2022
YEAR BOOK

Mehta Family Centre for Engineering in Medicine

Indian Institute of Technology Kanpur

Content

Prof. NITIN GUPTA, COORDINATOR MFCEM

Message

The Mehta Family Center for Engineering in Medicine has been founded to address the many and varied challenges at the interface of engineering and medicine. Under the guidance of our director Prof. Abhay Karandikar, IIT Kanpur; the MFCEM Advisory Board headed by Prof. Shankar Subramaniam, UCSD; and the constant support of Mr. Rahul Mehta of the Bhupat and Jyoti Mehta Family Foundation, USA, the MFCEM is steadily developing towards becoming a leading center for biomedical engineering. Keeping true to its multi-disciplinary nature, and a lofty vision to bring together the best minds in varied disciplines of engineering, physical sciences, and biology to tackle looming problems in medical sciences, we dedicated the past year to lay strong foundations for our understanding of the varied disciplines and diverse areas of research in biomedical engineering. Many global leaders and stalwarts in their respective areas of research were invited to share their research and interact closely with students. Members of the MFCEM Advisory Board willingly and generously gave their time, interacting with the MFCEM-associated faculty members, and mentoring & motivating young students. We will continue to work towards realizing the vision of the MFCEM. I strongly believe that the multi-disciplinary nature of IIT Kanpur, its nurturing atmosphere, a strong focus on technology development and transfer, compounded with the energy of vibrant young minds would together propel the center to great heights.

AWARDS & HONOURS

Prof. Subramaniam Ganesh was awarded the prestigious JC Bose fellowship, SERB, DST.

Prof. Nitin Gupta, was awarded The C.N.R. Rao Faculty Award (2020), for his outstanding work on neural networks underlying insect olfaction.

Prof. Pragathi Balasubramani, was awarded The Anjali Joshi New Faculty Fellowship award.

Prof. Dhirendra Katti was awarded the Rajeeva and Sangeeta Lahri Chair Professorship (2022-2025).

AWARDS & HONOURS

Prof. Bushra Ateeq was awarded for the Sun Pharma Science Foundation Research Award-2021 in the Medical Sciences-Basic Research category.

Prof. Bushra Ateeq was elected Member (2022) of the **Guha Research Conference (GRC) Association.**

Prof. Bushra Ateeq was conferred the **Joy Gill Chair** (April 2022) for academic excellence.

Prof. Sandeep Verma received the **5th Pran Nath Vohra Oration,** Panjab University, Chandigarh.

Prof. Sandeep Verma was awarded Gold Medal by The Society for Materials Chemistry, BARC, Mumbai.

Prof. Sandeep Verma, was awarded the **Gold Medal, Society for Materials Chemistry**, BARC, Mumbai (Dec 2022).

ELECTED AS FELLOW

Prof. Bushra Ateeq was elected as Fellow of the Indian Academy of Sciences, Bangalore, 2002.

Prof. Arun Shukla was elected as Fellow of the Indian Academy of Sciences, Bangalore, 2002.

Prof. Arun Kumar Shukla was elected Fellow, Indian National Science Academy, 2022.

Prof. S. Ganesh was elected Fellow, Indian National Science Academy, 2022.

RECOGNITION

Prof. Bushra Ateeq, was featured in the "75 under 50: Scientists Shaping Today's India" a compendium released by the Department of Science and Technology, Ministry of Science and Technology, India.

COMMITTEES

Prof. Bushra Ateeq, was selected to serve as member Expert Committee (2022 – 2025) of the INSPIRE Faculty Fellows task force for Life Sciences-Biomedical, Department of Science and Technology, Ministry of Science and Technology.

Prof. D.S. Katti has been appointed as a member of Department of Biotechnologies' Technical Expert Committee on Human Genetics, Genome Engineering and Nanotechnology Applications in Health Care for the duration 2022-2025.

GRANTS AND FELLOWSHIPS

Prof. Santosh K Misra . Sponsor/Agency: ICMR, India. Title: Intracellular Plasmonic Nanogold Generation for Sensing and Chemo-photothermal Combinatorial Cancer Therapy. Period: 3 Years

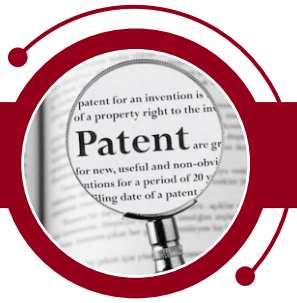
Prof. S. Ganesh, Sponsor/Agency: JC Bose National Fellowship, SERB DST Period: 5 years.

Prof. Sai Pydi, Sponsor/Agency DBT/Wellcome Trust India Alliance. Period:5 years.

Prof. Amitabha Bandyopadhyay, Co-PIs: Dr. Partha Sensarma (EE), Dr. J. Ramkumar (Design Department) and Dr. Aditya Kelkar (Physics).
Sponsor/Agency: ICMR, India.
Start-up involved - Lenek Technologies, SIIC Startup

Dr. Anjali Bajpai. DST WoS-A research grant. Period: 3 years.
Sponsor/Agency: DST, India.

PATENTS



DETAILS OF PATENTS

Inventors: Dr. Bushra Ateeq, Vipul Bhatia, Anjali Yadav.
Patentee: Indian Institute of Technology, Kanpur
Title: Medicament and Diagnosis for SPINK1 Positive Cancer.
Application Number: IN 201611016564/392861
Status: GRANTED

Inventors: Dr. Aswani Kumar Thakur, Nobodita Sinha
Pantentee: Indian Institute of Technology Kanpur
Patent: A fullerene c60nanoformulation for accelerated tissue repair
Patent no. 388661
Status: GRANTED.

Inventors: Dr. Dhirendra S Katti, Arijit Bhattacharjee
Patentee: Indian Institute of Technology Kanpur
Title: Disease modifying drug combinations for the treatment of osteoarthritis.
Application Number: 202211010244 A
Country: India
Status: Filed

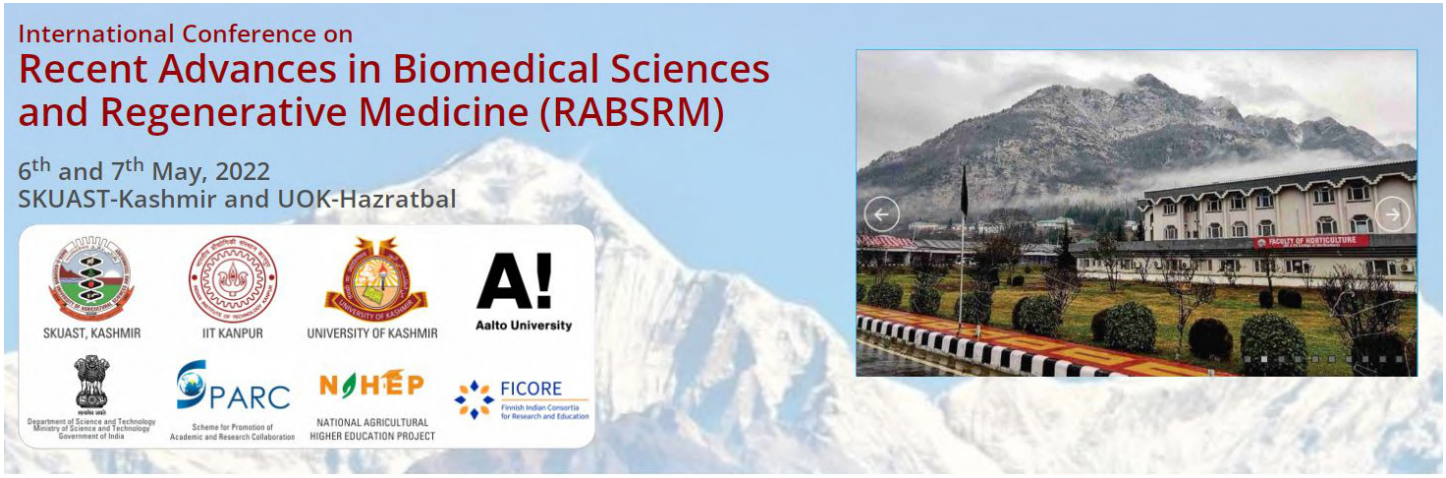
Inventors: Dr. Bushra Ateeq, Vipul Bjatia and Anjali Yadav
Title: Medicament and Diagnosis for SPINK1 positive cancer.
Patent Number: 392861
Filed: 12.05.2016
Status: Granted.

Inventors: Dr. Sandeep Verma, Dr. Ashok Kumar, Apurva Panjla, Irfan Qayoom
Title: Taurine functionalized diketopiperazine and process to synthesise the same.
Patent Number: 399932
Date: 24.05.2002

Inventors: Prof. Sandeep Verma.
Title: '3-(2-Benzothiazolyl)-tyrosine Conjugated Human Insulin for Real-time Monitoring of Insulin Quality and its Uses Thereof'.
Date: December, 2022

CONFERENCE/SYMPOSIA/WORKSHOPS ORGANIZED BY MFCEM FACULTY

Prof. Ashok Kumar, IIT Kanpur, along with Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST), Kashmir and University of Kashmir-Hazratbal organized The International Conference on "Recent Advances in Biomedical Sciences & Regenerative Medicine, 2022".



Prof. Bushra Ateeq, organized Mini-Symposia on Breaking the Glass ceiling in Academia - 9th June 2022 (Thursday), under "Gender Advancement for Transforming Institutions (GATI)" sponsored by Department of Science & Technology (KIRAN Division), Government of India.

INVITED TALKS

Prof. D.S. Katti gave the 2nd lecture of the webinar series organized by CDRI-ASTHI. 5th February 2022, titled: Moving towards improved cartilage health: regeneration and disease modification.

Prof. Nitin Mohan, delivered a talk at the International workshop on "Convergence of Photonics, Biology and Nanomedicine to Transform Healthcare", at Indian Institute of Technology, Delhi ,January 2022; titled: Shedding light on nanoscopic cellular transport with super-resolution microscopy.

Prof. Nitin Mohan, delivered lecture in the lecture workshop on 'Current Trends in Biotechnology' at School of Biotechnology, Madurai Kamaraj University, Madurai, March 2022; titled: Super resolution microscopy methods unravel cellular mechanisms regulating autophagy.

Prof. Bushra Ateeq delivered an invited talk (online) at the National Centre for Biological Sciences (NCBS), Bangalore annual talks focusing on the Facets of Biology January 11 2022, Session Theme: Signalling to regulation.

Prof. Bushra Ateeq delivered an invited talk (online) at the 3rd Indian Cancer Genome Atlas (ICGA) Conference 13th-14th January 2022 with "Biobanking to Omics: Collecting the Global Experience".

Prof. Bushra Ateeq delivered an invited talk (online) at the Biochemistry talk series "Point de Vue in Biochemistry" at the Department of Biochemistry, Central University of Rajasthan, Rajasthan, India.

Prof. Bushra Ateeq delivered an invited talk (online) at the 41st International Annual Conference of the Indian Association for Cancer Research (IACR-2022) on "Combating Cancer: Biology to Therapy to Drug Resistance" from 2nd to 5th March 2022 held at Amity University, Noida.

Prof. Bushra Ateeq delivered an invited talk (online) on the occasion of International Women's Day 2022 (8th March 2022) organized by the University of Manchester, UK.

Prof. Bushra Ateeq delivered an invited talk (online) on the occasion of International Women's Day event (8th March 2022) organized by the Department of Biotechnology, Ministry of Science and Technology, Government of India, in collaboration with International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi.

Prof. Santosh K Misra delivered a talk: "Personalized Approaches for Improving Outcomes of Advance Therapeutic Methods" invited by chemical engineering seminar series hosted at IIT Gandhinagar on 3rd March 2022.

INVITED TALKS

Prof. Santosh K Misra, delivered a talk: "Point of Care Diagnostics for Correction in Imbalances of Life Processes" in the workshop: Current Trends in Biotechnology" organized by Madurai Kamraj University, TN, India on 14th march, 2022.

Prof. Ashwani Kumar Thakur, delivered a keynote talk: "Product discoveries originating from fundamental protein-peptide-amino acid self assembly", at the 2nd National Conference on Engineering, Arts, Sciences & Technology (NEAST). Theme Life Sciences and Healthcare Management (LSHM-2022). Council of Industrial Innovation and Research (CIIR), Noida, Shobhit Institute of Engineering & Technology.

Prof. Ashwani Kumar Thakur. Presentation title: Broadening the antimicrobial spectrum of Fmoc-Phenylalanine hydrogel with a regulatory based approach, in Student Indian Peptide Symposium 2022-Therapeutics,materials and beyond
Date: 31.3.2022

Prof. D.S. Katti presented a keynote address titled 'Vaccine/nanovaccines for multi-drug resistant diarrhea' at the Prof. Rinti Banerjee (RB) Memorial Conference, on Translational Research in Medicine, IIT Bombay. 19th April, 2022.

