

The background of the cover is a close-up photograph of a large green daisy flower. The petals are a vibrant green, and the center is a dense cluster of small purple flowers. A large, white circular graphic is centered over the flower, containing the text 'INDO-GERMAN SCIENCE & TECHNOLOGY CENTRE' in a dark green, serif font. At the bottom of the cover, there are white circuit-like lines that resemble a printed circuit board (PCB) pattern, extending across the width of the page.

# INDO-GERMAN SCIENCE & TECHNOLOGY CENTRE

ANNUAL REPORT 2025-26





INDO-GERMAN  
**SCIENCE &  
TECHNOLOGY  
CENTRE**

ANNUAL REPORT 2025-26

# CONTENT

|                                                                                                                                                                        |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Foreword                                                                                                                                                               | 06 |
| From the Director's Desk                                                                                                                                               | 08 |
| The Year 2025-26 at a Glance                                                                                                                                           | 09 |
| Governing Body                                                                                                                                                         | 14 |
| Finance Committee                                                                                                                                                      | 16 |
| IGSTC Programmes                                                                                                                                                       | 17 |
| 2+2 Projects                                                                                                                                                           | 23 |
| AI for Sustainability                                                                                                                                                  | 27 |
| PARAM-VC: Promoting Agricultural Resilience with AI-based Modeling and Value Chain Analysis                                                                            | 28 |
| AQUASURGE: AI-based Quantification of Availability and Sustainability of Renewable Energy and Groundwater for Irrigation across India                                  | 30 |
| FLAIR: Flood inundation Forecasting using AI for Regional Sustainability                                                                                               | 32 |
| MELODY: Machine Learning and Remote Sensing Synergy for Sustainable Crop Production                                                                                    | 34 |
| RESONANCE: Responsible compliance assistance platform for deploying fair and privacy-preserving AI in SMEs                                                             | 35 |
| Waste to Wealth                                                                                                                                                        | 37 |
| BETTERyRec: Integrated bio and hydro metallurgical techniques for the recovery of metals from spent battery waste and recycling wastewater                             | 38 |
| BIOMOPAC: Biobased functional molded fiber packaging from regional agricultural residues                                                                               | 41 |
| ECOPAVE: Sustainable concrete pavements using high volumes of construction, demolition, and industrial wastes as constituent replacements                              | 45 |
| MAX-RAP: From Waste to Resource: Challenges and Opportunities in Maximising Reclaimed Asphalt Pavement Usage                                                           | 48 |
| TRANSFORM: Transforming Industrial Silicon Carbide and Silicon Nitride Ceramics Waste into Products towards Material & Environmental Sustainability (Circular Economy) | 51 |
| Women Involvement in Science and Engineering Research (WISER)                                                                                                          | 55 |

|                                                                                                                                                           |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>IGSTC Industrial Fellowships</b>                                                                                                                       | <b>85</b>  |
| <b>Paired Early Career Fellowship in Applied Research (PECFAR)</b>                                                                                        | <b>109</b> |
| <b>IGSTC-Connect Plus</b>                                                                                                                                 | <b>137</b> |
| <b>Small Immediate Need Grants (SING)</b>                                                                                                                 | <b>141</b> |
| <b>Workshops</b>                                                                                                                                          | <b>149</b> |
| <b>InDeVet: Indo-German Veterinary Partnership: Fostering Innovation in AI-Powered Diagnostics, One Health and Animal Welfare</b>                         | <b>151</b> |
| <b>UPFLOO: Unconventional Perspectives on Flood Risk: Opportunities and Motivating Narratives</b>                                                         | <b>153</b> |
| <b>QTCCS 2025: Indo-German Workshop on Quantum Technologies – Computing, Connectivity and Security</b>                                                    | <b>155</b> |
| <b>AWM: Ageing, Workplace and Mental Health: A Multipronged Approach to Addressing a Complex Bio-Social Challenge</b>                                     | <b>158</b> |
| <b>MAITRE: Metrics for Measurement of Artificial Intelligence for Trustworthy, Reliable and Explainable Applications</b>                                  | <b>160</b> |
| <b>RaCoPBuS:NET: Indo-German workshop on leveraging Radiative Cooling Potential of Building Surfaces: Stepping towards Net-zero Emissions Target</b>      | <b>163</b> |
| <b>Indo-German Medical Partnership Workshop – InDeMed: AI, Extended Reality, and Robotics in Healthcare – Emerging Pathways from Diagnosis to Therapy</b> | <b>165</b> |
| <b>SHINE 2025: Sustainable Handling of Innovative Membrane Technologies for Environmental Protection</b>                                                  | <b>168</b> |
| <b>Cat4SusChem: Catalysis for Sustainable Chemical Synthesis and Energy Technologies: Towards Industrial Relevance</b>                                    | <b>170</b> |
| <b>DPG-WaSPUR: Digital Public Goods for Water Sensitive Planning and Urban Flood Resilience</b>                                                           | <b>173</b> |
| <b>Indo-German Joint Scientific Workshop on Receptor Modelling, Applications and Technical</b>                                                            | <b>175</b> |
| <b>IGSTC Research &amp; Innovation Dialogue Series</b>                                                                                                    | <b>179</b> |
| <b>Outreach Activities</b>                                                                                                                                | <b>183</b> |
| <b>List of Publications</b>                                                                                                                               | <b>195</b> |

# Foreword



**Dr. Simon Preker**

German Embassy  
New Delhi

Science thrives on curiosity, but its greatest achievements emerge through collaboration. For more than a decade, the IGSTC has embodied this principle, serving as a trusted platform where researchers, innovators, entrepreneurs, and institutions from India and Germany come together to address shared challenges and seize new opportunities. Luckily, this is truer than ever in 2026, a year in which both countries celebrate 75 years of diplomatic relations.

In today's increasingly interconnected world, scientific cooperation is a necessity. The partnership between India and Germany demonstrates how two countries with distinct traditions, strengths, and perspectives can jointly advance knowledge, innovation, and sustainable development. In this regard, IGSTC has become an essential pillar of this relationship, fostering scientific excellence while creating the personal and professional connections that sustain long-term cooperation.

What makes IGSTC particularly valuable is its unique ability to bridge the worlds of science and industry. Through its flagship 2+2 model, research institutions and companies work hand in hand from the outset, ensuring that scientific breakthroughs are not confined to laboratories but translated into practical applications, technologies, and solutions. This approach benefits both sides: it strengthens innovation ecosystems, accelerates technology transfer, and demonstrates how international cooperation can create tangible value for society and the economy alike.

The achievements highlighted in this Annual Report testify to the strength of this model. Yet they represent more than successful projects or technological advances. Every joint proposal, every researcher exchange, and every collaborative innovation contributes to something equally important: trust. Over time, professional partnerships become enduring networks, and networks become friendships. In this way, IGSTC does not

merely connect institutions—it builds bridges between people.

Beyond collaborative research projects, IGSTC's fellowship and mobility programmes continue to strengthen the human foundations of Indo-German scientific cooperation. Initiatives such as the IGSTC Industrial Fellowships, WISER, PECFAR, SING, and the IGSTC-CONNECT Plus Fellows programme provide valuable opportunities for researchers, innovators, and young professionals to gain international experience, build lasting networks, and deepen mutual understanding. These exchanges not only advance individual careers but also cultivate the next generation of Indo-German scientific partnerships.

The future potential of this cooperation is immense. As India and Germany deepen their strategic partnership and confront common challenges ranging from climate change and sustainable industrial transformation to digitalization and health innovation, the role of scientific collaboration will only grow in

importance. IGSTC is uniquely positioned to help shape this future by connecting outstanding research with entrepreneurial ambition and by bringing together the talent, creativity, and determination of both nations.

IGSTC has consistently demonstrated its ability to evolve, adapting to emerging priorities while remaining true to its founding mission: enabling excellent science, fostering innovation, and strengthening Indo-German ties. As we look ahead, we can be confident that the Centre will remain not only a catalyst for discovery, but also a cornerstone of one of the world's most dynamic bilateral scientific relationships.

On behalf of the German Embassy, I would like to express my sincere appreciation to all researchers, innovators, industry partners, institutions, and stakeholders whose dedication makes this success possible. Their work reminds us that while knowledge may know no borders, meaningful cooperation is built by people willing to cross them.

## From the Director's Desk



**Dr Kusumita Arora**

Director  
IGSTC

It is my privilege to sign off the IGSTC Annual Report of 2025-2026. India's Science and Technology (S&T) legacy spans thousands of years, blending profound ancient discoveries with robust post-independence modernization, encompassing pioneering mathematical concepts and astronomical observatories, which evolved into modern day landmark achievements in space exploration, defense and strategic technologies, nuclear energy, biotechnology and digital innovation. Germany's leadership in S&T is foundational to the development of the modern world: pioneering breakthroughs in the theory of relativity, quantum mechanics, and leading innovations in the automobile, medical and pharmaceutical, advanced materials, and manufacturing sectors. When India and Germany decided to join forces to conduct S&T research to solve specific challenges of the modern world, this organization IGSTC was born in 2010.

Science and Technology (S&T) research is a highly collaborative, interdisciplinary, and iterative process. In today's ecosystem, instances of breakthroughs increase when scientific theory and technological application advance simultaneously. The global challenges of climate change, sustainable development and health for all, require merging of physical sciences, engineering, and even social sciences. Impactful outcomes emerge from networks that link universities, national laboratories, and private industries to foster rapid technology translation. The ultimate goal is to translate data and knowledge into commercially viable solutions, which can improve public well-being.

Over the past months I have experienced in person, the increased synergy between the Indian and German researchers and their convergence towards solving global issues. The Governing Body, the Finance Committee and all the IGSTC research partners contribute to make this happen. I am of the firm belief that the future will bring new strength and growth for IGSTC and its partners.

# The Year 2025-26 at a Glance

Every year leaves behind a few defining moments that shape an institution's journey. For IGSTC, 2025-26 was one such year. It was a year of continuity and change—one that built upon the foundations laid over the past sixteen years while opening a new chapter in the Centre's evolution.

Science and technology partnerships are not created in a single project or a single year. They are built patiently—through sustained collaboration between researchers, institutions, industries and governments. Since its establishment, IGSTC has worked towards strengthening this partnership between India and Germany by creating opportunities for people to work together, exchange ideas and develop technologies that address common challenges. Looking back today, the Centre has grown well beyond its original mandate

of supporting collaborative research projects. It has evolved into a platform that connects researchers across career stages, promotes industry-academia engagement, encourages women in science, supports young investigators and creates space for new scientific ideas to emerge.

This gradual evolution has been possible because IGSTC has continuously responded to changing priorities. Scientific cooperation today extends far beyond laboratory research. It requires stronger engagement with industry, faster translation of knowledge into technologies, support for young researchers, greater participation of women scientists and sustained dialogue between governments, funding agencies and the scientific community. The programmes of IGSTC have expanded over the years with precisely this objective.

## The year under review reflected this evolution in many ways.

One of the most significant developments during the year was the transition in leadership. On 31 July 2025, Mr. R. Madhan completed his tenure as Director of IGSTC. During his leadership, the organisation witnessed an important phase of expansion. New programmes such as the Industrial Fellowship, Women Involvement in Science and Engineering Research (WISER), Paired Early Career Fellowship in Applied Research (PECFAR) and Small Immediate Need Grants (SING) were introduced, broadening IGSTC's engagement with the scientific community and creating opportunities that extended well beyond collaborative research projects. These initiatives have now become integral parts of the Centre's portfolio and continue to benefit researchers at different stages of their careers.



On 11 September 2025, Dr. Kusumita Arora assumed charge as Director of IGSTC. Her appointment marked a historic milestone as she became the first woman to lead the Centre. At the same time, it represented continuity rather than change in direction. Building upon the strong foundations laid over the years, the focus remains on strengthening Indo-German partnerships through high-quality research, innovation and institutional collaboration while responding to emerging scientific priorities.

The programmes implemented during the year reflected this approach. The flagship 2+2 Collaborative R&D Programme continued to support application-oriented research in areas such as artificial intelligence for sustainability, advanced manufacturing, circular economy, battery technologies and water technologies.

With more than sixty-five collaborative projects supported since its inception, involving over 240 organisations from academia, research institutions and industry, the programme continues to demonstrate the

value of bringing together complementary expertise from India and Germany to address problems of mutual interest.

Equally important was the continued investment in people. Scientific collaboration ultimately depends on researchers, and during the year IGSTC strengthened support across different stages of the research ecosystem. Twenty researchers were selected under the Industrial Fellowship Programme to undertake research in German industrial R&D organisations. Twenty pairs of women researchers were supported under the WISER Programme—the highest number of awards made under the programme so far—reflecting both the quality of proposals received and the growing enthusiasm for bilateral collaboration among women scientists.

The PECFAR Programme supported another twenty Indo-German pairs of early-career researchers, while SING continued to encourage promising new collaborations requiring modest but timely support.



IGSTC Partners Meet 2025 at Bremen

Networking remained an equally important part of IGSTC's activities. Throughout the year, bilateral workshops brought together researchers working in diverse fields ranging from quantum technologies and artificial intelligence to One Health, mental health, flood resilience and digital surgery. While each workshop addressed a different scientific theme, together they served a common purpose: enabling researchers to meet, exchange ideas and develop the collaborations that often become the basis for future joint projects.

During the year, IGSTC also strengthened its role as a platform for strategic dialogue. Two Strategic Conclaves on Mobile Health & Telemedicine and Integrated Water Resource Management brought together policymakers, scientists, industry leaders, startups and research organisations from

both countries. These discussions went beyond presenting ongoing research. They focused on identifying areas where India and Germany could work together to address future challenges through science, technology and innovation.

Another memorable moment for the Centre was the visit of Dr. Silke Launert, Parliamentary State Secretary of the Federal Ministry of Research, Technology and Space (BMFTR), to India. The visit reaffirmed the importance attached by both governments to scientific cooperation and provided an opportunity to showcase the outcomes of IGSTC-supported programmes. It also coincided with the reconvening of the 12th India-Germany Joint Science and Technology Committee, underlining the continuing strength of the bilateral partnership.



*Glimpse from the Dr. Silke Launert's, Parliament State Secretary, Federal Ministry of Research, Technology and Space (BMFTR) visit to India*



*Glimpse from the Dr. Silke Launert's, Parliament State Secretary, Federal Ministry of Research, Technology and Space (BMFTR) visit to India*

IGSTC organised a three-day Team Workshop from 1–3 July 2025 bringing together colleagues from its India and Germany offices to review ongoing programmes, exchange experiences, and identify practical measures for improving programme implementation and institutional processes. The discussions focused on strengthening flagship initiatives, enhancing the Project Management System, expanding outreach in both countries, improving website and social media engagement, developing an IGSTC alumni network, and streamlining administrative and financial procedures. The workshop concluded with a set of actionable recommendations that will guide improvements in programme delivery, stakeholder engagement, digital systems and internal coordination, while supporting IGSTC's continued efforts to strengthen Indo-German science and technology cooperation.

IGSTC continued to increase its visibility through participation in conferences,

institutional roundtables and outreach activities across the country. Whether at Hyderabad during the Transforming Healthcare with IT Conference or at Chandigarh during the Indo-German Science & Technology Roundtable, the objective remained the same—to build new connections, understand emerging priorities and expand the network of institutions participating in Indo-German collaboration.

Looking back, the year cannot be described simply in terms of the number of projects funded, workshops organised or fellowships awarded. More importantly, it demonstrated the growing maturity of an institution that has steadily expanded its programmes while remaining focused on its core purpose—bringing together the scientific strengths of India and Germany. The year also reminded us that meaningful international partnerships are built over time, through trust, continuity and sustained engagement.

As IGSTC moves forward, it does so with the confidence of an institution that has grown through experience while continuing to evolve. The challenges before us are changing rapidly, but the need for strong international scientific partnerships remains constant. With this

understanding, IGSTC will continue to strengthen collaborative research, support scientific excellence and create opportunities for researchers and innovators from both countries to work together in developing solutions that benefit society.



*Deliberations during the Team workshop*

# Governing Body



**Praveenkumar  
Somasundaram**

DST  
Indian Co-Chair



**Yatinder Prasad**

DST



**K K Pant**

IIT Roorkee



**Ankit Mehta**

ideaForge Technology  
Limited



**Tata Narasinga Rao**

Sri Venkateswara University



**Kathrin Meyer**  
BMFTR  
German Co-Chair



**Martin Goller**  
BMFTR



**Michaela Wilhelm**  
University of Bremen



**Viktoria Apitzsch**  
German Embassy



**Wolf Muth**  
KfW

# Finance Committee



**Yatinder Prasad**  
DST



**Renata Ch. Feldmann**  
BMFTR



**Arindam Bhattacharya**  
DST



**Martin Goller**  
BMFTR

# IGSTC Programmes

## An Overview of Programme Portfolio

The Indo-German Science & Technology Centre (IGSTC) is a premier joint initiative established by the Department of Science and Technology (DST), Government of India, and the Federal Ministry of Research, Technology and Space of Germany (BMFTR), Government of Germany. As a flagship bilateral funding agency, IGSTC envisions fostering advanced Indo-German research collaborations by supporting joint R&D+I

projects, capacity building, and networking opportunities across diverse domains of Science, Technology, Engineering, and Mathematics (STEM).

By bridging academia and industry, IGSTC's robust portfolio empowers researchers at all stages—from PhD scholars to senior industry professionals—to create scalable, real-world technological solutions.

## Core Research & Innovation Programme

### IGSTC 2+2 Projects

This flagship programme supports joint R&D+I projects of high industrial relevance through a unique '2+2 Mode of Partnership'. It mandates the combined participation

of research/academic institutions and industrial partners from both nations to develop exploitable research results leading to new technologies, products, or services.

#### Partners



Minimum of 4 and maximum of 6 partners. The structure requires one academic/ research institute and one industry player from India, alongside one academic/ research institute and one industry player from Germany.

#### Duration



3 years (eligible for an extension phase of up to 2 years for selected projects).

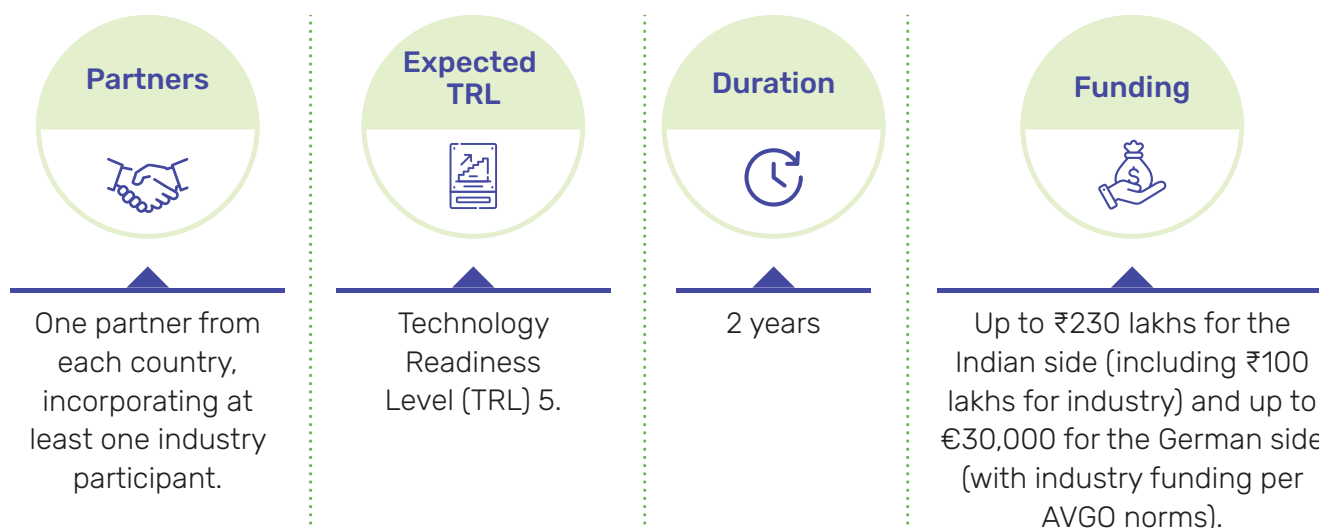
#### Funding



Indian side: ₹350 lakhs (includes ₹150 lakhs allocated for industry). German side: €500,000 (includes industrial funding aligned with De-Minimis or AGVO frameworks).

## Phase II of 2+2 Projects

Designed for selected 2+2 projects that demonstrate highly promising results, this phase provides an extension with additional financial support to bridge the transition between relevant environment validation and full system qualification.



