



# R&D Newsletter

## Indian Institute of Technology Kanpur



Initiation of the building development of Gangwal School of Medical Science & Technology and Yadupati Singhania Super Speciality Hospital

### more highlights

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- Technology Transfer & MoUs
- Events & Lecture Series
- Technopark @iitk
- Recent Major Projects

# Technology Transfer & MoUs

## Technology Transfer to Laurus Labs limited



IIT Kanpur signs a breakthrough Memorandum of Agreement with Laurus Labs for licensing novel gene therapy assets developed by Prof. Jayandharan G. Rao.

In accordance with the MOA, IIT Kanpur will transfer several gene therapy assets through in-licensing to Laurus Labs, who will provide a research grant to facilitate their progression through pre-clinical development.

Laurus Labs will also fund the necessary clinical trials and spearhead the launch of these cutting-edge products not only in India but also in emerging markets. In addition, Laurus Labs will establish a state-of-the-art Good Manufacturing Practice (GMP) facility at Techno Park@ IIT Kanpur, bolstering the production capabilities of gene therapy products.

## Technology Transfer to Sensa Core Medical Instrumentation Pvt. Ltd.

Novel point-of-care technology for rapid analysis of bilirubin in human blood/serum developed at IIT Kanpur has been transferred to Sensa Core Medical Instrumentation Pvt.



Ltd. for mass manufacturing and sales. The inventive technology developed at the National Centre for Flexible Electronics, IIT Kanpur, by Prof. Siddhartha Panda, and Dr. Nishant Verma, discloses the fabrication.

Neonatal jaundice is a prevalent clinical condition, affecting roughly 60% of full-term and 80% of preterm new-borns with a mortality rate of 7.3 per 1000 live births in India. The developed sensor is portable, inexpensive and directly applicable for blood sample analysis. This sensor is expected to be used for bedside testing, in diagnostic laboratories, and even in health screening centres.

## MoU with IICD, Jaipur



Indian Institute of Craft & Design, Jaipur (IICD) and Indian Institute of Technology Kanpur entered into an MOU for undertaking collaborative work on development of rural handmade products with the objective of developing craft sector, preserving traditional arts and crafts, developing improved processes, etc. and thereby creating a positive impact in the eco system. The MOU was signed by the Director of IICD, Prof. (Dr.) Toolika Gupta and Prof. A R Harish, former Dean Research & Development IITK.

## MoU with Airbus



Airbus Group India Private Limited (Airbus) and Indian Institute of Technology Kanpur entered into an MOU to work in the areas of technology, research and training in the areas of aerospace. The MOU was signed by the South Asia President of Airbus, Mr. Remi Maillard and former IITK Director, Prof. Abhay Karandikar.

## Collaboration with KSSSCI

Kalyan Singh Super Specialty Cancer Institute (KSSSCI) partnered with Karkinos Healthcare and IIT Kanpur to establish the Center for Advanced Molecular Diagnostics and Research for Cancer (CAMDRC) in Lucknow. The CAMDRC Lab will feature cutting-edge NGS machines for high throughput testing in its 25,000 square feet space. This initiative aligns with the shift towards molecular diagnostics in cancer care, offering personalised treatments based on genetic insights and improving patient outcomes.



# Events & Lecture Series

IIT Kanpur participated in the prestigious "Maa Tuhje Pranam" programme and exhibited a Tableau on Aug 15th 2023 conducted by Amar Ujala in Collaboration with district administration. The Tableau consisted two drones namely "Vibhram" and "Orbit" and also a prototype of Bi-Propellant Semi-Cryogenic Liquid Rocket Engine by Space-Phyllic an incubated company of SIIC, IIT Kanpur. The Tableau was very well received by the local people.



Department of Sustainable Energy Engineering in collaboration with SIIC, CESE and Office of Research and Development organized the "World Environment Day" on June 5th 2023. The program included expert lectures, panel discussion on environmental issues, and a workshop on composting and waste management techniques.

IIT Kanpur has ranked number one in the prestigious NIRF (National Institutional Ranking Framework) Innovation category 2023.



The **Bhoomi Pujan** for the construction of the Gangwal School of Medical Science and Technology and Yadupati Singhania Super Speciality Hospital took place on September 25th, 2023.

