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R&D Newsletter

Indian Institute of Technology Kanpur

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IIT Kanpur bags National Intellectual Property Award 2024

IIT Kanpur received the prestigious "**National Intellectual Property (IP) Award 2024** for Indian Academic Institution - Patents" at Bharat Mandapam, New Delhi on March 26, 2024. The award was presented by the Government of India in the presence of Hon'ble Minister Shri Piyush Goyal, and accepted by IIT Kanpur Director Prof. Manindra Agrawal. The institute also received the "**WIPO National Award for WIPO Users**," recognizing its innovative use of WIPO IP services.

Record-Breaking Innovation Milestone

152 IPRs filed in 2024

Till Date

1229 IPRs filed **854** IPRs granted

4th Consecutive Year of growth in filings

Licensing Success

12.91% Licensing Rate shows strong industry-academia collaboration

Technology Transfer

Anālakṣhya, a metamaterial cloaking system, licensed to Meta Tattva Systems Pvt. Ltd.

IIT Kanpur launched '**Analakshya**', an advanced stealth technology developed in collaboration with **Meta Tattva Systems Pvt. Ltd**. Based on textile metamaterials, the innovation provides radar-absorbing capabilities for military aircraft, ships, and missiles, making them effectively invisible to enemy detection. The project was led by Prof. S. Anantha Ramakrishna, Prof. K. V. Srivastava, Prof. J. Ramkumar, and their students.

'Soil Nutrient Sensing Device' licensed to ScaNxt Scientific Technologies Pvt. Ltd.

IITK licensed a technology titled '**Soil Nutrient Sensing Device**' to **ScaNxt Scientific Technologies Pvt. Ltd.**, invented by Prof. Jayant Kumar Singh and team, is a portable gadget for real-time soil analysis. The portable and handheld device operates via a smart phone app, needs no chemicals, and enhances agricultural productivity by optimizing fertilizer use, benefiting farmers and the environment.

MoU with GSVMC

MoU signed with **Ganesh Shankar Vidyarthi Memorial Medical College (GSVMC)** in the areas of Biomedical materials, Implants and Technologies in Medicine. The MoU was signed by the Principal of GSVMC, Prof. (Dr.) Sanjay Kala and Prof. Manindra Agrawal, Director IIT Kanpur.

MoU with MoSPI

An MoU was signed with **Ministry of Statistics and Programme Implementation (MoSPI)** to undertake a research project on X-13-ARIMA-SEATS for Seasonal Adjustment.
It was signed by the Director of MoSPI, Shri Shivnath Singh Jadawat and Prof. Tarun Gupta, Dean Research and Development (DORD), IIT Kanpur.

MoU with Office of the Registrar General & Census Commissioner

IIT Kanpur signed a MoU with the **Office of the Registrar General &Census Commissioner, Ministry of Home Affairs**, Government of India, for the establishment of a Census Data Research Workstation at its Computer Center. The MoU was signed between Prof. Manindra Agrawal, Director IIT Kanpur, and Ms. Sheetal Verma IAS, Director, Census Operations and Civil Registration, Government of India.

MoU with Indian Army Central Command

Indian Army Central command and IIT Kanpur entered into an MoU to collaborate on developing an advanced Remote Piloting Training Module and a Software-in-the-Loop Simulator for drones and Unmanned Aerial Vehicles signed by the central army Lt. Gen. Mukesh Chadha, COS, HQ Central Command and Dr. Subrahmanyam Saderla, Dept of Aerospace Engineering.

MoU with Mars (India) Antennas & RF Systems Pvt. Ltd.

Mars (India) Antennas & RF Systems Pvt. Ltd. (Mars) and IIT Kanpur entered into an MoU to work in the areas of Renewable & Green Energy and EV Components which was signed by Arbind Pilania, CEO of Mars and Prof. Tarun Gupta, DORD IIT Kanpur.

MoU with UTS

IIT Kanpur signed an MoU with **University of Technology Sydney (UTS)** to strengthen innovative collaboration between the two institution. The MoU was signed by the Director of UTS Dr. Tania Bezzobs and Prof. Tarun Gupta, DORD IIT Kanpur.

Dr. Rajesh Kumar, Ramanujan Fellow, Dept. of Mech Engineering received the prestigious **Friedrich Wilhelm Bessel Research Award 2024**. His research is focused on 2D layered materials and their nanocomposites for application in energy, sensors, EMI shielding, etc.