## Women Involvement in Science and Engineering Research (WISER)

WISER targets the gender gap in research by supporting proposals in paired mode from women researchers in India and Germany. The program fosters innovation, enhances networking, and builds long-term collaboration across all areas of STEM.

### Eligibility & Age

Open To Women Holding Regular Or Long-term Research Positions In Academia, Research Institutes, Or Industries. No Age Limit.

### Tenure

3 years, featuring 1-month per year research stays in the host country.

### Financial Assistance

Indian Awardee: Up to ₹39 lakhs (covers research staff, consumables, travel, etc.). German Awardee: Up to €48,000. Both include a €2,300 per diem while in the host country.

## Capacity Building & Early Career Fellowships

### Paired Early Career Fellowship in Applied Research (PECFAR)

PECFAR facilitates a two-way exchange of early-career Indian and German researchers working in pairs. It supports short-duration stays to explore the bilateral research landscape, build networks, and nurture future partnerships with complementary expertise in STEM fields.

#### Eligibility



Early career researchers holding regular positions in academic/research institutions/industries or long-term nationally recognized fellowships. Minimum qualification requires a Master's in Science or a Bachelor's in Engineering (Age limit: 40 years). Applications must be submitted jointly by the pair.

#### Tenure



Minimum of 1 month, maximum of 2 months.

#### Financial Assistance



A fellowship stipend of €2,300 per month per awardee, alongside a single round-trip economy class airfare, visa fees, and medical/travel insurance up to €1,500.

### IGSTC Industrial Fellowships (IF)

To motivate and facilitate young Indian researchers toward applied research, this program provides direct exposure to the advanced German industrial ecosystem and enhances institutional capacity building.

#### PhD Industrial Exposure Fellowship (PIEF)

Pursuing or completed one year of a PhD in Science/Engineering (Age limit: 28 years). Duration: 3 to 6 months. Funding: Stipend of €1,500 per month, plus travel, visa, and medical insurance.



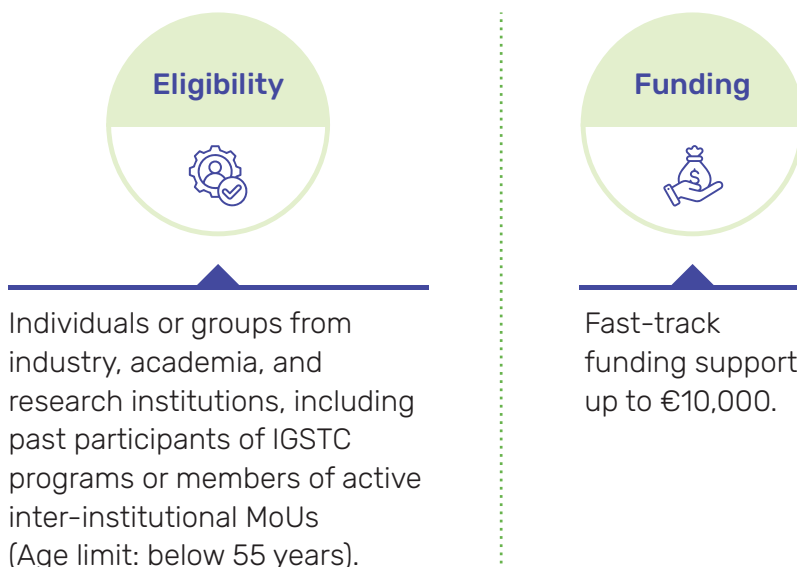
#### Post Doctoral Industrial Fellowship (PDIF)

Awarded a PhD in Science/Engineering within the last 2 years (Age limit: 35 years). Duration: 6 to 12 months. Funding: Stipend of €2,500 per month, plus travel, visa, and medical insurance.

## Targeted & Agile Support Grants

### Small Immediate Need Grants (SING)

An agile, single-window grant scheme with fast-track processing and low turnaround times. SING provides quick assistance for ad-hoc opportunities and modest-scale collaborative ideas that hold potential to ignite long-term technology development.



## Knowledge Networks & Platforms

### IGSTC Bilateral Workshops

This initiative funds bilateral workshops hosted in India or Germany, designed around specific research topics of mutual interest to DST and BMFTR. It serves as a vital platform for the cross-fertilization of ideas, establishing joint knowledge pools, and enhancing industrial competitiveness.

**Eligibility:** Proposals must feature joint coordinators from India and Germany holding regular positions in universities, higher education institutions, or public/private non-profit research organizations (Training workshops are excluded).

**Funding & Support:** Approximately €30,000 / ₹25 lakhs. The grant covers international and domestic airfare, accommodation, organizational/logistics expenses, and event costs for up to 30 participants.





# 2+2 PROJECTS



IGSTC 2+2 Projects has a unique consortia based partnership model wherein of at least one academic or research institute and one industrial partner from both India and Germany are required to execute the project. This framework targets joint research, development, and innovation (R&D+I) of direct industrial relevance. The primary expectation is for projects to deliver exploitable results that translate into new technologies, products, or services, achieving a minimum Technology Readiness Level (TRL) of 5.

For the 2025-2026 cycle, the portfolio addresses two critical themes: "AI for Sustainability" and "Waste to Wealth". Within "AI for Sustainability," PARAM-VC combines process-based crop simulations with machine learning to issue hyperlocal, climate-resilient agricultural advisories. AQUASURGE deploys an AI-informed physical model to map sustainable groundwater yields and renewable energy potentials for irrigation. FLAIR develops a near-real-time probabilistic flood forecasting framework by assimilating multi-source Earth observations into AI-driven hydrodynamic models. Additionally under this theme, the MELODY project leverages satellite remote

sensing and machine learning to develop an Agricultural Sustainability Key Performance Indicator (ASK) to guide sustainable crop production, while the RESONANCE project provides a compliance assistance platform to help SMEs successfully deploy fair and privacy-preserving AI systems.

Under "Waste to Wealth," the projects focus on scalable circular economy technologies. Batteryrec utilizes integrated bio- and hydrometallurgical processes to selectively recover critical metals from spent batteries and recycling wastewater. BIOMOPAC transforms agricultural residues into fully biobased, recyclable molded fiber packaging with functional barrier coatings. For sustainable infrastructure, ECOPAVE designs concrete pavements that replace over 60% of virgin aggregates and Portland cement with construction and industrial waste, while MAX-RAP implements an industrial-scale dry centrifuge process to maximize the recovery and reuse of reclaimed asphalt pavement. Finally, TRANSFORM recycles industrial silicon carbide and silicon nitride waste into advanced ceramic components using Polymer Derived Ceramic (PDC) technology.





# AI FOR SUSTAINABILITY

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# PARAM-VC: Promoting Agricultural Resilience with AI-based Modeling and Value Chain Analysis

## Project Investigators



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## Project Summary

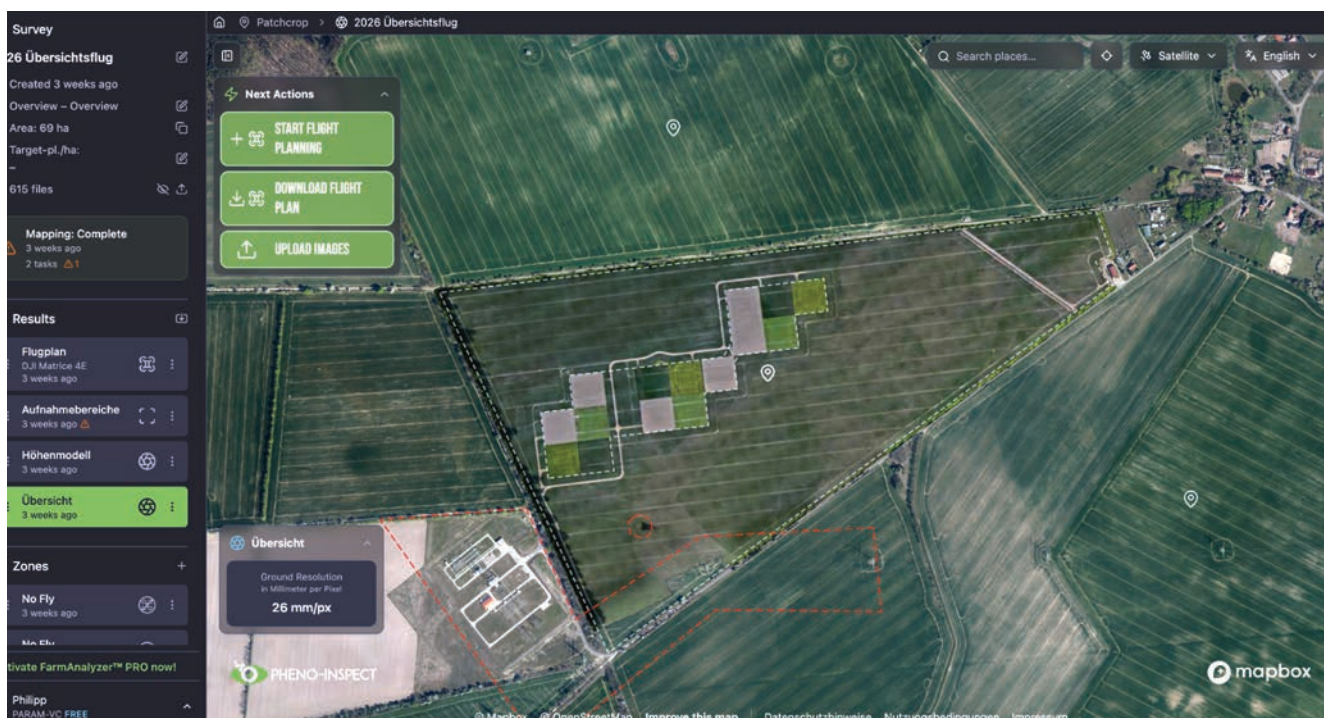
The project aims to develop an intelligent, hyperlocal analytics framework for farm-level crop advisories, enabling sustainable agriculture and climate resilience. Focusing on wheat and maize in India and Germany, it will forecast seasonal crop yield per farm and quantify risks from extreme weather (drought, floods, heat waves, excessive rainfall). Using

Machine Learning to fuse satellite, drone, and sensor data, the project will create dynamic farmland maps with annotations on crop type, health, and soil properties. AI/ML models combining process-based crop simulations with downscaled weather forecasts will generate data-driven agro-advisories optimizing outcomes for all stakeholders.

## Key Highlights

- Built a Hybrid Crop Modelling framework integrating the Lintul5 Process-Based Model with Machine Learning algorithms, fusing physical reliability of biological processes with AI-driven predictive power.
- Developed a standardized, high-resolution farmland dataset schema and a knowledge graph for LULC classification, integrating multi-source sensing data with complex-valued Neural Networks to enhance AI-ready analytics and land-use mapping accuracy.
- Developed a high-resolution weather forecast pipeline for India by coupling global forecast models with regional bias correction and downscaling, with benchmarks established.

- Operationalized drone-based crop monitoring tested DJI Matrice 4T, performed thermal sensor radiometric calibration, built RGB/thermal registration workflows, and acquired field datasets in the Templiner region for AI model development and plant stress detection.
- Generated agricultural masks for Bulandshahr and Hisar (India) and Brandenburg (Germany), along with a wheat acreage map of Hisar for the 2025-26 season.



Centralized organization of WP4 field data in the FarmAnalyzer platform, supporting structured data management and later integration of drone-derived outputs into the PARAM-VC modelling workflow. (Credits: Dr. Philipp Lottes, PhenolInspect, Germany)



Centralized organization of WP4 field data in the FarmAnalyzer platform, supporting structured data management and later integration of drone-derived outputs into the PARAM-VC modelling workflow. (Credits: Dr. Philipp Lottes, PhenolInspect, Germany)

# AQUASURGE: AI-based Quantification of Availability and Sustainability of Renewable Energy and Groundwater for Irrigation across India

## Project Investigators



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## Project Summary

The primary goal of AQUASURGE is to develop an interactive online map service that provides stakeholders with high-resolution, actionable insights into sustainable groundwater (GW) resources and renewable energy potential across India. This platform aims to support agricultural production by offering detailed information on the sustainable GW supply and the renewable energy needed for water pumping in irrigation systems. This clarifies if the current GW abstraction scheme is sustainable, if not, where action for transition towards more effective GW utilisation is necessary. By integrating advanced Artificial Intelligence (AI) techniques with environmental data and in situ measurements, the research will generate spatially continuous maps of these resources not only for the current situations but also offer predictive insights into their future availability under the impact of climate change, focusing on the 2030 to 2100 timeframe.

To achieve this, the project will establish a physically-informed AI framework that uses land surface hydrology and energy balance equations. The model will incorporate critical data on human water usage and ecological water demand to estimate GW sustainable yield

under a variety of environmental and climatic conditions. The validity and robustness of these estimates will be enhanced through geophysical and geochemical surveys in selected hotspots, allowing detailed analysis of feasibility and limitations for sustainable GW extraction. In addition to GW, the project will evaluate the potential of renewable energy resources, specifically wind speed and shortwave incoming solar radiation, which are essential for agricultural irrigation. By mapping the spatial and temporal distribution of these energy sources across India, we will provide stakeholders with cost estimates and identify regions with significant renewable energy potential, facilitating targeted infrastructure development. Climate change impacts form a key focus of the research. Outputs from advanced predictive climate models (both global and regional climate models) will assess how long-term shifts in climate affect both GW sustainable yield and renewable energy availability across India. These models will provide scenario-based projections, enabling more strategic resource planning for agricultural water and energy needs in the future. The computations will be implemented on the Jülich supercomputing facilities.

# FLAIR: Flood Forecasting using AI for Regional Sustainability

## Project Investigators



**A.K. Keshari**

IIT Delhi



**Drissia TK**

Centre for Water  
Resources Development  
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**Swarn Pant**

Suhora Technologies



**Antara Dasgupta**

RWTH Aachen University



**Julian Hofmann**

FloodWaive Predictive  
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## Project Summary

FLAIR addresses a critical and growing societal challenge: the lack of reliable, high-resolution, near-real-time flood inundation forecasts for vulnerable and data-scarce regions. Its uniqueness lies in integrating trustworthy AI, Earth Observation, deep data assimilation, and AI-based reservoir operation optimization into a single operational forecasting framework. By using AI as a dynamic emulator of flood processes and assimilating satellite-derived flood extents and water levels, the programme moves beyond static hazard maps and computationally intensive physics-based

modelling toward real-time probabilistic forecasts of flood extent, depth, timing, and reservoir-controlled releases. Tested across contrasting flood-prone basins in Germany and India, FLAIR offers strong translational potential through API-based deployment, open-source toolboxes, and commercializable EO and forecasting products. Its broader impact lies in enabling earlier warnings, more adaptive reservoir management, improved disaster preparedness, and enhanced climate resilience for communities exposed to increasingly frequent and severe floods.

## Key Highlights

- Successfully installed the CaMa-Flood hydrodynamic model and initiated test simulations for the Chalakudy River Basin targeting the 2018 Kerala flood event; database preparation for model forcing and validation is currently underway.
- Suhora and Floodwaive have started building the data pipelines for the project and setting up the AI models for the flood mapping and modelling, respectively.
- Organization of virtual project Kick-off and planning the in-person kick-off meeting in India in 2027.

# MELODY: Machine Learning and Remote Sensing Synergy for Sustainable Crop Production

## Project Investigators



**Neeraj Goel**

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**Mukesh Saini**

IIT Ropar



**Sridhar Kotra**

AgriMatrix India Pvt Ltd



**Sohan Lal**

TU Berlin



**Riazuddin Kawsar**

Spacenus GmbH

## Project Summary

This interdisciplinary research project aims to develop an Agricultural Sustainability Key Performance Indicator (ASK) to monitor and guide policy decisions on sustainable crop production, addressing climate change challenges and ensuring food security. Leveraging satellite remote sensing and Machine Learning (ML) technologies, the project will generate essential agricultural data for advanced crop modeling and conduct comprehensive analyses of agricultural inputs to optimize efficiency. The development of a comprehensive ASK and a robust business case

will drive policy guidance and commercialization efforts. Through collaboration between German and Indian academia and industry, the project combines expertise in satellite imaging, sustainable farming practices, compute-intensive processing, and AI/ML, offering innovative solutions for global agricultural challenges. This partnership promotes technology exchange, addresses global concerns about plant diseases, and supports data-driven policy formulations for climate-resilient agriculture.

# RESONANCE: RESPONsible compliance assistANCE platform for deploying fair and privacy-preserving AI in SMEs

## Project Investigators



**Mainack Mondal**  
IIT Kharagpur



**Srinivas Padmanabhuni**  
TestAlng.com  
(AIEnsured)



**Avikarsha Mandal**  
Fraunhofer Institute for  
Applied Information  
Technology FIT



**Martina Schuster**  
ai.dopt GmbH

## Project Summary

Today Small and medium-sized enterprises (SME), often develop and leverage customized data collection-storage-process pipelines and AI technologies based on the collected data. However, these SMEs are often subjected to privacy/fairness laws to ensure responsible handling of data in their data pipeline (e.g., GDPR in EU, DPDP in India, upcoming EU AI regulations). Ensuring such compliance is possible for large enterprises via auditing and engineering systems by a team of expert lawyers and developers. However, this process is both time-consuming and resource intensive,

resulting in a huge barrier for SMEs to be compliant with such regulations, putting them at a significant risk. In this project, the investigators aim to address the challenges by proposing a system titled "RESPONsible compliance assistANCE platform for deploying fair and privacy-preserving AI" (RESONANCE, in short). RESONANCE will help SMEs across EU and India by identifying the system specifications, aligning these specifications with applicable regulations and recommending concrete SME-specific legally compliant data pipelines and AI models.



An aerial photograph of a dense, vibrant green forest. A winding river or stream flows through the lower-left portion of the image. Wisps of white mist or smoke rise from the forest canopy, particularly in the center-right area. The top of the image is partially obscured by a solid green horizontal band.

# WASTE TO WEALTH

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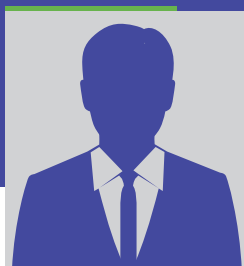
# Betteryrec: Integrated Bio and Hydro Metallurgical Techniques for the Recovery of Metals from Spent Battery Waste and Recycling Wastewater

## Project Investigators



**Nilotpala Pradhan**

CSIR-Institute of Minerals & Materials Technology (CSIR-IMMT)



**Debasish Das**

Himadri Speciality Chemical Ltd. (HSCL)



**Martin Rudolph**

Helmholtz-Zentrum Dresden-Rossendorf (HZDR)



**Carsten Dittrich**

MEAB Chemie Technik GmbH

## Project Summary

BETTERyRec aims to develop an innovative and environmentally friendly process that integrates biotechnology with hydrometallurgy for the recovery of critical and base metals from spent batteries and battery recycling wastewater. Valuable metals in streams, if not recovered, may be permanently lost and contribute to environmental pollution. The project is expected to provide novel insights into the development of a sustainable bioionflotation process for metal recovery from wastewater. The main goals of the project are to optimize and scale up a novel bioleaching process for metal recovery from solid fractions of battery waste; develop a key bioionflotation process for metal recovery from dilute battery

recycling water; and their integration into traditional flotation and leaching methods, followed by metal recovery in pure forms and production of battery grade materials. Such a recycling technology will not only help bridge the gap between the supply and demand of key metals like Li, Co, Ni, and Mn, but also support natural resource conservation and promote the circular economy in battery value chains. The benefits are multi-faceted—economic, environmental, and regulatory—while also enhancing raw material security. The project aligns well with India's Waste to Wealth campaign and Germany's strategic focus on critical metal recovery, circular economy, and research and innovation in battery raw materials.