Prof. Bushra Ateeq, outreach talk, at the G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. 21st April 2022.

Prof. Bushra Ateeq, invited talk: Guha Research Conference (GRC), at the Country Inn, Bhimtal, Uttarakhand. 22nd – 25th April 2022.

Prof. Bushra Ateeq, invited talk, Frontier Symposium in Biology – 2022, during at the School of Biology, IISER-TVM, Trivandrum. April 29th – May 01st, 2022.

Prof. Santosh K. Misra, panelist on India Medical Device 2022, at Dr. Ambedkar International Centre, New Delhi in Session 4: R&D and Innovation in MedTech. 25th-27th April, 2022.

Prof. Bushra Ateeq, outreach talk, at the Rajiv Gandhi Centre for Biotechnology (RGCB), Trivandrum. 30th April 2022.

Prof. Santosh K. Misra, Keynote talk on "Point of Care Diagnostics for Early Detection of Disease and Recalibration of Therapeutic Regimens" at Srinagar University during RABSRM conference. 06-07 May, 2022.

INVITED TALKS

Prof. Santosh K. Misra, Lecture on "Development of Biosensors for Disease Diagnosis" in Biotechnology Industrial Training Program, organized by SIIC, IIT Kanpur. May 26, 2022.

Prof. Bushra Ateeq, invited talk and interaction session, on Women in STEMM under GATI (Gender Advancement for Transforming Institutions) at the University of Kashmir, Srinagar. 28th June 2022.

Prof. S. Ganesh Invited talk: "Glycogen and Neuronal Health" delivered in the US-Indo Workshop on Design, synthesis, and data-driven discovery of nanomaterials for electronics photonics and biotechnology, Organized by the University at Buffalo (UB), Buffalo, New York, USA. May 16-17, 2022.

Prof. S. Ganesh Invited talk: "Glycogen and neuronal health: Lessons from a rare genetic disorder", Dr. Lalji Singh Memorial Lecture delivered at Centre for DNA Finger Printing and Diagnostics, Hyderabad, July 5, 2022.

Prof. S. Ganesh Invited talk: "Impact of Computational Approaches on Biology and Medicine", delivered at the University of Aizu, Aizuwakamatsu, Japan, October 6, 2022.

Prof. Sandeep Verma, Invited lecture titled "Of Bugs, Brain and Batteries" and open house in FIASConversation, Faculty of Interdisciplinary and Applied Sciences, Delhi University, July 19, 2022.

Prof. Sandeep Verma , Invited lecture on "Lifecycle of a PhD Program", on Chemical Society Day, Department of Chemistry, IIT Kanpur, July 22, 2022.

Prof. Sandeep Verma Lecture on "Swadeshi Needs and Solutions for Healthcare" International Conference on Higher Education, Research & Innovation, organized by S&T Digital and IISER Pune, July 28, 2022.

Prof. Sandeep Verma Participated in the "Provocateurs Session" in "Developing a Diverse AI Workforce' Indo U.S. Visioning Workshop, organized by Indo-US Science and Technology Forum, at IISc Bangalore, August 10, 2022.

Prof. Sandeep Verma Delivered Convocation Oration as a Chief Guest in 7th Convocation of NIPER Raebareli, Lucknow, August 18, 2022.

Prof. Sandeep Verma Delivered Plenary Lecture titled "Lifecycle of a PhD and Alternate Careers", in 10th International Conference on Issues and Challenges in Doctoral Research, Amity University, New Delhi, August 25, 2022.

INVITED TALKS

Prof. Sandeep Verma Delivered Convocation Oration as a Chief Guest in XXIInd Convocation of Kakatiya University, Warangal, Telangana, August 25, 2022.

Prof. Sandeep Verma Delivered special address in "Women Driving S&T Agenda in India", organized by Center for Biomedical Research, Lucknow, August 26, 2022.

Prof. Sandeep Verma Delivered special address titled "How to Prepare for a Successful PhD", in "PhD Student Orientation Program", organized by CSJM University, Kanpur, August 27, 2022.

Prof. Sandeep Verma Delivered 10th Chetana Lecture organized by University Grants Commission, New Delhi, on "Structuring Research and Innovation Upconversion in Universities", September 1, 2022.

Prof. Bushra Ateeq, Invited Talk at the 33rd Mid-Year Meeting, 08–09 July 2022, of the Indian Academy of Sciences (IASc, Bangalore) at the Indian Institute of Science, Bengaluru.

Prof. Bushra Ateeq, Invited Talk at the 9th Annual Conference of the Molecular Pathology Association of India, MPAICON 2022 on 6th – 7th August 2022 at Narayani Heights, Ahmedabad.

Prof. Bushra Ateeq, Invited Talk at the 33rd Mid-Year Meeting, 08–09 July 2022, of the Indian Academy of Sciences at the Indian Institute of Science, Bengaluru.

Prof. Bushra Ateeq, Invited Talk at the 9th Annual Conference of the Molecular Pathology Association of India, MPAICON 2022 on 6th – 7th August 2022 at Narayani Heights, Ahmedabad.

Prof. Bushra Ateeq, Invited, Online Talk at the Cancer Biology Cluster, Amity University, Gurugram (Manesar) on 24th August 2022.

Prof. Bushra Ateeq, Invited Panellist on the "Women Driving Science and Technology in India" organized by Centre of BioMedical Research, Lucknow on August 26th, 2022.

Prof. Bushra Ateeq, Invited Talk at the Department of Biotechnology, NIPER-Raebareli on 5th September 2022.

Prof. Dhirendra Katti Self contracting and stiffening hydrogels for cartilage regeneration: Engineering dynamic microenvironments for cells. Keynote speaker at IIT Guwahati for Biomaterials, Regenerative Medicine and Devices (BIO-Remedi), 15th- 18th Dec 2022.

INVITED TALKS

Prof. Sandeep Verma Invited lecture titled "Hydrogen sulfide-mediated concurrent imaging and apoptosis induction by peptide conjugates", in 1st Indo-French symposium on Molecules and Nanosciences for Health (SiTH Fall School), University of Bordeaux, Bordeaux, France, November 7-9, 2022.

Sandeep Verma Invited lecture titled "Delivering Gaseous Neuromodulators in Cells and in C. elegans", in RSC-"Contemporary Facets in Organic Synthesis, IIT Roorkee, December 1-4, 2022. Invited lecture titled "Bioactive Materials for Bone Tissue Engineering", 9th Interdisciplinary Symposium on Materials Chemistry (ISMC-2022), December 7-10, 2022, at DAE Convention Centre, Anushakti Nagar, Mumbai.

Sandeep Verma Invited lecture titled ""Peptide-based Constructs for Therapeutic Gas Delivery and Structural Coloration" at School of Chemistry, University of Glasgow, UK, December 14, 2022.

Prof. Ramasubbu Sankar. Invited Talk: International Symposium on Recent Trends in Macromolecular Structure and Function 2022 (ISRTMSF2022) Organized to celebrate the Birth Centenary Year of Prof. G. N. Ramachandran, AMET University, Chennai, October 2022.
Invited Talk: Symposium on "Molecular Simulation: Focus on Method", TIFR Hyderabad, December 2022.

Prof. Bushra Ateeq. Invited Online Talk at the Conference in Molecular and Translational Research - Sri Shankara Cancer Hospital and Research Center on 14th October 2022.

Prof. Bushra Ateeq Invited Online Talk at the North Zone Conference of Indian Academy of Biomedical Sciences (NZIABSCON2022) on 4th November, 2022, organized by Postgraduate Institute of Medical Education & Research, Chandigarh.

Prof. Bushra Ateeq Invited Online Talk at the NIPER-PHARMACON 2022 organized by the NIPER Mohali on 10th November 2022.

MFCEM Dialogues

"The **MFCEM Dialogues** is an interactive event that include a brief presentation aimed at a wide audience, followed by an extended interaction session with the speaker, covering new developments in the field and the speaker's experiences."

Prof. Prashant Mali, from the Department of Bioengineering, University of California San Diego. Title of the talk: From Reading Genomes to Interpreting Genomes to rationally engineering Genomes. 26th Jan 2022.

Prof. Sharad Ramanathan, Professor of Neurosciences and of Molecular and Cellular Biology Harvard University; and Professor of Applied Physics and of Stem Cell and Regenerative Biology Harvard University. Title of the talk: Understanding morphogenesis during early human development. 28th Feb 2022.

Prof. Noel Buckley, Professor of Neurobiology, Department of Psychiatry, University of Oxford. Title of the talk: Using Deep Learning to Distinguish Neurodegenerative Phenotypes: teaching an old dog new tricks. Date: 28th April 2022.

Prof. Shyni Varghese, Duke University, Departments of Biomedical Engineering, Mechanical Engineering and Materials Science, and Orthopaedic Surgery.
Title of the talk : Bioengineering platforms for mechanistic understandings and therapeutic interventions. Date: 26th May 2022.

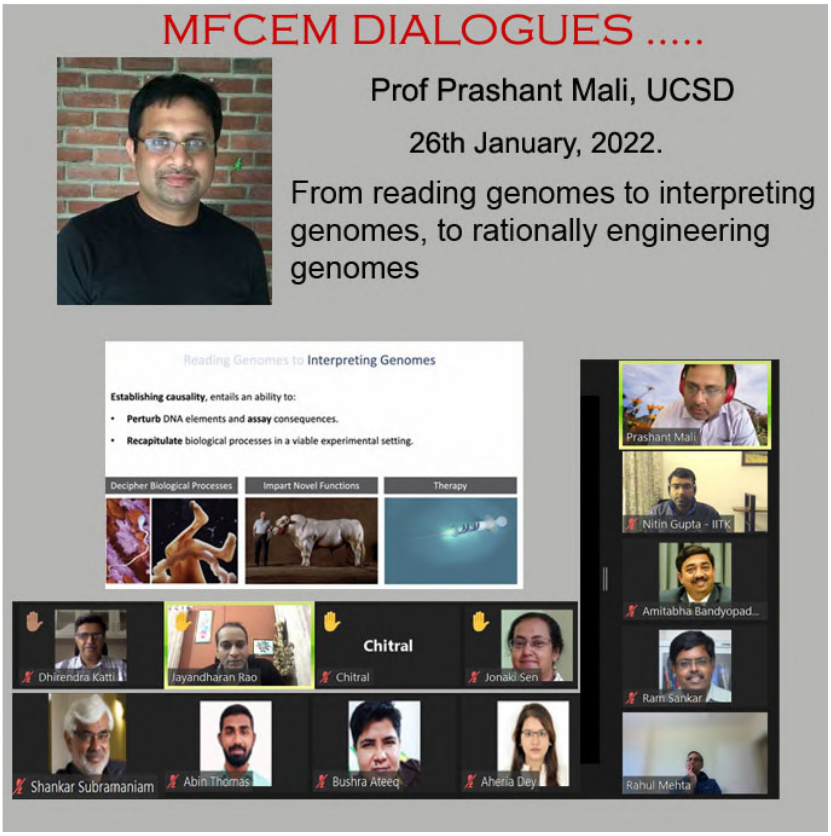
Prof. Sriram Subramaniam, University of British Columbia, Department of Biochemistry and Molecular Biology. Title of the talk : Cryo-EM and AI: A paradigm shift in structural biology. 20th July 2022.

Prof. Nitish Thakor, Johns Hopkins University was organized for 12th and 13th October, 2022, as part of the MFCEM Dialogue series. Title of the talk: Humans and Machines - Being Better Together?

Prof. Suman Chakraborty, IIT Kharagpur was invited speaker for the 7th MFCEM Dialogue series, on the 22nd December. Prof. Chakraborty is a global-pioneer of disruptive diagnostic-technologies for resource-limited settings.. Title of the talk: Democratized Diagnostic Technologies for Affordable Healthcare.

