National Conference

BIOENGINEERING -2020

December 10-11, 2020, Online Mode: MS Teams, NIT Rourkela

	Day 1, 10th December 2020	Titles
Inaugural Session	09.30 AM – 10.00 AM	
	Session 1	
Prof. Deepthy Menon (Professor, Amrita Vishwa Vidyapeetham Kochi, Kerala)	10:00 AM -11:00 AM	Innovative nano surface engineering of biomaterials for improved device performance
Prof. Praveen Kumar Vemula Associate Professor Institute for Stem Cell Biology and Regenerative Medicine (inStem) UAS-GKVK Campus,	11:00 AM – 12:00 PM	Designing Prophylactic and Therapeutic Technologies for Solving Unmet Clinical Needs
Presentation of Participants	12:00PM -1:00PM	
	Lunch Break 1:00PM – 2:00 PM	
	Session 2	
Dr. Eswaramoorthy K. V Assistant Professor, Indian Institute of Information Technology, Design and Manufacturing, Kurnool Kurnool- Andhra Pradesh	2:00 PM – 2:45 PM	Non-Invasive sensing of body fluid
Dr. Suhail Rizvi Mohd Assistant Professor, Biomedical Engineering Department Indian Institute of Technology Hyderabad, Telengana	2:45 PM – 3:30PM	Mathematical Modeling of Mechanics of Fibrous Scaffolds for Tissue Engineering Applications
Dr. Mohit Kumar Jolly Assistant. Professor, Biosystem science and engineering Department Indian Institute of Science Bangalore, Karnataka	3:30 PM – 4:15 PM	Computational Systems Biology of Cancer: How can mathematical models help us understand cancer better

Presentation of Participants	4:15-5:15 PM	
Poster Presentation	5:15 PM-6:00 PM	
Day 2, 11th December 2020		
Session 3		
Dr. Binulal Nelson Sathy Assistant Professor, Amrita Centre for Nanosciences & Molecular Medicine, Amrita Vishwa Vidyapeetham Kochi, Kerala	9:00 AM – 9:45 AM	Human tissues and organoids in a dish: potentials and challenges in recapitulating the in vivo environment ex vivo
Dr. Akshay Srivastava Associate Professor, Department of Pharmaceuticals National Institute of Pharmaceutical Education and Research, Ahmedabad	9:45 AM -10:30 AM	Bioengineered Cell Instructive Collagen Hydrogel Patch for Intervertebral Disc Repair and Regeneration
Dr. Sakthi Swarrup J Assistant Professor, Centre for Nanotechnology Research (CNR) VIT ,Vellore, Tamil Nadu	10:30 AM – 11:15 AM	Ionic Polymer Metal Composites as actuators and sensors for bio medical applications
Dr. Alok Jain Assistant Professor, Bioengineering Department Birla Institute of Technology MESRA, Jharkand	11:15 AM – 12: PM	A combined atomistic and coarse grained simulation study of peptide based nanostructures: From atomistic details to a mechanistic interpretation
Presentation of Participants	12:00PM -1:00PM	
Lunch Break 1:00PM – 2:00 PM		
Session 4		
Dr. Shamik Chowdhury Assistant Professor, Environmental Science and Engineering Department Indian Institute of Technology Kharagpur, West Bengal	2:00 PM – 2:45 PM	Plant-derived nanomaterials for sustainable urbanization
Dr Rabi Narayan Sahu, MCh, DNB (Neurosurgery) Professor & Head	2:45 PM – 3:30PM	Neural Bio-Prosthesis in Neurosurgery

Department of Neurosurgery, All India Institute of Medical Sciences, Bhubaneswar, Odisha		
Dr. Indranil Banerjee Associate Professor Department of Bioscience and Bio engineering Indian Institute of Technology Jodhpur	3:30 PM – 4:15 PM	Proangiogenic Nano-Biomaterials for Bone Tissue Engineering
Dr. Sreerup Banerjee Associate Professor Department of Mechanical Engineering Haldia institute of technology, West Bengal	4:15 PM -5:00 PM	Understanding gastrointestinal biomechanics: Role of medical image processing
Valedictory and Student Award Ceremony	5:45 PM – 6:00 PM	