Centre of Excellence in Specialty Chemicals at IIT Kanpur

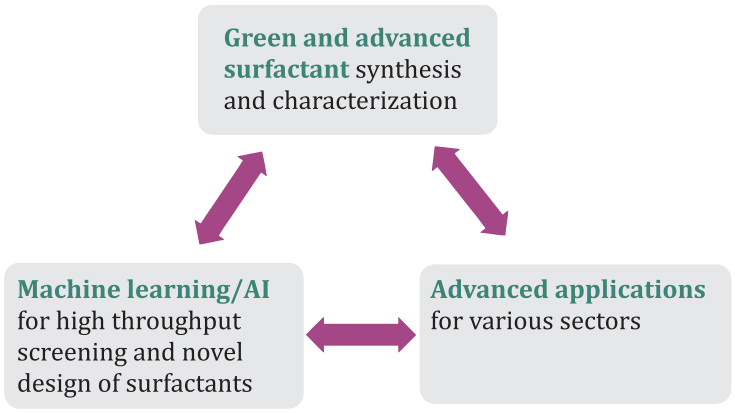
PI: Prof. Jayant K. Singh
Dept. of Chemical Engineering

Sponsor: Ministry of Chemicals & Fertilizers

Specialty chemicals, such as surfactants and polymeric coatings, are vital for applications in-home care, agrochemicals, and CO_2 sequestration. The Indian surfactant industry relies heavily on imported advanced specialty surfactants, making it vulnerable to global market changes. To tackle these issues, the Department of Chemicals and Petrochemicals, under the Ministry of Chemicals and Fertilizers, has established the first **Center of Excellence (CoE) for specialty chemicals at IIT Kanpur.**

Objective

- Connect industry and academia to address the sector's needs.
- Develop green and innovative surfactants with local production methods.
- Create Digital Twin platforms for advanced surfactant design
- Conduct fundamental and applied



Outereach Event

IIT Kanpur at IInvenTiv-25

IIT Kanpur showcased its commitment to scientific innovation at **IInvenTiv-25** held in February 2025 at IIT Madras showcasing **shape-morphing quadcopter drone with gripper**, **contactless Automated Crack Extension Measurement (ACEM) system**, and **auxiliary metal cutting retrofit assembly with advanced safety controls**, alongside innovative technologies from startups like **ScaNxt (BhuParikshak)**, **VU-Dynamics**, **Hacklab Solutions**, **H2Power Energy**, and **Simactricals Solutions**. IIT Kanpur delegates from the R&D office led by Prof. Raja Angamuthu, Associate Dean of Research & Development, Ms. Swagath Bhandari, OSD, and Prof. Jitendra K. Bera, Dean of Faculty Affairs participated, highlighting the importance of academic innovation and collaboration in driving impactful research and technological progress.

IIT Kanpur at PIWOT-25

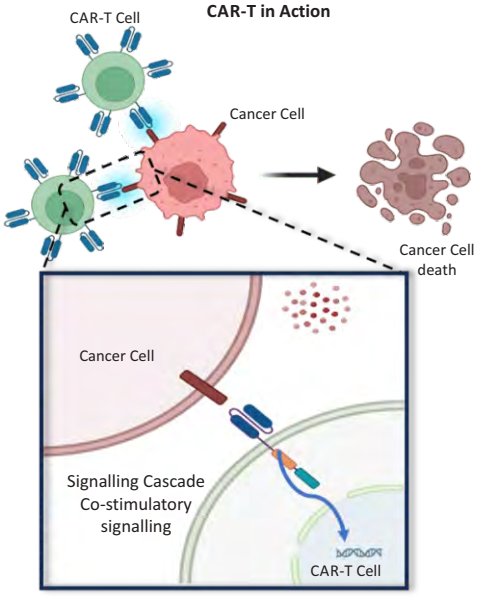
IIT Kanpur participated in the **PIWOT (PanIIT World of Technology) 2025 Global Summit**, held in January 2025 at the Jio World Convention Centre, Mumbai. The institute showcased its **C3I Center** and innovations including the **Haptic Smartwatch for the Blind and Visually Impaired** developed by Prof. Siddhartha Panda's team, and the **Soil Sensing Device** presented by Mr. Rajat Vardhan of ScanNXt Technologies, incubated at SIIC. The event featured participation from Prof. Manindra Agrawal, Director IIT Kanpur, Prof. Raja Angamuthu, Associate Dean of Research & Development, Prof. Siddhartha Panda, Ms. Swagata Bhandari, OSD, underscoring the institute's commitment to cutting-edge research and technologies.