## Institute Lecture (June 2023 - September 2023)



**Prof. Arnab Rai Choudhuri**  
*The Mysterious Magnetic Personality of Our Sun*



**Shri Sanjay Dubey**  
*India's Energy Transition: Challenges and Way Forward*



**Dr. Dipankar Choudhury**  
*Improving Health Outcomes with Physics-based Simulation*



**Prof. Edgar Knobloch**  
*Geostrophic Turbulence and the Formation of Large Scale*



**Prof. Perumal Nithiarasu**  
*Building Digital Twins - Fundamental challenges*

# Technopark@IIT Kanpur

IIT Kanpur's expertise in engineering, healthcare collaborations and the forthcoming Gangwal School of Medical Research and Technology, including the established Biological Sciences Bioengineering department and the Mehta Family Centre for Engineering in Medicine (MFCEM), drive pioneering advancements. Aligning with our commitment to healthcare innovation, Technopark@iitk proudly hosts industry leaders such as Q-line Biotech and Laurus Labs, all esteemed members with their operations based within the park premises.



Q-Line Biotech, formerly POCT Services Group, has been a prominent player in in-vitro diagnostics (IVD) since 2013.

The company seeks collaboration with IIT Kanpur in equipment development, nanomedicine, biotechnology, biochemistry research, AI-enabled diagnostic tools, and medical devices. This collaboration aims to leverage the strengths of both the entities to develop innovative, affordable solutions that improve disease diagnosis and treatment. Q-Line Biotech's expertise in IVD and IIT Kanpur's proficiency in engineering, biotechnology, and AI present a unique opportunity to advance cutting-edge diagnostic technologies with global healthcare implications.

The company already has its physical presence in the transit facility of Technopark@iitk. And plans to set up a bigger R&D facility spread over an area of 10,000 sq. ft. within the upcoming Technopark@iitk Phase I building.



Founded in 2006, Laurus Labs Limited is an integrated pharmaceutical manufacturer based in India. From its roots as an API ARV company, it has expanded its expertise to encompass human health, animal health, consumer health, agro-chem, and food and nutrition markets.

Laurus Labs is set to license gene therapy assets from Prof. Jayandharan Rao's groundbreaking research. This partnership targets cost-effective gene-based drugs for retinal degeneration, haemophilia, and muscular dystrophy. The company will build a top-tier GMP facility at Technopark@iitk Phase I building, supporting IIT Kanpur's dedication to affordable healthcare and academia-industry collaboration. This represents a significant milestone in IIT Kanpur's innovation journey toward advancing healthcare solutions.

## Recent Projects

### Investigation of Turbulence over Porous Walls

PI: Prof. Pranav R. Joshi

Dept. of Mechanical Engineering

Sponsor: Science and Engineering Research Board (SERB)



**T**urbulent flow over porous surfaces occurs in many natural and technologically relevant situations. Flow over porous riverbeds, urban structures, and forest canopies exemplify the former, while the flow over transpiration-cooled turbine blades and porous surfaces of implantable blood pumps illustrate the latter. Understanding such flows can help us better predict, e.g., dispersion of pollutants, local weather patterns, and device performance. Characteristics of such turbulent flows developing over porous surfaces can be very different from those over impervious surfaces which have been studied to a much greater extent.

The present study will use optical measurement techniques to probe in detail the properties of turbulent flows over porous walls with the hope of developing better models to predict them.

# Recent Projects

## Rf Transceiver soc with DSP for 27mhz - 1.05 ghz

PI: Prof. Imon Mondal

Co-PI: Prof. Ashwin Kumar, Prof. Chithra

Dept. of Electrical Engineering

Sponsor: Ministry of Electronics & Information Technology

Collaborator: Silizium Circuits Pvt. Ltd ( PI: Dr. Arun Ashok, Co-PI: Mr. Rijin John)



The project aims at development of an integrated circuit prototype for a system on chip (SoC) for wireless communication for sub-1 GHz frequency range. The developed SoC will have an RF front end capable of transmitting in sub-1GHz UHF frequencies and will be compatible with various standards like LoRa, 802.15.4 WLAN, ZigBee, WiSUN and also supports modulation formats like FSK/ MSK/ 4-FSK/ GFSK/GMSK/ ASK/ FSK/ FM / PSK hence forming the backbone of most of the long, short-range, wide and narrowband communications. Together with the RF front end, the designed SoC also houses an indigenous RISC-V core powered with SHAKTI processor enabling support of a multitude of modulation formats for the above-mentioned standards.