BIOENGINEERING CONFERENCE-2020

ORAL PRESENTATION SCHEDULE

S.No	Author name	Serial number of abstract	Timings	Title of the abstract
Session 1 (10-12-2020)				
1	Satyanarayana Murthy Malladi	BE-202	12:00-12:10 PM	Controlling Breast Cancer Cell line Proliferation in Humans by Morin, 9,10 anthraquinone
2	Imdadul Hoque Mondal	BE-203	12:10-12:20 PM	Trial and error and statistical design based parametric optimality of tray dried Musa splendida
3	Arindam Sain	BE-204	12:20- 12:30 PM	Exploring the potential of Apigenin as a dual PI3K/mTOR inhibitor to target PIK3CA mutant colorectal cancer: an in-silico analysis
4	Ayushi Chaurasiya	BE-205	12:30-12:40 PM	Peptide/Protein engineering for therapeutic intervention against cancer
5	Muktesh Mohan	BE-206	12:40-12:50 PM	Investigation of Er3+, Yb3+ doped Gd2O3 upconversion nanoparticles as a contrast agent for optical coherence tomography
6	Nagendran Valarmathi	BE-207	12:50-1:00 PM	Green Synthesis of α-Fe2O3 nanoparticles from Hibiscus rosa-sinensis and evaluation of their anticancer and dye degrading activities
Session 2 (10-12-2020)				
7	Anil Sindhu	BE-208	4:15-4:25 PM	Nano Al2O3 incorporated Chitosan scaffold for Hard Tissue Engineering Applications
8	Veeramma Yatnalli	BE-209	4:25-4:35 PM	Wheelchair Control Using Brain Computer Interface
9	S Geetha	BE-210	4:35-4:45 PM	Lung cancer and its association with Chronic Obstructive Pulmonary Disease (COPD): Role of inflammatory genes.
10	Sonika kag	BE-211	4:45-4:55 PM	Chemical hydrolysis of potato peel waste for sugars and value-added metabolites production
11	Uzma Afreen	BE-212	4:55-5:05 PM	In silico identification of microRNAs and their target genes in Wheat (Triticum aestivum L.) responsive to leaf rust infection.
Session 3 (11-12-2020)				
12	NEHA KUKRETI	BE-213	12:00- 12:10 PM	A thermochemical pre-treatment study of stubble waste for value-added product
13	Abhishek Indoliya	BE-214	12:10- 2:20 PM	In-vivo investigation of superparamagnetic iron oxide nanoparticles (SPIONs) as a theranostics agent for Magnetomotive optical coherence tomography (MMOCT)
14	Menon Divya Ramesh	BE-216	12:20-12:30 PM	In silico analysis of Papillary Thyroid Cancer Patient samples for HIF1α responsive genes as a Prognostic marker

15	Aditya Dev Rajora	BE-217	12:30-12:40 PM	Preparation and Evaluation of OKM-g-PAM graft copolymer for the biomedical applications and as a biodegradable food packaging material
16	Divyasree Dinesh	BE-218	12:40-12:50 PM	Nanoparticle-based intracellular delivery of microtubule stabilizers overcome microtubule disassembly in corneal endothelium under hypothermia and cytokine stress
17	Apeksha Devadiga	BE-219	12:50-1:00 PM	Microtubule disassembly in corneal endothelium subjected to oxidative stress, a hallmark of Fuch's dystrophy

POSTER PRESENTATION (10-12-2020)

S.No	Reference number	Title of the abstract
1	BE-101	Sustainable solid waste management in rural and semi-rural areas of Ladakh: A critical review of Project Tsangda
2	BE-102	PRETREATMENT PROCESSES FOR PRODUCTION OF BIOETHANOL BY LIGNOCELLULOSIC BIOMASS
3	BE-103	Vitamin D supplementation and COVID-19 severity – regulation of angiotensin-converting enzyme 2 (ACE2), renin angiotensin system(RAS), kinin-Kallikrein system (KKS).
4	BE-104	A review on the various systems under Forensic DNA Phenotyping for the prediction of externally visible characteristics.
5	BE-105	The metabolic interplay between obesity and breast cancer
6	BE-106	KETOGENIC DIET FOR KIDNEY STONES
7	BE-107	Multiple Sclerosis and Antigen specific therapy
8	BE-108	Applications of Internet of Things (IoT) in Healthcare
9	BE-109	Vegan diet and its effects on Diabetes, Cardiovascular diseases (CVD), Blood pressure, and Obesity
10	BE-110	INTERNET OF MEDICAL THINGS: A REVIEW
11	BE-111	Biodiesel production from dairy wastewater using from microalgae (Chlorella pyrenoidosa)
12	BE-112	PHARMACOGENOMICS OF ANTICANCER DRUGS FOR TARGETED THERAPY
13	BE-113	Stubble Burning Impact : not only Ambient Air Quality but also Depleting ground water
14	BE-114	Application of ionic liquids as a derivatizing agent for enhancing solubility of lignocellulosic biomass in biorefineries
15	BE-115	Microtubule disassembly in corneal endothelium subjected to oxidative stress, a hallmark of Fuch's dystrophy
16	BE-116	Cloaking of nanoparticles with stem cell membranes to render stealth and tumor targeting properties for targeted drug delivery
17	BE-117	Nanoparticle-based intracellular delivery of microtubule stabilizers overcome microtubule disassembly in corneal endothelium under hypothermia and cytokine stress
18	BE-118	Smart Health Care and Tracking System Based on Internet of Things
19	BE-119	Segmentation of MRI Images of Gliomas Using Convolutional Neural Networks