## Key Highlights

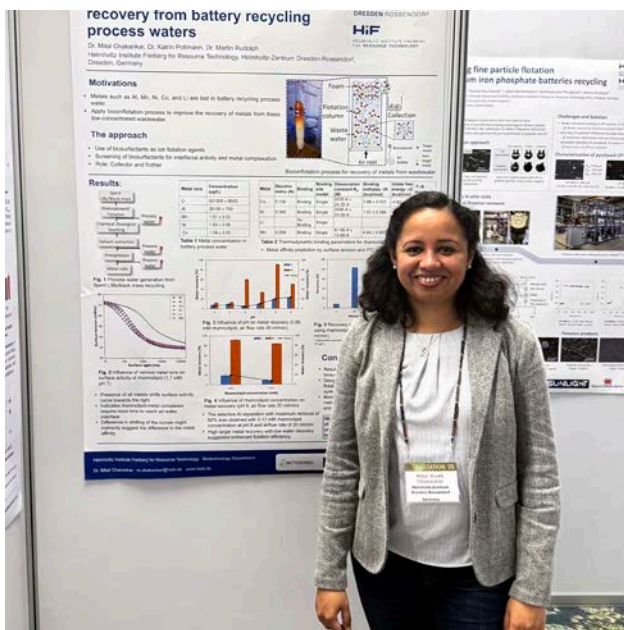
- Magnetic separation of black mass was done, followed by flotation with conventional chemicals, and is being further optimized.
- Chemical leaching was done at a lower temperature roasting. The process achieved significant recovery rates, specifically 99.9% for Cobalt and Manganese, along with 85% Nickel. Further optimization and scale up being done.
- The sequential metal separation process from simulated leach liquors demonstrated high selectivity and efficiency for the recovery of iron, copper, and manganese. Further, methods are being developed for selective recovery from real leach liquor solutions.
- Three types of biosurfactants were evaluated for target metal complexation and further recovery of metals from battery process water by the bioflotation process.
- Rhamnolipid biosurfactants show promising results for Al recovery from battery process water.

## Salient Contributions

- Assessment of the biosurfactant-based bioflotation process for metal recovery from battery recycling process waters. Poster presented by Dr. Mital Chankar at Flotation 2025 Conference, 17-20 November 2025, Cape Town, South Africa.
- Battery dismantling – A business opportunity. Talk presented by Dr. Mamata Mohapatra at the Skill Development Workshop on “Opportunities in Battery Materials and Recycling” on 8-9 December and 15-17 December 2025, CSIR-IMMT, Bhubaneswar, India.
- Microorganism-based valuable recovery from e-wastes. Talk presented by Dr. Nilotpala Pradhan at the Skill Development Workshop on “Opportunities in Battery Materials and Recycling” on 8-9 December and 15-17 December 2025, CSIR-IMMT, Bhubaneswar, India.
- Physical Separation Techniques for Recycling Battery Materials. Talk presented by Dr. Shivakumar Angadi at the Skill Development Workshop on “Opportunities in Battery Materials and Recycling” on 8-9 December and 15-17 December 2025, CSIR-IMMT, Bhubaneswar, India.
- Demo on leaching / downstream processing and separation of target metals. Talk presented by Dr. V. Aishvarya at the Skill Development Workshop on “Opportunities in Battery Materials and Recycling” on 8-9 December and 15-17 December 2025, CSIR-IMMT, Bhubaneswar, India.



Participants attending the Skill Development Workshop on "Opportunities in Battery Materials and Recycling" at CSIR-IMMT. Photo credit- CSIR-IMMT.



Poster presentation by Dr. Mital Chakankar at Flotation 2025 conference, South Africa; Photo credit- Arda Temizkalb



Dr Mamata Mahapatra presenting at Skill Development Workshop on "Opportunities in Battery Materials and Recycling" at CSIR-IMMT. Photo credit- CSIR-IMMT

# BIOMOPAC: Biobased Functional Molded Fiber Packaging from Regional Agricultural Residues

## Project Investigators



**Vibhore Kumar Rastogi**  
IIT Roorkee



**Madhure Desarda**  
Parason Machinery  
India Pvt Ltd



**Roland Zelm**  
TU Dresden



**Frederik Feuerhahn**  
Bionatic GmbH & Co. KG

## Project Summary

Molded Fiber Packaging (MFP) made from natural fibers has diverse applications, but for direct food contact, it traditionally relies on virgin fibers. The main challenge is incorporating functional barriers such as grease resistance, typically achieved using additives derived from fossil raw materials, which compromise the recyclability of the packaging. This project introduces an innovative approach by utilizing vegetable residues from the agricultural industry as both fiber raw material and biogenic additives. Specially treated, highly fibrillated fibers can act as effective barriers against grease and oxygen. However, the dewatering and drying processes for this fiber layer require significant effort and energy, impacting the productivity of

the molded fiber process. In addition to optimizing pulping processes, the project focuses on developing a spray application method to apply these fibers onto a preformed porous fiber network. This innovation aims to streamline the application of fiber-based barrier materials derived from various waste streams, ensuring a balance between protective performance, recyclability, and a favourable environmental footprint, as assessed through life cycle analysis (LCA).

BIOMOPAC addresses the growing global demand for sustainable packaging solutions by transforming underutilized agricultural residues into high-value molded fiber packaging products. The project responds to increasing regulatory and market pressure to replace

single-use plastics and PFAS-containing packaging materials with renewable, recyclable, and environmentally benign alternatives.

The uniqueness of BIOMOPAC lies in its holistic approach. Agricultural residues such as wheat straw, bagasse, and other non-wood biomass streams are not only utilized as the structural fiber source for molded fiber products but are also processed into highly fibrillated materials for functional barrier applications. This creates a fully biobased packaging concept that maximizes biomass utilization while maintaining compatibility with existing paper recycling systems.

The project has demonstrated that agricultural residues can be converted into high-yield pulps

with promising mechanical performance and significantly reduced resource consumption compared with conventional fiber production routes. In parallel, the development of “India's First Automated Laboratory Molding Machine with Barrier Coating” provides a technological platform for integrating biogenic barrier systems directly into molded fiber manufacturing.

Beyond its scientific achievements, BIOMOPAC contributes to the circular bioeconomy by creating new value chains for agricultural residues that are often underutilized or openly burned. The project strengthens Indo-German collaboration by combining complementary expertise in biomass processing, sustainability assessment, packaging technology, and industrial implementation.

## Key Highlights

- **Life Cycle Assessment Framework Established** – Developed a comprehensive methodology for raw material screening and process-level Life Cycle Assessment (LCA), enabling the environmental evaluation of agricultural residues and pulping technologies at an early stage of process development.
- **Agricultural Residues Characterized and High-Yield Pulping Optimized** – Selected and characterized promising feedstocks such as wheat straw, bagasse and rapeseed straw, while optimizing pulping strategies and process parameters to produce high-yield pulps suitable for molded fiber packaging applications.
- **Biobased Barrier Concept Developed** – Advanced the development of functional barrier coatings derived from agricultural residues, supporting the production of recyclable molded fiber packaging without relying on fossil-based or PFAS-containing materials.
- **India's First Automated Laboratory Molding Machine with Barrier Coating** – Designed and developed a novel laboratory-scale molded fiber production system integrating a barrier coating technology, enabling the direct application of biogenic barrier formulations during product manufacturing.
- **Strengthened Indo-German Research and Industry Collaboration** – Organized the International Symposium on “Innovations in Molded Fiber Products” in India, bringing together researchers, technology providers and industry representatives, generating significant visibility and fostering new collaboration opportunities for sustainable packaging solutions.

## Salient Contributions

Staffa, L., Maletz, R., Kleinert, R., Feuerhahn, F., Rastogi, V.K., Ranjan, R., Desarda, M., Verma, A. et al.: "Using Agricultural Residues for the Circular Bioeconomy – The Project BIOMOPAC", published in Müll und Abfall

(2026), presenting the project concept, material selection strategy, pulping approaches, barrier development and sustainability assessment.

### Two patent applications under preparation

1. A biogenic lignin-based barrier coating for molded fiber packaging and tableware, providing a renewable alternative to PFAS-containing barrier systems.
2. A novel process for improving the quality and performance of bagasse-based pulp for molded fiber product manufacturing.



BIOMOPAC Project Team at IIT Roorkee in February 2026



*Developed Automated Laboratory Molding Machine with Barrier Coating*



*Participants of the International Symposium on Innovations in Molded Fiber Products in February 2026*

# ECOPAVE: Sustainable Concrete Pavements Using High Volumes of Construction, Demolition, and Industrial Wastes as Constituent Replacements

## Project Investigators



**Manu Santhanam**

IIT Madras



**Devendra Kumar Pandey**

UltraTech Cement Ltd



**Frank Dehn**

Karlsruhe Institute of Technology (KIT)



**Peter Knoblich**

Hypercon Solutions GmbH

## Project Summary

Rigid pavements provide long service life and high durability. However, their dependence on large quantities of natural aggregates and Portland cement makes them resource and carbon-intensive. ECOPAVE addresses this challenge by developing sustainable concrete pavements through the high-volume use of locally available construction, demolition, and industrial wastes in India and Germany. The project focuses on meeting pavement design requirements while replacing at least 60% of both virgin aggregates and Portland cement with multiple waste streams. The final demonstrator further aims to use more than 80% waste-derived materials in the unbound pavement layers. The work integrates waste

processing, material activation, carbon storage assessment, microstructural characterization, dimensional stability, durability and long-term performance evaluation, mechanistic modelling, and life-cycle assessment within a single framework. By demonstrating the developed approach at the field scale, ECOPAVE establishes a practical pathway towards low-carbon and resource-efficient concrete pavements. The work is expected to reduce landfill disposal, conserve natural resources, lower CO<sub>2</sub> emissions, and advance circular construction practices. The findings will also provide scientific evidence to support future standards, policy development, and large-scale industrial adoption.

## Key Highlights

- Developed mix design approaches for pavement quality concrete containing RCA (Deliverable 4). This approach addresses the concern of high-moisture demand related to RCA. The results of this phase will soon be submitted to an international journal.
- A methodology has been developed to assess the carbon reduction and carbon storage potential of concrete pavements incorporating high volumes of industrial and C&D wastes throughout the pavement life cycle. Preliminary results quantified the CO<sub>2</sub> uptake potential of adhered mortar content of RCA using accelerated carbonation and TGA analysis, with a measured mass loss (CO<sub>2</sub> %) of 12.48% between 500–800°C. Repeat validation and binder CO<sub>2</sub> uptake studies are ongoing to support integration into the mix design methodology.
- Pilot-scale test sections are finalized at two contrasting geographical field locations in India, i.e., Ladakh and Chennai, to validate the optimized paving mixes developed through WP1–WP5.

Preparatory coordination with UltraTech Ltd. has been initiated, marking a key step toward translating laboratory-developed sustainable pavement technologies into field-scale implementation.

- A data-driven model based on Bayesian optimization for concrete mix design optimization has been implemented and tested.
- Activation of recycled concrete fines via thermal, mechanical, and carbonation activation has been tested at the laboratory scale.
- Processed material with optimized particle packing was received from Hypercon Solutions and tested in the laboratory for compressive strength and reaction kinetics.
- A multiscale modeling framework for the prediction of the mechanical properties (elastic modulus and strength) of concrete has been implemented.

## Publications

- Bhardwaj, B. B., & Singh, S. (2026). **Elucidation of asphalt characteristics influencing cement mortar constituted with reclaimed asphalt pavement aggregates.** Journal of Materials in Civil Engineering, 38. <https://doi.org/10.1061/JMCEE7.MTENG-21904>
- Bhardwaj, B. B., Singh, S., & Brand, A. S. (2026). **A strategic framework for using reclaimed asphalt pavement (RAP) aggregates in concrete pavements.** Construction and Building Materials, 514, 145628. <https://doi.org/10.1016/j.conbuildmat.2026.145628>
- Bhardwaj, B. B., Singh, S., & Swaroop, C. R. S. (2025). **Role of asphalt binder film thickness on the behaviour of RAP-incorporated concrete.** Construction and Building Materials, 473, 141012. <https://doi.org/10.1016/j.conbuildmat.2025.141012>



ECOPAVE Meeting at IIT Madras (5th to 7th January 2026)



Site visit at WESTART, Chennai, India (Perungudi C&D Waste Processing Plant)

# MAX-RAP: From Waste to Resource: Challenges and Opportunities in Maximising Reclaimed Asphalt Pavement Usage

## Project Investigators



**J. Murali Krishnan**

IIT Madras



**M. R. Nivitha**

PSG College of  
Technology Coimbatore



**Sonal Maheshwari**

Bharat Petroleum  
Corporation Ltd.



**Sabine Leischner**

TU Dresden



**Jörg Kranz**

Heitkamp

## Project Summary

MAX-RAP aims to maximize the reuse of reclaimed asphalt pavement (RAP) in pavement construction. The India–Germany bilateral collaboration drives groundbreaking advances in materials science, recycling

processes, and construction practice, delivering tangible benefits for circular economy, resource efficiency, and CO<sub>2</sub> reduction in road construction.

## Key Highlights

- Demonstrating laboratory-based aging simulations to capture field RAP binder aging in a systematic, reproducible manner.
- Development and standardization of new analytical protocols (TLC, FTIR, asphaltene separation, and column chromatography) for chemical characterization of aging bitumen–RAP systems, including fractionation where no standards exists.
- Introduction of a dry centrifuge process on an industrial scale to separate bitumen/mastic from RAP aggregates, enabling maximum binder recovery and clean aggregates.
- Advances in high-pressure rheology for binders: measuring viscosity under pressure reveals pronounced pressure dependence, yielding better bitumen/asphalt material behavior under in-service conditions.
- Direct industry integration via partners (Bharat Petroleum Corporation Ltd., Heitkamp GmbH) ensures laboratory findings are rapidly transferable to production and practice.
- The dry centrifuge approach offers an efficient RAP processing leading to lower environmental impact, with potential adoption in domestic facilities.
- Results will aid in material selection, rejuvenation strategies, and recycling framework in road construction across India and Europe.

## Salient Contributions

- Significant progress has been achieved across the project, including laboratory aging of fresh binders using hot-air oven and RTFO, comprehensive chemical characterization through FTIR, TLC, asphaltene separation, and column chromatography, along with the development of standardized TLC protocols for bitumen. Initial laboratory investigations on high-pressure rheology have also demonstrated pronounced pressure effects and shear-thinning behaviour.
- A major milestone was the successful completion of the first industry-scale dry centrifuge RAP separation trials in Germany, where approximately 20 tonnes of RAP were processed in collaboration with BHS Sonthofen and Heitkamp to optimize separation parameters. In parallel, BPCL identified, procured, and supplied suitable low-viscosity refinery fractions for evaluation as sustainable substitutes for rejuvenators and virgin binders in recycled asphalt blend design.
- Going forward, the project will focus on further standardizing analytical methodologies, optimizing dry centrifuge separation parameters, and strengthening the predictive capability of high-pressure rheology for field applications. Efforts are also underway to identify suitable trial stretches on Indian highways for technology demonstration, while results will continue to be disseminated through high-impact journals, conferences, and industrial guidelines to facilitate wider industry adoption in both India and Germany.

- Shine, A. M., Thushara, V. T., Falla, G. C., Zeißler, A., & Leischner, S. (Year). Evaluation of Ageing Effects in Polymer-Modified Bitumen Using Rheological, Chemical, and Morphological Analyses. In: 12th International Conference on Bearing Capacity of Roads, Railways, and Airfields (BCRRA 26).
- Shine, A. M., Kumar, S. D., Savio, D., Nivitha, M. R., Leischner, S., & Krishnan, J. M. (2026). Quantifying RAP Processing Effectiveness Using a White-Black Gradation Divergence Index. In: ROADLCA Conference Palermo (ROADLCA 2026).
- Thushara, V. T., Shine, A. M., Leischner, S., Kamratowsky, E., Köberle, T., & Krishnan, J. M. (2026). Chemical and Morphological Evolution of Polymer Networks in Bitumen during Aging: Insights from FTIR and Fluorescence Microscopy. In: 2nd RILEM International Symposium on Bituminous Materials (ISBM 2026).



*Dry Centrifuge Processed Aggregates*



*High Pressure Rheometer*

# TRANSFORM: Transforming Industrial Silicon Carbide and Silicon Nitride Ceramics Waste into Products towards Material & Environmental Sustainability (Circular Economy)

## Project Investigators



**Ravi Kumar**

IIT Madras



**Santanu Mandal**

Carborundum Universal Limited



**Günter Motz**

University of Bayreuth



**Ulrich Degenhardt**

QSIL Ingenieurkeramik GmbH

## Project Summary

This project promotes sustainability and circular economy by reprocessing industrial silicon nitride ( $\text{Si}_3\text{N}_4$ ) and silicon carbide ( $\text{SiC}$ ) waste using Polymer Derived Ceramic (PDC) technology.

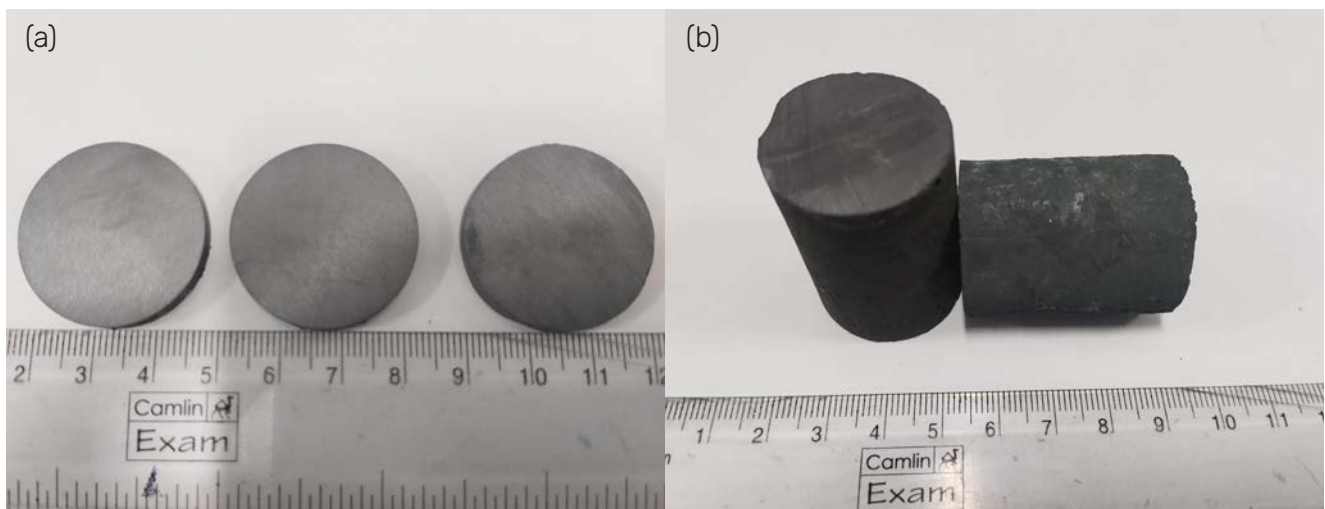
Development of the platform technology of  $\text{RbSiC}$  composite having in-situ impregnated nano- $\text{Si}_3\text{N}_4$  / nano- $\text{SiC}$  derived from pre-ceramic polymeric materials, towards achievement of improved mechanical properties such as hardness, flexural strength, fracture toughness over the base  $\text{RbSiC}$ .

This transformative method aims to address the mass market through isostatic pressing products and cater to special products by

additive manufacturing. State-of-the-art advanced characterization techniques are used to unveil & evaluate the chemistry and microstructure of the recycled products coupled with comprehensive thermo-mechanical analysis to assess product reliability. We affirm the performance of recycled products through meticulous testing and validation in industries for potential product development, thus promoting waste-to-resource conversion and fostering a greener future. This comprehensive project aligns with circular economy principles, presenting an innovative solution to address industrial waste while paving the way for a more sustainable and efficient industrial landscape.

## Key Highlights

- Precursor-bonded Si<sub>3</sub>N<sub>4</sub> with minimized post-pyrolysis porosity and electrically conductive Si<sub>3</sub>N<sub>4</sub>-TiN ceramics have been densified by gas-pressure sintering; due to extensive cracking in most samples, screening for the cause is required and evaluation of the microstructure was started.
- Mixed-fraction Si<sub>3</sub>N<sub>4</sub> waste (STEREON type 2) was successfully cleaned and recycled. Experiments show that a new Si<sub>3</sub>N<sub>4</sub> quality with a 50 vol.% recycling rate can fulfill the mechanical performance target for technical application in aluminium foundry industry ( $\geq 600$  MPa average 4-point bending strength).
- The green body of the ceramic watch has been successfully fabricated from the reclaimed Si<sub>3</sub>N<sub>4</sub> powder and rectangular blocks from reclaimed SiC powder by gel-casting.
- The firing protocol for the pre-ceramic polymer treated SiC reclaim specimen by liquid silicon infiltration process has been evaluated and established at CUMI. The physical properties and the preliminary microstructure evaluation of the fired SiC specimen has been performed.
- The preliminary gel cast specimen made using SiC reclaim has been fired and evaluated for basic properties at CUMI. Further optimization of the gel casting process including the preceramic polymeric treatment is planned along with IITM.



Liquid Silicon Infiltrated (LSI) (a) RbSiC reclaim + 20 % HTTS specimen prepared by uniaxial pressing (b) RbSiC reclaim specimen prepared by Gel casting.