Switchable Tandem CAR-T Cells Targeting tMUC1 and ROR1 for Breast Cancer Immunotherapy

PI: Prof. Sivaprakash K Ramalingam
Dept. of Biological sciences & Bioengineering
Sponsor: ICMR

Breast cancer is the most common cancer among women in India. Up to one-third of those diagnosed have the triple-negative subtype. Triple-negative breast cancer (TNBC) is an aggressive subtype of breast cancer with limited treatment options and poor prognosis. Hence, there is a pressing need for the development of effective treatment modalities for patients with TNBC who face elevated risks of metastasis and poor survival rates. Currently, TNBC treatment depends on chemotherapy since estrogen and HER2 therapies are ineffective without their respective receptors. Hence, there is a critical need for more effective, targeted treatment strategies for TNBC patients. Chimeric antigen receptor (CAR)-T cell therapy combines the ability to target a tumor-specific antigen with increased effector functions of T cells, and has emerged as a promising immunotherapeutic strategy to improve the survival rate of cancer patients.

The project aims to develop a proof of concept on the generation of bi-specific CAR-T cells combined with knockout of PD-1 immune checkpoint protein to overcome immune suppression of T cells in the tumor microenvironment and promote TNBC tumor killing. In addition, we will incorporate the safety switch (suicide gene) RQR8 into our CAR molecule, which will allow for the selective removal of administered CAR-T cells in the event of toxicity.



CAR-T in action illustrates how engineered T cells target and destroy cancer cells by recognizing specific antigens

Unravelling SNARE Complexes Involved in Autophagy as a Therapeutic Strategy for Mycobacterium Tuberculosis



PI: Prof. Suresh Kumar
Co-PIs: Prof. Saravanan Matheshwaran, Prof. Appu Kumar Singh
Dept. of Biological Sciences & Bioengineering
Sponsor: ICMR

Despite ongoing efforts, Tuberculosis (TB) remains a major global health threat, causing millions of cases and deaths annually. Enhancing host defence through autophagy, which plays a key role in controlling intracellular Mycobacterium tuberculosis (Mtb), is imperative. However, precise molecular mechanisms and clinical trials for autophagy-modulating drugs against Mtb are lacking. SNARE proteins, pivotal for membrane fusion and involved in cellular functions including autophagy and lysosomal activity, present unexplored potential in defending against Mtb. This project proposes a novel SNARE complex aids in eliminating intracellular Mtb, with structural analyses identifying this complex and its associated calcium channel TRPV6, advancing SNARE biology.

The project aims to investigate the cellular and molecular events related to the novel autophagy intermediate HyPAS in combating intracellular Mtb, utilizing the team's expertise to identify potential drug targets for enhanced pathogen elimination. In vitro studies will involve infecting macrophages with Mtb, aerosol infection of transgenic mice, GST-pulldown assays, and Isothermal Calorimetry. Cryo-EM will reveal HyPAS machinery structures post-Mtb infection, elucidating autophagy and calcium channel interplay. Electrophysiological recordings will validate structural models. Elucidating the SNARE complex structure involved in autophagosome formation is expected to uncover novel drug targets within the autophagy pathway, enabling more effective strategies to combat Mtb infections.

Next-Generation Genome Engineering & Chemo-genetic Platform Technologies for Gene Therapy of Ocular Disorders