Keynote Speaker

Innovative nano surface engineering of biomaterials for improved device performance

Deepthy Menon

Centre for Nanosciences & Molecular Medicine
Amrita Vishwa Vidyapeetham, Kochi, Kerala - 682041
E-mail:deepthymenon@aims.amrita.edu, deepsmenon@gmail.com

Abstract: The response of host organisms to nanomaterials and nanostructures is documented to be unique and significantly different from that of conventional materials. This is mainly attributed to the differences in the interactions of nanoscale materials at the protein and cellular level. Capitalizing on this concept, the emerging field of nanobiomedical implants holds the promise of novel and improved implant materials. Concurrently, there is a huge demand for innovative technologies for the regeneration of functional tissues and organs. This talk would focus on how modulations of nanoscale structural features of biomaterials can help to alter cellular interactions in vivo. Specifically, the impact of nanosurface engineering of biomedical implants such as the coronary stents and dental implants would be elaborated. There is now ample evidence to prove that this emerging field of nano-engineering definitely holds promise in developing novel and improved nanomedical implants with potential for translation to the clinics.

BIOSKETCH

Dr. Deepthy Menon is a Professor at the Centre for Nanosciences and Molecular Medicine, Amrita Vishwa Vidyapeetham (University), India. She received her Ph.D in Physics from Indian Institute of Science, Bangalore and completed post-doctoral trainings from the Technical University of Eindhowen, The Netherlands; National Cancer Institute, Maryland, USA and International School of Photonics, Cochin University, India. She joined Amrita Vishwa Vidyapeetham in 2006 as Assistant Professor to work at the interface of nanotechnology and biology for biomedical applications. Her current research is primarily focused on understanding the potential of nanoscale engineering of biomaterials and medical implants for translational applications in the fields of tissue engineering & regenerative medicine and cancer nanomedicine. Her pioneering work in transforming polymeric nanofibers

to novel medical textiles has led to the development of highly dynamic polymeric 3D constructs with defined architecture for a wide range of biomedical applications, especially in orthopedic, dental and cardiovascular areas. She is the inventor of 8 patents and her research team has produced more than 100 research publications. She is the recipient of several recognitions in her research career including the Young Research Award from International Union of Materials Research Society, Young Scientist Fellowship and BOYSCAST fellowship, both from Department of Science & Technology, Government of India. She serves as the Council Member of Materials Research Society of India and Task Force Member of Nanosafety Regulations in India.

Keynote Speaker

Developing Prophylactic and Therapeutic Biomaterials for Unmet Clinical Needs

Dr. Praveen Kumar Vemula,
Institute for Stem Cell Science and Regenerative Medicine (inStem)
UAS-GKVK Campus, Bellary Road
Bangalore 560065 India

Abstract: Our lab is focusing on clinical translational research through biomaterials and chemical biology programs. By using chemical design tools, we have been developing therapeutic and prophylactic biomaterials for medical applications. A significant leap in drug delivery is an autonomous system that titrates the amount of drug released in response to a disease, for instance, inflammation, ensuring the drug release in an on- demand manner at a therapeutically relevant concentration. These disease-responsive biomaterials have proven to improve the efficacy in i) preventing rejection episodes of the transplanted organs, ii) in the treatment of inflammatory arthritis, and iii) inflammatory bowel diseases. We will discuss a new class of prophylactic materials to prevent pesticide-induce lethality. Additionally, we will discuss our efforts in translating these technologies into the clinic.