# **WOMEN INVOLVEMENT IN SCIENCE AND ENGINEERING RESEARCH (WISER)**

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The WISER program supports projects in paired mode from women researchers from India and Germany holding a regular or long-term position in academia, research institutes, or industry. The program aims to promote gender parity in STEM fields, facilitate bilateral scientific exchange, and build capacity by creating avenues for long-term Indo-German research collaborations. By funding annual one-month research stays in the host country, WISER works toward driving strategic career growth, expanding international professional networks, and delivering high-impact peer-reviewed publications and patentable technological demonstrations as core program outcomes. The framework provides a three-year tenure with no age limits, scaling financial assistance up to 39 lakhs for Indian awardees and up to €48,000 for German awardees to cover research staff, consumables, contingencies, and travel allowances.

The featured projects in this reporting period show significant progress across health, environment, and agricultural systems. In biomedical engineering, the research led by Dr. Dipti Gupta focuses on combining organic electronic sensors with lipid microarrays. This work aims to create a rapid method for detecting cancer markers directly from blood samples without the need for prior processing. In aquatic life sciences, Prof. Radha Chaube's project looks at how the nervous and immune systems of stinging catfish interact during bacterial infections. The goal is to design targeted

vaccines to protect these fish in aquaculture settings. Addressing fundamental structural biology, Dr. Gayathri Pananghat is studying the specific protein complexes that control how *Myxococcus xanthus* bacteria move and organize themselves. In thermal engineering, the work of Dr. Janani Srree Murallidharan involves creating an advanced computer model to better understand heat transfer and evaporation. This research will help improve cooling systems for next-generation microelectronics.

Environmental and agricultural sustainability are being addressed through targeted field research and digital models. Dr. Poulomi Ganguli's project uses a comprehensive risk framework to study complex flooding events, specifically looking at how extreme heatwaves impact pluvial flooding in coastal megacities around the world. In soil ecology, Prof. Meenu Saileshkumar Saraf is testing specific native soil bacteria, such as *Klebsiella quasipneumoniae*, to see how well they promote plant growth. Her research seeks to reduce the negative effects of high salinity and improve the overall performance of sorghum crops. Finally, Dr. Thanammal Ravichandran's work involves setting up a digital platform for dairy herd management across rural villages. This project evaluates how digital tools and local institutions can work together to help farmers increase their dairy productivity.

In addition to these active research updates, the complete list of newly selected awardees for the WISER Call 2025 is appended in the subsequent section of this report.

## WISER Awardees 2025



**Khushubo Devi**

Assistant Professor  
IIT Indore

### Research Area

Understanding Impurity Effects on Agglomeration and Microstructure in Hydrogen-Reduced Low-Grade Iron Ores.



**Maria Jazmin Duarte Correa**

Group Leader  
Max Planck Institute for Sustainable Materials

### Research Area

Role of impurities on the kinetics and transport during hydrogen reduction of low-grade iron ores.



**Nirmali Gogoi**

Associate Professor  
Tezpur University

### Research Area

Impact of High Temperature and Drought on Physiological Responses, Root Architecture and Quality Traits in Millet Genotypes.



**Sandra Schmoeckel**

Professor  
University of Hohenheim

### Research Area

Response of Millet Genotypes to a Combined High Temperature and Drought



**Ruchi Anand**

Professor  
IIT Bombay

### Research Area

Understanding targeting mechanism in antibiotic resistance mechanisms by combining chemical biology and structural biology approaches.



**Claudia Hoebartner**

Chair of Organic Chemistry  
University Würzburg

### Research Area

RNA-catalyzed synthesis of post-transcriptional RNA modifications targeting ribosomal rRNA methylation related to antibiotic resistance.



**Ranjita G. Moulick**

Assistant Professor  
Amity University Haryana

#### Research Area

Mapping early synaptogenesis in primary neurons grown on an EphrinA5 embedded model membrane using MEA system.



**Francesca Santoro**

Group Leader  
Forschungszentrum Juelich

#### Research Area

Mapping early synaptogenesis in primary neurons grown on an EphrinA5 embedded model membrane using MEA system (MAPSEN).



**Shweta Agarwala**

Professor  
Ahmedabad University

#### Research Area

Advancing Piezoelectric Material Systems for Non-Invasive Internal Pressure Sensing in Healthcare.



**Jasmin Aghassi-hagmann**

Professor  
Karlsruhe Institute of Technology

#### Research Area

Development of Piezoelectric Materials for Non-Invasive Monitoring of Internal Pressures in Biomedical Applications.



**Gayathri Ananthanarayanan**

Assistant Professor  
IIT Dharwad

#### Research Area

Adaptive Resource Orchestration for DNN-based Mixed Criticality Workload deployments in Edge-Cloud.



**Diana Goehringer**

Professor  
TU Dresden

#### Research Area

Self-aware Reconfigurable Computing Systems for Autonomous Systems.

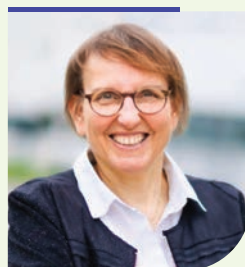


### **Nisha Singh**

Assistant Professor  
Gujarat Biotechnology  
University

#### **Research Area**

Identification and validation of key genomic regions associated with high seed micronutrient content in pigeonpea.



### **Petra Bauer**

Professor  
Heinrich Heine University

#### **Research Area**

Identification and validation of key genomic regions associated with high seed micronutrient content in pigeonpea.



### **Helen P. Kavitha**

Professor  
SRM Institute of Science &  
Technology

#### **Research Area**

Synergetic Rational Design and Machine Learning Analysis of  $\text{ZrO}_2$ - $\text{WO}_3$  Co-Doped Chitosan/GO Nanocomposite for Supercapacitor Applications.



### **Silke Christiansen**

HoD  
INAM gGmbH/Fraunhofer  
IKTS

#### **Research Area**

Synergetic Rational Design and Machine Learning Analysis of  $\text{ZrO}_2$ - $\text{WO}_3$  co-Doped Chitosan/GO Nanocomposite Materials for Supercapacitor Applications.



### **Jayanthi Ganapathi**

Scientist  
Gujarat Institute of  
Desert Ecology

#### **Research Area**

Assessment of microplastic-heavy metal interactions in Coastal and freshwater ecosystems in Gujarat and their ecotoxicological effects on selected aquatic biota.



### **Wibke Busch**

Scientist  
Helmholtz-Centre for  
Environmental Research -  
UFZ

#### **Research Area**

Combined effects of plastic, plastic leachates and heavy metals – towards improved risk assessment for mixtures in aquatic environments.



### **Kripa MK**

Institutional Postdoc  
Ashoka Trust for Research in  
Ecology and the Environment

#### **Research Area**

The biodiversity and climate nexus in mangrove ecosystems: a remote-sensing perspective on contrasting mangrove forests in India.



### **Véronique Helfer**

Senior Scientist  
Leibniz Centre for Tropical  
Marine Research (ZMT)

#### **Research Area**

The biodiversity and climate nexus in mangrove ecosystems: a comparative study of inland and coastal mangrove forests in India.



### **Durba Roy**

Associate Professor  
BITS Pilani, Hyderabad

#### **Research Area**

Understanding peptides with intrinsically disordered regions and poly-disulfide backbone through the lenses of advanced molecular dynamics and machine learning.



### **Diana Imhof**

Professor  
University of Bonn

#### **Research Area**

Unraveling the folding mechanisms of non-ordered regions in disulfide-bonded peptides and proteins.



### **Debjani Nag**

Principal  
Scientist Tata Steel

#### **Research Area**

Conversion of steel mill off gas CO<sub>2</sub> to alternate fuel with photo thermal catalysis method.



### **Jennifer Strunk**

Chair & Professor  
TU Munich

#### **Research Area**

Material development for light-assisted catalytic CO<sub>2</sub> conversion.



**Sumati Surya**

Professor  
Raman Research Institute

#### Research Area

Quantum Techniques in Space and Time:  
Emergent Properties of Causal Spacetime  
Networks.



**Astrid Eichhorn**

Professor  
Heidelberg University

#### Research Area

Quantum Techniques in Space and Time:  
Emergent Properties of Causal Networks.



**Kuljeet Kaur Marhas**

Professor  
Physical Research Laboratory

#### Research Area

The Evolving Protostellar Environment:  
A Study of Spatial and Temporal Variations of  
Rare Earth Elements in Calcium  
Aluminium-rich Inclusions: Isotopes.



**Jutta Zipfel**

Section leader  
Senckenberg Society for  
Nature Research

#### Research Area

The Evolving Protostellar Environment:  
A Study of Spatial and Temporal Variations  
of Rare Earth Elements in Calcium  
Aluminium rich Inclusions – Petrology.



**Geetha Thangavelu**

Associate Professor  
IISER Thiruvananthapuram

#### Research Area

On the Schur algebras and the Affine  
cellularity of certain classes of groups and  
diagram algebras.



**Anne Henke**

Professor  
University of Stuttgart

#### Research Area

Homological stability of diagram algebras.



**Akanksha Rathore**  
Assistant Professor BITS  
Pilani

#### Research Area

Collective Intelligence in Desert Ecosystems: Agent-Based Modeling for Ephemeral Oasis Tracking.



**Ariana Strandburg-peshkin**  
Group Leader  
Max Planck Institute of  
Animal Behavior

#### Research Area

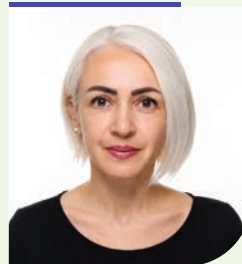
Collective tracking of ephemeral resources in dynamic landscapes.



**Tasneem Bano Rehman**  
Associate Professor  
Muffakham Jah College of  
Engineering and Technology

#### Research Area

AI-Enabled Scout Drone for Real-Time Pest Detection and Geotagging in Precision Agriculture.



**Marina Tropmann-frick**  
Professor  
Hamburg University of  
Applied Sciences

#### Research Area

AI-Assisted Pest Management System for Precision Agriculture (AIPeMS).



**Nitin Yadav**  
Assistant Professor  
IIT Delhi

#### Research Area

Spinning Secrets of Sun: Bridging Simulations and Observations for Detection of Multiscale Vortex Flows.



**Meetu Verma**  
Senior Post-Doc Researcher  
Leibniz Institute for  
Astrophysics

#### Research Area

Coupling multi-wavelength observations and MHD simulations for a comprehensive study of solar vortex flows.



**Shabnam Iyyani  
Syamsunder**

Assistant Professor  
IISER Thiruvananthapuram

#### Research Area

Probing Gamma-Ray Burst Jet Composition and Physics Through Multi-Wavelength Spectro-Polarimetry.



**Anna Franckowiak**

Professor  
Ruhr-University Bochum

#### Research Area

High-energy neutrinos and optical afterglow polarimetry studies unveiling GRB jet composition and physics.

The following section highlights the projects awarded under the WISER Call 2022, showcasing the diverse research collaborations between Indian and German women scientists and the innovative solutions they are advancing across key areas of science and technology.

**Gayathri Pananghat**

IISER Pune

**Host**

Max Planck Institute for Terrestrial Microbiology, Marburg

**Area of Work**

Structural and biochemical characterization of protein complexes in myxococcus xanthus polarity regulation

## Project Summary

The collaborative research carried out as part of the WISER project focused on understanding how a social bacterium Myxococcus bacterium moves on soil surfaces. The major contribution of the project was towards understanding how a small Ras-like GTPase, a family of proteins implicated in cell polarity and signalling in eukaryotes as well, contributes to the motility by determining the direction of movement of the bacterium. The research on Myxococcus motility has led to novel insights into regulation of prokaryotic small Ras-like GTPases, and has enabled their comparison with the eukaryotic equivalents. The results have a long-term impact in terms of

understanding evolution of motility mechanisms and multicellularity, further leading to future applications in synthetic biology and drug discovery against pathogenic bacteria by targeting motility mechanisms. WISER program has been very impactful in initiating long term collaborations with established research groups in the concerned area of research. It has helped in reaching out to the international scientific community, and made a difference to the impact of the work. This has been an impetus for future continuing research collaborations to be continued with the German host, and also initiated new collaborations in the Myxococcus community.

## Key Highlights

- Research goals achieved: Characterization of Ras-like GTPases and novel roles of their interacting partners in regulation of motility – mechanistic insights
- Publications planned in high impact journals as a result of complementary collaborative experiments
- Training of PhD, MSc and undergraduate students
- Networking with Max Planck Institute of Terrestrial Microbiology, Marburg and IISER Pune for future collaborations
- Networking with the international community of researchers working in Myxococcus xanthus biology

## Project Contributions & Activities

### Publications

- Chakraborty, S., Gayathri, P.\* (2024) RomX, a novel prokaryotic regulator, links the response receiver domain with the GTP-bound MglA for establishing *Myxococcus xanthus* polarity. *bioRxiv*, doi.org/10.1101/2024.02.20.581209.

Invited talks in national and international meetings:

- Invited talk titled 'Reconstitution of the Frz chemosensory complex in *Myxococcus xanthus*' at The 51st International Conference on the Biology of Myxobacteria, Asilomar, California, USA, 1st – 4th June 2026.
- Invited talk titled 'Reconstitution of the Frz chemosensory complex in *Myxococcus xanthus*' at The 50th International Conference on the Biology of Myxobacteria, Asilomar, California, USA, 3rd – 6th August 2025.
- Invited talk titled "A tale of two GTPases in *Myxococcus xanthus* polarity", 49th International conference on the Biology of Myxobacteria, Neustadt an der Weinstrasse, Germany, 3rd – 6th June 2024.
- Invited talk titled 'Polarity oscillations driven by Frz pathway of *Myxococcus xanthus*' at the 52nd National Seminar on Crystallography, at Pondicherry University, 24th – 26th September 2025
- Invited talk titled 'From small Ras-like GTPases to P-loop NTPases: Mechanistic insights into nucleotide hydrolysis and exchange' at the Horizons in Structural and Computational Biology (HSCB 2025), IIT Hyderabad, 28th February – 1st March 2025



With collaborators Anke Treuner-Lange and Luca Blöcher at the 50th *Myxococcus* Meeting at Asilomar, California, Aug 2025



At the 49th *Myxococcus* Meeting at Hambach Castle, Neustadt an der Weinstraße, Germany, June 2024



**Dipti Gupta**  
IIT Bombay

#### Host

Karlsruhe Institute of Technology (KIT), Karlsruhe

#### Area of Work

An integrated liquid/electrolyte gated transistor(EGT) technology platform for rapid, detection of Cancer-associated extracellular vesicles

## Project Summary

Cancer remains one of the leading causes of mortality globally, and the inadequacy of current diagnostic tools – particularly their inability to detect malignancy at early, treatable stages – represents a critical unmet clinical need. This WISER-funded project addresses that gap through a fundamentally new diagnostic paradigm: the direct electronic detection of cancer-associated extracellular vesicles (EVs) from blood, without sample preprocessing.

The platform's scientific novelty lies in its dual-innovation architecture. By integrating Organic Electrochemical Transistors – which exploit volumetric ionic gating through a PEDOT:PSS channel to achieve exceptionally high transconductance – with antibody-functionalised supported lipid bilayer microarrays that recapitulate native membrane environments, the device achieves a synergy unavailable to either technology alone. The lateral mobility of antibodies within the lipid bilayer enables dynamic clustering upon EV binding, dramatically enhancing avidity and capture efficiency compared to conventional static immobilization strategies. This results in a sensor with sensitivity, selectivity, and speed characteristics that collectively exceed existing electrochemical or optical EV detection benchmarks.

The translational relevance is substantial. Liquid biopsy is widely recognised as the next frontier in oncology diagnostics, yet clinical adoption has been constrained by the technical complexity and cost of existing EV isolation methods. By eliminating sample preparation requirements entirely and integrating the detection electronics into a compact, PSoC-based portable device, this platform is positioned as a genuine Point-of-Care tool suitable for deployment in primary care settings, low-resource environments, and longitudinal disease monitoring applications. Its modular architecture – wherein the sensing element can be reconfigured to target pathogens or other disease biomarkers – extends its impact well beyond oncology, with applicability to infectious disease surveillance and non-communicable disease management. The Indo-German collaborative framework underpinning this work further exemplifies the value of sustained bilateral research partnerships in accelerating globally relevant biomedical innovation.

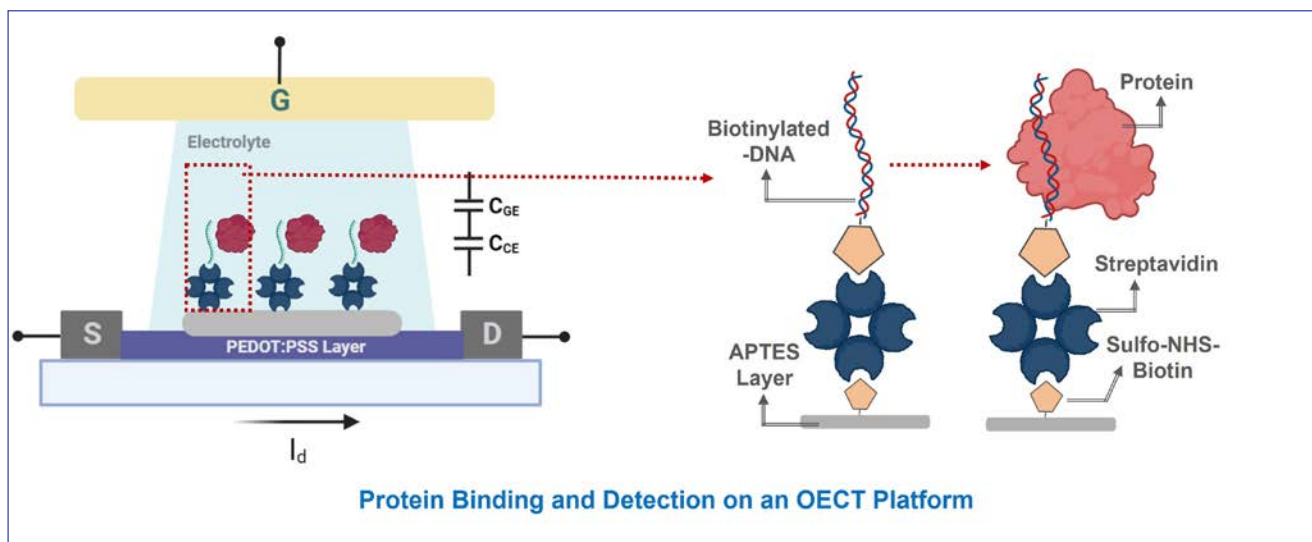
The WISER Programme has been a defining inflection point in my scientific trajectory, and its impact extends across dimensions that conventional research grants rarely address. The Indo-German collaborative structure embedded within the programme compelled

genuine international collaboration, requiring me to lead technically rigorous discussions with senior researchers at KIT, navigate the intellectual and cultural dynamics of a bilateral research partnership. This has sharpened both my scientific confidence and my professional vocabulary as an independent researcher. Beyond the specific project outcomes, WISER provided me access to a peer community of women scientists across India and Germany.

WISER did not merely fund a project; it invested in a research identity. That distinction matters enormously for early-to-mid career women researchers who often receive support for safe, well-scoped work but rarely for transformative ideas. The programme has strengthened my resolve to pursue exactly that kind of science, and to mentor the next generation of women researchers in my group to do the same.

## Key Highlights

- Developed a novel integrated bio-electronic sensing platform by merging Organic Electrochemical Transistor (OECT) technology (IIT Bombay) with lipid-patch microarray-based EV capture (Karlsruhe Institute of Technology), establishing a first-of-its-kind cross-institutional, cross-disciplinary device architecture.
- Demonstrated high-transconductance OECT operation in physiologically relevant high-ionic-strength media (PBS/blood-equivalent matrices), validating stable electronic transduction under real-world diagnostic conditions – a key technical milestone for clinical translation.
- Achieved proof-of-concept detection of cancer-associated extracellular vesicles (EVs) using Anti-CD63 and Anti-EpCAM functionalized transistors and testing with MCF7 breast cancer cell-derived EVs, confirming selective biomarker capture and electronic signal generation.
- Proof of concept of a "direct-from-blood" EV capture workflow eliminating the need for ultracentrifugation or size-exclusion chromatography, drastically reducing sample-to-answer time and enabling Point-of-Care (PoC) deployment.