MFCEM Dialogue with Prof. Prashant Mali, UCSD La Jolla

From Reading Genomes to interpreting Genomes to rationally engineering genomes

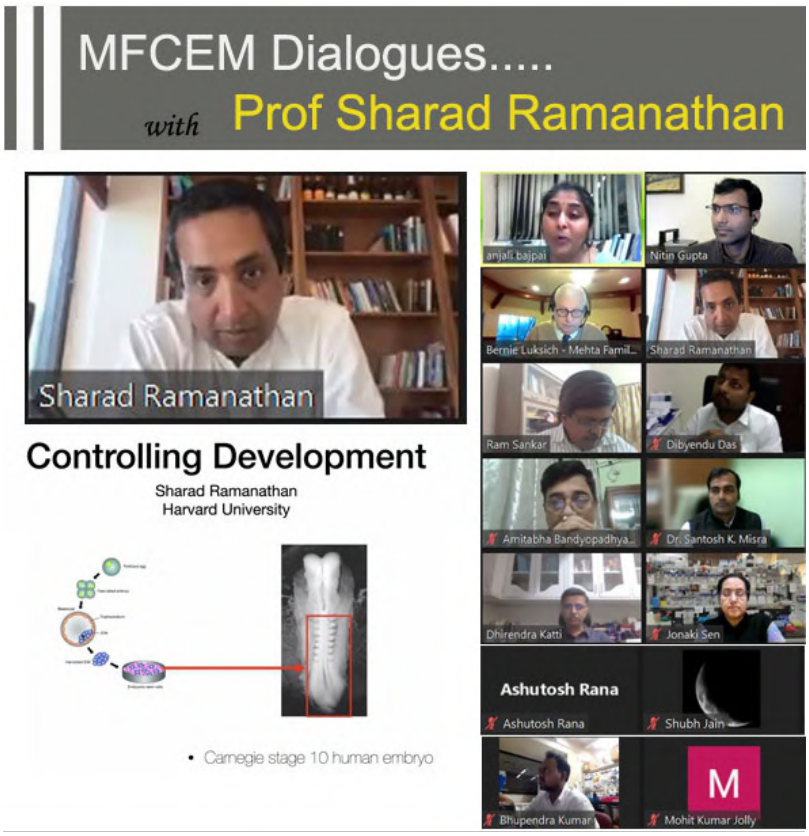


The first event of **MFCEM Dialogues** was held on the 26th January 9:30 pm over a zoom discussion with **Prof. Prashant Mali,** from the Department of Bioengineering, of **University of California San Diego**. Prof. Mali's research interest lies in the field of synthetic biology and regenerative medicine, with a long-term focus on developing tools for enabling gene and cell based human therapeutics. Prof. Mali holds a Bachelor's and Master's degrees in Electrical Engineering from the Indian Institute of Technology Bombay. He is recipient of numerous awards and felicitations. Prof. Mali shared some of his very interesting work on the use of CRISPR Cas9 technology for rational engineering of genomes, such as correcting faulty genes in vivo. He also elaborated on the use of the technology for executing targeted therapeutic screens on PDXs thus inching closer to precision medicine-based interventions. He spoke about his recent work on bioprinting 3D perfusable vascularized matrices for long term ex vivo co-cultures.

MFCEM Dialogue with Prof. Sharad Ramanathan, Harvard University

Controlling Development

The second event of the **MFCEM Dialogues** was held on the 28th February 2022 over a Zoom online discussion with **Prof. Sharad Ramanathan**, Professor of Neurosciences and of Molecular and Cellular Biology Harvard University; and Professor of Applied Physics and of Stem Cell and Regenerative Biology Harvard University.



Prof. Sharad Ramanathan shared some of the exciting ongoing research in his laboratory, particularly, how his team is trying to decipher the signaling events/triggers involved in early human embryonic development of the Somites lining the neural tube. He gave a glimpse of his teams' efforts to combine experimental, computational and theoretical tools to uncover the signaling permutations that orchestrate patterning of the neural tube. Prof. Ramanathan enthralled the audience with striking display of organoids cultured on 3D-printed microplates that allows unprecedented control of tempo-spatial activation of signaling pathways.

MFCEM Dialogue with Prof. Noel Buckley, University of Oxford

Using Deep Learning to Distinguish Neurodegenerative Phenotypes: teaching an old dog new tricks

The third event of the **MFCEM Dialogues** was held on the 28th April 2022 over a Zoom online discussion with **Noel Buckley**, Professor of Neurobiology, Department of Psychiatry, University of Oxford. Prof. Buckley's research interest lies in understanding gene networks in neuronal development and disease. His research focuses on understanding how neuronal phenotype emerges from interactions among genes of a network, and how these networks vary across individuals.

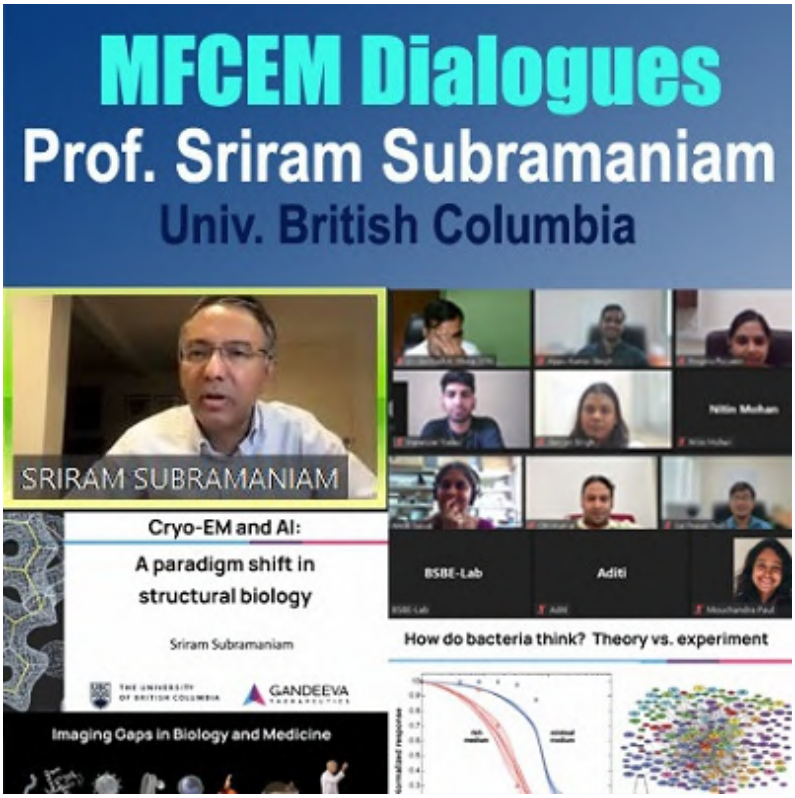
In his talk entitled: Using Deep Learning to Distinguish Neurodegenerative Phenotypes: teaching an old dog new tricks, Prof. Buckley shared some of the recent exciting developments from his lab.

Prof. Buckley at the onset pressed upon the importance and urgency to better understand the many progressive and near irreversible neurological disorders, which are predicted to increase to 153 million cases by 2030 from the current 57 million. He further emphasized that the approach to these complex disorders need to be multi-disciplinary going beyond the current approach of single-gene - single-phenotype.

Prof. Buckley discussed at length how his team which is made up of an eclectic group of individuals with diverse training and skill sets: from cell & neurobiologists, to data scientists, to computational analysts work collectively to better understands the underlying genetic networks that prefigure emerging neuronal phenotypes.

MFCEM Dialogue with Prof. Sriram Subramaniam, University of British Columbia

Cryo-EM and AI: A paradigm shift in structural biology



The fourth event of the **MFCEM Dialogues** was held on the 20th July 2022 over a Zoom discussion with **Prof. Sriram Subramaniam,** University of British Columbia, Department of Biochemistry and Molecular Biology. He holds the Gobind Khorana Canada Excellence Research Chair (CERC) in Precision Cancer Drug Design. Prof. Subramaniam delivered a talk titled "Cryo-EM and AI: A paradigm shift in structural biology". Prof. Subramaniam is globally recognized for his pathbreaking contributions in cryo-electron microscopy (cryo-EM)—he was the first to demonstrate atomic resolution cryo-EM of proteins and small molecule interactions, and ultimately use of cryo-EM in precision medicine.

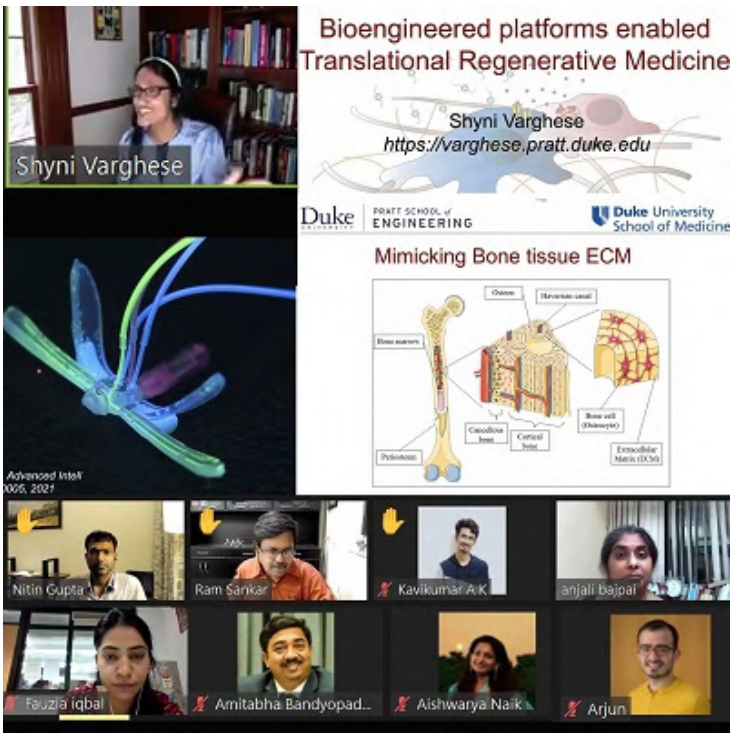
. In his talk, Prof. Subramaniam spoke at length on methodological advances in cryo-EM, its use to gain unprecedented insights into structures of proteins and their multiple conformational states when bounds with interacting proteins, DNA/RNA, small molecule drugs or larger biomolecules. He shared some of his pathbreaking work on unravelling the structural basis of increased fitness of SARS-CoV2 variants. He also shared the power of cryo-EM in capturing the structure of proteins when in "action", and how snap shots of these can provide unseen real-time behavior of proteins.

Prof. Subramaniam, also spoke about **Gandeeva Therapeutics** Inc., of which he is the founder and CEO, and on how he hopes to revolutionize drug discovery using Cryo-EM and machine learning technology and ultimately bring personalized therapy within easy reach.

MFCEM Dialogue with Prof. Shyni Varghese, Duke University

Bioengineering platforms for mechanistic understandings and therapeutic interventions

The fifth event of the **MFCEM Dialogues** was held on the **26th May 2022** over a Zoom discussion with **Prof. Shyni Varghese**, who holds a triple appointment at Duke University departments of Biomedical Engineering, Mechanical Engineering and Materials Science, and Orthopaedic Surgery. She is also the first MEDx Investigator at Duke, an initiate to enhance collaborations between doctors and engineers.



In her talk titled: Bioengineering platforms for mechanistic understandings and therapeutic interventions, Prof. Varghese provided a bird's-eye view of the multiple ongoing research tracks in her group and elaborated some. In brief, she spoke of developing biomaterial for culturing stem cells for regenerative studies. In particular, she shared her work on mimicking Bone Tissue ECM, having a characteristic mineral rich environment to develop "in situ" tissue repair mechanisms. Prof. Varghese also provided a peak into how her group is trying to understand the dual functions of "secreted Adenosines" during bone injury as molecular cues for damage, as well as a trigger for pain.

Yet another interesting work she shared was on smart Biomaterials, particularly on self-healing hydrogels and developing Macro-encapsulated technology as subcutaneous implants for tissue repair. Prof. Varghese, also talked about her groups' efforts on building organ-on-chip, wherein she discussed Tumor-on-a-Chip Device which allowed the study of Cancer-and-Immune Cell Interactions.

Prof. Varghese ended her talk with a fascinating display of a stimuli-responsive, self-healing, multifunctional Soft Robot, which started more as a fun exercise in her lab. Intriguingly, the dragonfly-shaped body allows the soft robot to undergo user- and environment-controlled locomotion even over water surface, and could be used to detect water acidification, temperature changes, and hydrophobic impurities such as oil

MFCEM Dialogue with Prof. Nitish Thakor, Johns Hopkins University.

Human and Machines- Being Better

Dr. Nitish Thakor is a professor of Biomedical Engineering and Neurology at the Johns Hopkins University School of Medicine. He received his undergraduate degree from the Indian Institute of Technology Bombay, India, and went on to earn both an M.S. and a Ph.D. in biomedical engineering from the University of Wisconsin-Madison.

Prof. Thakor over two days, interacted with students sharing with them his academic journey, the challenges he faced and how he overcame them—on day one; and on day two he shared his research works on neurological instrumentation, neural prosthesis and biomedical signal processing and the many applications of neural and rehabilitation technologies at the brain-machine interface, in an engrossing talk, titled: "Humans and Machines - Being Better Together?"

Prof. Thakor shared his research on developing next generation neurally-controlled upper limb prosthesis. He discussed about neuromorphic encoding to naturalistically convey sensory information in amputees. Prof. Thakor further explained how these could be incorporated in the design of the sensors themselves to facilitate extraction of high-level abstract information such as texture or shape. Prof. Thakor also discussed how the brain particularly of individuals with an amputation, response, perceives and process sensory feedback signals.