BIOSKETCH

Dr. Praveen Kumar Vemula is an Associate Professor at the Institute for Stem Cell Science and Regenerative Medicine (inStem), Bangalore. He has completed Masters in Chemistry from Osmania University, and obtained PhD from Indian Institute of Science, Bangalore. His expertise is developing chemical technologies for medical applications. His work spans the fields of biomaterials, drug delivery, medical devices, and chemical biology. He has published >65 peer-reviewed papers, has given >150 national and international invited lectures including two TEDx talks, and has >25 issued or pending national/international patents which have been licensed to multiple biotech companies. Several technologies developed in his lab have formed the foundation for multiple products on the market and currently under development. His technologies have led to the launch of five companies including Sepio Health (anti-pesticide technologies company, in India), Artus Therapeutics (a drug discovery company for IBDs, in USA), Skintifique (a skincare company, in France), and Alivio Therapeutics (an inflammation

targeting company, in USA), and Color Threads (innovative textile company, India). Thus far, 12 products that are developed based on his technologies are in the market worldwide.

PhD – Indian Institute of Science, Organic Chemistry, 2005

Postdoc-1 – City University of New York, 2005-2007

Postdoc-2 – Harvard Medical School, Harvard-MIT Health Science and Technology, 2008-2012

Faculty – inStem, 2013 to present

Invited Speakers

Non-Invasive sensing of analytes in body fluid

Dr. Eswaramoorthy K. V
Assistant Professor,
Indian Institute of Information Technology, Design and Manufacturing, Kurnool
Kurnool- Andhra Pradesh

Abstract: The non-invasive monitoring of analytes in blood fluid would be useful in the diagnosis and treating the disease. It also pays the way for continuous monitoring of various analytes in the blood through the wearable device. Sample can be interstitial Fluid, tear, sweat, and saliva. However, sensing of the biomarker through a non-invasive method is challenging due to the presence of less concentration of an analyte in the sample. They are various studies being conducted on the correlation between analyte level in sample and blood. Microneedle, ultrasound, near infra-red, microwave resonators, reverse iontophoresis, microfluidics, etc. are methods are used to collect a sample to enable non-invasive sensing. In the talk, we shall discuss various analytes and efficient techniques used to measure body fluid concentration through different non-invasive methods.

BIOSKETCH

Dr. Eswaramoorthy K V is a Assistant Professor at the Indian Institute of Information Technology, Design and Manufacturing, Kurnool India. He received his Ph.D in Instrumentation Engineering from Indian Institute of Science, Bangalore. He joined in Indian Institute of Information Technology, Design and Manufacturing, Kurnool in 2018 as Assistant Professor and his research areas are Electrochemical Biosensor, Biomedical Instrumentation, and Industrial Automation. His skill sets include fabrication techniques like screen printing, MEMS device Fabrication, Experience in clean room protocols and using equipment; Awards and Distinctions: Recipient of fellowship including contingency funds from the Ministry of Human Resources and Development (MHRD), Government of India, during PhD program at Indian Institute of Science, Bangalore, India (2009-2015). Also he is a IEEE member (Annual) and ISOI Life Member.

Mathematical Modeling of Mechanics of Fibrous Scaffolds for Tissue Engineering Applications

Dr. Suhail Rizvi Mohd
Assistant Professor,
Biomedical Engineering Department
Indian Institute of Technology Hyderabad, Telengana

Abstract: Fibrous materials are extensively utilized as scaffolds in many tissue engineering applications. The mechanical properties of the scaffolds have been known to influence the cell behavior. Given the resource and time intensive nature of the experimental methods, mathematical modeling has become an immensely useful tool which has also been utilized to study the mechanical response of the fibrous scaffolds. In my talk I will present our work on the modeling of the mechanical response of the fibrous scaffolds under macroscopic uniaxial and shear loading, and microscopic cellular forces. In this work, we have utilized two approaches- discrete network modeling and peridynamics to study the scaffold mechanics. I will show that network-like architecture of the scaffold gives it sample size dependent mechanical response, which stands in contrast to the conventional materials which do not demonstrate sample size dependence. The dynamics of cell adhesion on such scaffolds and its dependence on the fiber arrangement (random fiber architecture vs aligned fiber system) will also be presented. We hope that this modeling approach will provide a useful tool to the experimentalist for optimization of the fiber scaffold structure for different tissue engineering applications.