PI: Prof. Jayandharan G. Rao

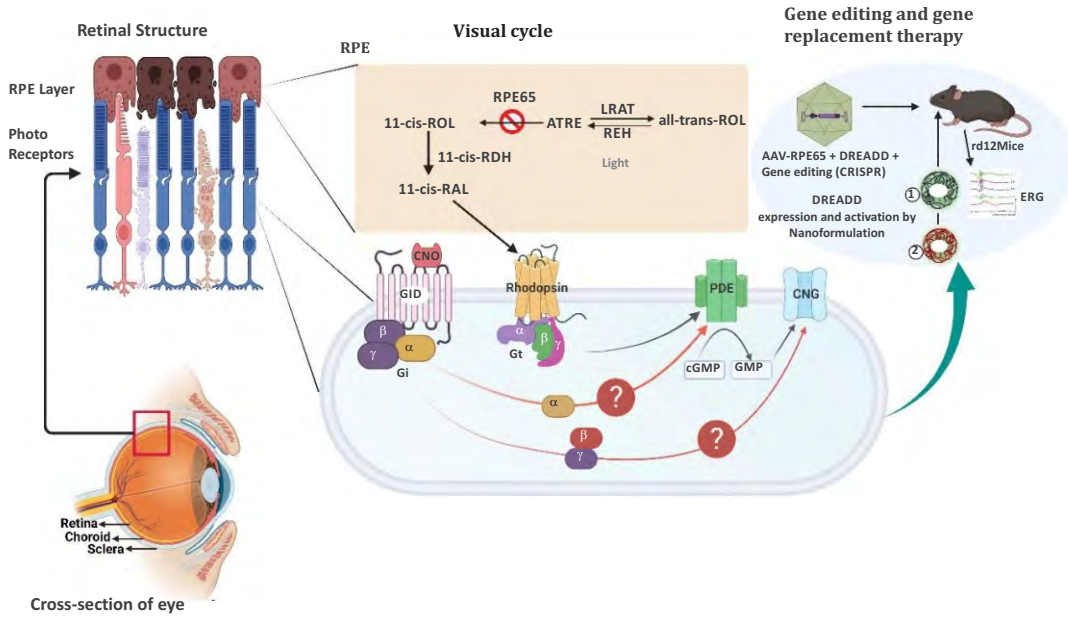
Co-PI: Prof. Santosh K. Misra, Prof. Nitin Mohan,
Prof. Appu K. Singh, Prof. Sai Prasad Pydi

Dept. of Biological Sciences & Bioengineering

Sponsor: SERB (Anusandhan National Research Foundation (ANRF)

Gene therapy has emerged as a promising therapeutic approach for treating genetic disorders. As a gene therapy target, the eye in general and retina in particular, is a well-suited organ for therapeutic interventions and comes with the advantage of being immune-privileged and ease of access for delivery. One of the many inherited retinal disorders, is Leber congenital amaurosis type 2 (LCA2) which occurs as a result of a defect in the retinal pigmental epithelial gene encoding a 65kda protein (RPE65). As a result, the vision is impaired from birth and progressive degeneration leads to complete blindness until adulthood. Though LCA2 gene therapy provides functional benefits by restoring the visual cycle- the degenerative pathology continues even after gene therapy. This further calls for an elaborate understanding of the visual cycle, identifying additional targets and molecular signaling networks.

Towards this, a multidisciplinary team consisting of PI and the Co-PIs from the department of Biological Sciences & Bioengineering will be utilizing chemogenetic receptor approach in combination with AAV based gene replacement or gene-editing therapy to treat LCA2. The research team anticipates that this will involve deciphering the novel molecular regulators of visual cycle where a combination of molecular and structural biology approach is required to validate the findings. Furthermore, it is expected the development of novel AAV based technologies for gene replacement/ genome engineering and optimal non-invasive delivery system for chemo-genetic triggers as part of this efforts.



Augmenting LCA2 Gene Therapy with Chemogenetic Technology. *Gene editing/ replacement for RPE65 with AAV as the vehicle for gene delivery into the eyes of rd12 mice is expected to bring phenotypic rescue. This strategy supplemented with DREADD activation of PDE and regulation of CNG channels is expected to have enhanced therapeutic rescue in LCA2.*

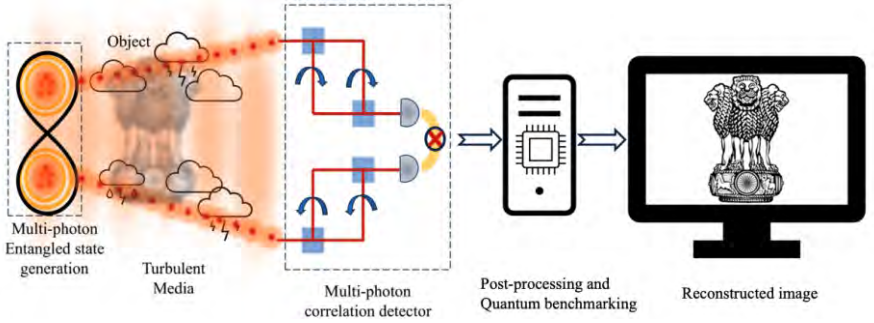
Design and Development of Quantum Entanglement-enhanced Imaging Systems

Lead PI: Prof. Anand Kumar Jha
Dept. of Physics

Member PIs: Profs Harshawardhan Wanare (IIT Kanpur), Venkata Jayasurya (IIT Kanpur), G. Rajshekhar (IIT Kanpur), Kedar Khare (IIT Delhi), Girish Kulkarni (IIT Ropar), Vishwa Pal (IIT Ropar), Manik Banik (SNBNCBS).

