

R&D Newsletter

Indian Institute of Technology Kanpur



Highlight of the Issue

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- Vigyan Jyoti Programme
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IITK to set up Centre of Excellence for Bundelkhand Defence Corridor

The Uttar Pradesh government and the Indian Institute of Technology, Kanpur (IIT-K), will set up jointly a Centre of Excellence for the proposed Bundelkhand Defence Corridor. The centre would help boost industrial growth in UP at large, apart from boosting the defence manufacturing sector in particular.

IITK to develop flying taxis in India jointly with VTOL

IIT Kanpur and VTOL Aviation India Pvt Ltd join hands to develop Vertical Take-Off and Landing (VTOL) aircrafts, which have the potential to be used as flying taxis, for Civil Defence and Civil Aviation. The collaboration between IIT-K and VTOL Aviation India is looking at developing functional prototypes within five years.

SIHH 2018



Smart India Hardware Hackathon 2018 (SIHH 2018) was inaugurated by Hon'ble Minister of HRD, Shri Prakash Javadekar on June 18 via live video conferencing at IIT Kanpur and the other 9 nodal centers of the competition. IIT Kanpur worked on the theme: "Drones and Robots".

Credit Suisse Machine Learning Hackathon 2018



IIT Kanpur team comprised of three undergraduate students - Tushar Goswamy, Vatsalya Tandon and Surya Teja under the mentorship of Prof. Sandeep Shukla, department of Computer Science and

Engineering secured the 2nd Runner-up Position in the **Credit Suisse Machine Learning Hackathon 2018** held at Mumbai.

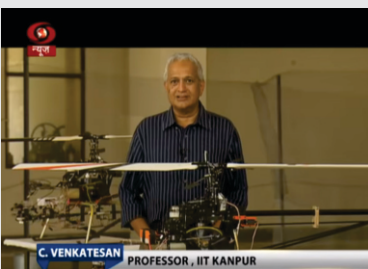
DRDO Robotics and Unmanned Systems Expositions



N. Mohan Krishna and Lavish Arora secured first position at the **DRDO Robotics and Unmanned Systems Exposition, Zonal Level Competition 2018 (North Zone)**. The team was supervised by Prof. Rajesh Hegde and Prof. Ketan Rajawat, department of Electrical Engineering.

Qualcomm Innovation Fellowship

Dr. Aditya K. Jagannatham with his students Mr. Suraj Srivastava and Ms. Saumya Dwivedi, Department of Electrical Engineering, selected for the Qualcomm Innovation Fellowship (QInF) 2018-2019. The fellowship is an award for an innovative idea entitled "Sparse Signal Processing for 5G mm Wave MIMO Technology."



A documentary on research project on autonomous helicopter design at IIT Kanpur

DD News channel broadcasted a documentary on IIT Kanpur's research project on the autonomous helicopter design, under the leadership of Prof. C. Venkatesan, department of Aerospace Engineering.

<https://youtu.be/CIWCA-JpMTM>

Workshop on "Real-time Nationwide Low-Cost Sensor Network for Air Quality Monitoring"

A workshop on "Real-time Nationwide Low-Cost Sensor Network for Air Quality Monitoring" was organised on 29th August, 2018 at Ganga Auditorium, Indira Paryavaran Bhavan, Jor Bagh Road, MoEF&CC, New Delhi. The workshop was meant to give a platform for sharing of knowledge amongst stakeholders. The intent was to deliberate upon full spectrum of low-cost sensor monitoring of air pollution including policy issues, modelling and remote monitoring of air quality.

Vigyan Jyoti Programme

Vigyan Jyoti is a new venture of the Department of Science and Technology (DST), Government of India which is aimed at increasing the presentation of girls in all areas of Science and Technology. Under the Vigyan Jyoti pilot programme, IIT Kanpur conducted three weeks summer residential camp for girls' students from different Government schools, Kendriya Vidyalayas and Navodaya Schools in the Kanpur educational district, from June 4 to June 22, 2018. A total number of 26 students participated in the programme. The objective of the camp was to create excitement and interest in science and technology among the girls and to create awareness about possible career avenues in science and technology.

Students were exposed to Physics, Chemistry, Mathematics and Biology session as well as on the domain of technology and engineering with a series of the lecture and laboratory experiments from the eminent professors of the respective field. Different sessions were organized to make them aware of the opportunity in the science and technology domain. Students visited 4i lab and National Wind Tunnel Facility, Flight lab, Unmanned Aerial Vehicle (UAV) lab, Computer-aided Design (CAD) lab, Computer Centre, as well to get familiarized with the ambiance of advanced laboratories.