Prof. Thakor, also provided a glimpse of his work in augmented or virtual reality. He reiterated the fact that traditional rehabilitation environments for amputees are costly, require skilled clinical and technical helps; and how his team, is working to develop training and evaluation environments in augmented and virtual reality, particularly for use by upper limb amputees. Prof. Thakor displayed how an amputee could control prosthetic limb to manipulate virtual objects using a variety of control strategies and feedback modalities. Prof. Thakor also spoke about soft prostheticsm such as biomimetic finger with texture discrimination feedback. One of the fascinating point of discussion was on muscle reinnervation, inorder to allow amputated nerves that are still capable of sending electrical control signals from the brain, to reconnect to muscle grafts.

MFCEM Dialogue with Prof. Suman Chakraborty

"Democratized Diagnostic Technologies for Affordable Healthcare"

Prof. Suman Chakraborty is a global-pioneer of disruptive diagnostic-technologies for resource-limited settings. For his trailblazing works leading to affordable healthcare, he has been awarded the Infosys prize and the Shanti Swarup Bhatnagar Prize.

In the MFCEM Dialogue series, on 22nd December, Prof. Chakraborty gave an overview of the area of disruptive diagnostic-technologies and emphasized on the need to bridge the wide chasm in diagnostics that exist between urban and rural India.

He shared many of his innovations including the very low cost "Printed Paper Strips" for disease detection using body fluids such as, blood plasma, serum, saliva etc. Prof. Chakraborty demonstrated how innocuous items of the paper, pencil coupled with simple electrodes could be used to construct effective and affordable devices for diagnostics. He showed how such portable and handy analytical units with embedded electronics can serve as on-chip detection of multiple target analytes. He also touched upon wearables digital devices, such as simple pH sensor as well as paper-based devices for testing antibiotic resistance.

Prof. Chakraborty displayed how he coupled 5G digital technology, having created a built in App for smart phones for robust image processing and color detection of biological reaction which would allow real time biological screening such as for hemoglobin. He also demonstrated a scalable multiplex electrochemical detection on a paper strip with smart phone interfaced spectrometry.

Further Prof. Chakraborty discussed, lowcost, portable, hand held Imaging device for early detection of Oral cancer and pre-cancer based on measured changes in blood flow rates of the tissue from thermal imaging and analytics; the early prototype with minor sophistication and automation is ready to be used in the field for commercial purposes. Prof. Chakraborty also shared his recent innovation on Nucleic acid-based Rapid Point-of-care testing technology for infectious disease detection.

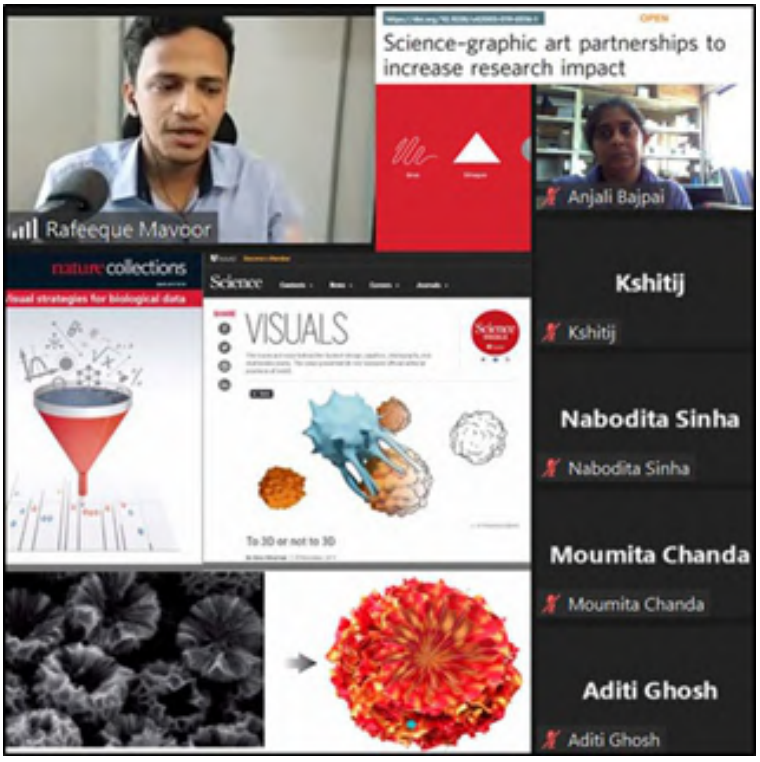
Further, Prof. Chakraborty also shed light on how making these simple affordable devices also ensured convergence with rural livelihood; training and empowerment of frontline health workers, in parallel facilitating entrepreneurship and livelihood generation.

MFCEM Workshop
Scientific Illustrations

MFCEM is organized an online workshop on Scientific Illustration conducted by Mr. Rafeeque Mavoor, SciDart studio, on the 28th of June, 2022. The workshop was organized acknowledging much need to be able to communicate science in understandable and engaging way using visual mediums such as images, graphics, illustrations, animation, movies etc. The workshop was open to all IIT Kanpur community with the aim to introduce the various tools and skill sets required to create telling scientific illustration.

Mr. Rafeeque Mavoor of SciDart studio has to his credit numerous Cover Art, Web Art, Illustrations, Animations & Science Films. He has conducted workshops at IISER-Pune, IISER-Bhopal, IIT Gandinagar, Vigyan Prasar among others. He received a BS-MS Dual Degree in Chemical Sciences, from IISER-TVM, and continues to serve as part of the creative team for Scientific Illustration & Animation, Science Media Centre-IISER-Pune and IISER-TVM.

In this workshop, Mr. Mavoor covered various aspects of Scientific Illustrations, such as the tools, practices, case studies and career possibilities in science illustration. This was followed by open discussion. In the following 45 minutes, Mr. Mavoor then demonstrate how to use **Blender**, **a 3D illustration software**. From the concept sketch to creating a publication ready illustration.



MFCEM Workshop by Dr. Sarah.....

Science and Public Engagement

The MFCEM workshop on **Science and Public engagement** was conducted by Dr. Sarah Hyder Iqbal on 24th Sep. 2022. Dr. Sarah is a communications and science engagement strategist. She received her PhD in Biochemistry from Oxford University. Her focus is to build capacity in science engagement in India and develop creative, inclusive and participatory tools for public and policy engagement with science for a sustainable future. She has initiated and is part of many national and international engagement programs, such as **Superheroes Against Superbugs**: an initiative to build a community to tackle antibiotic resistant-infections in India; and international programms such as **Arting Health for Impact** and **Planet Divoc-91** among others.

In the workshop Dr Sarah delved into the WHAT, the WHY and the HOW of Science and public engagement, highlighting the need to bring **Science, Technology** and **Engineering** to the public and society at large. In a highly engrossing session she introduced the audience to the various facets of public engagement particularly in the Indian context: namely communicating science; engaging with the public; co-creating solutions and ultimately empowering the public to have a say in matters science. Dr. Sarah encouraged young researchers to actively think, participate and if possible initiate public engagement activities.

During the workshop the participants were introduced to the various Indian government policies on science and public engagement: such as the Science Technology and Innovation Policy (STIP 2020) and Scientific and Social Responsibility (SSR). Dr. Sarah also brought to fore the various existing platforms for public engagement, such as the Indian Science Festival, as well as workshops, webinars and events organized by Public Communication of Science and Technology (PCST) and Mesh, a global community engagement network.

Introduction to imaging

The MFCEM workshop on "**Introduction to imaging**" was conducted by Mr. Rishi Kant, Application Specialist, Zeiss India, on November 5th 2022.

Imaging is an essential tool in the research arsenal, and therefore to keep abreast with the fast developing technologies in microscopy, one of the leaders in microscopy technologies, Zeiss (India), were invited to conduct a workshop. In the workshop a wide range of topics were discussed: from basic of microscopy, image acquisitions and quantitation, lifetime imaging (FRAP), to more advanced topics such as Laser Scanning Microscopy (LSM), LSM-based SR Imaging Techniques, Lattice SIM-based SR Techniques, Single Molecule Localization Microscopy and Correlative Workflow (LM to EM Correlative Microscopy).

Further, the underlying principles defining the various feature and modules of light-, fluorescence- and laser scan- microscopy were explained at length. Various imaging-associated modalities, as well as the choice of the microscope optimum for the research question at hand were discussed. Finally, how future technologies could further enhance imaging capabilities of existing microscopes were touched upon.

MFCEM BSBE Joint Seminar Series

Dr Narendra Pratap Singh, NIH, USA. Title: Diversification of proteins function and evolution of phenotypic novelties. 17th Jan 2022.

Dr Rakesh Kumar Majhi, University of Oslo, Norway. Title: Harnessing the therapeutic potential of ion channels. 10th Jan 2022.

Dr Ashish Kumar Title: Characterization of Single-Fiber (SF) Mach-Zehnder. Interferometer (MZI) for Sensing Applications. 25th Jan 2022.

Dr Anusmita Sahoo, Emory University, USA. Structural insights of proteins derived from Saturation mutagenesis and design of HIV-1 vaccine candidates. 12th Jan 2022.

Dr Ashish Kumar, NIH, USA. Structural Insight of the mechanism of viral entry into host cells: Co-complex of Host Receptor and Viral Protein. 27th Jan 2022.

Dr Narendra Kumar, BioNTech SE, Germany. Title: Ribozymes: Chemical Reaction and Adaptability to High Pressures. 28th Jan 2022.

Dr Rafiq Ahmad, Jamia Millia Islamia, India. Title: Advanced Nanomaterials for Sensing Applications. 2nd Feb 2022.

Prof. Amitabha Chattopadhyay, CSIR Bhatnagar Fellow, Centre for Cellular and Molecular Biology, Hyderabad. Title: Cholesterol and GPCR Function: A Molecular Sensor for Cholesterol in the Serotonin1A Receptor Date: 30 June 2022

Prof. Chandrasekhar Kanduri, Institute of Biomedicine, University of Gothenburg, Sweden; and VAJRA Faculty, IIT Kanpur.
Title: An RNA binding protein regulates the oncogenic properties of FGF-2 induced sense-antisense pair of transcripts through regulating double-strand RNA formation and sub-cellular distribution. **Date: 25. June, 2022**

Dr. Garima Chauhan, title of the talk: Impact of stress on brain structures, behavior and their molecular co-relates, on July 25.

Dr. Vijesh K R, Title of the talk: Biological interaction of carbon nanoparticles for bio-imaging applications, on August 03.

Dr. Varun Aggarwala, Icahn School of medicine, Mount Sinai, USA; Title of the talk: Precise quantification of bacterial strains after fecal microbiota transplantation explains outcome and candidate strains for Live Biotherapeutics. 8th Aug 2022

Dr. Shikha Singh, Columbia University, USA. Title: Mechanistic insight into molecular regulators involved in signal transduction. 10th Aug 2022.

Dr. Sai Chaitanya Chiliveri, National Institutes of Health, USA. Title of the talk: Structural insights into transient states of viral membrane fusion. 12th Aug 2022.

Dr. Shalabh Gupta; Title of the talk: Entrepreneurship in Healthcare Space -Views from a US Biotech Entrepreneur on 6th Sep 2022.

Dr. N. Apurva Ratan Murty, MIT, USA; Title of the talk: Towards a computationally precise account of human vision. 26th Sep 2022

Dr. Bhagawat C. Subramanian, University of North Carolina, USA; Title of te talk: Regulation and functions of force generating structures: from sub-cellular to tissue level homeostasis. 29th Aug 2022.

Dr. Shruthy Suresh Aggarwal, Memorial Sloan Kettering Cancer Center, USA. Title of the talk: Identifying transcriptional drivers of metastasis using CRISPR screening in vivo. 10th October 2022

Dr. Sourav Kumar Dey, Assistant Professor at Indian Institute of Technology (ISM) Dhanbad. Title of the talk: Life of RNA - a Chemical Perspective. 18th October 2022.

Dr. Mrityunjoy Kar, Postdoctoral Research Associate, Max Plank Institute of Molecular Cell Biology and genetics. Dresden, Germany. Title of the talk: Nano to mesoscale assembly of biomacromolecules in physiology and pathology. 2nd November 2022.

Dr. Ashutosh Srivastava, Assistant Professor at Indian Institute of Technology Gandhinagar. Title of the talk: Molecular insights into the regulation of mammalian circadian clock. 12th December 2022

Dr. Zenia Motiwala, Bridge Institute USC Michelson Center for Convergent Biosciences, University of Southern California, Los Angeles, CA, USA Title: Structural basis of GABA reuptake inhibition. Date and time: December 19th 2022.

Dr. Sanjana Gopalakrishnan, Tufts University, USA. Title of the talk: Biomedical Applications of Biopolymers and Polymeric Nanomaterials. December 21th 2022.

STUDENT ACHIEVEMENTS

Anjali Yadav, PhD student of **Prof. Bushra Ateeq,** has been selected for the American Association for Cancer Research **(AACR).** Global Scholar-in-Training Award **(GSITA)** for presenting a paper at the AACR Annual Meeting 2022.