Such an SoC supporting all prominent standards in sub GHz will drive innovations in the IoT and indoor applications whose revenue are forecasted to be \$ 1.3 Trillion in 2030. In addition to the final SoC, the IPs such as ADCs, PLL and RF front end will be developed. All the low-power applications require an ultra-low power receiver since it has to be alert to an incoming signal at all times. A working prototype embedded in a product (and associated innovations during the process of design) will form a lucrative backbone for the entire low-power front-end community.

## Characterization of Natural Killer cells in Prostate Cancer and Therapeutic Interventions utilizing 3D-Tumoroid model system

PI: Prof. Rakesh Kumar Majhi

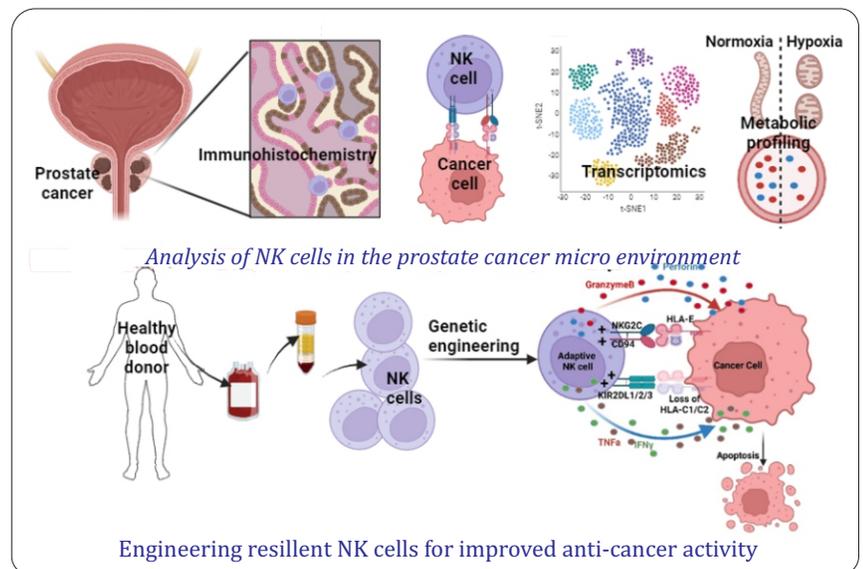
Dept. of Biological Sciences & Bioengineering

Sponsor: Department of Health Research (DHR)



Majority of prostate cancer patients succumb to lethal castration-resistant cancer after developing resistance to androgen deprivation therapy. Prostate cancer is an “immunologically cold” solid tumour, with high incidence of metastasis, making it further difficult to treat pharmacologically.

This project aims at developing an off-the-shelf cellular immunotherapy product via generating designer Natural Killer (NK) cells, with improved activity against solid tumours. Prostate cancer tissue samples will be utilized to understand the ligand expression profiles of cancer cells and receptor expression profiles of circulatory and tumour infiltrating NK cells. Further, the inflammasome pathway of prostate cancer cells will be activated to transform immunologically cold tumour into immunologically hot tumour. Disrupting the oxygen sensor can facilitate production of NK cells resilient against hypoxic environment of solid tumours. Further, metabolic rewiring of the NK cells via altering the lysosomal-mitochondrial dynamics, is expected to improve their anti-cancer activity.



## Recent Projects

### Synergizing Existing Skills with Aspirations of the Indian Youth: Lessons for Economic Diversification

PI: Prof. Pradip Swarnakar

Dept. of Humanities & Social Sciences

Sponsor: American Friends of Edelgive Foundation



**T**ransitioning to a low-carbon economy is a long-term process, the implications of which may become prominent in the coming 15-30 years in the coal regions of India. By then the economy and the workforce in these regions will witness significant changes, majority of them will come from the today's youth. To make this transition just and inclusive there needs to be a fine-tuning of the aspirations and skills of the young people and the demands of the changing labour market.

In this context, the primary objectives of the current project include identifying the latent skills of the Indian youth, aligning them with their aspirations, and fostering economic growth through skill utilization.

This project operates in collaboration with leading institutions, government bodies, and coal stakeholders to create a holistic approach towards sustainable economic diversification. It will facilitate comprehensive survey research along with data analytics to match individual skills with emerging job opportunities. Therefore, promoting economic diversification in coal dependent Indian states and contributing to the nation's sustainable growth.