Apart from highlighting on the Science and Technology domain, throughout the three weeks programme, different sessions had been organised to raise awareness on different aspects related to socio-economic issues related to Women. Towards this direction, different sessions had been organised on gender sensitization, women health, and career options in different domain. Motivational talk and meet the achievers' sessions were the key attractions. There were outdoor activities, like Yoga, games, Tae Kwon Do, Gliding and Campus walk. Students visited Science city Lucknow and the famous science bus project.



Vigyan Bus, designed by IIT Kanpur, was inaugurated by the Hon'ble Uttar Pradesh Chief Minister, Shri Yogi Adityanath on May 11, 2018. Equipped with apparatus for science experiments, this bus is expected to popularize science in rural areas.



Recent Project

Targeting Nexus of Metabolic and Neurodegenerative Disorders: Application in Lafora Disease and Islet Amyloid Deposits

PI: Prof. Sandeep Verma, Dept. of Chemistry

Co-PI: Prof S Ganesh, Dept. of Biological Sciences & Engineering

Sponsor: Special Call in Chemical Biology, Science and Engineering Research Board



Numerous disorders are known to affect the brain and nervous system in human beings bringing in the inextricable complexity of innumerable molecular mechanisms for such disorders. Over last few years, a large body of evidence revealed fascinating commonalities in molecular pathologies amongst a wide range of neurodegenerative disorders such as Parkinson's disease, Alzheimer's disease, multiple sclerosis, and chronic neurodegenerative conditions. Irrespective of their diverse molecular origins and clinical manifestations, it is increasingly being realized that only limited sets of cellular mechanisms trigger the diverse range of diseases. Inevitably, the unraveling of mechanistic details of one neurodegenerative disorder would lead to useful information about the understanding and amelioration of other disorders.

The current proposal aims to probe glycogen metabolism with the help of chemical biology-based approaches to prevent or delay amyloid formation. We propose to use chemical, cell biological and animal models as the tools and assay systems.

Specific objectives and implications of this project is to study and provide intervention for:

- Amyloids of islet amyloid polypeptide
- Glycogen synthase to prevent polyglucosan bodies
- Serum and glucocorticoid-inducible kinase to prevent excessive glucose uptake and to enhance autophagy

Mix-Energy Source Electric Vehicle Charging System Design

PI: Prof. Santanu K. Mishra, Dept. of Electrical Engineering

Sponsor: Department of Science & Technology (Mission Innovation Scheme)



India is planning to become 100 % EV by 2030 and it is a huge challenge for the distribution grid. This proposal aims at studying the technical feasibility of this approach and proposes development of feasible, robust, and cost-effective technologies and methodologies to facilitate this plan, using a hybrid-energy-mix approach.

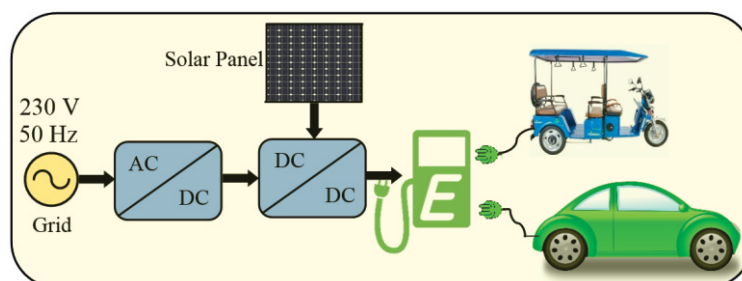
The primary objective of this proposal is to design Electric Vehicle chargers in an Indian context and study its impact on the distribution grid. The specific objectives are as follows:

- Design EV chargers with Input from multiple sources such as Grid and Solar PV
- Study of impact of EV chargers on distribution grid

As a part of this project, prototypes will be developed and successfully working prototypes will be deployed for E-rickshaw and Electric Vehicles.

Collaborations

IIT Kanpur, IIT Kharagpur, and IIT BHU are collaborating in this project with industry support from GE Global Research, Bangalore. Virginia Tech, University of Texas, Denton, Concordia University, and Imperial College are Mission Innovation partners for this project.



Recent Project

Addressable Peptide-Polymer Electrospun Nanofibers for Cell Sorting, Diagnostics & Delivery

PI: Prof. Sandeep Verma, Department of Chemistry

Co-PI: Dr. Sandip Patil, E-Spin Nanotech Pvt Ltd

Sponsor: Ministry of Human Resource Development, Indian Council of Medical Research (ICMR)

Industry Partner: E-Spin Nanotech Pvt. Ltd.