Anjali Yadav was selected for the DST-AWSAR 2021 best scientific story.

Sneha Gupts, PhD student of **Prof. Ashok Kumar,** has been awarded the first prize of Dr. M.S. Valiathan "Researcher Award in biomaterials, for Biomedical Devices" for her research presentation titled "Exosome-functionalized, antibacterial bone substitute along with antioxidant herbal membrane for bone and periosteum regeneration in osteomyelitis" in the annua BIOTEM 2021 meeting of the society of biomaterials and artificial organs India **(SBAOI).**

Sanket Patil, a Btech- Mtech, dual degree student of **Prof. Nitin Mohan** was awarded the **Sagnik Asis Ray** Scholarship for Biological research.

Mr. Sanket Patil received Sports Scholarship for outstanding sports performance from IIT Kanpur.

Shivansh Nigam PhD student of **Prof. Bushra Ateeq** received the SERB travel grant for presenting the poster at American Association for Cancer Research (AACR) Conference at New Orleans, US from April 8-13th, 2022.

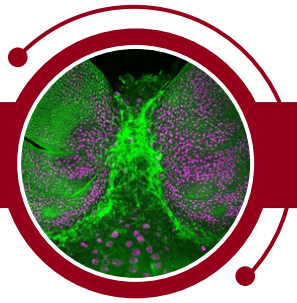
Dr. Sakshi Goel, student, **Prof. Bushra Ateeq,** received Outstanding Thesis Award (29th June 2022) during the 55th Convocation Indian Institute of Technology Kanpur.

Ms. Chitral Chatterjee, PhD student of **Prof. S. Matheshwaran** for being selected for Best Oral Presentation for her talk: "Elucidation and characterization of the mechanism of action of 3-aminophenyl boronic acid: a potential inhibitor of mycobacterial "SOS" response", at the-Workshop-cum-International Conference on "Recent Advances in Biomedical Sciences and Regenerative Medicine, 2022", organized by IIT Kanpur, SKUAST Kashmir and University of Kashmir.

Ms Pallavi Dethe, PhD student of **Prof. Jonaki Sen** EMBO Workshop: Cell and Developmental systems 22nd to 26th August 2022. Arolla, Switzerland

Ms. Meenu Sachdeva, PhD student of **Prof. Jonaki Sen** EMBO Workshop: Cell and Developmental systems 22nd to 26th August 2022, Arolla, Switzerland

PUBLICATION HIGHLIGHTS



Athilingam T, Parihar SS, Bhattacharya R, Rizvi MS, Kumar A, ***Sinha P****. Proximate larval epidermal cell layer generates forces for Pupal thorax closure in Drosophila. Genetics. 2022 Feb 15.*

Model organisms are an invaluable resource to gain useful insights into fundamental biological processes. In a recent study by **Prof. Pradip Sinha** and team, the underlying mechanobiology of tissue/organ closure, has been revealed, using the fruit fly Drosophila as a model system. Tissue/organ closures come into play at various stages of early embryonic development, in as much as in adult life, such as during wound healing. Impairment of the process in early development can lead to various congenital defects, such as cleft palate. Using a combination of Genetics, Cell Biology and Mathematical modelling the authors have studied the closure of thorax during pupa development, which entails movement of one cell layer over another. Through this study the authors display the critical role of the lower embryonic epidermal cell layer, which via active contraction, orchestrated by its elaborate actomyosin cytoskeleton drives the closure of the overlying layer. It is likely that such mechanistic cross-talks between distinct cell layers are conserved across the animal kingdom. Dissecting out the key molecules involved, could thus provide an understanding of the critical molecular players formig the basis for developing novel strategies for future medical interventions.

Image: *Curtesy, Saurabh S. Parihar. The image displays the two halves of the thorax in a process of coming close. Cell actin is marked in green, and the nucleus in pink.*

PUBLICATION HIGHLIGHTS

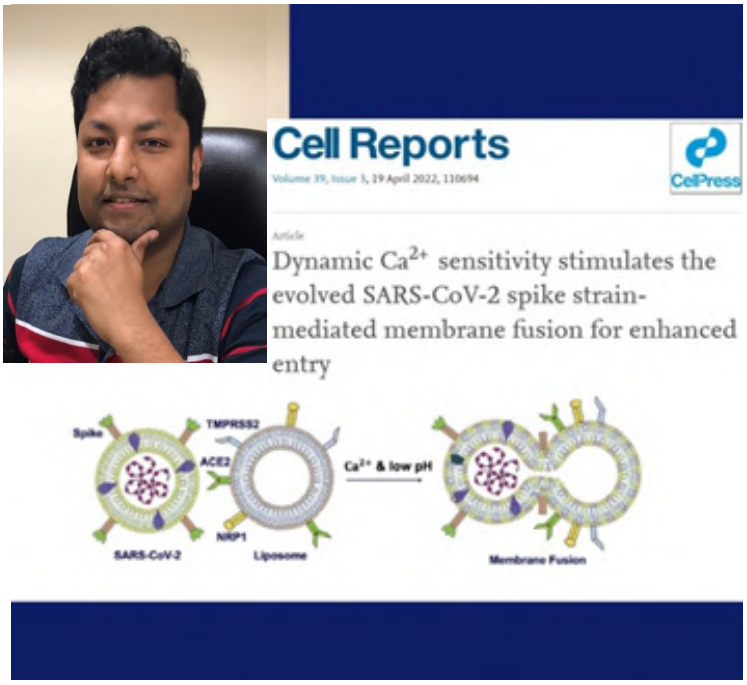
Verma A, Murugan PA, Chinnasamy HV, Singh A, ***Matheshwaran S.*** *Identification and Genome Analysis of an Arsenic-Metabolizing Strain of Citrobacter youngae IITK SM2 in Middle Indo-Gangetic Plain Groundwater. BioMed research international. 2022 Mar 10;2022.*

Prof. Saravanan Matheshwaran and team have identified a new strain of Citrobacter youngae—IITK SM2, from groundwater of mid Indo-Gangetic plain. Members of the Citrobacter genus are implicated in human diseases such as meningitis in infants, and inflammation of the peritoneum lining in adults. Importantly, Citrobacter are known to be resistant to several heavy metals, including Arsenic (As), due to presence of As-metabolizing enzymes. Arsenic (As) is a well-known metallic contaminant that affects health of animals and humans. Depending on its electronic configuration, As can exhibit multiple oxidation states, and in mammals As(III) is found more toxic than As(V).

Characterization of the new strain, IITK SM2, showed that it could survive under high concentrations of dissolved As and could reduce As(V) to As(III). Whole-genome sequencing (WGS) of the strain further revealed of presence of many As-metabolizing genes such as arsC, arsB, arsA, arsD, arsR, and arsH with duplications of some. Further the study revealed various characteristic features of the new strain, particularly, related to membrane transporters, virulence and defense, protein metabolism among others.

A major fall out of the study is that it provides a mechanistic understanding of potential biogeochemical processes that control arsenic levels in groundwater. The study thus paves way to develop long term in situ solutions for As-remediation.

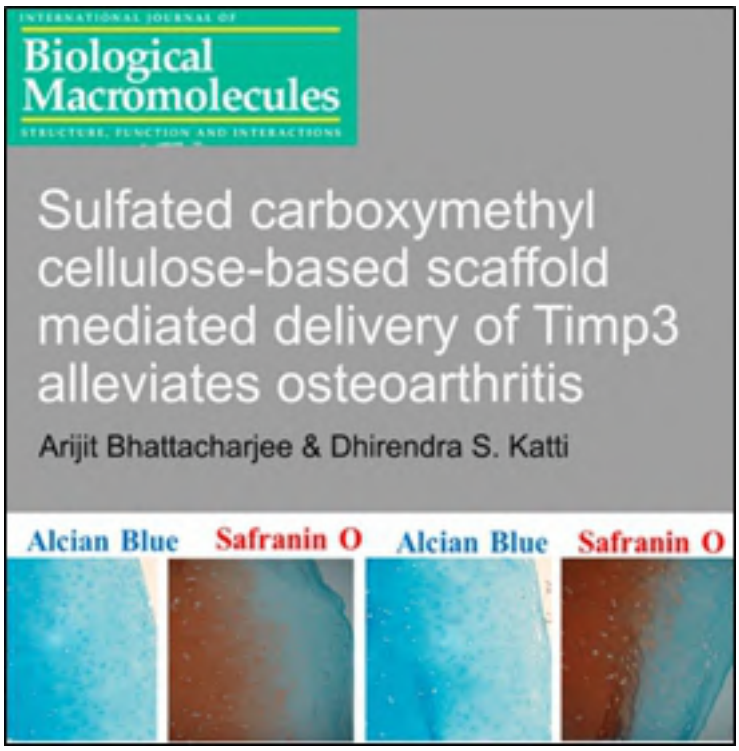
Singh P, Mukherji S, Basak S, Hoffmann M, ***Das DK.*** *Dynamic Ca2+ sensitivity stimulates the evolved SARS-CoV-2 spike strain-mediated membrane fusion for enhanced entry. Cell Reports. 2022 Apr 19;39(3):110694.*



In a significant study Prof. Dibyendu Das & team uncovered the underlying mechanism for increased infection by Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) D614G variant. The study shows that the D614G, Alpha, Beta, and Delta spike variants of SARS-CoV-2 display enhanced membrane fusion owing to increased calcium sensitivity of spike protein. Further, the authors elucidate the role of Ca and show that efficient fusion of SARS-CoV-2 is dependent on Ca^{2+} concentration at low pH, and the fusion activity of the spike dropped as the Ca^{2+} level rose beyond physiological levels. Thus, over all the study established that evolved spike variants may control the high fusion probability for entry by increasing Ca^{2+} sensing ability.

PUBLICATION HIGHLIGHTS

Bhattacharjee A, **Katti DS.** Sulfated carboxymethylcellulose-based scaffold mediated delivery of Timp3 alleviates osteoarthritis. International Journal of Biological Macromolecules. 2022 May 16.



In this study spear headed by Arijit Bhattacharjee, under the mentorship of **Prof. Dhirendra Katti**, the authors display a disease-modifying therapeutic strategy for Osteoarthritis (OA). The authors display, the effective use of sulfated carboxymethylcellulose-based scaffold mediated delivery of tissue inhibitor of metalloprotease 3 (Timp3) to alleviate OA associated disease phenotypes. The study delineates the method to modify carboxymethylcellulose (CMC) to sulfated carboxymethylcellulose (sCMC) to impart native-like electrostatic interaction-based binding of cationic proteins. Further, the authors show how cartilage ECM mimicking sCMC-gelatin scaffolds could be modified to facilitate preferential binding and sustained delivery of Timp3, or tissue inhibitor of metalloprotease 3. Significantly, sustained delivery of Timp3 was also seen in human OA samples, thus lending great promise to the use of these engineered scaffolds for clinical purposes.

PUBLICATION HIGHLIGHTS

A simple, robust and scalable route to prepare sub-50 nm soft PDMS nanoparticles for intracellular delivery of anticancer drugs. Maparu AK, Singh P, Rai B, Sharma A, ***Sivakumar S.*** *Nanotechnology. 2022 Sep 21;33(49):495102.*

Soft Nano Particles (soft-NP) as a drug delivery system has garnered much interest owing to their ability to easily overcome the biological barriers for diffusion and ability to penetrate deep into the tissues more efficiently than the analogous non-deformable hard NPs.

However, one of the major challenges is the lack of long term stability of the biocompatible soft-NP, and poor scalability of the manufacturing processes. Furthermore, the complicated conjugation strategies involved in the design of the targeted drug delivery systems make the process of production daunting.

Polydimethylsiloxane (PDMS) is among the FDA-approved soft polymers to develop drug delivery vehicle. In this study by **Prof. Sivakumar** and team, have for the first time, developed a simple, robust and scalable one-pot synthesis strategy to prepare virgin sub-50 nm PDMS NPs at room temperature using nanoprecipitation method. The synthesized NPs approximately 30 nm in size, are biocompatible and possess an inherent ability to selectively localize to mitochondria and nucleus of cancer cells, without the need for any targeting ligand.

The synthesized soft PDMS NPs displayed great efficacy for delivering anticancer drug doxorubicin to cancer cells such as cervical and breast and also to 3D multicellular tumor spheroids. The treated cancer cells including spheroids showed elevated cell death, resulting in drastic improvement in the therapeutic efficiency of doxorubicin.

