer biology and apoptosis. Recent studies have expanded the focus beyond transcriptional regulations, demonstrating that PUM1 specifically binds to a conserved RNA sequence motif, UGUAHAUW, located primarily within the 3′ untranslated regions (3′UTRs) of target mRNAs, thereby determining the fate of these mRNAs. Depending on the recruited protein cofactors, PUM proteins can direct their target mRNAs toward translation, repression, activation, degradation, or specific localization. Dysregulated expression of PUM1 is found in numerous cancers including colon, gastric, pancreatic, and ovarian cancers, where it promotes tumor progression by enhancing proliferation, migration, metabolic reprogramming and immune evasion. PUM1 exerts oncogenic effects by repressing tumor suppressor genes such as p27 and modulating key signaling pathways including PI3K/AKT and PERK/eIF2/ATF4, which are in turn linked to apoptosis regulation. Studies suggest PUM1 influences apoptosis by affecting pro- and anti-apoptotic factors at the post-transcriptional level helping cancer cells to evade programmed cell death and develop therapy resistance. PUM1 hence interacts with protein cofactors and non-coding RNAs, shaping complex regulatory networks that control cancer cell survival and apoptotic responses. Studies highlight the potential of targeting PUM1-mediated pathways as novel therapeutic strategies to restore apoptosis and inhibit malignancy.

Sustainable Conversion of Fruit-waste into Biofertilizer for Soil Enrichment and Plant Growth Enhancement

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Abstract

Fruits are an excellent source of vitamins, minerals, and antioxidants, but some fruits produce a massive amount of fruit waste and often get discarded, yet are rich in essential nutrients. Due to improper disposal, the accumulation of fruit waste in the kitchen and at the fruit market poses a significant environmental pollution problem. Therefore, the objective of this study is to address the issue of fruit-waste accumulation by recycling the fruit waste for sustainable conversion into biofertilizer using a solid-state fermentation (SSF) process, allowing us to recycle the fruit waste's nutrients back into the soil. SSF is used for its efficiency in producing biofertilizer in low-moisture environments, so it makes the sustainable conversion of waste into nutrient-rich biofertilizer and applies it to crop plantations to assess the effectiveness of the biofertilizer in the enhancement of soil fertility by analyzing the pH of the soil, essential macronutrients, and microbial growth. And plant growth parameters, including shoot length, root length, and number of leaves. The resulting data will be analyzed statistically to compare different fruit-based biofertilizer treatments. It offers a cost-effective and environmentally sustainable alternative to chemical fertilizers.

Keywords: Fruit-waste utilization, Solid-state fermentation, Sustainability, Biofertilizer

Comprehensive evaluation of polymorphism in SLC11A1 and its association with susceptibility to Tuberculosis

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Abstract

Tuberculosis, a contagious infectious disease caused by Mycobacterium tuberculosis, is a major cause of worldwide mortality, causing over 2 million deaths. SLC11A1- Solute carrier 11 of family 1 (also called NRAMP1- Natural resistance associated macrophage protein 1) plays a key role in macrophage activation and innate immune response. It regulates iron concentration inside phagosomes for Reactive oxygen species production- an important defence mechanism against Mycobacterium tuberculosis. Host genetic variations are studied to understand their contribution to differences in disease susceptibility. GTG repeat deletion in the 3'UTR of the human NRAMP1 gene is associated with increased susceptibility to TB and may lead to reduced NRAMP1 production. Past meta-analysis and case studies have yielded conflicting and inconclusive results. Some studies confirm high risk in Asian populations for 3'UTR variants while some studies confirm effect across ethnicities, not confined to a single population. Based on given reports, we propose an updated Meta Analysis which will help clarifying the role of these genetic mutations towards susceptibility to Tuberculosis. In the current study, an updated Meta Analysis is being conducted.

The multifunctional role of HDAC3 gene in metabolism, neurobiology and cancer

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Abstract

The HDAC3 [Histone deacetylase3] gene codes for a zinc-dependent enzyme that plays a crucial role in the regulation of gene expression by chromatin remodelling. The gene HDAC3 works to remove acetyl groups from histone proteins, which results in chromatin condensation and silencing of gene transcription. Apart from histones, HDAC3 deacetylates non-histone proteins, affecting the cellular pathways like cell cycle control, apoptosis, and metabolism. It has been observed that it regulates various physiological processes, including lipid and glucose metabolism, neural plasticity, and circadian rhythm. HDAC3 is highly expressed in most human tissues, mainly in the brain, liver, and heart. In the liver, HDAC3 maintains lipid homeostasis, and in the nervous system, it promotes learning and memory. HDAC3 is overexpressed in multiple cancers, which leads to tumour growth and repression of tumour suppressor genes. It is also expressed in neurodegenerative conditions such as Alzheimer's and Parkinson's diseases. Complete loss of HDAC3 function is embryonically lethal in mammals. The dysregulation of this gene has been shown in metabolic and inflammatory disorders. In reproduction, HDAC3 is important in gametogenesis and early embryonic development. It controls the gene expression, which is necessary for oocyte maturation, sperm formation, and zygotic genome activation. HDAC3 deficiency disrupts chromatin remodelling during meiosis and embryogenesis, which results in impaired fertility. HDAC3 activity is expressed through post-translational modifications and interactions with co-regulators. So, HDAC3 represents an epigenetic regulator of chromatin dynamics to cellular metabolism, development, and disease.