BIOSKETCH

Dr. Suhail Rizvi Mohd did his B.Tech. and Ph.D. from IIT Kanpur in the Department of Biological Sciences and Bioengineering. After finishing B.Tech., he worked as a business analyst for Global Analytics (currently GAIN Credit Inc.) in Chennai where he specialized on the decision systems for the microlending platforms. In Ph.D., he studied the mechanical behavior of fibrous biomaterials using theoretical modeling and numerical simulations. Subsequently, he worked as a CNRS post-doctoral fellow at the Laboratory of Interdisciplinary Physics in Grenoble, France. He joined IIT Hyderabad earlier this year. His research interests lie at the interface of biology and physics, particularly mechanics, which include mechanics of biomaterials, role of mechanical forces in embryonic development and tissue engineering.

Computational Systems Biology of Cancer:

Dr. Mohit Kumar Jolly
Assistant. Professor,
Biosystem science and engineering Department
Indian Institute of Science Bangalore, Karnataka

Abstract: Metastasis – the spread of cancer cells from one organ to another – remains an unsolved clinical challenge and causes above 90% of all cancer-related deaths. It is a highly dynamic process with extremely high attrition rates. Despite extensive ongoing efforts in cancer genomics, no unique genetic or mutational signature has emerged for metastasis. However, a hallmark that has been observed in metastasis is adaptability or phenotypic plasticity – the ability of a cell to reversibly switch among different states (phenotypes) in response to various internal or external stimuli. How do cells switch their states reversibly? This talk will describe how mechanism-based mathematical models have helped identify the origins of such cellular transitions in cancer – the underlying multistability in biological networks driving cancer metastasis. Our results also suggest how perturbing these networks in specific ways can restrict multistability and consequently reduce adaptability in cancer cells, providing a rational network-based approach for identifying therapeutic targets to potentially curb the metastatic load.

BIOSKETCH

Dr. Mohit Kumar Jolly leads the Cancer Systems Biology group at the Centre for BioSystems Science and Engineering, Indian Institute of Science. He has made seminal contributions to decoding the emergent dynamics of epithelial-mesenchymal plasticity (EMP) in cancer metastasis, through mathematical modeling of regulatory networks implicated in EMP; his work has featured on the cover of Journal of Clinical Medicine, Cancer Research, and Molecular and Cellular Biology, and he won the 2016 iBiology Young Scientist Seminar Series – a coveted award for communicating one's research to a diverse audience. He is an elected fellow of the Indian National Young Academy of Sciences (INYAS), serves as Secretary of The Epithelial-Mesenchymal Transition International Association (TEMTIA), and co-chair of Mathematical Oncology subgroup at Society for Mathematical Biology (SMB).

Human tissues and organoids in a dish: potentials and challenges in recapitulating the *in vivo* environment *ex vivo*

Binulal N. Sathy

Amrita Centre for Nanosciences and Molecular Medicine, Amrita Vishwa Vidyapeetham, AIMS, Kochi, Kerala, India

Engineering healthy or pathological tissues that can recapitulate the *in vivo* conditions *ex vivo* in a reliable fashion have remarkable applications in biology and medicine. Self-assembly of stem/progenitor cells without an artificial matrix, seeding/encapsulating them in suitable biomaterial matrices (scaffolds or hydrogels), and culturing them in the static or dynamic condition are the widely used strategies for developing tissues and organoids *ex vivo*. Although these methodologies have been established as standard approaches for engineering tissues and organoids *ex vivo*, attaining *in vivo*-like functionality in the engineered tissues remains challenging. Facilitating appropriate environmental conditions, including the mechanical environment, oxygen tension, and arranging the cells in a spatially defined manner in the engineered construct using 3D bioprinting, etc., are the recent approaches we use in our lab to overcome this challenge. We have been working on creating functional models of tissues/organoids such as bone, bone marrow, cartilage, and ligament. Besides, developing tumor organoids that can mimic the *in vivo*-like solid tumor is also underway. Among the various approaches we investigate for developing *ex vivo* tissues and organoids, specific focus has been given to examining the significance of the scaffolding matrices' structural dimensions and developing new *in situ* gelating extracellular matrix mimicking hydrogels. Engineering the developmental precursors and growing them through the developmental pathway is another major approach used in our lab to recreate tissues and organs in the dish.

Bioengineered Cell Instructive Collagen Hydrogel Patch for Intervertebral Disc Repair and Regeneration

Akshay Srivastava, PhD.