The project is awarded under “Uchcharat Aviskar Yojana (UAY), Govt. of India

Biological applications necessitate that nanofibers are biocompatible and present favorable interactions with cells, extracellular matrix, growth factors and other biomolecules. Exploration in this domain includes modification of hydrophobic/hydrophilic properties, creation of a robust mesh-like structure enabling optimal fluid sorption, transport and delivery properties supporting the overarching aim to achieve cell interaction, adhesion and proliferation. It is desirable that biocompatible nanofibers also exhibit mechanical strength and present a good enough surface area to allow for high volume cell attachment and favourable interactions.

Peptide-polymer hybrid biomaterials are interesting new class of materials which have been extensively studied for various biomedical applications due to their unique physical, chemical and biological properties. These novel smart materials have combined properties of both peptides and polymers such as biocompatibility, molecular recognition and mechanical strength. The potential biomedical applications of these hybrid biomaterials are in bio-imaging, drug delivery, drug loading and release, cell adhesion and tissue engineering.

Specific objectives and implications of this project are:

- Single versatile scaffold (Nanofibers, Nanogels) for both selective entrapment of cancer cells and controlled delivery of dopamine-conjugated Pt(IV) in cancer cells
- Electrospinning for scaffold fabrication and scale up for affordable commercialization
- Integrated photoactivatable stimuli-responsive controlled drug delivery system for precise control of drug release to avoid systemic toxicity and side effects
- 3D nanofibrous scaffold and nanogels to mimic ECM for easy facilitation and integration in vivo

Stability Analysis, Protection, and Coordinated Control of Networked Microgrids

PI: Prof. Saikat Chakrabarti

Co-PI: Prof. Sandeep Anand

Prof. S.R. Sahoo

Prof. Abheejeet Mohapatra

Department of Electrical engineering

Sponsor: Department of Science and Technology



The project focuses on understanding the stability problems of networked microgrids, their control in a coordinated manner, and the associated protection challenges. The key objectives of the proposal are the classification and understanding of the stability problems in networked microgrids, designing effective primary and secondary control strategies for the microgrids, and the associated converter designs, developing algorithms for coordinated control of several interconnected microgrids, and developing adaptive protection philosophies for coordinated, grid connected, and/or islanded modes of operation of networked microgrids. A field pilot is also proposed to be set up to test and validate the algorithms developed as part of the project. The project is for a duration of three years.

Collaborators

Dr. A. K. Pradhan, IIT Kharagpur

Dr. A. Ghosh, Curtin University, Australia

Dr. X. Linag, Memorial University of Newfoundland, Canada

Dr. Gokaraju, University of Saskatchewan, Canada

Sh. Subrata Sarkar, NETRA, NTPC, India

Fabrication of New Generation of Self-Resorbing Implants and Devices from Bioactive and Biodegradable Materials for Orthopedic Applications



PI: Prof. Ashok Kumar, Dept. of Biological Sciences & Bioengineering

Co-PI: Prof. Vivek Verma, Dept. of Materials Science & Engineering

Sponsor: Ministry of Human Resource Development (MHRD) and Indian Council of Medical Research (ICMR)

Industrial Partner: Ortho Regenics Pvt. Ltd., Hyderabad India

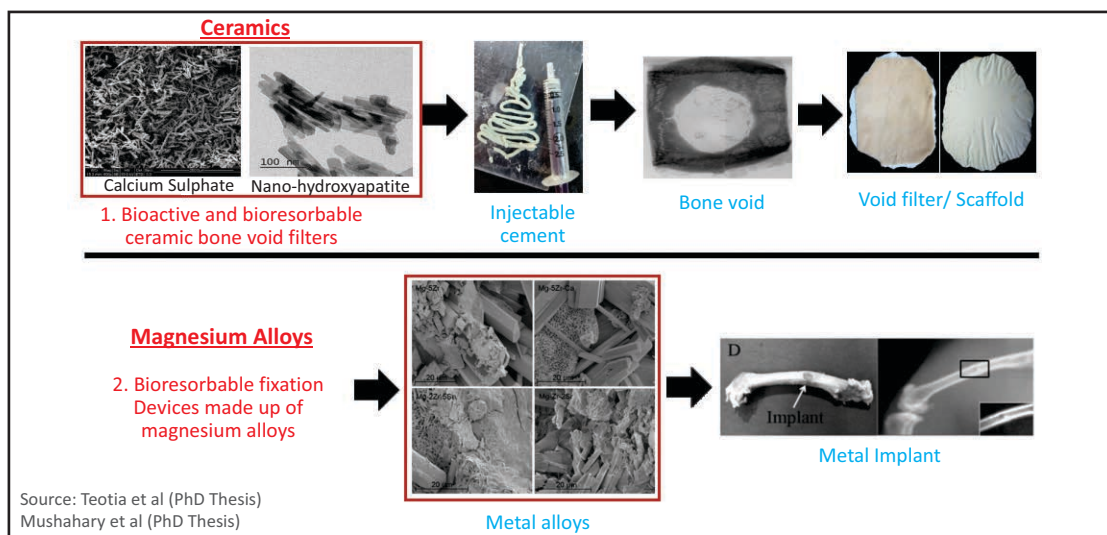
The project is awarded under “Uchchar Aviskar Yojana (UAY), Govt. of India