## Project Contributions & Activities

### Publications

- Lokesh Kumar, Bharat Bhushan Bhatt, Dipti Gupta\*, "Low voltage photo-thermally reduced graphene oxide transistor device based on ion gel dielectric", Carbon, 120946, (2025)
- Subhankar Sahu, Lokesh Kumar, Sumita Das, Dipti Gupta and Ruchi Anand, "Ultrasensitive detection of aromatic water pollutants through protein immobilization driven organic electrochemical transistors", Chem. Sci. of Royal society of chemistry, v15, p 710, (2024)

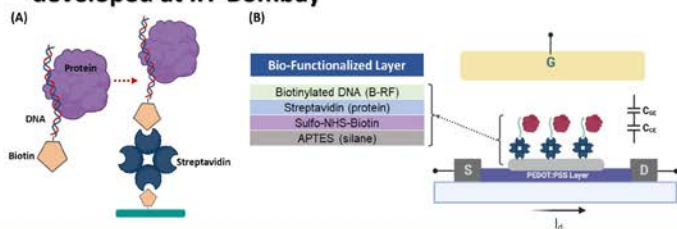
### Technology Demonstration:

- Proof-of-concept demonstration of OECT biosensor platform.

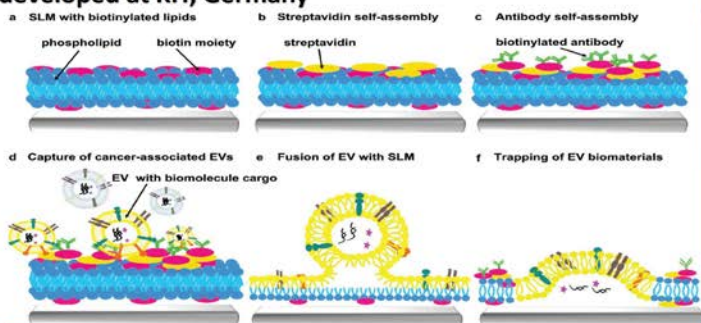
### Patent

1. D. Gupta, Lokesh Kumar, BHARAT Bhushan Bhatt, AN ORGANIC ELECTROCHEMICAL TRANSISTOR (OECT) AND A METHOD OF FABRICATING THEREOF, Indian Application No. App. No. 202521063172
2. D. Gupta, R. Anand, L. Kumar, S. Sahu, "Protein immobilized organic electrochemical biosensor for detecting phenolic pollutants and process for producing the same", Indian Application No. 202321015908, Granted, Patent Number : 474656

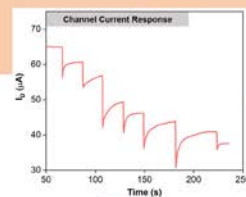
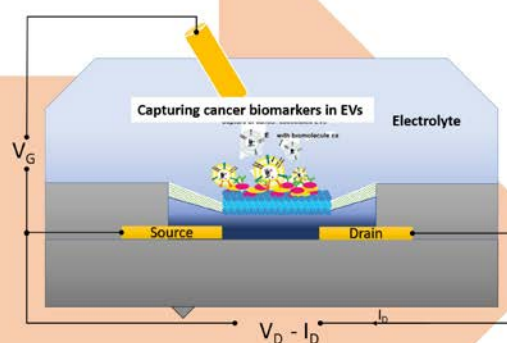
### Liquid/Electrolyte gated transistor technology developed at IIT-Bombay



### Technology for Rapid Capture of Cancer Extracellular Vesicles developed at KIT, Germany



### An integrated EGT platform for Rapid capture and Sensing of Cancer EVs



Integrating OECT platform and rapid capture of Extracellular Vesicles technology



**Poulomi Ganguli**  
IIT Kharagpur

#### Host

GFZ German Research Centre for  
Geosciences, Potsdam

#### Area of Work

ACRA Floods: Compound Risk Assessment of  
heat-stress induced pluvial floods

## Project Summary

Sequential compound hazards with different weather conditions, e.g., hot-wet compound hazards across coast can cause substantial damage to livelihood and urban infrastructure. Further, rising sea-levels and tropical cyclones ahead/after the heatwaves can further alter the frequency and intensity of hot-wet compound hazards by altering severe to exceptional heatwave characteristics over land and ocean (marine heatwaves) linked to storm cyclogenesis (Ganguli & Lin, 2025). Further, at the coast, regional and global scale climate models often fail to capture humid heat stress and precipitation extremes owing to complex terrain and circulation patterns, making it challenging to project humid hot-wet compound hazards in warming climate. In a broader context, the proposed framework can be extended to investigate hot-wet compound events arising from diverse atmospheric and land-surface stressors, particularly tropical cyclones and irrigation-driven anthropogenic influences. Furthermore, a comprehensive multi-hazard cascading framework can be developed by integrating and mapping multiple hazard components and their interactions. Such an approach would facilitate the development of real-time early warning systems, identification and delineation of high- and low-risk zones, and the design and

deployment of smart urban flood warning systems across urban and peri-urban regions. Being a first batch of WISER awardee, it enhances my scientific reputation and visibility within India and abroad. The knowledge gained during the research is helpful in training and preparing a diverse cadre of students as researchers and professionals in the field of water science and technology back in the home country, and intriguing an experiential learning environment, seemingly important in today's curricula. Further, the knowledge gained during the execution of project enhanced the graduate and undergraduate curricula focusing on 'Uncertainty concepts' and 'Statistical Methods', designed by the P.I. Findings of the project are published in leading scientific journals, spanning from Nature group, ASCE and AGU, which can help stakeholders and city planners with necessary information about sectoral loss and inform citizens of science to develop effective adaptation strategies for hot-wet compound events. As a woman researcher in STEM, the WISER Program has strengthened my confidence, expanded my professional network, and provided valuable international exposure, enabling collaboration with leading researchers and broadening my perspectives on interdisciplinary water science and hydroclimatic research.

## Key Highlights

- Dr. Poulomi Ganguli, in association with Prof. Bruno Merz from GFZ Potsdam, developed and published a set of maps and quantified the risk to population and exposed urban infrastructure of heatwave-preconditioned floods, compared to the isolated and discrete occurrence of rainfall-driven floods. One of the primary outputs of this project is the development of a multi-hazard flood risk model for the Chennai Metropolitan Area. They quantified heatwave-preconditioned extreme rainfall and contrasted this with discrete rainfall extremes using 6 demographic and damage-specific indices. Their results show up to an 8-fold amplification in damage potential from heatwave-preconditioned extreme rainfall compared to extreme rainfall solely.
- They have identified hotspot megacities across the globe and within the Indian subcontinent where extreme heatwaves and subsequent precipitation extremes are of particular concern. In addition, they identified areas where there is a frequent transition of hydroclimatic whiplash (hot-wet extremes).
- On a cascading hazard domain, the team developed and updated an extreme precipitation-induced moisture-driven landslide threshold atlas for key landslide hotspot areas of the Northwestern and Northeastern Himalayas, considering the compounding influence of antecedent moisture content at an optimum time lag and landslide-triggering rainfall. Further, on a global scale, they developed a risk-based decision framework for compound streamflow droughts, which is a function of onset time and deficit volume, thereby aiding seasonal drought predictability and seasonal-to-sub-seasonal forecasts.
- Dr. Ganguli developed strong scientific collaborations with leading scientists and engineers in the Hydrology Section and fostered interactions with researchers at the GFZ German Research Centre for Geosciences, facilitating the exchange of ideas and expertise on hydroclimatic extremes. As a recipient of the inaugural cohort of the WISER Fellowship, the experience significantly enhanced her scientific visibility, professional network, and research reputation both within India and internationally.



Presentation of a plenary talk at IAHS 2025, Oct. 5–10, IIT Roorkee, India.



Group photo with the members of section Hydrology

## Project Contributions & Activities

### A) Major Publications

- Raut, A., & Ganguli, P. (2026): Onset seasonality controls compound streamflow drought risk at a global scale. *Npj Natural Hazards*. DOI: 10.1038/s44304-026-00221-8
- Monga, D., & Ganguli, P. (2026): Development of precipitation-induced moisture-driven landslide threshold atlas for the Northwestern and Northeastern Himalayas. *ASCE Journal of Hydrologic Engineering*, 31(2), DOI: 10.1061/JHYEFF.HEENG-6745.
- Ganguli, P. and Merz, B. (2025): Increasing probability of extreme rainfall preconditioned by humid heatwaves in global coastal megacities, *npj Clim Atmos Sci*, 8, 1–16, <https://doi.org/10.1038/s41612-025-01023-x>, 2025.
- Ganguli, P., Nithila Devi, N., Apel, H., Vorogushyn, S., Jena, P. P., Chatterjee, C., and Merz, B. (2025): Growing pluvial flood hazard and exposure from heatwave-preconditioned rainfall extremes in Chennai metropolitan area, India, *Geophysical Research Letters*, 52, e2025GL115795, <https://doi.org/10.1029/2025GL115795>, 2025.
- Ganguli, P. and Merz, B. (2024): Observational evidence reveals compound humid heat stress-extreme rainfall hotspots in India, *Earth's Future*, 12, e2023EF004074, <https://doi.org/10.1029/2023EF004074>, 2024.

**B) Proposals/Recognition**

- Dr. Ganguli was selected for Fulbright-Kalam Climate Fellowship for Academic and Professional Excellence at Princeton University during 2024-25 academic year.
- Recipient of Roland Schlich Established Scientist's travel support (ESTS) and DST ITS grants for in- person presentation at EGU2023.

**C) Invited Talks**

- 2026: Virtual presentation at Centre for Multi-hazard Risk and Resilience, SPARK seminar series on 13/03/2026.
- 2025: Guest Speaker: "Unveiling Inland and Coastal Compound Floods: Global to Local Scale Assessments". At 2-week SPARC Short-term course on "Networks and Causal Statistics for Climate Science" (Program ID: IIT/CEP/STC/SP/2024-2025/AI/97). Organized by Department of Artificial Intelligence, IIT Kharagpur. 10th January, 2025, IIT Kharagpur.
- 2025: Plenary presentation: In session HS2.1 Hydrologic Statistics, Abstract ID:

IAHS25\_ABS\_C2483, IAHS 2025, Oct. 5-10, IIT Roorkee, India.

- 2024: Presented invited poster on hot-dry compound events in American Geophysical Union's Fall meeting, 9-13 December, 2024.
- 2024: Invited Speaker: "Understanding Heatwaves and Associated Compound Hazard Potentials in Urban India". At the seminar series, "navigating the storm: Modelling the Intersection of Hurricanes and Extreme Heat Exposure in India and the US" organized by Metropolis Initiative in Partnership with the Centre for Global India (CGI), at Princeton University, November 19, 2024.
- Distinguished speaker: "Translating Climate Uncertainty to Risk: A process-based Statistical Perspective". Distinguished Speaker Series at the Centre for Complex Hydrosystem Research at the University of Alabama. November, 8, 2024.
- 2024: Keynote speaker for the workshop, Hydrology in Anthropocene at ICWaR, IISC. February 13 - 16, 2024. IISC Bengaluru.



**Meenu Saileshkumar Saraf**

Gujarat University  
Ahmedabad

#### Host

Leibniz Institute DSMZ-German Collection of Microorganisms and Cell Cultures, Braunschweig

#### Area of Work

Nutrient dynamics and functional aspects of microbial diversity in saline soils

## Project Summary

This project demonstrates the successful identification, characterization, and validation of native plant growth-promoting bacterial inoculants for enhancing the performance of *Sorghum bicolor* under saline conditions. The study integrates microbial characterization, transcriptomic profiling, root colonization analysis, bioformulation development, and field validation, providing a comprehensive assessment of plant-microbe interactions across controlled and field environments. Transcriptomic analyses revealed the induction of stress-responsive, nutrient assimilation, and detoxification-related genes in bacterially treated plants, providing molecular evidence for microbial modulation of salinity response pathways. Scanning electron microscopy further confirmed effective root colonization by the selected bacterial strains, supporting their ability to establish and persist in association with the host plant. The translational relevance

of the work is demonstrated through the successful development and field evaluation of bioformulated native bacterial inoculants in naturally saline agricultural soils. Improved plant growth and vigor observed under field conditions indicate the potential utility of these microbial resources for supporting crop production in salt-affected environments.

As a woman in science, this award provided a prestigious platform to demonstrate leadership in global research. By spearheading this partnership, Prof. Saraf successfully bridged fundamental microbial ecology with applied agricultural solutions, reinforcing her role as a key authority in rhizospheric biology. Furthermore, her mentorship of research scholars within the project inspires the next generation of women in STEM. The project significantly elevated the global research footprint of Gujarat University.

## Key Highlights

1. Identification and validation of robust PGPR isolates: Selected bacterial isolates exhibited stable and reproducible plant growth-promoting and stress-mitigating traits, leading to significant improvements in *Sorghum bicolor* growth and physiological performance under both saline and non-saline conditions.
2. Elucidation of molecular mechanisms of salinity tolerance: Transcriptomic analysis revealed bacterial-induced upregulation of stress-responsive, nutrient assimilation, and detoxification genes, including WRKY35, AMT3, glutamine synthetase, and cytochrome P450 genes, demonstrating enhanced adaptive responses to salinity stress.

3. Confirmation of successful root colonization: Scanning electron microscopy (SEM) verified effective colonization of *Sorghum bicolor* roots by the selected bacterial strain, *Klebsiella quasipneumoniae*, including root surface attachment and microcolony formation indicative of rhizosphere competence.
4. Development and successful field validation of bioformulations: Bioformulated native bacterial inoculants consistently improved plant growth and vigor in naturally saline agricultural fields, demonstrating ecological adaptability and practical potential for sustainable crop production in salt-affected soils.
5. Generation of functional genomic and systems-level insights: Gene Ontology enrichment and network analyses identified key defense-, metabolism-, and stress-related pathways activated by bacterial inoculation, providing a comprehensive understanding of plant-microbe interactions underlying salinity stress mitigation.

## Project Contributions & Activities

- Prepared and communicated two research manuscripts focusing on salt-tolerant PGPR selection and the transcriptome reprogramming of *Sorghum bicolor* under salinity stress.
- Presented the research model and findings at IGSTC, New Delhi, to Dr. Jitendra Singh (Hon'ble Union Minister of Science and Technology, India) and Ms. Bettina Stark-Watzinger (Federal Minister of Education and Research, Germany).
- Strengthened Indo-German ties through Prof. Meenu Saraf's visit to Prof. Dr. Michael Schlöter's lab at the Technical University of Munich to explore future collaborative microbiome research.
- Prof. Meenu Saraf delivered a guest lecture at the Technical University of Munich in 2025 on plant growth-promoting microorganisms and microbiome-based solutions for salinity stress.
- Hosted Prof. Dr. Jörg Overmann as a keynote speaker at a January 2026 International Conference at Gujarat University (with IIT Gandhinagar), which included a dedicated discussion session with WISER project research scholars.
- Conducted a scientific field visit to the White Rann of Kutch with Prof. Overmann to study extreme natural saline ecosystems, reinforcing the practical applications of the project's microbial research in harsh environments.



Prof. (Dr.) Meenu Saraf delivering Guest Lecture at Technical University of Munich 2025



Comparative growth response of *Sorghum bicolor* seedlings under saline hydroponic conditions. The seedling on the left was inoculated with the WGE bacterial isolate, which exhibited enhanced shoot development, increased root length, and a more extensive root system. The seedling on the right represents the uninoculated control, showing reduced growth and limited root development under the same conditions. The image illustrates the growth-promoting effect of the WGE isolate under salinity stress in the hydroponic screening experiment.



**Thanammal  
Ravichandran**

Kumaraguru College of  
Liberal Arts and Science  
Coimbatore

#### Host

University of Hohenheim Stuttgart

#### Area of Work

Potential of digital innovations and its institutional dimensions to enhance dairy productivity in developing countries

## Project Summary

By monitoring over 2,400 dairy animals through a digital herd management platform, the project identified key reproductive, nutritional, and health constraints, enabling targeted interventions that reduced repeat breeding and infertility while enhancing farmers' access to timely advisory services. Through collaboration with the University of Hohenheim, the project strengthened Indo-German scientific partnerships and research capacity in digital livestock management. Overall, it demonstrated a scalable, data-driven approach to dairy development, advancing precision livestock farming and sustainable dairy productivity in India.

The WISER Programme enhanced Dr. Thanammal's scientific growth through international collaboration with the University of Hohenheim, strengthening my expertise in digital agriculture and livestock systems research. It provided opportunities to present research internationally and contribute to state and national policy discussions on sustainable livestock development and digital agriculture. As a woman researcher in STEM, WISER offered valuable exposure, confidence, and leadership opportunities, advancing her research career and professional development.

## Key Highlights

- Established a digital dairy extension platform across 31 villages, enrolling 633 farmers and 2,455 dairy animals in the NITARA herd management system.
- Developed data-driven advisory and monitoring approaches integrating digital tools, animal health records, and farmer engagement.
- Implemented targeted health, nutrition, and reproductive interventions to address repeat breeding and infertility.
- Strengthened Indo-German collaboration through joint research and academic engagement with the University of Hohenheim.
- Enhanced farmer outreach through training programmes, health camps, village meetings, and digital advisory services.

## Project Contributions & Activities

- Developed and deployed a digital herd monitoring and advisory system using the NITARA platform, including fertility, disease surveillance, and farmer decision-support tools.
- Presented research findings at international and national conferences, including Tropentag (Austria and Germany) and the ISSAR National Symposium.
- Published a research article in Tropical Animal Health and Production and submitted a second manuscript on digital tools for infertility management in dairy cattle.
- Contributed to policy initiatives, including the Tamil Nadu Dairy Development Policy (2026–2030) and a White Paper on buffalo value chain development in India.



Training for productivity enhancement through silage production at Erode, Tamilnadu



Dr. Thannamal presented research findings at Tropentag conference held at University of Bonn



**Janani Srree  
Murallidharan**

IIT Bombay

#### Host

TU Darmstadt

#### Area of Work

Computational modeling of boiling heat transfer

## Project Summary

This project establishes a high-fidelity, physics-based numerical framework that successfully captures the complex microscale heat transfer phenomena governing nucleate boiling. Working with ultra-high resolution experimental data provided by TU Darmstadt, advanced Direct Numerical Simulations (DNS) were performed at IIT Bombay leading to computational work which uniquely resolves the transition between contact-line and microlayer evaporation regimes.

The translational relevance of this research lies in its predictive capability; by removing restrictive empirical assumptions, it provides a robust, open-source tool for engineering design. Gaining this fundamental understanding of microlayer-driven processes offers a critical foundation for optimizing high-performance cooling configurations. Ultimately, this framework supports the broader impact of developing efficient thermal management systems required for next-generation microelectronics, space

applications under reduced gravity, and high-heat-flux energy systems.

The WISER Programme has been instrumental in advancing Dr. Murallidharan's scientific growth and expanding my professional footprint as a woman researcher in STEM. By facilitating a structured partnership with leading researchers at TU Darmstadt, the grant provided vital international exposure and enabled her research group at IIT Bombay to merge high-level computational modelling from our end with state-of-the-art European research expertise.

Leading this international, energy-relevant domain project allowed her to drive critical advancements in multiphase thermal fluidics. It has enhanced her professional development by strengthening leadership capabilities, fostering long-term global collaborations, and showcasing the impactful role of women scientists in directing rigorous, cross-border engineering research.

## Key Highlights

- **Complex Code Development:** Successfully developed and coupled a lubrication-theory-based microlayer model with a VoF-based OpenFOAM solver to create a physically realistic, computationally efficient nucleate boiling framework.
- **High-Fidelity Simulations towards Experimental Validation:** High-fidelity Direct Numerical Simulations (DNS) of evaporative dip-coating performed to compare against state-of-the-art experimental measurements from TU Darmstadt, showing excellent agreement in resolving ridge and wedge structures thereby shedding light on key physics of phenomenon. Successfully captured and validated the physical transition between the contact-line- dominated regime and the microlayer formation regime against existing literature.
- **Parametric Insights:** Quantified that microlayer evaporation contributes 50%-80% of total heat transfer during nucleate boiling at atmospheric pressure, dropping to 40% at increased system pressure, while subcooling was shown to have a less significant effect.
- **International Collaboration:** Fostered a synergistic research partnership between IIT Bombay and TU Darmstadt, resulting in a fruitful exchange of cutting edge research ideas.



Dr. Murallidharn explaining her project to the Science ministers of both India and Germany

## Project Contributions & Activities

### Accepted Manuscript

"Numerical Investigation of Microlayer Formation in Dewetting of a Superheated Solid"  
by Shubhranil Chatterjee, Janani Srree Murallidharan, Tatiana Gambaryan-Roisman, and Peter Stephan.