#### Deliverables

- Field reports with policy-relevant and community-centric recommendations
- Stakeholder-level workshops
- Expert talks

### PAHAD-3K Paleohydrological variability and socio-ecological dynamics in high-altitude Kashmir over the last 3000 years

PI: Prof. Debajyoti Paul

Dept. of Earth Sciences

French PI: Dr. Elodie Brisset, Mediterranean Institute of Biodiversity and Ecology IMBE, France

Sponsor: Centre Franco-Indien pour la Promotion de la Recherche Avancée (CEFIPRA)



**T**he ongoing global and regional climate shifts aided by anthropogenic forcings are a challenge to fragile ecosystems and directly affect socio-economic development. Lake sediments are valuable archives of past Human-Environment interactions and climate changes because they act as a sink.

This project aims to study drill-sediments from several lakes in the Kashmir Himalayas as a proxy for reconstruction of centennial-scale hydroclimatic variability in this region over the last 3000 years. It is planned to collect drill-sediment cores from eight new lakes in the western Himalayas. Based on a Source-to-Sink approach in these geosystems, and high-resolution multidisciplinary (sedimentological, geochemical, geochronological, paleobotanical, and glacial geomorphological) data generated in this project, they will reconstruct centennial-scale hydrological variability and associated socio-ecological changes in response to climate fluctuations in the high-altitude western Himalayan regions over the past 3000 yrs. The outcome will help management efforts for sustainable conservation actions, suitable to this under-investigated region.



*A view of a Himalayan Lake from where two drill-sediment cores have been obtained for this study*

# Recent Projects

## Biofuel Production from Carbon Dioxide (CO<sub>2</sub>) and Utilisation in the Transport Sector for Reducing Greenhouse Gas (GHG) Emissions

PI: Prof. Avinash Kumar Agarwal  
Dept. of Mechanical Engineering

Austrian PI : Prof. Franz Winter

Institute of Chemical, Environmental and Bioscience Engineering, Technical University, Wien, Austria

Sponsor: Ministry of Human Resource & Development (MHRD)



Due to strict environmental protection regulations, controlling greenhouse gases, especially CO<sub>2</sub>, is necessary. It can be utilised as a raw material to produce fuels. By utilising biofuels such as methanol produced from CO<sub>2</sub> as a fuel in two-wheeler engines, we can reduce the dependence of the two-wheeler segment of the Indian automotive sector on fossil fuels. India plans to achieve ethanol blending of petrol up to 20%, which is 11% at this stage. Ministry of Road Transport and Highways, and the National Institution for Transforming India (NITI Ayog) are preparing a road map to reduce crude import bills by adopting the 'Methanol Economy'. Methanol will be blended with gasoline to formulate M15 (85% gasoline v/v and 15% methanol v/v). This study aims to utilise the methanol produced and ethanol to prepare M15 and E20 (80% gasoline v/v and 15% methanol v/v) blends for fuelling the vehicles. This project will compare the performance, combustion, and emission characteristics of biofuel (Methanol and Ethanol) powered two-wheeler engines with baseline gasoline-powered engines.

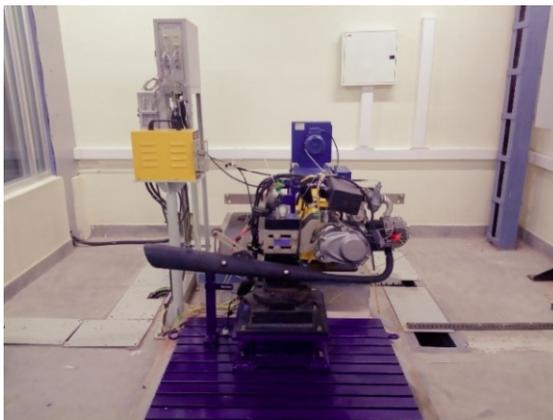
### TU Wien

First, the team will focus on the process development and methodology for producing methanol from carbon dioxide (CO<sub>2</sub>). An experimental setup/ pilot plant will be developed to produce methanol. By this concept, CO<sub>2</sub> can also be recovered from industrial sources and human activities and converted into methanol.

Secondly, other fuel alcohols, namely ethanol, will be investigated for production via direct biological CO<sub>2</sub> utilisation in combination with H<sub>2</sub> or conversion of glucose derived from cellulosic biomass generated from CO<sub>2</sub> utilisation.