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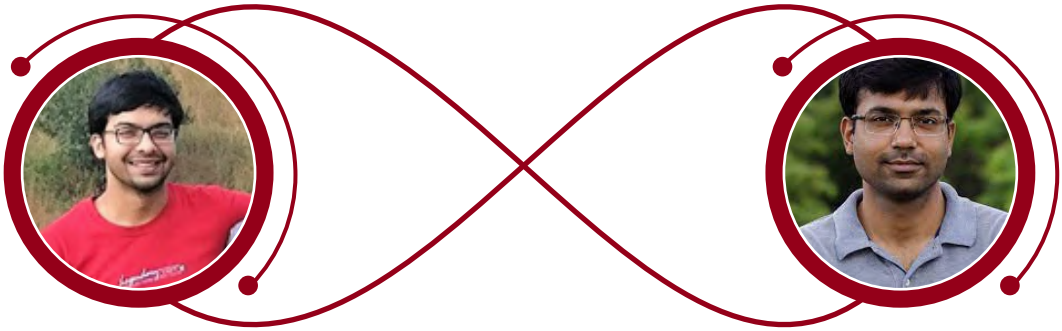
In conversion with first author: Abhishekh Gupta



Abhishek Gupta **Prof. Nitin Gupta**

Gupta et al., Mosquito Olfactory Response Ensemble enables pattern discovery by curating a behavioral and electrophysiological response database. iScience, 103938.

MFCEM: Congratulations!! Abhishek to you and all authors of the study. What was the motivation behind the study?

Abhishek Gupta: Mosquitoes spread many deadliest diseases such as Malaria, Dengue, Zika virus, Chikungunya virus, etc. Olfaction plays a prominent role in the detection of hosts. Mosquitoes detect the odors released by hosts with the help of the sensory organs, which harbors sensory neurons.

Over the past several decades, hundreds of studies have been conducted on mosquitoes' olfaction. Researchers have employed several behavioral paradigms to quantify the behavior of mosquitoes towards a large set of odors. Alongside, various electrophysiological techniques have been used to quantify the activity of sensory neurons. The data generated from these studies was scattered across hundreds of research articles in an unformatted way. The primary motivation behind our research was that if we have this data in a structured format, that could enable us some new insights that cannot be seen in the individual studies.

MFCEM: We understand that the study aimed to bring together experimental data from varied sources onto a common platform. What was the major challenge?

Abhishek Gupta: In this study, we have overcome several challenges involved in curating this dataset. For example, in most articles, the data were reported in text or plots rather than spreadsheets and thus had to be extracted manually. Moreover, different studies used different metrics to report the experimental results, which made it difficult to make a comparison across them. Here, we converted the data into a standard format, which allowed direct comparison.

....conversation with Abhishekh Gupta, continued.

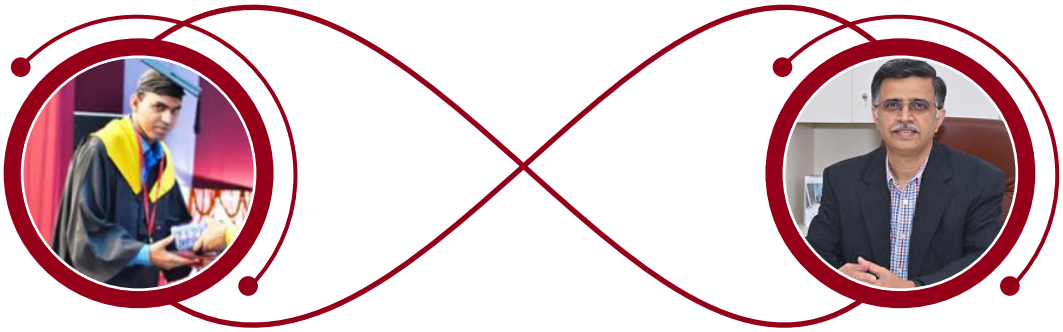
MFCEM: Ultimately, how accessible is MORE (Mosquito Olfactory Response Ensemble), would it be constantly updated?

Abhishek Gupta: Yes, we will maintain the database and update it annually with new data.

MFCEM: Olfactory behavior of mosquitoes is of immense interest because of its relevance to diseases. Would you like to share any interesting insight that this meta-analysis facilitated?

Abhishek Gupta: Understanding the responses of odorant receptors (chemoreceptors responsible for detecting odorants) to different odorant molecules can help design a better mosquito repellent. In MORE, we have shown that the odorant receptors are tuned to specific ranges of several physicochemical properties of odor molecules, such as molecular volume, molecular weight, odorant-water partition coefficient, etc. Furthermore, we have conducted several comparisons across different behavioral and electrophysiological experimental approaches, which could help the researchers build the exemplary assay for their experiments.

In conversion with first author: Arijit Bhattacharjee.



Arijit Bhattacharjee **Prof. Direndra S. Katti**

Arijit Bhattacharjee & Dhirendra S Katti Human osteoarthritis mimicking goat cartilage explant-based disease model for drug screening. ALTEX. 2022 Mar 7.

MFCEM: Congratulations!! Arijit for driving this study and for its publication. What was the motivation behind the study?

Arijit Bhattacharjee: Thank You for allowing me to discuss our work. Osteoarthritis (OA) is a debilitating disease that affects 7% of the global population. OA severely affects the lifestyle of affected individuals and despite decades of efforts, effective therapeutic intervention for OA remains elusive. When we set out on our journey to find a cure for OA, we observed the absence of a suitable model system to screen/test drugs which significantly hindered the development of newer and improved therapies. Also, we noticed a discord in preclinical and clinical outcomes of candidate drugs owing to the absence of effective models for drug screening. Therefore, we decided to develop a disease model which would closely mimic the hallmarks of human OA and facilitate screening of effective OA drugs

MFCEM: What was the major challenge of the study? Do you believe there is scope for further optimization of the ex vivo culture platform to mimic human OA more closely?

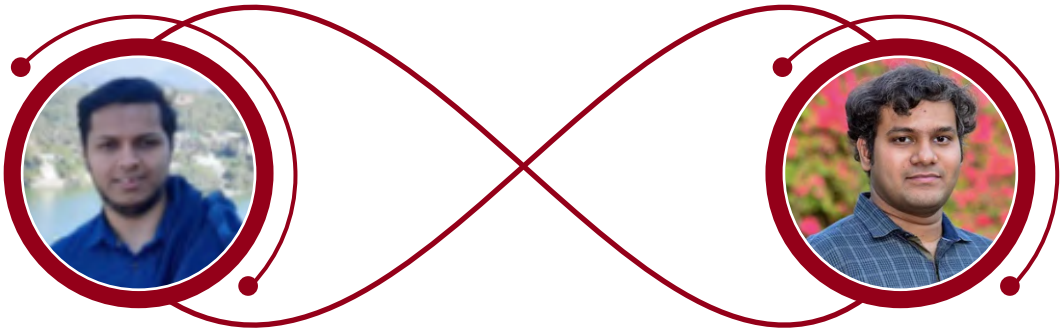
Arijit Bhattacharjee: The major challenge of the study was to find a source of ex vivo tissue for OA induction that would closely mimic human cartilage in terms of architecture, cellularity, thickness as well anatomy while being cost-effective and reproducible.

Yes, we believe there is a scope for further optimization. Although we have performed extensive characterization to ensure mimicking of human OA in the . developed goat ex vivo OA model, we are in the process of further optimizing this model to make it more robust with a relatively higher translational success of candidate drugs identified using this disease model.

MFCEM: Your study shows that the system responds well to some of the known drugs, are you currently undertaking a screen to discover new lead compounds for treatment of OA using this system.

Arijit Bhattacharjee: Yes, we are undertaking screening to identify candidate drugs using the developed model system in order to discover new lead compounds for the treatment of OA.

In conversation with first author, Kushagra Pandey.



Kushagra Pandey **Prof. Hamim Zafar**

Pandey K, Zafar H. *Inference of cell state transitions and cell fate plasticity from single-cell with MARGARET. Nucleic Acids Research, 25 may, 2022*

MFCEM: Congratulations to you Kushagra, and to your advisor Prof. Hamim Zafar on your recent publication. Let me start by acknowledging that single-cell-omic studies is happening in a huge way resulting in an overload of data, having said so, what "gap" did you identify that motivated you to come up with MARGARET.

Kushagra Pandey: The main computational problem that we try to tackle in this work is that of Trajectory Inference or TI where the goal is to study how certain biological processes evolve over time. For instance, consider a fundamental biological process like cell differentiation where immature cells gradually undergo cell division to form more mature cell types which are important for performing different functions in our body. Using TI to model the landscape of cell differentiation can help us in understanding why certain types of cells give rise to some other types of cells. This type of modelling becomes even more important when dealing with scenarios which hinder the normal workflow of these biological processes (like cancer). When we first started with the problem, we found that even though TI as a computational problem is well studied, existing computational methods make certain assumptions on the type of trajectory underlying these biological processes. Now, these assumptions can hold for some biological systems but not for others. This was the primary motivation behind MARGARET: To come up with a TI method that does not make any assumptions about the underlying trajectory and can generalize to different biological processes.

MFCEM: What was the most challenging part of developing MARGARET?

Kushagra Pandey: In the development of any computational method there are usually two stages involved in development: method design and experimental justification. Interestingly, I feel the method design was not very challenging since we had some clarity on the abstract design framework from the very beginning.

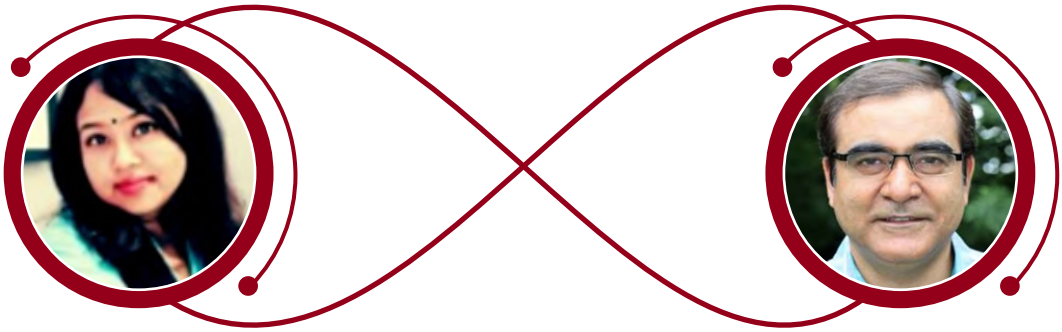
However, since MARGARET is a computational tool to be used by biologists, we wanted to see if we can indeed recover correct biological insights from different biological systems which the end-users might ultimately care about. Therefore, we undertook validation case studies in this work involving well-studied biological processes like

hematopoiesis (the process of blood formation) and we found that the insights we obtained by applying our method to these biological processes well conformed with the experimental findings in the existing literature. I feel this part was the most challenging during the development phase since we had to perform an extensive literature survey in each of the case studies to justify our findings. However, I have to admit it was also the most fun part since you are effectively finding out novel biological insights directly from single-cell data.

MFCEM: Could you share with us one feature of the platform that you have developed that is a game changer? Will we see the diversifying further in the near future?

Kushagra Pandey: Without going into too much method details, MARGARET kind of provides a playground for interactively visualizing single-cell datasets at the cell-level and also at the cluster-level. So any user can get started with exploring the dataset by projecting gene or transcription factor expressions on the visualized graph to get important biological insights from the dataset which I think is important. We are also planning to work on extending MARGARET to gain insights from different multi-omic views (like scRNA-seq, CITE-seq etc.) of the same biological process collectively. We believe this would improve our method when dealing with complex biological processes like cell differentiation in cancer tissues etc.

In conversation with first author, Ankita Das.



Ankita Das **Prof. Ashok Kumar**

Das et al., Kumar A. Preparation of thermo-responsive polymer encapsulated exosomes and its role as a therapeutic agent for blood clot lysis. Colloids and Surfaces B: Biointerfaces. 2022 May 18:112580.

MFCEM: Congratulations Ankita to you and all authors of the study. Let me start by asking you, what gap does this study fill with respect to known and standard methods for thrombus degradation?

Ankita Das:
First of all, on behalf of all the authors, I would like to thank MFCEM for appreciating our work and thanks for the opportunity to discuss on the key aspects of the study.
To tackle the problem of arteries getting blocked by a clot, clinically the first line of defense is systemic injections of tissue plasminogen activators like streptokinase and urokinase. But this strategy has a downside in aspects of various side effects including bleeding and bruising at the injection site, blurred vision, fast heart rate, bleeding from the nose and gums, among others. So, such treatment has to be used with caution with other medications that alter platelet function and increase the risk of bleeding. Our group wanted to propose an effective solution for this problem with enhanced efficiency to fill the limitations of standard methods for thrombus degradation. So, in our study we selected a combinatorial injectable therapy where the treatment was provided locally to the clot, in comparison to the conventional systemic approach applied in the in vivo system. In this approach exosomes isolated from a cell line reported to have urokinase releasing activity have been utilized to check the thrombolytic effects and a thermo-responsive polymer was used as the delivery vehicle for exosomes. When exosome laden thermo-responsive polymer will be injected over the clot, polymer would undergo phase-change in situ and encapsulate the clot and there will be sustained release of the exosomes which will eventually lead to clot lysis. The sustained release approach has been adapted to avoid the risk of thrombo-embolism, which might occur if clot is detached from its site by direct treatment of exosome. Hence, the proposed treatment system will enable clot dissolution without associated limitations.