Bone injury is the most common medical condition in any accidental or occupational trauma situation. Presently for bone fracture fixations metal implants made up of materials that are non-biodegradable and with high mechanical strength, this causes stress shielding of bone leading to bone loss and implant failure.

A new generation biomaterial for orthopedic application with the following properties are envisaged:

- Bioresorbable
- Bioactive, and with
- Mechanical properties matching to bone

The project has the following objectives: (a) Developing bone cements, fillers and porous scaffold materials from nano-hydroxyapatite (n-HA) and functionalize them for orthopedic applications, (b) Developing bulk and functionalized alloys using magnesium (Mg), its alloys and ceramics (nHAP) as per GMP/GLP guidelines, (c) To carry out detailed in-vitro and in-vivo analysis for the bioefficacy and safety of these materials (d) Developing prototypes/products (e.g. pins, screws, scaffolds etc.) for use in humans for orthopedic applications. Developing precision machining and moulding processes for shaping selected materials into implants such as pins, screws, scaffolds etc. for use in humans for orthopedic surgeries, and (e) Technology transfer for commercialization of products/prototypes to industrial partners.



This industry/academic partnership will lead to development of technological know-how and advancement in biodegradable metal and ceramic materials for orthopedic applications. The technologies developed will be transferred to industry after patenting for clinical evaluation and commercialization.

Developing Bone Active Molecule Functionalized Biomaterials for Prevention/Treatment of Osteoporotic Fractures



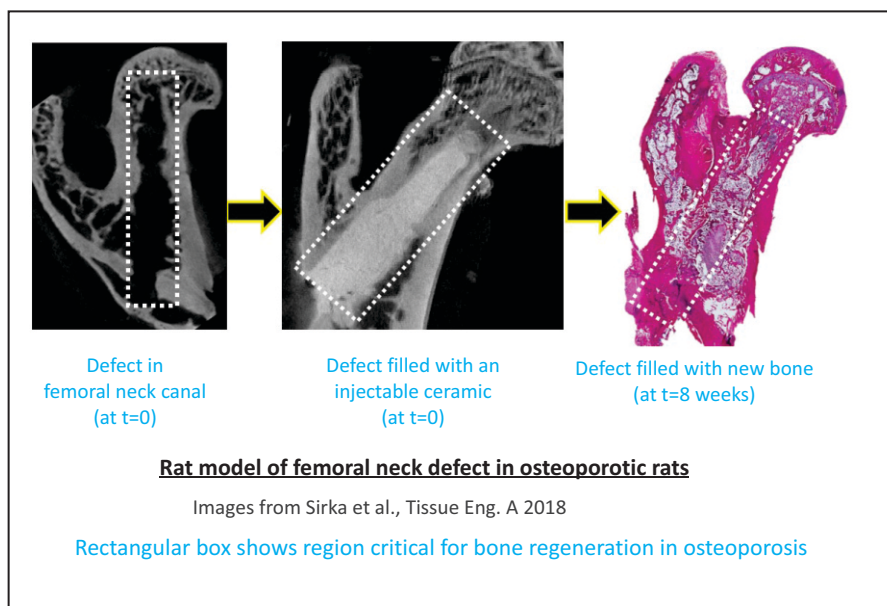
PI: Prof. Ashok Kumar, Dept. of Biological Sciences & Bioengineering

Co-PI: Prof. Mainak Das, Dept. of Biological Sciences & Bioengineering

Sponsor: Department of Biotechnology (DBT) and VINNOVA, the Swedish agency

The project aims to develop **novel strategies to prevent osteoporotic fractures**. The project has a major impact on the older population and is aimed at reducing osteoporosis related patient morbidity and economic burden.