National Institute of Pharmaceutical Education and Research-Ahmedabad, Gandhinagar, Gujarat

India Pathophysiology of intervertebral disc (IVD) degeneration, a major cause of low back pain (LBP) is still uncertain, majorly due to limitations in the in-vitro and in-vivo disease models. The IVD microenvironment comprises of central nucleus pulposus (NP), peripheral concentric annulus fibrosus (AF) and cartilaginous endplate (EP) regions which works coherently to maintain the functional integrity of the spine. Inflammatory response along with cellular senescence, reduced synthesis of extracellular matrix (ECM) leads to onset of the disease-causing fissure or tear in the AF region and extrusion of nucleus pulposus. Furthermore, the AF cell niche possess very less reparative capacity for tissue regeneration. Thus, we developed a Hyaluronic acid (HA) functionalized iso-electrically focused align collagen type-I patch which showed high asymmetry and narrow peaks in FFT analysis, validating degree of alignment of collagen fibers. The functional characteristics were confirmed by ATR/FTIR analysis. These patches were further assessed for viability and cellular orientation study using mice annulus fibrosus (AF) cells where GAG modified col-I patch showed high proliferation, allowing cells to proliferate in an aligned manner confirmed by confocal microcopy. Also, these patches were assessed for mechanical properties which showed that GAG modification decreases the tensile strength as well as moduli of iso-electrically focused Col-I patch but show enhance extracellular matrix production which provide improved structural similarity to IVD microenvironment and help in regeneration of herniated AF region.

Ionic Polymer Metal Composites as actuators and sensors for bio medical applications

Dr. Sakthi Swarrup J
Assistant Professor,
Centre for Nanotechnology Research (CNR)
VIT ,Vellore, Tamil Nadu

Abstract: Ionic Polymer Metal Composites (IPMC) is a type of Electroactive polymer and a popular choice for biomimetic design and actuators and sensors. IPMC is advantageous compared to conventional materials due to its flexibility, light weight, ease of fabrication, low input voltage and large deformation, fast response operation in both air and water. Its biocompatibility, soft and hydrophilic nature makes it a suitable candidate for bio-medical applications. However, using IPMC for real time applications has certain disadvantages like dehydration of the polymer region in IPMC, time varying behavior and electrolysis after 1.23 V. Therefore, the sensing and actuation performance of IPMC is highly dependent on the ionic polymer layer properties (type of polymer, counter ion, conductivity and the degree of hydration) and the electrode layer properties (type, area and thickness. In this work, mathematical modelling to understand the behaviour of IPMCs with a deep insight into the material properties, dimensions, type of materials, optimized fabrication parameters and at various temperature and humidity condition is analysed. Experimental analysis on IPMCs with the aim of developing high performing IPMCs as actuators and sensors for biomedical applications is been carried out.

A combined atomistic and coarse grained simulation study of peptide based nanostructures: From atomistic details to a mechanistic interpretation

Dr. Alok Jain
Assistant Professor,
Bioengineering Department Birla Institute of Technology MESRA, Jharkand

Abstract: Development of new well ordered, functional biomaterials based on the underlying principal of self-assembly has immense application in nanotechnology, nanomedicine and tissue engineering. Peptide based nano-materials are not only biocompatible but also their properties can be altered easily by slight changes in environmental conditions and/or sidechains of amino-acids. Herein, we report a multiscale simulation study of penta-peptides that exhibit very different morphologies upon altering a single amino acid. Atomistic simulations identified governing factors that lead to specific peptide morphology such as peptide flexibility vs rigidity, role of dimerization and the partitioning of hydrophobic side chains. The study was extended with coarse grained simulations. That allowed general conclusions about the mechanistic origin of the different morphologies. Our systematic study with different backbone beads and supportive psedo-dihedral angles illustrate the importance of very careful and delicate selection of coarse grained parameters to reproduce the chemical and structural properties of the system

Plant-derived nanomaterials for sustainable urbanization

Dr. Shamik Chowdhury
Assistant Professor,
Environmental Science and Engineering Department
Indian Institute of Technology Kharagpur, West Bengal