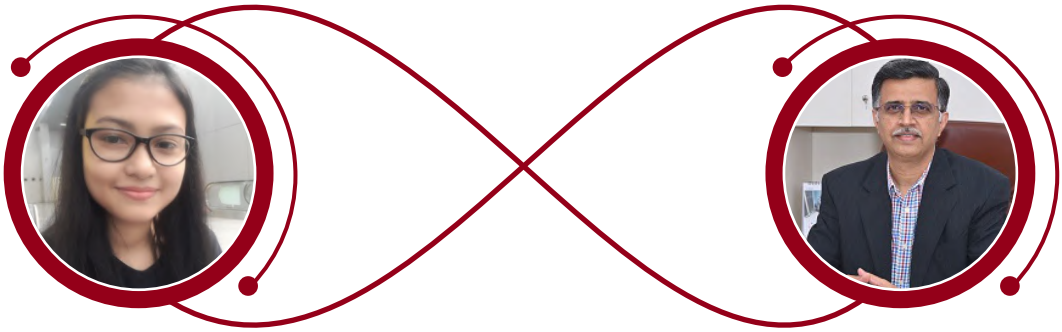
MFCEM: The study is very exhaustive, and I see that it spreads from harvesting exosomes from cell lines, to standardizing the polymer for encapsulation & release. What was the most challenging part of the study?

Ankita Das:
Yes, the study is quite extensive but has shown very interesting results. In this study, we have utilized different exosome concentrations and compared their activity with commercial tissue plasminogen activator (tPA) streptokinase. From the clot lysis activity assays which are routinely carried out for fibrinolytic drugs, we were able to deduce that these exosomes had the potential to serve as a replacement for streptokinase. Since, the activity of exosomes matched to that of streptokinase applied at a much higher concentration than the test tube equivalent (when a blood clot is placed in a static milieu), thereby showing the potential and application of these exosomes. The polymer solution was also optimized at a concentration where the released exosome will be sufficient enough in terms of concentration to carry out clot lysis. Challenge was to make a strategy that will be at par with the current clinical treatment strategies and study has to be designed such that its application will be clinically possible after its evaluation in pre-clinical trials. The ideology for this strategy was instigated by my mentor, Prof. Ashok Kumar, and our collective team effort yielded fruitful results.

MFCEM: Do you have any plans to test these polymer-encapsulated-exosomes for their efficacy in clot removal in animal models?

Ankita Das:
Yes, we are planning to test the efficacy of these polymer-encapsulated exosomes in animal model, where we will be generating a localized thrombus using chemical reagents and our combinatorial therapy will be utilized for clot degradation. The work will be carried out on a collaborative basis, and we are in the process of finalizing it.

In conversation with first author, Namrata Baruah



Namrata Baruah **Prof. Dhirendra S. Katti**

Baruahet al., Stable Recombinant Invasion Plasmid Antigen C (IpaC)-Based Single Dose Nanovaccine for Shigellosis. Mol Pharm. 2022.

MFCEM: Congratulations on this publication. It follows your previous study on Ipa-based nasal vaccine for Shigellosis. What was the motivation to engineer this vaccine and further improvise it?

Namrata Baruah: Thank you! This is year 2022 and hundreds of people are still dying due to shigellosis- a diarrheal disease, for which a commercial vaccine is unfortunately, not available. The situation is grim because most strains of Shigella, the bacterial pathogen, have become multi-drug resistant. There may soon be an outbreak we do not have antibiotics for. Therefore, the requirement of a vaccine is paramount.
Although there have been considerable research, a vaccine passing all the phases of clinical trials is still not available mainly because of low immunogenicity of the antigen(s) or serotype specific narrow-range protection of the vaccine candidates. Instability of immunogenic, potential vaccine antigens, exacerbates the problem. Therefore, we first stabilized a potential immunogen –IpaC, a protein found in all Shigella strains. We then assessed its vaccine potential with the available resources, and surprisingly found it to be cross-protective (heterologous protection) without any adjuvant. To further reduce dosing and increase eventual patient compliance, we encapsulated the minimum protective amount of the stabilized protein into PLGA (polymer with several FDA approved applications) nanoparticles to obtain a minimalistic single dose nanovaccine for shigellosis which is expected to protect against all Shigella strains.

MFCEM: Can you explain for the larger scientific community the technology used to develop this vaccine. How do the improvisations implemented by you push the field of vaccine development forward?

Namrata Baruah: To develop the nanovaccine, we first stabilized an immunogenic recombinant Shigella protein-IpaC (origin- Shigella dysenteriae 1, the most harmful Shigella with the most unstable IpaC) which resulted in a self-adjuvanting single-antigen nasal -protection against Shigella dysenteriae is difficult to achieve and there are only few reports showing minimal protection.

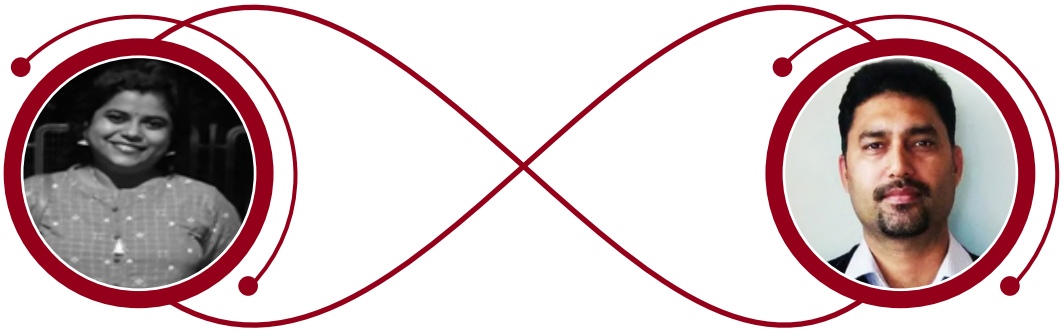
Therefore, we chose IpaC protein of S. dysenteriae origin (most vaccine candidates currently being explored are from S. flexneri origin), as it is bound to show homologous protection. Therefore, as expected, it protected immunized mice from bloody diarrhea. However, the vaccine needed to be administered in 3 doses which meant that eventually, patients would be required to visit a hospital or care facility for 3 times at regular intervals. As the disease mainly affects the infants and the elderly, decreasing hospital visits was a priority. Therefore, we explored a single-dose nasal vaccine. As biodegradable polymeric nanoparticles are known to show a depot effect leading to slow release of the encapsulants, we chose a nanoparticle system which was expected to result in greater circulation time of the stabilized IpaC in the body and hence, equivalent immunogenicity at 1/3rd the dose. We chose the biodegradable polymer PLGA with established safety (FDA approved for multiple applications) as it is expected to shorten the entire process of lab to the market.
Since, the current vaccine candidate is a single antigen, single dose, cross-protective, facile formulation, therefore, our work should accelerate the progress towards a protective commercial Shigella vaccine.

MFCEM: Could you comment on the possibility of translating this technique for developing vaccines for human use. Do you envisage it happening in the near future?

Namrata Baruah: The minimalistic, cross-protective, single dose nanovaccine is amenable to translation at a large scale because of the following reasons-

First, being recombinant, IpaC protein purification omits pathogenic Shigella culture requiring a BSL 2 facility. Second, the stabilized IpaC protein was found to be stable at a multitude of temperatures, which would ultimately reduce the cost of storage and/or transportation of the protein. Third, the nanovaccine is minimalistic requiring only a few elements to complete the whole process after which it can be lyophilized and stored for years at room temperature. Fourth, as it is an intranasal vaccine, trained personnels for vaccine administration would not be required. Finally, due to a single dose, it is expected to increase patient compliance and overall acceptance. All of these factors can reduce cost and effort and therefore, after rigorous testing, I expect the nanovaccine to at least be part of the solution especially in low and middle income countries where the disease causes greater harm.

In conversation with first Author, Shreya Ghosh



Shreya Ghosh **Prof. Ashwani K. Thakur**

Amyloid deposition in granuloma of tuberculosis patients: A single-center pilot study. Tuberculosis (Edinb). 2022 Sep;136:102249.

MFCEM: Shreya congratulations on your publication! India, unfortunately, still contributes to a major chunk of Tuberculosis cases worldwide. Does your study on the formation Amyloid deposits in frequently occurring granulomas in TB patients, encourage the medical community to think of alternate or additional therapeutic strategies for TB?

Shreya Ghosh: Thank you so much for your appreciation. Protein misfolding is accompanied by the formation of insoluble protein-derived fibrillar deposits termed as amyloid fibrils. The linkage between tuberculosis and SAA-driven amyloid formation is well documented. However, SAA-derived amyloid onset and deposition start sites are not well understood in tuberculosis. In this study, for the first time, we have identified granuloma as the amyloid deposition site in TB patients. The findings of our study might set a stage for clinicians to diagnose the progression of amyloid formation in the early stages of tuberculosis. In addition, this work would encourage the medical community to devise therapeutic strategies to prevent the amyloid formation in TB patients. However, this study reflects preliminary findings on a limited number of samples and needs to be validated in a large number of patients to implement those therapeutic strategies.

MFCEM: Would it be right to assume that amyloid formations could be used as a marker for the progression of the disease. If yes could you elaborate?

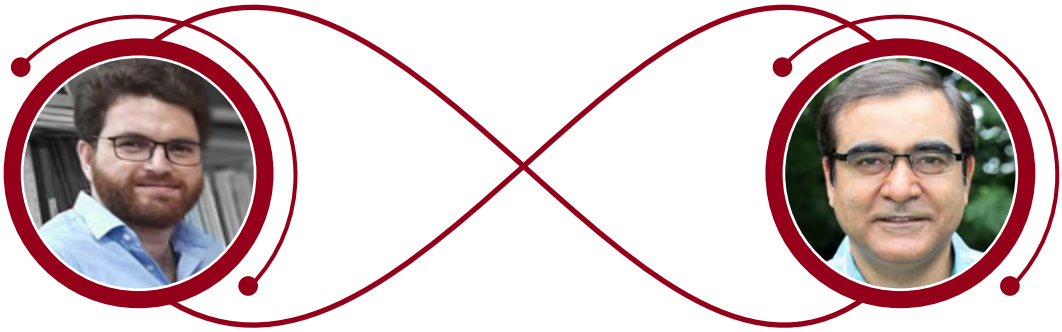
Shreya Ghosh: Our paper does not directly deal with this aspect. However, I think that it is a realistic possibility. Previous studies identified amyloid formation in TB patients several years after its onset. We captured such amyloid formation in early-staged TB patients. Future studies should foretell if there is any correlation between the progress of amyloid formation and tuberculosis.

MFCEM: I understand that this study was a collaborative effort by IIT Kanpur and the GSVM Medical College, Kanpur. How critical was this collaboration? Also do you envisage a possibility of a clinical translation of the study in the near future?

Shreya Ghosh: This paper made us believe in Alexandar Graham Bell: "Great discoveries and improvements invariably involve the cooperation of many minds". This work would not have been possible without collaboration. Initially, Professor Ashwani and I spent a lot of time convincing the clinicians and patients to obtain the biopsy specimens for our research. Finally, we could collaborate with GSVM Medical College, Kanpur. Dr. Chayanika Kala's active participation helped us a lot to conduct our study successfully.

Yes, of course. I genuinely believe that identifying amyloids in the early stages of TB patients has a high potential to be clinically translated. However, a huge effort involving multi-centers is needed to accomplish it

In conversation with first Author, Dr Irfan Qayoom



Dr. Irfan Qayoom **Prof. Ashok Kumar**

Qayoom et al., Anti-infective composite cryogel scaffold treats osteomyelitis and augments bone healing in rat femoral condyle. Biomaterials Advances. 2022 Nov 1;142:213133.

MFCEM: First and foremost, congratulations on your recent publication; could you share with us what need does the study address?

Dr. Irfan Qayoom: I would like to thank you on behalf of all authors for reaching to us and appreciating the work done by our team. In this study, we have tried to develop an improvised approach so as to improve the current clinical treatment strategies that are used to manage and treat osteomyelitis and related complications. The current clinical treatment modalities utilized to treat osteomyelitis infections are associated with enormous limitations which include lower bioavailability of antibiotic at the infectious site, off the target comorbidities, and secondary complications like fractures and amputations. We have hereby developed a biomimetic local antibiotic delivery system from biocompatible and osteo-active biomaterials, collagen and nanohydroxyapatite using cryogelation to clear the infection and at the same time enhance the bone formation at the debrided site created during surgical procedures.

MFCEM: How is your approach distinct from the existing ones; does the use of an inorganic-organic composite gel engineered in this study provide a distinct advantage over others?