– Heat and Mass Transfer Journal  
Springer Nature



*Subhranil Chhaerjee, student of Dr. Murallidharan at TU Darmstadt*



**Radha Chaube**

Banaras Hindu University  
Varanasi

#### Host

Ludwig-Maximilians-University, Munich

#### Area of Work

Brain endocrine indicators of welfare in fish subjected to autogenous vaccine against bacterial infection

## Project Summary

This WISER project establishes a pioneering paradigm in aquatic animal health and welfare by decoding the intricate neuroendocrine-immune interactions in the stinging catfish (*Heteropneustes fossilis*) during *Aeromonas hydrophila* infection. While traditional fish pathology predominantly focuses on isolated immunological parameters, this collaborative research successfully maps system-wide physiological shifts. By capturing the distinct brain transcriptome signatures of both subclinical and systemic infections, the study provides an unprecedented molecular blueprint of how bacterial stressors disrupt the hypothalamus-pituitary-gonadal (HPG) axis. The uniqueness of this work is further underscored by a robust multi-species homology validation that demonstrates the evolutionary conservation of core teleost immune machinery, alongside the publication of 8 open-access transcriptomic datasets to the NCBI SRA database, the project achieves direct translational relevance through the development of an autogenous formalin-killed vaccine (Autovac-Ah) tailored against highly virulent local strains. Demonstrating exceptional protective efficacy via both intraperitoneal injection and immersion routes, this formulation sets a clear trajectory toward multi-location field trials and commercial scale-up (Targeting TRL 7–8). By offering small-scale aquaculture farmers a

targeted, cost-effective preventative measure against Motile *Aeromonas* Septicemia (MAS), the outcomes actively advance a "One Health" approach, substantially curbing reliance on antibiotics and enhancing regional food security. On basis of the data gathered during the laboratory trials, new formulation of the vaccine has been prepared with the co-operation of the SAN Group Biotech Germany GmbH. This formulation was utilized in the subsequent field trial. In this procedure, 14900 fish were subjected to the two times bath vaccination followed by booster which has been applied orally with the standard pellet feed. During the performed field trials (up to date) of the vaccine, no mortalities regarded to the vaccination procedure, or the infection caused by the *Aeromonas salmonicida* ssp. *salmonicida* have been detected. Samples gathered during the field experiment were according to the same methodology as in the laboratory based experiment, and were subjected to the RNA extraction procedure, and are currently being prepared for the cDNA synthesis.

The IGSTC WISER Programme has been a great support for female researchers in aquatic sciences at Banaras Hindu University. Led by Prof. Radha Chaube, the project created a strong partnership with Ludwig-Maximilians- University in Munich,

combining advanced biological research with practical fish farming solutions. This teamwork raised the laboratory's global profile and provided essential lab resources, mentorship, and networking opportunities for younger female scientists. Overall, the successful

collaboration between Indian and European researchers highlights how important international programs are for producing high-quality science and advancing the careers of women in STEM.

## Project Contributions & Activities

### Intellectual Property & Technology Demonstrations

- Vaccine Delivery System Demonstration: Successful laboratory-scale formulation and safety/efficacy validation of a formalin-killed autogenous vaccine using both intraperitoneal injection and immersion delivery routes in *Heteropneustes fossilis*.

### Peer-Reviewed Publications & Book Chapters

- Snehashish, Palić, D., & Chaube, R. (2024). "Brain transcriptional profiles of an economically important catfish *Heteropneustes fossilis* (Bloch) against *Aeromonas hydrophila* (a common pathogen) infection." Proceedings of the International Conference on Endocrinology, Metabolism and Reproduction: Exploring New Frontiers (ICEMR 2024).
- Aksentijević, K., Rajewska, A. D., Wojnarowski, K., Cholewińska, P., Korzeniowska, M., Steinbauer, P., Palić, D., & Misic, D. (2024). Biofilm Production Capability of Clinical *Aeromonas salmonicida* Subspecies *salmonicida* Strains under Stress Conditions. *Applied Sciences*, 14(20), 9365. <https://doi.org/10.3390/app14209365>

- Wojnarowski K, Cholewińska P, Steinbauer P, Lautwein T, Hussein W, Streb LM, Palić D. (2024) Genomic Analysis of *Aeromonas salmonicida* ssp. *salmonicida* Isolates Collected During Multiple Clinical Outbreaks Supports Association with a Single Epidemiological Unit. *Pathogens*. 2024 Oct 17;13(10):908. doi: 10.3390/pathogens13100908. PMID: 39452779; PMCID: PMC11510180.

### Open-Access Genomic Resource Depositions

- NCBI BioProject Repository (PRJNA1381255): Published a comprehensive raw transcriptomic repository for *Heteropneustes fossilis* under BioProject ID PRJNA1381255 (Public Release Date: December 14, 2025). This database comprises 8 distinct Sequence Read Archive (SRA) datasets that capture tissue-specific physiological and reproductive responses under control and bacterial challenge conditions:
- Brain Transcriptome SRA Libraries (4): Accession numbers SRR36445387, SRR36445388, SRR36445389, and SRR36445390.
- Ovary Transcriptome SRA Libraries (4): Accession numbers SRR36445383, SRR36445384, SRR36445385, and SRR36445386.



*Prof Radha Chaube and Prof. Dusan Palic at farm for Vaccine trial*



*Prof. Radha Chaube demonstrating brain dissection in Arctic char for transcriptomic work.*



# IGSTC INDUSTRIAL FELLOWSHIPS (IF)

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The IGSTC Industrial Fellowships (IF) program immerses young Indian researchers in Germany's advanced industrial R&D ecosystem. It offers two distinct pathways: the Post Doctoral Industrial Fellowship (PDIF) for industry-driven research, and the PhD Industrial Exposure Fellowship (PIEF) for hands-on commercial experience. By bridging academic theory and practical application, the program fosters cross-border technological exchange and yields highly translational outcomes, including engineering solutions, patent filings, and the foundation for long-term institutional partnerships.

The featured Post Doctoral Industrial Fellowships (PDIF) for this reporting cycle showcase high-impact, industry-aligned research. In aerospace and manufacturing, fellows at Airbus drove critical advancements: Dr. Himanshu Gauttam designed an End-Edge-Cloud Synergy architecture to optimize distributed Extended Reality (XR) services; Dr. Prince Kumar Rai engineered a pump-assisted chemical coating system for complex 3D-printed structures; Dr. Sachin Rahi developed a substrate planarization method for integrating flexible organic transistors onto aircraft; and Dr. Sanjeet Kumar Singh utilized 3D/4D printing to design acoustic metamaterial liners that shift engine

noise signatures by up to 38%. At Testia GmbH, Dr. Satya Kumar Dewangan validated automated defect detection algorithms in additively manufactured components by optimizing AI-assisted X-ray Computed Tomography software.

Energy, environment, and biological sciences were similarly advanced through precise empirical frameworks. Dr. Arya Das (Skeleton Technologies GmbH) optimized electrolytes to prevent performance degradation in high-voltage industrial supercapacitors, while Dr. Siddhi Kesharwani (Wama Widder) conducted fluid dynamics modeling across 58 operational sites to refine electricity-free hydraulic ram pumps. In healthcare diagnostics, Dr. Pradnya Ranjan Kamble (Lionex GmbH) designed an Interleukin-2 Cytokine Release Assay capable of differentiating active from latent tuberculosis within 24 hours. Addressing sustainable agriculture, Dr. Vinay Mahadev Hegde (Bayer AG) validated bacteria-based biological seed treatments through quantitative trials on sunflower root architecture and biomass.

In addition to these active research updates, the complete list of newly selected fellows for the Industrial Fellowship Call 2025 is appended in the subsequent section of this report.

## Post Doctoral Industrial Fellowship (PDIF) 2025



**Tanu Sharma**  
IIT Bombay

### Host

CarLa (BASF)

### Area of Work

Employing AI/ML for the sustainable production of bio-based chemicals by catalytic processes



**Shrishti Sharma**  
BITS Pilani, Pilani Campus

### Host

Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM

### Area of Work

Developing next-generation all-solid-state batteries using a novel electrode-modification strategy



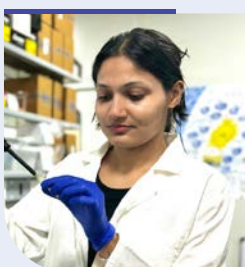
**Garima Nain**  
ABV-IIITM Gwalior

### Host

Airbus

### Area of Work

Federated Continual Learning at Edge Platforms



**Darshika Bohra**  
Tata Institute of Fundamental Research  
Hyderabad

### Host

ProBioGen AG

### Area of Work

Targeting host pathways that interfere expression of foreign DNA and virus infection



**Yash Mittal**  
IIT Bombay

#### Host

Fraunhofer Institute for Nondestructive Testing IZFP

#### Area of Work

Multi-Modal Characterization and Performance Optimization of Next-Generation Acoustic Metamaterials



**Neha**  
IIT Madras

#### Host

InnovationLab GmbH

#### Area of Work

Sustainable multifunctional wearable electronic device integrating micro-supercapacitor and pressure sensor for healthcare applications



**Jibin Boban**  
IIT Palakkad

#### Host

Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM

#### Area of Work

Surface refinement of additive manufactured structures for superior functional performance



**Priyanka Mukherjee**  
CSIR-IMMT

#### Host

Fraunhofer Institute for Materials Recycling and Resource Strategies IWKS

#### Area of Work

Process Development for Generation of Energy Grade Materials From Spent Photovoltaic Modules



**Gargi Konwar**  
IIT Jodhpur

#### Host

Fraunhofer Institute for Manufacturing Engineering and Automation IPA

#### Area of Work

Exploration of biobased materials to develop multifunctional flexible devices for sensing applications in printed electronics



**Kuzhandai Shamlee J.**  
IIT Madras

#### Host

LIONEX GmbH

#### Area of Work

Development and validation of a rapid immunochromatography test for Urticaria

## PhD Industrial Exposure Fellowship (PIEF) 2025



**Shimol Philip**  
NIT Puducherry

#### Host

Sonocrete GmbH

#### Area of Work

Experimental Assessment of High-Temperature Behavior of Hybrid Fibre-Reinforced Geopolymer Concrete and Prediction of Compressive Strength Using Explainable Machine Learning Approaches



**Shubhi Tripathi**  
CSIR-CECRI

#### Host

Fraunhofer Institute for Chemical Technology ICT

#### Area of Work

Advanced Diagnostic Approaches for Investigating Degradation in PEM Water Electrolyzers



**Dinesh Kumar**  
CSIR-CSIO (AcSIR)

#### Host

Fraunhofer Institute for Ceramic Technologies and Systems IKTS

#### Area of Work

Development of self-administered microneedle patches for non-invasive electrochemical detection of cholesterol



**Shubham Chobe**  
IIT Bombay

#### Host

BASF SE

#### Area of Work

Modeling the Impact of Chemical Admixtures on the Hydration of Environmentally Friendly Low-Clinker Cement



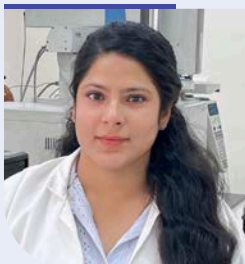
**Nikita Chaudhary**  
Institute of Nanoscience and Technology

#### Host

Fraunhofer Institute for Solar Energy Systems ISE

#### Area of Work

Nickel Oxide Hole Transport Layer for Efficiency Enhancement of Silicon Perovskite Tandem Solar Cell



**Manisha Madan**  
IIT Roorkee

#### Host

Siegwerk Druckfarben AG & Co. KGaA

#### Area of Work

Sustainable and Circular Barrier Coatings for Food Packaging Applications



**Sonali J. Jain**  
BITS Pilani, Pilani Campus

#### Host

LIONEX GmbH

#### Area of Work

Development of a rapid Sputum/urine-based test using monoclonal antibodies specific to multi-antigens, both carbohydrate and protein of the tuberculosis pathogen



**Ritam Guha**  
Cochin University of  
Science and Technology

#### Host

W42 Industrial Biotechnology

#### Area of Work

Cloning and expression of viral like particles in Pichia Pastoris system for a successful vaccine development in aquaculture



**Mainak Bhattacharyya**  
IISER Bhopal

#### Host

QC Design GmbH

#### Area of Work

Towards A General Quantum Resource Estimation Framework



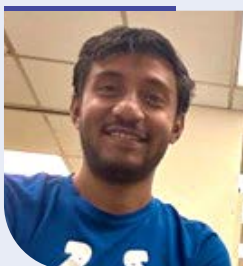
**Surbhi Kumari**  
Panjab University  
Chandigarh

#### Host

Bundesanstalt für Materialforschung und -prüfung (BAM)

#### Area of Work

Revolutionizing Dairy Safety: Instant  $\beta$ -Lactam Antibiotic(s) Detection in Milk via Microfluidic Flow Cell Technology



**Arya Das**  
CSIR-IMMT

#### Host

Markus Klose, Skeleton Technologies GmbH,  
Markranstädt, Germany

#### Area of Work

Next-Generation Electrolyte Systems for  
High-Voltage and High-Temperature  
Supercapacitors

## Project Overview

During the 12-month fellowship at Skeleton Technologies GmbH, Dr. Arya Das focused on developing and assessing next-generation electrolyte systems tailored for high-voltage and high-temperature supercapacitors. The research specifically addressed critical performance limitations observed in standard PC-DMPBF4 electrolytes, which demonstrated elevated Equivalent Series Resistance (ESR) and failed to achieve the nominal capacitance of 3200F under demanding operating

conditions. By conducting targeted optimizations of solvent selection and refining the overall electrolyte composition, Dr. Das successfully identified advanced chemical formulations. These innovations enabled significantly lower ESR and delivered stable, highly efficient electrochemical performance at elevated temperatures, successfully overcoming key barriers in supercapacitor performance degradation.

## Impact and Future Collaboration

The optimized electrolyte formulations developed during this fellowship hold significant commercial potential for improving the reliability, lifespan, and thermal stability of industrial and automotive supercapacitors. The research directly mitigates calendar and cycling aging, paving the way for more robust energy storage solutions. Working closely with the SuperBattery Development team

at Skeleton Technologies, Dr. Das facilitated a highly productive exchange of technological expertise. This fellowship has successfully laid the groundwork for enduring collaborative research and potential intellectual property development between the parent institution and German industry leaders in the advanced energy storage sector.



### **Himanshu Gauttam**

Atal Bihari Vajpayee-Indian Institute of Information Technology and Management (ABV-IIITM), Gwalior

### **Host**

Paulo Mendes, Airbus, Taufkirchen, Germany

### **Area of Work**

Deterministic Networking and Edge Computing for Mobile Extended Reality Services

## **Project Overview**

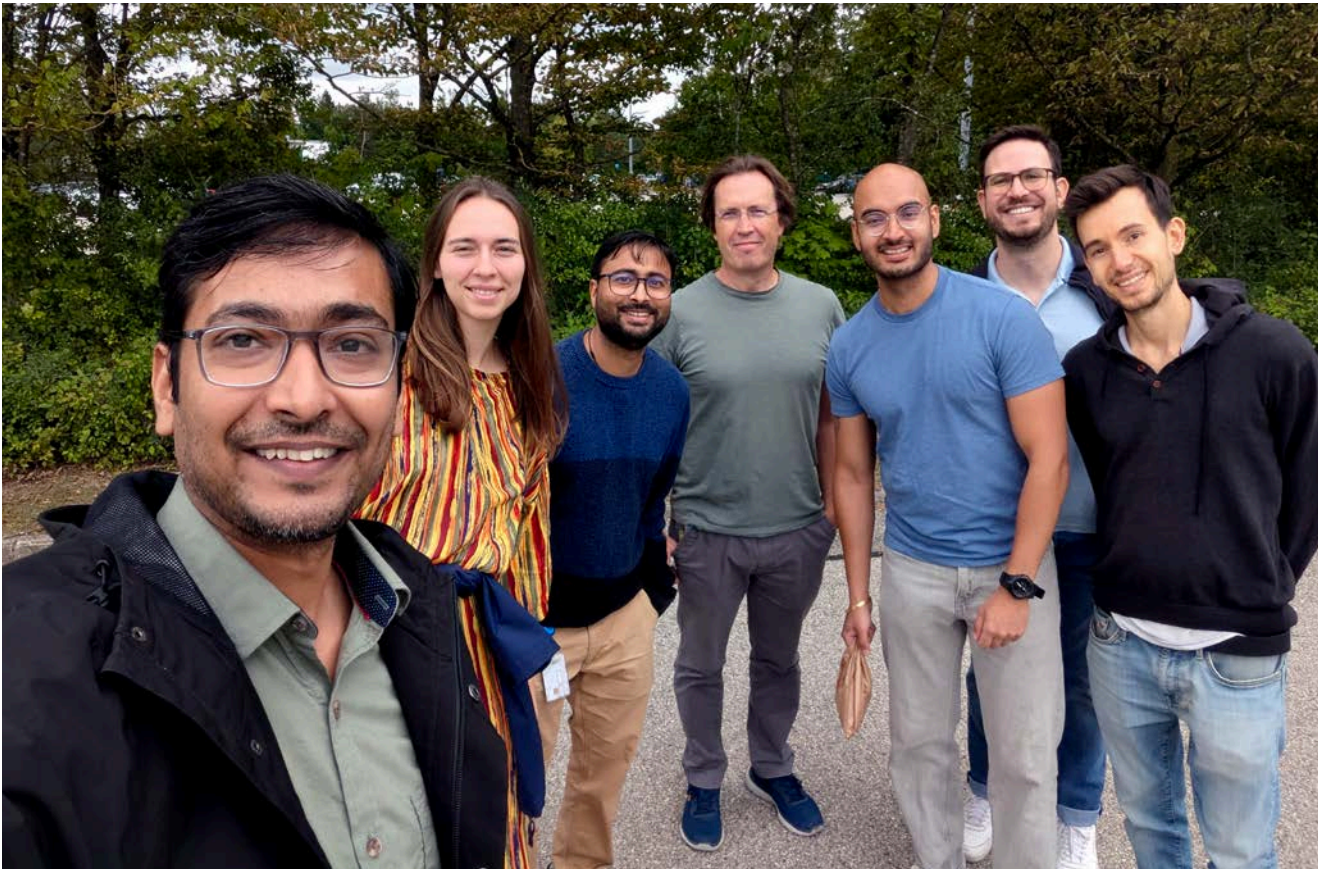
During his 12-month fellowship at Airbus, Dr. Himanshu Gauttam addressed the fundamental challenges of executing compute-intensive Extended Reality (XR) services on resource-constrained devices with limited battery, storage, and processing capabilities. Recognizing the high-latency drawbacks of cloud computing and the resource limits of standalone edge networks, he conceptualized an innovative End-Edge-Cloud Synergy solution. This architecture optimizes the distributed execution of XR pipelines by dynamically

determining "what to offload" and "where to offload" specific computational sub-services. A major technical achievement was the formulation of a generic graph-based representation model for the on-demand deployment of XR services. By intelligently distributing processing tasks across the available infrastructure continuum, the proposed method minimizes Motion to Photon (MTP) latency and maximizes the end-user's Quality of Experience (QoE) in constrained environments like aerospace.

## **Impact and Future Collaboration**

The fellowship yielded significant technological advancements with real-world applications in aerospace, logistics, and remote training. The core research output resulted in a patent filing titled "Microservice Architecture empowered Proactive Policy based deployment and Execution of Complex Services in End-Edge-Cloud Continuum" and a high-impact manuscript currently under review. According to the host

mentor, the initial analytical results of the XR deployment model are highly promising and set the stage for extensive simulation evaluations. The visit successfully established a robust foundation for long-term industrial and academic research collaborations between ABV-IIITM Gwalior and Airbus, specifically targeting future innovations in edge intelligence and collaborative networking.



*Dr. Gautam with his Airbus colleagues in Munich*



### Pradnya Ranjan Kamble

ICMR - National Institute for Research in Reproductive and Child Health

### Host

Mahavir Singh, Lionex GmbH,  
Braunschweig, Germany

### Area of Work

Development of whole blood based IL2-ELISA assay for distinguishing patients with active and latent tuberculosis

## Project Overview

During her fellowship, Dr. Kamble successfully designed and optimized an Interleukin-2 (IL-2) ELISA-based Cytokine Release Assay to accurately differentiate between active and latent tuberculosis (TB). By exploring IL-2 as a potential biomarker, her work directly addressed the limitations of existing Interferon Gamma Release Assays (IGRA), which rely solely on IFN- $\gamma$  detection and cannot distinguish active from latent cases. The developed human IL-2 ELISA demonstrated robust analytical performance, establishing high precision, accuracy, and an excellent linear relationship, with the capability to reliably

detect IL-2 at concentrations above 0.174 IU/mL. Moving beyond laboratory optimization, Dr. Kamble initiated an ongoing double-blinded clinical trial in collaboration with the Clinic for Pneumology and Respiratory Medicine at Städtisches Klinikum Braunschweig to validate the test kit using patient samples. To prepare for commercialization and European market entry, she also formulated essential regulatory documentation—including Master Batch Records, Instructions for Use, and Standard Operating Procedures—laying a strong foundation for EU In Vitro Diagnostic Regulation (IVDR) compliance and CE marking.