Keywords: HDAC3, Histone deactylase, cancer, gametogenesis, neurodegenerative, chromatin remodelling

Evaluation of the efficacy of a concoction of Banana Peels, Walnut Shells, and Human Hair as an Affordable Biofilters for treatment of Laundry Waste Water

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Abstract

This research aims to experimentally evaluate the efficacy of natural waste materials—banana peels, walnut shells, and human hair—as biofilters for treating laundry wastewater. The study will involve three test setups, each containing equal volumes of simulated laundry water with consistent contamination levels. Each test tube will be treated with a different biofilter composition: one containing a mixture of all three biomasses, and two others containing combinations of two materials each. These biofilters will be prepared by processing and mixing waste materials into filter media designed to trap dyes, grease, heavy metals, and other pollutants present in laundry effluent. Water will pass through each biofilter, and the filtered samples will be analysed for pollutant removal, including reductions in turbidity, Chemical Oxygen Demand (COD), and heavy metal concentration. Regular monitoring will assess filter performance, pollutant removal efficiency, and filter longevity. It is hypothesized that the tri-material biofilter will exhibit superior overall contaminant removal due to the synergistic adsorption properties of the combined materials, while dual-material filters may show efficiency in targeting specific pollutant classes. The expected findings aim to demonstrate the potential of sustainable, low-cost biofilters made from locally available waste materials to provide an effective treatment option for household laundry wastewater, particularly in resource-limited settings.

Synthesis of a Bi-herbal Formulation of Cucumber Peel and Pumpkin Seeds (Cp-Ps25) and assay of its Antimicrobial Efficacy

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Abstract

Antibacterial resistance (AMR) is a growing global health concern. SDG 3 focuses on good health and wellbeing motivating people to resort to ancient Indian Knowledge System (IKS) like Ayurveda for safer and long-lasting remedies. Use of food waste like peels and seeds offer a natural and eco-friendly way to fight harmful bacteria. The study explores the antimicrobial potential of a combined ethanolic extract of cucumber peels and pumpkin seeds. These materials are often seen as food waste, but they are full of essential nutrients and natural bioactive compounds. Cucumber peels have high amounts of dietary fibre, vitamin C, flavonoids and phenolic acids. Pumpkin seeds are also a good source of proteins, healthy fats, minerals and phytosterols. By designing the bi-herbal formulation, it will enhance the antimicrobial potential and can contribute to sustainability in food and healthcare. The aim of this study is to determine the inhibitory effect of bi-herbal formulation extract against Escherichia coli (Gram-negative) and Staphylococcus aureus (Gram-positive) using the disk diffusion method. The extract is prepared by drying and grinding the plant materials, mixing them in different ratios and soaking them in ethanol with continuous stirring at room temperature to obtain a most efficient herbal formulation. The bi- herbal formulation is expected to show a synergistic effect in which both extracts perform better together than individually. This study highlights an eco-friendly approach for converting plant waste into valuable antimicrobial agents.

Keywords: AMR, SDGs, IKS, Herbal Pumpkin seed, Cucumber peel

Role of LRRC8A in Mammalian Reproduction

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Abstract

The Leucine-Rich Repeat Containing 8A (LRRC8A) gene encodes an important part of the Volume-Regulated Anion Channel (VRAC). This channel helps cells regulate their proper volume by controlling the flow of chloride ions and various other osmolytes. While LRRC8A is specifically known for this crucial role in cellular balance, recent studies have shown its important role in reproductive biology. LRRC8A works with other LRRC8 isoforms to regulate osmotic pressure during crucial reproductive mechanisms like maturation of oocytes, spermatogenesis, and development of early embryo. Using knockout models and gene expression analyses shows that the lack of LRRC8A can affect gamete health and disrupt meiotic progression. This indicates how crucial it is for maintaining and regulating the ionic and osmotic conditions required for fertility. In mammals, LRRC8A is highly expressed in tissues related to reproduction such as the testis and ovary. It helps in cell to cell interaction and creates the microenvironment needed for successful reproduction. LRRC8A controls anion transport at the molecular level, its crucial expression in reproductive tissues, and its increasing importance in reproductive health and fertility issues. Understanding LRRC8A's role may lead to new ways of diagnosing and treating infertility related issues.

Keywords: lrrc8a, reproduction, mammals

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Annexure-XXII

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