Dr. Irfan Qayoom: The development of porous composite cryogel as an antibiotic delivery system provides advantage of using in large sized bone infectious lesions. The commercially available polymethylmethacrylate (PMMA) beads used to clear the infection has several disadvantages like PMMA is bioinert, has dysregulated antibiotic release profile and most importantly is non-porous which does not allow proper gaseous and nutritious exchange thereby causing anoxic injuries eventually leading to infection related complications. Our porous composite cryogel system is macroporous system which is osteoactive, show controlled antibiotic release and allows ambient gaseous and nutritious exchange thus enhancing the infiltration of immune cells and other osteoprogenitor cells to clear the infection and simultaneously, enhance the bone formation at the infectious lesions.

MFCEM In this study you have also made use of mathematical modelling to calculate the antibiotic release rate from the scaffold; did this allow you to transcend the experimental limitations?

Dr. Irfan Qayoom: In this study we have used mathematical modelling to support our experimental data that our system shows sustained release kinetics at physiological pH. It was observed that at physiological pH, the release kinetics follows a model that is fit for long-term release of antibiotic and will ensure the availability of antibiotic at the infectious lesion to clear infection completely and also prevent the formation of biofilm by the persister bacterial cells.

MFCEM What was the major challenge you faced while engineering the cryogel scaffold? How did you overcome it?

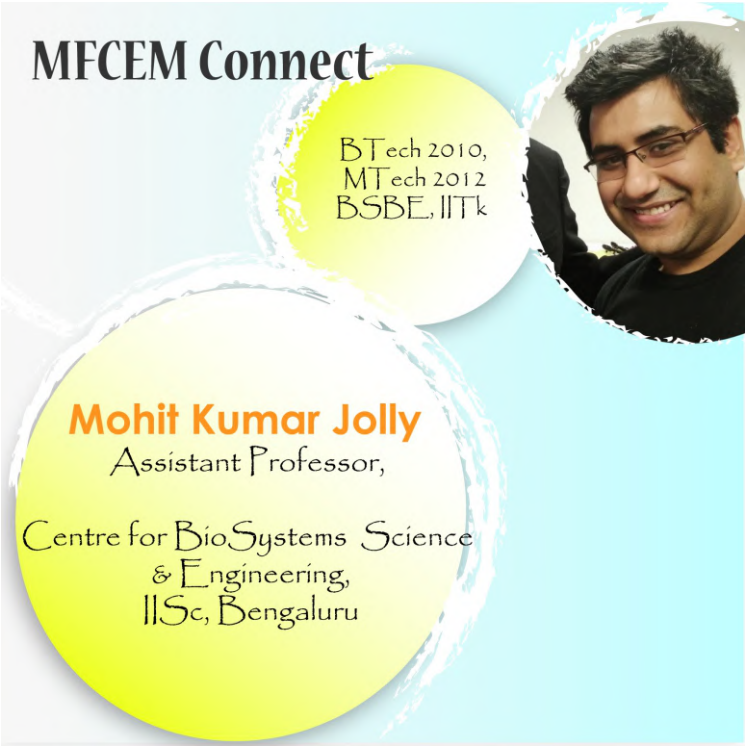
Dr. Irfan Qayoom: The major challenge was the synthesis and fabrication of porous composite cryogels itself with both organic and inorganic components. The synthesis of cryogel was optimized with multiple methods so that it contains optimum concentration of inorganic nanohydroxyapatite till we developed a new and modified method to synthesize an antibiotic loaded-biomimetic cryogel scaffolds with compositional and structural resemblance to the natural trabecular bone.

MFCEM Are you contemplating a technology transfer for scaling purposes in the near future?

Dr. Irfan Qayoom: The potential of our nanohydroxyapatite based antibiotic carriers have already been recognized by DBT-BIRAC and funded under BIG grant wherein we have started a startup if "REGENMEDICA PRIVATE LIMITED" to develop a prototype of the product that will be further commercialized for clinical applications in bone and spinal tuberculosis infections.

MFCEM CONNECT with Mr. Mohit Kumar Jolly

MFCEM: Being part of the Academia—was it a natural career path having done your BTech from IIT Kanpur?



MKJ: At IIT Kanpur, thanks to diverse courses in computational/mathematical biology and biomechanics, I got interested in applying tools from physics and mathematics to understanding the dynamics of biological systems but was not very sure how exactly to proceed to pursue research in that direction. During my M Tech with Prof. Pradip Sinha, I started developing mathematical models for planar cell polarity with Suhail and Amit, and came across dynamical systems approaches being applied to cancer progression, which I got very excited about. I pursued my PhD at Rice University with two leading theoretical biophysicists, where I worked on mathematical models for cancer metastasis and initiated experimental and clinical collaborations to test our model predictions. Experiencing those instances of synergy was my 'point of no return' to be in academia.

In my current role, that synergy continues - I get most energized by the lab members around. Our team is quite dynamic and interdisciplinary, with undergraduate students (Bachelors, Masters), PhD students and postdoctoral fellows from diverse backgrounds (cancer biology, physics, engineering, mathematics, bioinformatics), all enriching one another and collectively thinking about cancer as a complex adaptive dynamic system.

MFCEM CONNECT with Mr. Mohit Kumar Jolly

MFCEM Connect is an initiative to connect with IITK alumni and explore the multitude of possible career options at the interface of biology, medicine and engineering.

MFCEM: Industry, Academia or Entrepreneurship—how should a graduating student make a choice, if at all; have these distinctions blurred over time?

MKJ: Absolutely; these distinctions are getting increasingly blurred with time. Many academicians are now turning entrepreneurs or moving to top industry positions. Also, within academia, the rate at which disciplinary boundaries are getting smudged now is unprecedented. Thus, my suggestion would be to keep one's eyes, ears and mind open to opportunities that come one's way and stay in the 'growth mode' as much as possible.

MFCEM: In today's digital age, with unrestricted resource availability, can graduates equip themselves better, be better skilled?

MKJ: Yes, I completely agree. Over the past two years of the pandemic, our lab had many bachelors/masters students across disciplines and institutes, who all picked up various skills working remotely and attending various online conferences/workshops. Many top universities now have 'flipped classroom' strategies where students go through the content available before the class and then discuss concepts/questions during the class. Thus, in today's age, I don't see a dearth of opportunities to self-learn/update.

MFCEM: You have a keen interest in Science Communication. How viable a career option is it in India?

MKJ: Over the past 2-3 years, I have seen on social media a surge of science communication initiatives based in India; for instance, BioPatrika founded by BSBE alumnus Dr. Virender Singh. I am very optimistic towards it becoming a viable career option in times to come, given the encouragement by funding agencies too such as AWSAR competition organized by Department of Science and Technology (DST). Under a broader gamut of activities, science policy making/ science illustration are also careers where many transferrable skills that we have been learning can be applied effectively.

MFCEM CONNECT with Mr. Rohit Gole

MFCEM: Hi Rohit! Great to connect! You certainly have developed an expertise in quite a niche area of technology and patent portfolio development, and patent protection. Did your undergrad training, particularly in biological sciences help you navigate better, or did you also develop the much-needed skills along the way?

Rohit Gole IIT Kanpur was my second home and I have seen myself grown up. We were the pioneer batch of the department: not just in name, but in spirit and much needed skills to nurture ourselves. We had the opportunity to explore areas of our interest. It was Dr. Dhirendra S. Katti and his lab that helped me to explore my interest about innovation and IP rights. As I moved along my career, I become a seasoned IP thought leader.

MFCEM: Further, do you think with many top international Universities offering a wide range of tailormade courses today, can students today explore a little more beyond their formal training at IITs, to be better equipped with complimentary skill sets?

Rohit Gole

IIT Kanpur is not an institute which only gives you academic qualifications in a formal set-up, it is your dream. It helps you in improving your knowledge, expanding your horizons and instills within you a confidence. There are many examples that illustrates how students have explored and achieved greater heights beyond their formal education. I would want academic management to put conscious effort to modify the mandatory and optional courses based on industry and societal needs.

MFCEM: For the young undergraduates still deliberating on their preferred career choice, would you like to briefly tell them of the pros & cons of a career in IP development.

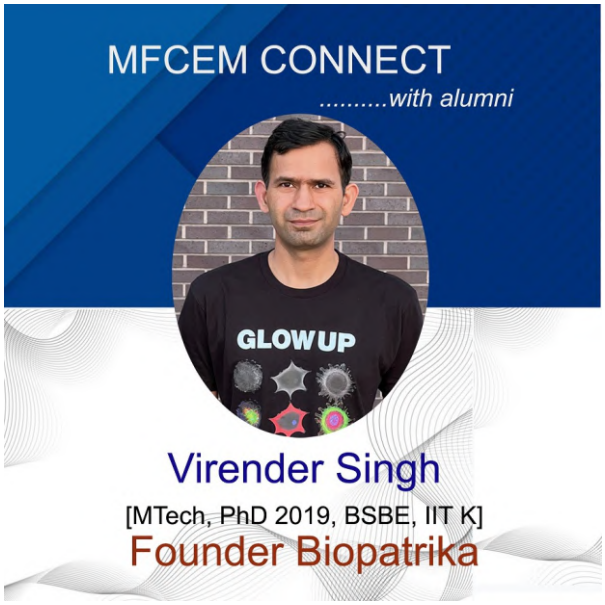
Rohit Gole

Innovation and protection are the key to thrive in today's dynamic and turbulent global community. IP strategy is an important core function of businesses.

IP as a career has a huge potential where you serve innovators with your legal and analytical capabilities. However, you will still see people and businesses not realizing the full potential of IP.

Make a career choice that reflects your capabilities, passion and happiness. Don't forget to change gears if it does not work in a longer run.

MFCEM CONNECT with Dr. Virender Singh



MFCEM: Hi Virender, great to connect. It is wonderful to see you straddle diverse fields with equal ease. You were part of the Biotech industry at one point, then you immersed yourself into research/academics, and with all this you have also managed to keep your passion for science communication on—having launched the **"BIOPATRIKA".** What motivates you? Is it possible to dabble in more than one activity and do full justice to it?

Virender Singh: My exploratory nature was always supported by my family. I was in biology-stream at school but opted for engineering in college. Later, I resigned from my very cushy job at Biocon to pursue a PhD and now left home behind to do my postdoctoral training in the USA. Having family's support is always a blessing but the top-up is having friends and mentors to help and guide at each career stage.I took the first step by starting a science based departmental painting competition 'Prakriti' with the help of my friends at IITK and it was very well received....It was only during the COVID-19 lockdown in 2020 that the idea of Biopatrika struck me and with the help of my wife, Preeti Singh who happens to be the co-founder of Biopatrika, it all began with a handful of articles.. ithin a few months, the "magazine" became a volunteer-run platform ... working on different aspects but towards a common goal - "To bring Science to Society."

MFCEM: I understand that one of the major focus of the Biopatrika is to take science to the common man. At any point does Biopatrika also hope to tap into the vast "Vernacular" space?

Virender Singh: Thanks for pointing out this important aspect. When we started we chose english to tap on the college students. But our aim is to reach society in a way where knowledge of the English language is not a prerequisite. We are a volunteer-run organisation, so it is difficult to find people who could communicate science in regional languages effectively. We are always on the lookout for interested folks! But we are surely working on expanding to the vast "Vernacular" space. In fact, we are keen on starting a space where language isn't necessary at all. Perhaps just some beats and tunes? You'll have to stay tuned for our next big move!

MFCEM: Does 'Biopatrika" facilitate a 2-way conversation, or for instance, there could be brilliant scientific ideas out there, that need a careful listening to. Would Biopatrika, at any point in the future provide such a platform?

Virender Singh: This is a great question. Biopatrika is moving in this exact direction. We are creating the "SciKonnect" platform as an independent entity with Biopatrika serving as our eMagazine. SciKonnect will serve to connect with science enthusiasts with brilliant ideas. We as well are always open to ideas and do our best to integrate all that matches to our mission

MFCEM: Do you believe that now more than ever there is dire need to introduce scientific writing/communication, not merely as a subject, but as a formal course for students to earn a degree in.

Virender Singh: Yes, I absolutely agree that it's the right time to have more experts dealing with scientific writing and communication.

MFCEM: Finally, for all the youngsters just starting on their career, what would your advice be?

Virender Singh: My advice for youngsters is to focus on long term goals and always take care of physical and mental health. Also, try to find mentors, not just one but a few, whom you could approach for guidance at different stages of your career. Create a healthy and productive network of people around you. I will recommend doing informational interviews with a few folks who are working in your field of interest. This will give you an idea what to expect if you pursue that field and then make a judgement whether it is something you would like to do or not. And in case you want to build your network and talk to professionals, you are invited every Tuesday for Biopatrika Mentorship sessions.

MFCEM Dialogues event with Prof.Nitish Thakor, 12th, 13th Ocotober 2022.

Website: https://www.iitk.ac.in/mfcem

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