## Impact and Future Collaboration

The fellowship yielded a highly promising diagnostic tool with the potential to identify both pulmonary and extra-pulmonary TB. According to her host mentor, the resulting LIOKINE active TB kit could become the world's first test capable of diagnosing active TB within 24 hours using only 1 mL of blood. This breakthrough has catalyzed

a strategic, long-term collaboration with Lionex GmbH to organize large-scale clinical trials in India. This continued international partnership aims to comprehensively evaluate the assay's clinical utility across diverse, TB-endemic populations and facilitate its future regulatory implementation.



### Prince Kumar Rai

Indian Institute of Technology  
(IIT) Jodhpur

### Host

Oliver Rohr, Airbus Technology & Engineering,  
Central R&T Materials, Munich, Germany

### Area of Work

Surface Treatment for Complex Metallic  
Additive Manufactured Product for  
Aerospace Applications

## Project Overview

During his 12-month fellowship at Airbus, Dr. Prince Kumar Rai investigated advanced surface treatment and coating techniques for complex, aluminum-based additive manufactured (AM) parts used in aerospace applications. To overcome the limitations of traditional dip coating—which struggles to adequately cover intricate geometries—he designed and developed a novel pump-assisted Chemical Conversion Coating (CCC) system. This setup utilized a Dalic pump to deliver chrome VI-free electrolyte solutions

through enclosed 3D-printed structures, ensuring constant flow and comprehensive surface coverage. The pump-assisted method successfully yielded significantly thicker passivation layers compared to conventional methods. By conducting rigorous morphological and electrochemical characterizations, Dr. Rai's work provided critical insights into optimizing coating uniformity and corrosion resistance for high-performance aerospace components like Scalmalloy gyroid structures.

## Impact and Future Collaboration

Dr. Rai's research successfully demonstrated the feasibility of applying continuous protective coatings to complex internal geometries, addressing a major hurdle in aerospace AM post-processing. A scientific manuscript detailing this modified pump-assisted CCC setup is currently in preparation for publication. His exceptional performance and seamless integration into

the Airbus CRT team have catalyzed strong mutual interest in long-term collaboration. The fellowship established a solid foundation for future joint academic-industry proposals, student exchange programs, and the co-development of advanced, corrosion-resistant applied technologies between his parent institute and Airbus.



*Dr. Rai with his host at Airbus, Munich*



### Siddhi Kesharwani

Indian Institute of Science (IISc), Bangalore

### Host

Norbert Samweber, Wama Widder, Oberneukirchen, Germany

### Area of Work

Design and Optimization of Electricity-Free Hydraulic Ram Pumps for Off-Grid Water Solutions

## Project Overview

During her fellowship at Wama Widder, Dr. Siddhi Kesharwani focused on developing and optimizing electricity-free, low-head hydraulic pumping solutions tailored for underserved and rural communities. Bridging theoretical fluid mechanics with practical engineering, she conducted extensive field assessments across 58 operational hydraulic ram pump sites in Germany and Austria to evaluate real-world efficiency metrics. Her methodology combined this empirical

data with advanced Computational Fluid Dynamics (CFD) simulations, translating traditional 2D technical drawings into complex 3D solid models. By analyzing stroke length variations and optimizing length-to-head (L/H) ratios, Dr. Kesharwani successfully mapped energy losses and refined the core theoretical mechanics of the pumps, significantly advancing the design capabilities for highly efficient, renewable- energy-driven water distribution systems.

## Impact and Future Collaboration

Dr. Kesharwani's research delivers scalable, cost-effective water supply solutions that directly benefit rural agriculture, livestock management, and off-grid industrial applications. Her proactive engagement with local farming communities and regional industries—including cross-training in advanced robotic welding techniques—ensured that the engineered solutions were highly site-specific and

practically viable. The fellowship cultivated a profound mutual exchange of technological expertise and cultural understanding, establishing a robust framework for long-term, cross-border collaborations between Indian research institutions and German renewable technology sectors to tackle global water accessibility challenges.



*Dr. Siddhi with her host at a project site in Germany*

**Sachin Rahi**

IIT Jodhpur

**Host**

Alois Friedberger, Airbus Defence and Space GmbH, Taufkirchen, Germany

**Area of Work**

Exploration of Flexible Organic Transistors for Aerospace Applications

## Project Overview

During his 12-month fellowship at Airbus Defence and Space, Dr. Sachin Rahi focused on designing and developing robust layers for flexible transistors tailored for aerospace applications. The primary challenge addressed was identifying and optimizing materials capable of withstanding the harsh environmental conditions of aircraft. A significant achievement involved the planarization of highly rough aircraft substrates, which typically cause electrical failures and charge-trapping defects.

By drop-casting and post-annealing a specialized, environmentally stable epoxy polymer, Dr. Rahi successfully reduced the surface roughness of the aircraft substrate. Further accomplishments included the deposition of organic dielectrics via spin coating, designing source/drain shadow masks, depositing organic semiconductor layers, and assembling an in-house setup for comprehensive electrical characterization. Eventually, electrical characterization of the devices was successfully performed.

## Impact and Future Collaboration

Dr. Rahi's research significantly advanced the understanding of how electronic devices can be directly integrated into aircraft structures, paving the way for the development of conformal sensor systems that improve overall aircraft functionality. The collaborative work conducted at Airbus Central R&T has fostered a strong

foundation for future academic-industry synergy. Both Dr. Rahi and his host mentor have expressed a firm commitment to continuing their partnership, aiming to explore further advanced material integrations and scalable fabrication techniques for next-generation aerospace electronics.



*Dr. Rahi with other IGSTC fellows and hosts at Airbus Munich*



**Satya Kumar  
Dewangan**  
NIT Raipur

#### Host

Jonas Holtmann, Testia GmbH, Taufkirchen, Germany

#### Area of Work

AI-Assisted X-ray Computed Tomography for Defect Detection in Aviation Components

## Project Overview

During his 12-month fellowship at Testia GmbH, Dr. Satya Kumar Dewangan addressed the critical need for ensuring the structural integrity of manufactured aerospace components by enhancing non-destructive testing (NDT). The project focused on evaluating and optimizing an in-house developed, AI-assisted X-ray Computed Tomography (CT) defect detection software designed to identify pores and inclusions. Dr. Dewangan conducted rigorous experimental studies using Image Quality Indicator (IQI) samples and actual additive-manufactured

cylindrical components. By systematically varying CT parameters—such as tube current and reconstruction contrast factors—he identified the optimal conditions that maximize voxel intensity and defect detectability. The research successfully validated the software's high-accuracy Laplacian of Gaussian (LoG) detection algorithms. Ultimately, the integration of 3D volumetric visualization and automated registration parameters significantly reduced both inspection time and operational costs, ensuring that no potential defects in critical aviation components are missed.

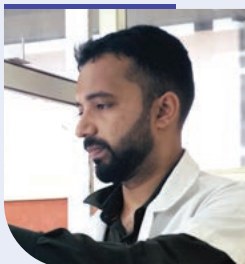
## Impact and Future Collaboration

Dr. Dewangan's research holds profound implications for aviation safety, offering a scalable, cost-effective framework for the high-precision inspection of additively manufactured parts. A scientific manuscript detailing this experimental evaluation of the CT defect detection software is currently in preparation. His work deeply integrated him with the Airbus and Testia teams, directly

contributing to software qualification and feature development for their evaluation tools. The fellowship established a strong foundation for ongoing collaborative research in AI-driven non-destructive testing, with Testia expressing high confidence in his continued potential as a scientist and a commitment to future joint explorations.



*Dr. Dewangan with his host at a Testia facility in Taufkirchen*



### Vinay Mahadev Hegde

Dr Panjabrao Deshmukh Krishi  
Vidyapeeth Akola & ICAR National  
Institute of Abiotic Stress  
Management, Maharashtra

### Host

Bernhardt Steinwender, Bayer AG,  
Monheim, Germany

### Area of Work

Bacteria-Based Biologics for Enhanced  
Crop Growth and Resilience

## Project Overview

During his Post-Doctoral Industrial Fellowship at Bayer AG, Dr. Vinay Mahadev Hegde focused on evaluating the efficacy of bacteria-based biological products to enhance sunflower growth and environmental resilience. Addressing key agricultural challenges related to seed germination, early seedling establishment, and nutrient uptake, Dr. Hegde designed and executed controlled experimental trials specifically targeting seed treatment applications. His methodology

involved comprehensive quantitative analyses of physiological traits, including advanced assessments of root architecture (length, volume, tip count) and shoot parameters such as biomass and chlorophyll content. By systematically analyzing these morphological and physiological responses, the research provided crucial insights into the modes of action of beneficial microbes, advancing the development of sustainable, biological alternatives for modern crop enhancement.

## Impact and Future Collaboration

Dr. Hegde's research significantly contributes to the transition toward sustainable agricultural practices by validating commercial biological seed treatments. His findings were prominently showcased during a poster presentation at the Bayer Annual Conference, "Innovation in Crop Science 2025," facilitating robust knowledge exchange within Bayer's global R&D divisions. The fellowship successfully

integrated Dr. Hegde into the complex product development ecosystem of a leading international agrochemical corporation. The Bayer Biologics team has committed to carrying forward the experimental frameworks he initiated, ensuring that his foundational work continues to inform future biological crop protection strategies and fostering enduring scientific ties.



*Dr. Vinay at experimental lab in Bayer AG, Germany*



**Sanjeet Kumar Singh**

IIT Kanpur

#### Host

Elmar Bonaccorso, Airbus Central R&T Materials, Taufkirchen, Germany

#### Area of Work

Acoustic Metamaterials and 3D/4D Printed Liners for Aircraft Noise Reduction

## Project Overview

During his 12-month fellowship at Airbus Central R&T, Dr. Sanjeet Kumar Singh addressed the critical challenge of aircraft noise reduction by developing next-generation nacelle acoustic liners. State-of-the-art liners perform exceptionally well at high frequencies but struggle with low-frequency broadband noise. To overcome this limitation, Dr. Singh designed and fabricated innovative acoustic liners using advanced metamaterial concepts and hybrid composites. Utilizing in-house 3D and 4D

printing technologies, he created customizable prototype structures, including double-honeycomb cores with modified perforation extensions. By rigorously testing these prototypes in an impedance tube facility, he successfully demonstrated a shift in the acoustic signature by up to 38% toward the lower frequency range. Furthermore, he successfully tested early concepts for programmable acoustic metamaterials capable of thermally adjusting cavity depths to dynamically adapt to varying engine noise profiles.

## Impact and Future Collaboration

Dr. Singh's research provides a highly promising pathway for manufacturing lightweight, high-performance acoustic liners that significantly mitigate engine noise without compromising fuel efficiency or aerodynamic design. His work on 3D and 4D printed acoustic metamaterials establishes a strong foundation for future industrialization in commercial aerospace. Although formal publications are currently

in preparation, his profound expertise in acoustics made him a highly sought-after resource within the Airbus CRT team. The fellowship successfully cemented a strong mutual relationship, with his host mentor praising his exceptional technological innovation and potential to contribute significantly to Airbus's long-term sustainability and acoustic objectives.



*Dr. Sanjeet with his host during a simulation exercise at Airbus, Munich*





**PAIRED EARLY  
CAREER  
FELLOWSHIP IN  
APPLIED RESEARCH  
(PECFAR)**

The Paired Early Career Fellowship in Applied Research (PECFAR) program facilitates the two-way exchange of early-career Indian and German researchers to build robust future partnerships with complementary expertise. By supporting targeted, short-duration research stays of one to two months, the program aims to help researchers explore the Indo-German landscape concerning entrepreneurship, joint research, and innovation across Science, Technology, Engineering, and Mathematics (STEM) fields. The core outcomes of these paired fellowships include establishing long-term institutional linkages, formulating joint international grant proposals, co-developing advanced materials and mathematical models, and delivering high-impact collaborative publications.

The featured paired fellowships for this reporting cycle showcase significant translational achievements across energy, healthcare, and computational sciences. In sustainable energy and infrastructure, Prof. Premkumar Senguttuvan and Prof. Matteo Bianchini conducted advanced operando characterizations of high-energy-density cathodes for sodium-ion batteries, establishing a strategic blueprint for an International Research Training Group (IRTG). Dr. Manish Kumar and Mr. Alexander Graef evaluated the environmental and performance reliability of Floating PV (FPV) systems, contributing to the DNV White Paper on FPV Guidelines and executing an official MoU between HPU Shimla and Fraunhofer ISE. Furthermore, Dr. Binson Babu and Dr. Juan Luis Gómez Urbano successfully co-developed

a fully bio-based, anode-free hybrid-ion capacitor that utilizes advanced lithium squarate-based sacrificial salts.

In biomedical engineering and healthcare, Dr. Muralimohan Gurusamy and Dr. Manuel Bange established a multimodal human gait assessment framework, integrating markerless motion capture with wearable sensors (ECG, IMU, EEG) to generate cross-cultural datasets for the early detection of neurological disorders. Advancing regenerative medicine, Dr. S. Dhakshinamoorthy and Prof. Andreas Blaeser optimized 4D bioprinting strategies for nerve conduits and heart valves, leading to the initiation of a joint PhD program between TU Darmstadt and IIT Madras. In the realm of computational mathematics and logistics, Dr. Samala Rathan and Dr. Jan Josef Friedrich designed higher-order numerical schemes (including Nessyahu-Tadmor and Kurganov-Tadmor types) for simulating nonlocal conservation laws relevant to traffic and pedestrian flow, while Dr. Sujeet Kumar Singh and Dr. Pirmin Fontaine developed multi-objective optimization algorithms for sustainable urban last-mile delivery. Finally, in fundamental photonics and chemistry, Dr. Kalaivanan Nagarajan and Dr. Marcus Seidel utilized hollow-core fiber setups at DESY to directly probe and track polariton-induced chemistry under vibrational strong coupling conditions.

In addition to these active research updates, the complete list of newly selected awardees for the PECFAR Call 2025 is appended in the subsequent section of this report.

## PECFAR Awardees 2025



**Rahul M R**

IIT (ISM) Dhanbad



**Jan Wegner**

University  
Duisburg-Essen

### Title of the Project

ICME-Based Approach to Design New High Entropy Alloys for Additive Manufacturing



**Athilakshmy Prabu**

Tamil Nadu Veterinary and  
Animal Sciences University  
Chennai



**Helen Mara Pluschke**

Thuenen Institute of  
Organic Farming  
Braunschweig

### Title of the Project

Innovations in Organic Poultry Farming: Insights from Germany's Best Practices



**Pradip Shashikant  
Pachfule**

S. N. Bose National Centre  
for Basic Sciences, Kolkata



**Oliver Dumele**

University of Cologne

### Title of the Project

Framework Materials for Energy Conversion and Energy Storage



**Naveen Chandra**

Wadia Institute of Himalayan  
Geology, Dehradun



**Mahmud Haghshenas  
Haghighi**

Leibniz Universität  
Hannover

### **Title of the Project**

Optimizing SAR-Based Deep Learning Models for Landslide Detection: A Comparative Study of the Himalayas and the Alps



**Premkumar Senguttuvan**

Jawaharlal Nehru Centre for  
Advanced Scientific Research,  
Bengaluru



**Matteo Bianchini**

University of Bayreuth

### **Title of the Project**

Exploration of High Energy Density Cathodes for Sodium-Ion Batteries



**Rahul Jaswantbhai  
Pandya**

IIT Dharwad



**Osman Musa**

TU Berlin

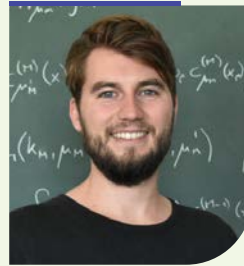
### **Title of the Project**

Neuro Symbolic AI (Nesy-AI) Enabled Resilient 6G Semantic Communication



**Hariprasad  
Manjunath Hegde**

Chanakya University  
Bengaluru



**Max Pfeffer**

Georg-August-Universität  
Göttingen

### Title of the Project

The Circulant Decomposition of Tensors and its Applications



**Manish Kumar**

Himachal Pradesh University  
Shimla



**Alexander Graef**

Fraunhofer Institute for  
Solar Energy Systems ISE  
Freiburg

### Title of the Project

Assessing Performance Reliability and Environmental Impacts of Floating PV Systems for Sustainable Integration



**Antarip Poddar**

IIT Dharwad



**Amirreza Aghakhani**

University of Stuttgart

### Title of the Project

Investigating the Role of Surface Wettability on Magnetically Guided Microrobots



**Ananth Govind Rajan**

IISc Bangalore



**Alexander Schlaich**

Hamburg University of Technology

**Title of the Project**

Probing The Effect of Nanoconfinement on the Reaction Microenvironment During Electrochemical CO<sub>2</sub> Reduction



**Suverna Trivedi**

IIT Kharagpur



**Harald Bürgmayr**

Karlsruhe Institute of Technology

**Title of the Project**

Selective Conversion of Fischer-Tropsch Products to Aromatics for Sustainable Aviation Fuels



**Ramesh Nayaka**

IIT Dharwad



**Cesare Signorini**

TU Dresden

**Title of the Project**

Experimental and Theoretical Investigation of 3D Printable Concrete Containing Recycled Construction Waste for Sustainable Structures



**Vishnu Sasidharan Nair**  
IISER Thiruvananthapuram



**Antonio Sánchez Benítez**

Helmholtz-Centre for Polar and Marine Research, Bremerhaven

### **Title of the Project**

Monsoonal Storms in a Global Warming Storyline Perspective



**Karanam Manjunath**  
Central Manufacturing Technology Institute Bengaluru



**Caroline Girmen**

Fraunhofer Institute for Production Technology IPT, Aachen

### **Title of the Project**

Advanced Fiber-Optic Low-Coherence Interferometry for High-Resolution Cavity Analysis



**Pradip Dey**  
IIT DharwaAVisva-Bharati University, West Bengal



**Daniel Christian Lauster**

Freie Universität Berlin

### **Title of the Project**

Polypeptide Based Dendronized Hydrogels for Capturing of Influenza, SARS-Cov 2 or Other Related Viruses



**Epparla Anusha**

Central Manufacturing  
Technology Institute,  
Bengaluru



**Frederic Cousin**

Fraunhofer-Einrichtung  
für Additive  
Produktionstechnologien  
IAPT, Hamburg

### Title of the Project

Design of an In-Situ Multi-Sensor Monitoring System and CNN-Based Optimisation for Critical Quality Assessment and Performance Evaluation in Large-Scale Wire DED



**Muralimohan Gurusamy**

Vellore Institute of  
Technology, Chennai



**Manuel Bange**

University of Augsburg

### Title of the Project

Multimodal Human Gait Assessment by Combining Foot Sole Pressure Sensing and Markerless Motion Capture



**Dharavath Kishan**

NIT Karnataka



**Moein Ghadrhan**

Karlsruhe Institute  
of Technology

### Title of the Project

Reliability-Oriented Design and Development of Re Configurable Off-Board EV Charging Systems

**Binson Babu**

Shiv Nadar Institution of  
Eminence, Delhi-NCR

**Juan Luis Gómez  
Urbano**

Friedrich Schiller University  
Jena

**Title of the Project**

Development of Anode-Free Hybrid-Ion Capacitors: From Bio-Based Conception to Sustainable Recycling

**Project:** Exploration of High Energy Density Cathodes for Sodium-Ion Batteries

### Paired Fellows



**Premkumar Senguttuvan**

Jawaharlal Nehru Centre for  
Advanced Scientific Research,  
Bengaluru



**Matteo Bianchini**

University of Bayreuth

## Project Summary & Key Achievements

The planned visits by Indian and German PIs were aimed to perform advanced characterizations, deliver talks and exchange ideas for developing next-generation battery materials through collaboration. To this end, Prof. Premkumar Senguttuvan visited the Helmholtz Institute Ulm (HIU) to deliver a scientific lecture and carried out crucial experiments at BayBatt, leading to advanced operando X-ray diffraction (XRD) studies on Na-Fe-Mn-Ni-O layered oxides and V-based NASICON cathodes. In reciprocal visits, Prof. Matteo Bianchini conducted extensive laboratory tours and delivered expert seminars across leading Indian institutes, including IISc, IIT Madras, and JNCASR, engaging deeply with numerous faculty members to discuss Na-ion materials chemistry. Together, Prof. Senguttuvan and Prof. Bianchini successfully laid the groundwork for at least two collaborative research papers based on their joint materials analysis. Furthermore, they jointly advanced institutional mobility by establishing a formal student exchange framework allowing PhD students and

postdocs to seamlessly transition between JNCASR and the University of Bayreuth. Culminating these achievements, both researchers developed a strategic blueprint for an International Research Training Group (IRTG) proposal, aiming to unite approximately 20 Principal Investigators across Germany and India for long-term battery research funding.