Abstract: With the current exorbitant rate of consumption of fossil fuels, and the subsequent and anticipated increase in their demand in the foreseeable future, the development of inexpensive and highly efficient CO2 capture and conversion technologies is critically important from the perspective of climate change mitigation. Attributing to its enormous specific surface area, intrinsic hydrophobicity, outstanding electrochemical stability and superior mechanical properties, two-dimensional (2D) graphene holds significant promise for such advanced clean energy related applications. However, the graphene that is synthesized to address these tasks is typically derived from non-renewable resources and involves complex synthetic approaches that are often difficult to scale. Therefore, to increase the efficiency of the existing sectors and to elaborate sustainable energy provision in the foreseeable future, graphene must be manufactured via industrially appealing, cost effective processes based on renewable and sufficiently abundant resources. This presentation will target this aspect amongst others, with an objective to provide a systematic overview of my latest research efforts towards developing graphene nanosheets from waste biomass, and exploring these materials to tackle the pressing global sustainability challenge of ‘carbon-free energy’.

BIOSKETCH

Shamik Chowdhury is an Assistant Professor in the School of Environmental Science and Engineering at the Indian Institute of Technology Kharagpur, India. He obtained his B.Tech. from the West Bengal University of Technology (Kolkata, India) and M.Tech.(Gold Medalist) from the National Institute of Technology (Durgapur, India), both in Biotechnology. He then earned his Ph.D. (2017) in Environmental Engineering from the National University of Singapore (NUS), Singapore. His current research activities focus on the design and development of advanced functional materials, with an emphasis on two-dimensional (2D) materials, for sustainable energy applications and environmental remediation. Dr. Chowdhury takes keen interest in dissemination of his research findings, and has authored/co-authored more than 60 scholarly publications (including research articles, review papers, and book chapters) with over 5000 citations. In addition, he has presented over 50 oral communications

at national and international conferences/symposia. His research endeavours also include serving as an ad-hoc referee for over 60 high-impact journals. In recognition of the quality, impact and practical relevance of his research, Dr. Chowdhury has been honored through several intra- and extra-mural awards, notably the ‘Green Talents Award’ by the Federal Ministry of Education and Research Germany, in 2016.

Neural Bio-Prosthesis in Neurosurgery

Dr R N Sahu, MBBS, MS, MCh, DNB, (Neurosurgery)
Professor & Head, Department of Neurosurgery
AIIMS Bhubaneswar, Odisha.

Abstract: Many people are disabled because of neuro-paralysis due to brain stroke, spinal cord injury diseases of brain etc. Some of these these people can still be able to see the object they want to hold (for example a glass of water) and can still process the information commands inside their brain, the action cannot be executed because of neurological deficits in limbs. Similarly, in case of specialized function such as micturition the same set of commands doesn't reach the target organ (urinary bladder) to empty in case of spinal cord lesion & paraparesis. If we assume that in most cases the brain of these persons is intact, the possibility of reading brain signals would allow the development of neuro-prosthetic devices, such as a robotic arm or a bladder prosthesis for execution. In the last decade, following the success of cochlear and brainstem implant devices for people who have lost hearing deficits; neuroscientists see a limitless horizon for related devices that are able to read & post process the electrical and chemical signals from the nervous system to stimulate capability and restore quality of life in persons suffering from these disorders. Some of the studies have shown that the posterior parietal cortex (PPC) in brain is a key area in sensory integration process, involved in different types of movement plans & execution. In fact, the PPC lies between the primary visual areas in the occipital lobe and the motor cortex, thus having a privileged location for visuo-motor transformations. The author will discuss some of the existing neural prostheses & implants and highlight some recent scientific developments in details.

BIOSKETCH

Dr R N Sahu,: Dr Rabi Sahu is a graduate from VSS Medical College, Sambalpur University. He completed his masters in Neurosurgery from the prestigious Sanjay Gandhi Institute of PGI in Lucknow, India. He did his fellowship training in Paediatric Neurosurgery from Asan Medical centre Seoul, South Korea and served as academic faculty as Additional professor of Neurosurgery in SGPGI Lucknow before joining AIIMS Bhubaneswar in 2016. He has more than 100 publications to his credit in different peer reviewed journals and text books. His main areas of interest are Paediatric Neurosurgery, Epilepsy surgery & spinal cord diseases. He is presently serving as Professor & Head of Neurosurgery at AIIMS Bhubaneswar, Odisha.