Sponsor: Department of Science & Technology (through National Quantum Mission)

This is a technical group (TG) project granted under the national quantum mission (NQM) of the department of Science and technology. The project is on developing quantum-entanglement-enhanced imaging systems.



The main objective of this project is to design and develop enhanced imaging and microscopy systems that are based on harnessing the quantum-correlations of entangled photons. Such quantum-enhanced imaging and microscopy systems are expected to provide increased imaging resolution and sensitivity, enhanced signal-to-noise for low-light level imaging, improved methods for non-invasive imaging, and enhanced imaging capabilities in the presence of turbulent and scattering media.

Food Insecurity, Intrahousehold Dynamics and Lifecourse Outcomes in India

PI: Prof. Sukumar Vellakkal
Dept. of Economics

Sponsor: Medical Research Council , UKRI
Collaborator: Lancaster University, UK

This collaborative research project examines Food Insecurity (FI)—a pressing global issue worsened by climate change, conflict, and supply chain disruptions. Despite its significance, long-term evidence on FI in Global Majority countries, particularly among children and adolescents, remains scarce. Existing research also fails to capture disparities in FI experiences within households.

Building on ongoing work, this project aims to bridge these gaps by providing policy-relevant insights on FI in India through survey analysis and qualitative interviews.

Beyond academic impact, this research will inform policy by engaging stakeholders, publishing policy briefs, responding to government inquiries, and hosting an online workshop to discuss findings and future research directions.

Key Focus Areas

- Generating New Evidence on FI in India – Addressing the lack of country-specific research by examining the experiences of children, adolescents, and inequalities within households.
- Understanding Household Strategies for Managing FI – Exploring how low-income households cope with FI through social networks, government programs, and decision-making processes.
- Redefining FI Measurement – Challenging household-level FI metrics to reveal hidden disparities, much like advancements in poverty measurement have uncovered gendered inequalities.

Featured Technologies

Portable Readout Unit For Chemiresistive Sensor (PRuCSor)

Invented by: Dr. Santosh Kumar Misra & his team

Dept. of Biological Sciences & Bioengineering

IPA No. 202411100478

- Half-palm-sized, 180 gm portable readout unit called PRuCSor (Portable Readout Unit for Chemiresistive Sensor)
- Uses flexible, paper-based carbon electrode chips to measure resistance in liquid samples.
- Compact, lightweight, affordable, and battery powered. With a built-in screen and Bluetooth connectivity, it offers portable, user-friendly sensing anywhere.

Fuel Cell and Battery Hybrid Powered Electric Tower Car with DC Traction Motor

Invented by: Dr. Prabodh Bajpai, Dr. Amarendra Edpuganti & their team

Dept. of Sustainable Energy Engineering

IPA No. 202411068288

- Electric tower car powered by a hybrid system that uses both fuel cells and lithium-ion batteries and is equipped with a DC traction motor to drive the vehicle.
- The novel system replaces Diesel Electric Tower Cars with a zero-emission, fuel-free alternative, reducing carbon emissions, noise, vibration, and maintenance while enhancing operational efficiency and sustainability.

Sugarcane Skin Electrode for Electrochemical Sensing

Invented by: Mr. Nachiket Aashish Gokhale (ChE), Dr. Chiranjeevi Srinivasa Rao Vusa (SCDT, Project Scientist) & Prof. Siddhartha Panda (ChE/SCDT),

IPA No. 202411001912

- This invention are natural substrates made from sugar-cane skin for producing screen-printed electrodes, enabling applications in healthcare, water quality monitoring, and portable chemical analyzers.
- This invention serves as a sustainable alternative to commercially used substrates.

A Multipurpose Proctoscope, Nested and Hinge Type

Invented by: Prof. J Ramkumar and his team

Dept. of Design

Indian Patent Application no. 202411003111

- The novel recyclable - Nested Type Proctoscope is designed in a way to easily increase and decrease the exposure of the surgical area wherein a silicon layer is placed for smooth insertion along with an inflating balloon on the front to help retain its position inside the canal.
- Hinge Type Proctoscope has been designed to simplify the operation and inspection of the surgical area by providing easy in-out and expansion and contraction of the scope along with a detachable light source.

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