Osteoporosis causes reduced bone quality at several anatomical locations with wrist, vertebrae and hip as the most commonly affected areas. Osteoporosis of the hip is associated with high morbidity, mortality and hospital costs. Common treatment strategy is to use systemic bisphosphonates (oral or parenteral routes) but there is a constant decline in patient compliance to treatment. Furthermore, bisphosphonates have been associated with side effects like myalgia, osteonecrosis of the jaw, atypical femoral fractures and reduced bone quality due to reduction in bone remodelling.



In this interdisciplinary project, the main aim is to use biomaterials as carriers for bioactive molecules that can be injected into the femoral neck canal to bolster bone regeneration and hence the mechanical strength and prevent fractures.

Within the scope of the project, the team at IIT Kanpur will develop and characterize biomimetic injectable materials consisting of a hydroxyapatite backbone with or without polymeric components. The aim is to achieve injectability and spreadability of these materials within the trabecular bone. These materials will also be combined with bone active molecules like bisphosphonates to provide a local supply of anti-bone resorbing drugs and circumvent the systemic side effects. Developed materials will then be implemented in clinically relevant models of bone regeneration in osteoporotic animals.

The final stage of the project involves the clinical translation of the developed biomaterials and techniques in a small set of patients. Patients with osteoporosis and high risk of a femoral neck fracture will be stratified and injected with the best combination of the developed biomaterial and bioactive molecules. If successful, the long-term goal of the project is to use this approach to prevent osteoporotic fractures by means of a single injection of the biomaterials together with bone active molecules.

Collaborators

The project is to be performed in collaboration with the Department of Orthopedics, Lund University, Sweden, a world-renowned centre for orthopedic surgery and a member clinic of the prestigious International Society of Orthopedic Centres (ISOC) with Professor Magnus Tägil (M.D., Ph.D.) as the PI on the Swedish side. Dr. Rabinarayan Dash, founder of the Indo-Swedish Rheumatology Foundation Trust (ISRFT), Balasore, Odisha is the clinical support partner of the project from India. Besides academia, a biomaterial manufacturing company Bone Support AB, Sweden and Orthoregenerics Pvt. Ltd., India form the industrial support partners of the project

Low cost devices to reduce cases of Neonatal Jaundice ■■■

IIT Kanpur has developed a low-cost phototherapy machine to cure neonatal jaundice. The machine has been developed by Prof. S. Anantha Ramakrishna and Prof. Harshwardhan Wanare of the Department of Physics, and Prof. J. Ramkumar of the Department of Mechanical Engineering.

These new phototherapy units will make the treatment more efficient by reducing the time duration for irradiation and the treatment cost. The units differ from the common machines in the way that they not only make use of LEDs but also offer well-calibrated intensities, wave lengths and uniformity of blue light in an inexpensive manner.

The institute gifted three new units to the LLR Hospital. Prof. Abhay Karandikar, Director and Prof. S. Ganesh, Dean of R&D, IIT Kanpur handed over the units to Dr. Navneet Kumar, Principal and Dr. R.C. Gupta, Superintendent, GSVM Medical College, Kanpur.



Institute Lecture (July-August, 2018)

Prof. Edgar Knobloch

Spatially Localized Structures: Experiments, Theory and Numerics



Dr. Edgar Knobloch is a Professor of Physics at the University of California at Berkeley. His interests range from bifurcation theory and nonlinear dynamics to pattern formation, fluid dynamics and

astrophysics. In recent years, he has focused on the properties of rapidly rotating flows and other fluid problems with strong restraints, as well as on spatial localization in dissipative systems. He is the recipient of honorary doctorates from Universite Paul Sabatier, Toulouse, France and Universidad Politecnica de Madrid, Madrid, Spain.

Mr. Arvind Gupta

Making Things, Doing Science

Mr. Arvind Gupta has written 30 books on science activities, translated 400 books into Hindi and presented 125 films on science activities on Doordarshan. He worked at the Children's Science Center at IUCAA, Pune. The Centre produced 8600 short videos on simple experiments and science toys in 20 different languages. Every day over 12,000 books are downloaded from his popular website <http://arvindguptatoys.com>. He has received many honors including the Distinguished Alumnus Award of IIT Kanpur and the Padma Shri.



Industry-Academia Collaboration

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Feedback/Suggestions

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