Proangiogenic Nano-Biomaterials for Bone Tissue Engineering

Indranil Banerjee
Department of Biotechnology and Medical Engineering
National Institute of Technology, Rourkela
Odisha, Pin No.: 769008, India

Effective replacement / restoration of traumatized, damaged or lost bone is a major clinical and socio-economic challenge. In recent years, emergence of the bone tissue engineering (BTE) as a therapeutic alternative of conventional clinical modalities especially as a replacement of auto- and allo- grafting has brought new hope in clinical orthopaedics. The success of the BTE depends on the integration of the biologically active osteogenic scaffolds (with / without bone cells) to the native osteo-chondral system after implantation at the injury or defect site. It has now been confirmed that such integration process seemingly relies on angiogenesis, which leads to the generation of vascular network in the neo-bone tissue. Angiogenesis is essential for the delivery of nutrients and gases to the cells present at the distal location of an implant, which can hardly be reached through interstitial fluid diffusion. Plenty of clinical evidence showed that impaired vascularisation results in atrophic non-union of the bone. Keeping this perspective in mind, people have adopted diverse strategies to improve the extent and the quality of angiogenesis in BTE. However, those strategies have failed to be a commercial success because of number of factors including cost, technical difficulties, genotypic variation of cells and potential health risks. To overcome the stalemate, research focus has now been shifted towards the angiogenic biomaterials, materials that can stimulate the cells for biased production of angiogenic factors, both *in vitro* and *in vivo*. Different research groups has now working on the development of angiogenic biomaterials. We are one of the leading research groups, involved in developing low cost proangiogenic nano-hydroxyapatite (nHAp). Hydroxyapatite is the most common bioceramic used in bone tissue engineering because of its chemical resemblance with bone apatite. We have adopted a novel strategy that leads to the angiogenesis through the activation of tissue hypoxia mimicking HIF-1α pathway. Following that strategy we have developed several types of proangiogenic hydroxyapatite either by doping 'group - d' bivalent ions like Co^{+2} , Ni^{+2} in nHAp crystal or by conjugating the hydroxyapatite with natural biopolymers like gum tragacanth. All the chemically modified nHAp are subjected for extensive physico-chemical characterization that includes XRD, FT-IR, SEM, TEM, BET, DLS and Zeta potential analysis. we confirm the osteo-conductive property of the modified nHAp by checking the response of the osteoblast cells (MG-63) in vitro. For this purpose , detailed studies pertaining to the cell viability and proliferation (MTT and flow cytometry based live -dead assay, cell cycle analysis), and cell differentiation (done by RT-PCR and Western blot) was done. We also test the osteogenic properties in vitro using human mesenchymal stem cell. The angiogenic property especially the expression of cellular VEGF and its related mechanistic pathways is proved in both MG-63 cell line and in human mesenchymal stem cells. We finally confirm the formation of endothelial linkage in vitro through tube formation assay. We believe that these set of experimental evidences will help the researcher in designing and developing proangiogenic biomaterials in coming future.

Understanding gastrointestinal biomechanics: Role of medical image processing

Dr. Sreerup Banerjee
Associate Professor
Department of Mechanical Engineering
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How our body processes the food we eat so that it can be assimilated in the body? We read about it from our school days. But how much we know about the role of mechanics in the functioning of gastrointestinal tract? Not fully understood, as it is challenging to examine the intertwining relation of structures and functions of different parts of gastrointestinal tract in health and different disease conditions. Medical imaging and subsequent processing of these images is a non-invasive way to assess the structure and function that allows to partly capture the events without intervening them. To understand the events as slow as the gastric ones, a large number of medical images needs to be processed to carve out the three-dimensional structures of interest. Further post-processing is needed to extract meaningful information that sheds light on the structure-function relationship of the organs of gastrointestinal tract.

This talk will cover advanced medical image processing technique that helps processing large number of medical images in an efficient manner to extract three-dimensional structures. It will also elaborate on post-processing technique to extract geometrical information that gives insight into the accommodation of food in the stomach and its controlled emptying, and approach to assess structure-function relation of upper gastrointestinal geometry to understand disease etiology.

BIOSKETCH

Dr. Sreerup Banerjee is currently serving as Associate Professor in the department of Mechanical Engineering, Haldia Institute of Technology, Haldia, West Bengal. He has 6+ years of experience in academics and research experience in the field of biomedical engineering. His area of research interest is biomechanics and medical image processing. He has done bachelor's degree in Mechanical Engineering in 2004 and master's degree in Biomedical Engineering in 2006. He has obtained his PhD from Department of Biological Sciences and Bioengineering, IIT Kanpur in 2014. He has served in the department of Bioengineering in NIT Agartala and VIT Bhopal University respectively in various capacities before joining HIT Haldia.