### IIT Kanpur

M15 and E20 blends will be prepared outside the fuel tank to prepare homogeneous miscible blends. M15 and E20 injection in the engine is quite an economical method of fuel induction because it does not require hardware modifications or external devices for separate methanol injection into the engine. A single-cylinder test bench facility is available for performance, emission, and combustion assessment. This test will be based on a comparative analysis of M15 and E20-fuelled engines with respect to baseline gasoline-fueled engines. The calorific values of methanol and ethanol are significantly lesser than gasoline. Hence, ECU recalibration is required for all engine operating points for using methanol as a fuel in the tests.



*Transient Dynamometer for Engine Development*



*Chassis Dynamometer for Vehicle Development*

# Recent Projects

## Deciphering the role of nuclear Arp8 in rRNA Recognition - Role beyond Chromatin Remodelling

PI: Prof. Saravanan Matheshwaran

Dept. of Biological Sciences & Bioengineering

Sponsor: Science & Engineering Research Board (SERB)

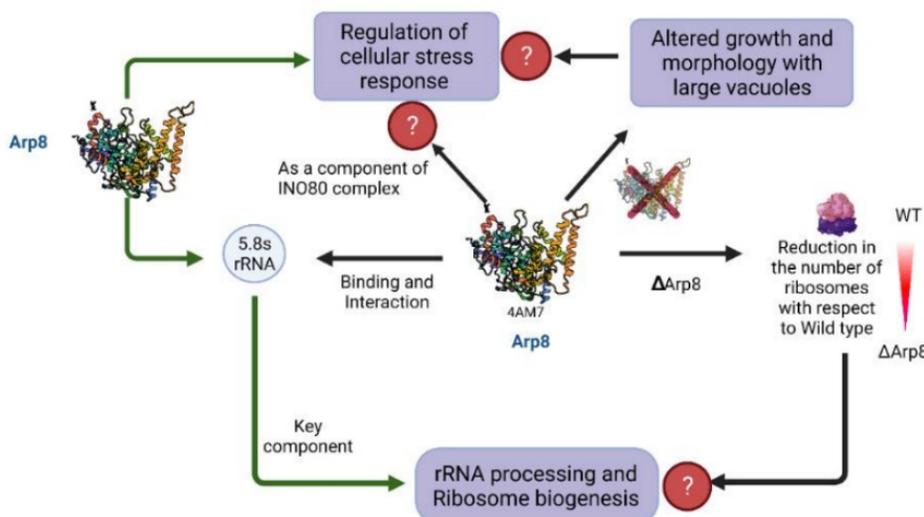


Ribosome biogenesis is extremely challenging with respect to energy and resources, its fidelity and rRNA transcription is strictly examined and regulated during cellular stress conditions. The role of CRCs or its components in ribosome biogenesis is not very clear. A wealth of accumulating evidences supports moonlighting functions for DNA repair proteins in the nucleolar function of making ribosomes. Werner syndrome RecQ like helicase (WRN) and Bloom syndrome RecQ like helicase (BLM) are DNA repair proteins having defined role in ribosome biogenesis by regulating the transcription of pre-ribosomal RNA and quality control of rRNA. Arp8 plays important role in DNA repair and cell cycle progression. Arp8 deletion showed decreased resistance to chemical, acidic and oxidative stress than wild type. These interesting observations from PI's laboratory led them to this proposal to understand the roles of Arp8 beyond chromatin remodelling, especially in ribosomal RNA processing and biogenesis during normal and stress conditions.

### Objectives

- ❑ Biochemical and in silico characterization of yArp8 and 5.8S rRNA binding and determine their Kinetics using wildtype and mutant proteins.
- ❑ To study the in vivo role of yArp8 in genotoxic stress in *Saccharomyces cerevisiae*.
- ❑ To understand the role of yArp8 in ribosome biogenesis/ rRNA processing

The proposed work will provide a handle to delineate the underlying mechanisms by which genotoxic stress impedes rRNA processing/ribosome biogenesis and how Arp8 is involved in these processes. Given the reputation of Arp8 in DNA repair and importance of ribosome biogenesis in critical cellular processes, the cross talk of these two processes will lead to the identification of novel drug targets and development of novel therapeutics.



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### Feedback/Suggestions

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