Through this PECFAR fellowship, the paired researchers significantly advanced fundamental research in sodium-ion battery technology by performing high-resolution operando characterizations of phase evolution in energy-dense cathode materials. Beyond their immediate experimental success, they fostered extensive academic networking, effectively bridging Prof. Bianchini's base at the University of Bayreuth with Prof. Senguttuvan's leading Indian research ecosystems, including JNCASR, IISc, and IIT Madras. This dynamic partnership has catalyzed a sustainable framework for long-term Indo-German cooperation.

## Project Contributions & Activities

- Preparation of two collaborative high-impact research articles based on joint experimental data and materials exchange.
- Establishment of a continuous PhD and Post-Doctoral student exchange framework between JNCASR and the University of Bayreuth.
- A series of invited technical talks on active materials and solid electrolytes for Na-based batteries delivered at leading Indian and German institutions.



*Dr Senguvattan at University of Bayreuth*



*Dr Bianchini at IISc Bangalore*

**Project:** Assessing Performance Reliability and Environmental Impacts of Floating PV Systems for Sustainable Integration

### Paired Fellows



**Manish Kumar**

Himachal Pradesh University  
(HPU) Shimla



**Alexander Graef**

Fraunhofer Institute for  
Solar Energy Systems (ISE)  
Freiburg

## Project Summary & Key Achievements

The focus of the study is on assessing the environmental impact and performance reliability of floating PV (FPV) systems. Dr. Manish Kumar (HPU, India) and Mr. Alexander Graef (Fraunhofer ISE, Germany) are collaborating to investigate the ecological, hydrological and performance-related aspects of FPV. Dr. Manish Kumar visited the Fraunhofer Institute for Solar Energy Systems (ISE) to conduct environmental measurements beneath floating PV (FPV) systems alongside Alexander Graef. During his residency, Dr. Kumar contributed to the DNV White Paper on FPV Guidelines, engaged with the Agri-PV research group, and visited leading institutions across Germany, including HI-ERN, ISC Konstanz, and ISFH Hamelin, where he participated in the IEA PVPS Task 13

workshop. Reciprocally, Alexander Graef undertook an extensive research visit to India, networking and delivering expert lectures at MNIT Jaipur, IIT Roorkee, YSP University Solan, and HPU Shimla. Mr. Graef also conducted vital site visits, including a technical evaluation at an FPV plant in Chandigarh, and facilitated the finalization of an official Memorandum of Understanding (MoU) between HPU and Fraunhofer ISE, alongside drafting multiple joint Indo-German grant proposals.

By merging Dr. Kumar's academic expertise with Mr. Graef's practical and scientific experience at Fraunhofer ISE, the paired researchers established a sustainable framework for international solar energy research.



*MoU Signing between HPU Shimla and Fraunhofer ISE for joint research and remote PhD co-supervision*



FPV site visits at Ihringen and Merdingen, Germany

## Project Contributions & Activities

- Finalization of an official Memorandum of Understanding (MoU) between HPU Shimla and Fraunhofer ISE for joint research and remote PhD co-supervision.
- Formation of an Indo-German academic-industry consortium (Fraunhofer ISE, Khare Energy, HPU) to design and implement an agro-PV demonstration system in India.
- Co-authorship contributions to the DNV White Paper on Floating PV Guidelines and inclusion of Dr. Kumar as the first Indian expert in the IEA PVPS Task 13 FPV subtask.
- Drafting and facilitation of multiple joint bilateral grant proposals, including IGSTC-SING and MNIT-ISE WISER.

**Project:** Assessing Performance Reliability and Environmental Impacts of Floating PV Systems for Sustainable Integration

### Paired Fellows



**Karanam Manjunath**

Central Manufacturing  
Technology Institute  
Bengaluru



**Caroline Girmen**

Fraunhofer Institute for  
Production Technology  
IPT, Aachen

## Project Summary & Key Achievements

The focus of the study is on developing and evaluating a fiber-optic-based system for the high-resolution analysis of internal industrial cavities. Dr. Karanam Manjunath (CMTI, India) and Dr. Caroline Girmen (Fraunhofer IPT, Germany) are collaborating to investigate micro-optical probes by merging Single-Mode Fibers (SMF) and Gradient-Index (GRIN) fibers. Dr. Karanam Manjunath visited the Fraunhofer IPT to conduct optical simulations, build hardware prototypes, and perform rigorous beam quality testing. During his residency, Dr. Manjunath optimized the fiber probe utilizing Zemax OpticStudio and successfully translated the design into a physical beam delivery system equipped with an 848.93 nm SLD source and a piezomotor-driven stepper stage.

To broaden the impact of the research, Dr. Manjunath also conducted extensive strategic networking visits across the German manufacturing ecosystem. This included visits to RWTH-WZL to explore the integration of robotic sensors into digital twins, and technical engagements at Fraunhofer ILT to study femtosecond laser micro-machining and surface functionalization.

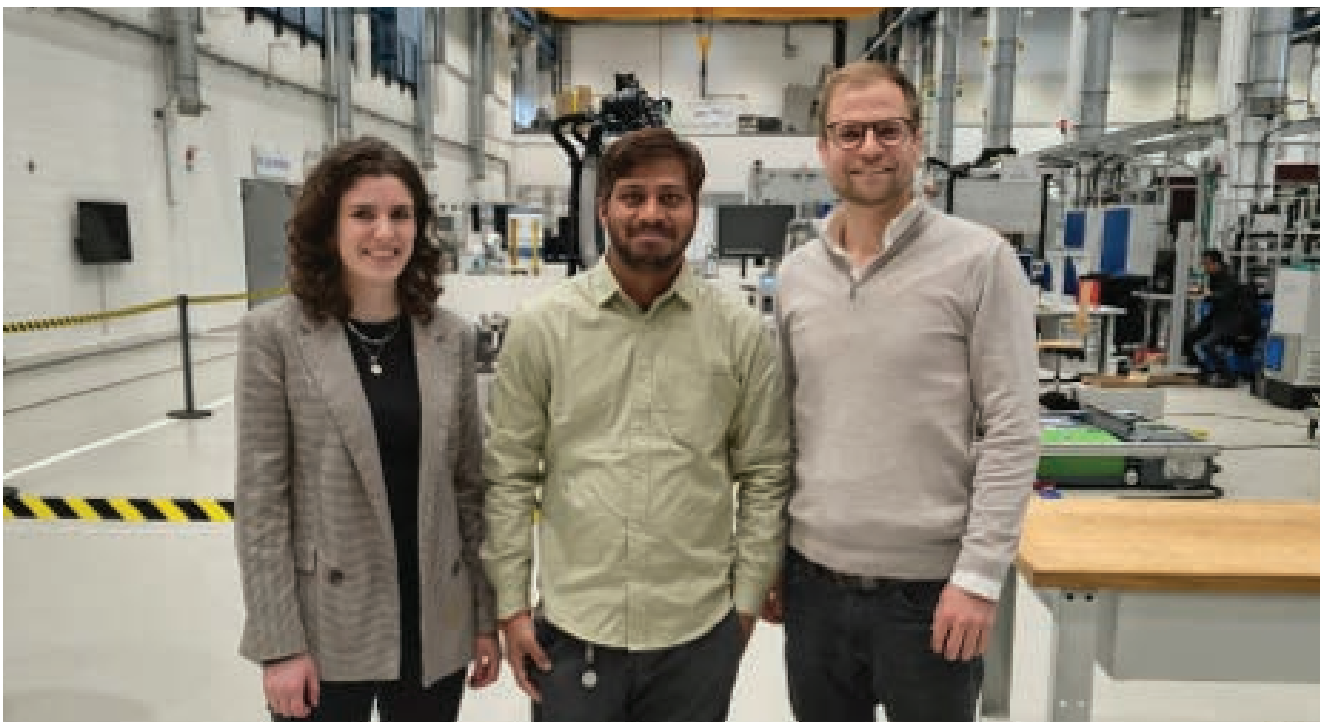
By merging Dr. Manjunath's technical expertise with the advanced engineering facilities at Fraunhofer IPT, the paired researchers established a robust framework for non-destructive industrial inspection and catalyzed sustainable avenues for future international manufacturing research.

## Project Contributions & Activities

- Successful design, simulation, and physical prototyping of an advanced hybrid SMF and GRIN fiber-optic delivery system for non-destructive industrial cavity inspection.
- Initiation of preliminary discussions for a joint research proposal under the IGSTC 2+2 Call framework, specifically targeting femtosecond laser micro-machining applications.
- Exploration of synergies between ultra-short pulse (USP) processing and MEMS fabrication for high-precision industrial components alongside researchers at Fraunhofer IPT/RWTH.
- Initiation of formal discussions for a collaborative Indo-German Science & Technology Centre (IGSTC) workshop and a similar joint initiative involving the CSIR-Central Scientific Instruments Organisation.



*Dr Manjunath with the group members of Dr. Girmen at Fraunhofer IPT*



*Lab visit to RWTH Aachen by Dr Manjunath and Dr. Girmen*

**Project:** Multimodal Human Gait Assessment by Combining Foot Sole Pressure Sensing and Markerless Motion Capture

### Paired Fellows



**Muralimohan Gurusamy**

Vellore Institute of Technology  
Chennai



**Manuel Bange**

University of Augsburg  
Germany

## Project Summary & Key Achievements

Human posture is crucial for musculoskeletal health, movement efficiency, and overall well-being. Poor posture can lead to chronic pain, fatigue, and biomechanical issues. Posture and gait analysis play a key role in diagnosing disorders like Parkinson's disease. This project introduces an intelligent postural correction system that integrates foot sole pressure sensing with markerless motion capture for real-time assessment and correction of postural misalignments. Dr. Muralimohan Gurusamy visited the University of Augsburg, Germany, where he developed and validated an experimental protocol for an eight-camera markerless motion capture system. His research focused on an emotional gait assessment framework, leading to successful pilot data recordings from German participants. Dr. Gurusamy also expanded institutional linkages through research discussions at Johannes Gutenberg University, Mainz. In reciprocal exchange, Dr. Manuel Bange visited the Vellore Institute of Technology (VIT), Chennai. Dr. Bange successfully installed, calibrated (using the open-source tool Caliscope), and tested the

eight-camera system in India. He oversaw the multimodal data acquisition from Indian subjects and further engaged with the Centre for Human Movement Analytics at VIT. Additionally, Dr. Bange broadened his networking footprint by participating in the IGSTC Strategic Conclave on Mobile Health & Telemedicine in New Delhi.

By combining Dr. Gurusamy's expertise in experimental protocol design with Dr. Bange's successful implementation and calibration of a multi-camera markerless motion capture system, the paired researchers successfully integrated complex wearable sensors including ECG, IMU, EEG, and foot-sole pressure monitors. Their collaboration directly resulted in a unique, cross-national dataset containing human movement data from both German and Indian participants. This effort lays groundwork for training robust artificial intelligence and machine learning models for the early detection of neurological disorders, while fostering long-term institutional linkages between VIT Chennai and the University of Augsburg.

## Project Contributions & Activities

- Development and calibration of a comprehensive eight-camera markerless motion capture platform integrated with multimodal wearable sensors (ECG, IMU, EEG, and foot-sole pressure).
- Creation of an initial cross-cultural (Indo-German) dataset for intelligent gait and postural analysis.
- Extensive scientific networking and strategic institutional linkages across VIT Chennai, the University of Augsburg, and Johannes Gutenberg University.



*Dr. Guruswamy with the sensor set-up*



*Dr Guruswamy and Dr Bange at the experimental set-up lab at Augsburg, Germany*

**Project:** Development of Anode-Free Hybrid-Ion Capacitors: From Bio-Based Conception to Sustainable Recycling

### Paired Fellows



**Binson Babu**

Shiv Nadar Institution of Eminence, Delhi-NCR



**Juan Luis Gómez Urbano**

Friedrich Schiller University, Jena

## Project Summary & Key Achievements

In this project, the objective is to develop a fully bio-based, recyclable, hybrid-ion capacitor (HIC), that can comprise the virtue of both high-energy batteries and high-power capacitors. Furthermore, within this collaboration the “anodeless” or “anode-free” design, wherein the cation host is entirely removed, will be pursued for the first time for a HIC. Dr. Binson Babu visited Friedrich Schiller University Jena, where he successfully assembled and evaluated initial Swagelok cells for anode-free lithium-ion capacitors. During his tenure in Germany, Dr. Babu expanded his collaborative network through research visits to leading institutions including the University of Bayreuth, Helmholtz Institute Ulm (HIU), and Fraunhofer IKTS, and engaged actively as an organizing committee member and presenter at the 76th Annual Meeting of the International Society of Electrochemistry in Mainz. In a reciprocal visit, Dr. Juan Luis Gómez Urbano traveled to Shiv Nadar University to build upon these foundational tests by introducing sacrificial

salts as the source of lithium ions. Dr. Gómez Urbano systematically optimized device parameters such as pressure, temperature, and electrolyte additives to maximize performance, while also delivering invited technical talks at IIT Delhi and IIT Mumbai to foster long-term Indo-German academic-industrial linkages.

By combining Dr. Babu’s foundational device assembly techniques with Dr. Gómez Urbano’s specialized knowledge of electrolyte chemistry, the paired researchers successfully transitioned their experimental energy storage devices from relying on electrolyte-sourced lithium to utilizing advanced lithium squarate-based sacrificial salts. This synergistic approach drastically enhanced the electrochemical performance and stability of anode-free lithium-ion capacitors. Beyond their immediate experimental milestones in the laboratory, the researchers established a robust, long-term bilateral network across Germany and India.

## Project Contributions & Activities

- Co-development and systematic optimization of an anode-free lithium-ion capacitor utilizing advanced lithium squarate-based sacrificial salts.
- Preparation of a collaborative perspective article focusing on the recycling and sustainability of high-power energy storage devices.
- Extensive scientific networking and invited technical presentations across major Indian and German research hubs, including active engagement at the 76th Annual Meeting of the International Society of Electrochemistry.



Dr Babu at Freidrrich Schiller University, Jena



Dr. Urbano performing experiments at Shiv Nadar lab

**Project:** Design and Development of Numerical Schemes for Nonlocal Conservation Laws in Multi-Dimensions

### Paired Fellows



**Samala Rathan**

Indian Institute of  
Petroleum and Energy  
Visakhapatnam



**Jan Josef Friedrich**

RWTH Aachen University

## Project Summary & Key Achievements

In this project, the objective is to design and develop efficient finite volume-based numerical methods to simulate nonlocal conservation laws, which are essential for realistic modeling of systems with collective behavior like pedestrian and traffic flow. Dr. Jan Friedrich traveled to the Indian Institute of Petroleum and Energy (IIPE), where the pair successfully developed second-order Nessyahu-Tadmor (NT) and Kurganov-Tadmor (KT) type schemes for nonlocal hyperbolic systems of balance laws in one dimension. During his visit, Dr. Friedrich also initiated collaborations at Mahindra University to research Discontinuous Galerkin (DG) schemes for 2D nonlocal conservation laws.

In a reciprocal visit, Dr. Rathan Samala visited RWTH Aachen University, joining Prof. Michael

Herty's group to work closely with Dr. Friedrich and Anika Beckers. Dr. Rathan carried out rigorous analysis of the numerical methods, verifying key qualitative properties such as positivity preservation and boundedness, and extended earlier central schemes into higher-order methods using the Weighted Essentially Non-Oscillatory (WENO) framework. The team successfully designed a new central-upwind flux tailored for nonlocal conservation laws and implemented it within the central-WENO framework. Dr. Rathan also expanded his collaborative network by giving talks and visiting the research groups of Prof. Simone Göttlich at the University of Mannheim and Prof. Christian Rohde at the University of Stuttgart. Furthermore, he attended and presented at the NumHyp 2025 conference in Darmstadt.

## Project Contributions & Activities

- Development of second-order Nessyahu-Tadmor (NT) and Kurganov-Tadmor (KT) type schemes for nonlocal hyperbolic systems of balance laws in one dimension.
- Design of a new central-upwind flux specifically tailored for nonlocal conservation laws and its successful implementation within the central-WENO framework.
- Initiation of a collaboration on a third-order CWENO scheme in 2D, resulting in a robust hybridization algorithm tailored for multidimensional problems.
- Extensive scientific networking and presentations at leading institutions such as the University of Mannheim, the University of Stuttgart, and Mahindra University, along with participation in the NumHyp 2025 conference in Darmstadt.



Dr. Samala Rathan at RWTH Aachen with the group members of Dr. Friedrich labs

**Project:** Development of Multi-Objective Optimization Models for Sustainable Urban Logistics

### Paired Fellows



**Sujeet Kumar Singh**

Indian Statistical Institute (ISI), Hyderabad Unit



**Pirmin Fontaine**

Catholic University of Eichstätt-Ingolstadt

## Project Summary & Key Achievements

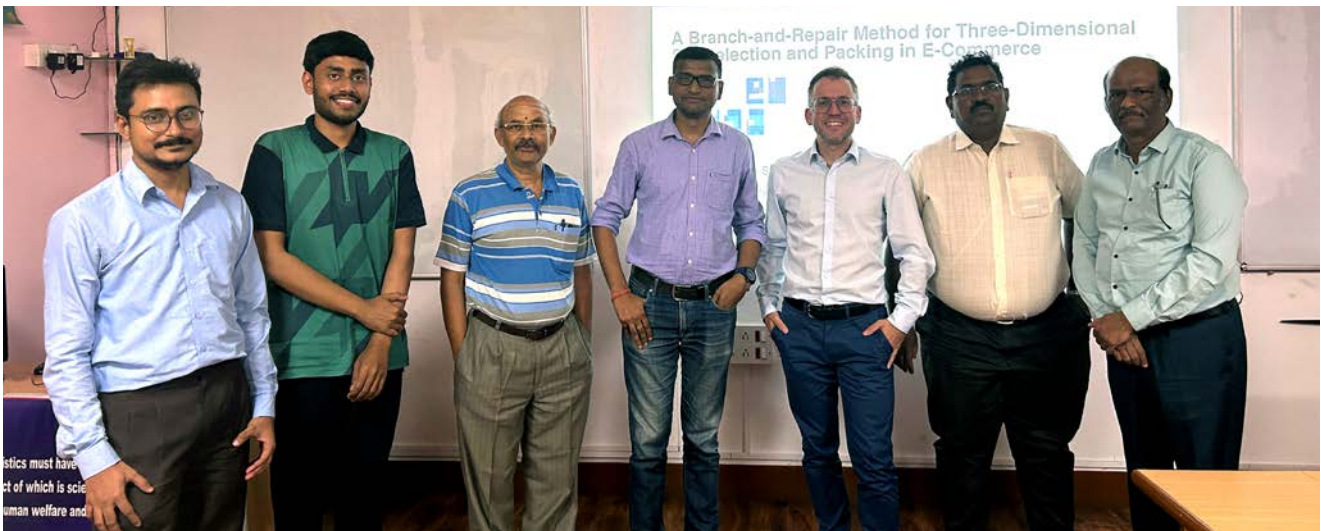
In this project, the objective is to develop a fully bio-based, recyclable, hybrid-ion capacitor (HIC), that can comprise the virtue of both high-energy batteries and high-power capacitors. Furthermore, within this collaboration the “anodeless” or “anode-free” design, wherein the cation host is entirely removed, will be pursued for the first time for a HIC. Dr. Binson Babu visited Friedrich Schiller University Jena, where he successfully assembled and evaluated initial Swagelok cells for anode-free lithium-ion capacitors. During his tenure in Germany, Dr. Babu expanded his collaborative network through research visits to leading institutions including the University of Bayreuth, Helmholtz Institute Ulm (HIU), and Fraunhofer IKTS, and engaged actively as an organizing committee member and presenter at the 76th Annual Meeting of the International Society of Electrochemistry in Mainz. In a reciprocal visit, Dr. Juan Luis Gómez Urbano traveled to Shiv Nadar University to build upon these foundational tests by introducing sacrificial salts as the

source of lithium ions. Dr. Gómez Urbano systematically optimized device parameters such as pressure, temperature, and electrolyte additives to maximize performance, while also delivering invited technical talks at IIT Delhi and IIT Mumbai to foster long-term Indo-German academic-industrial linkages.

By combining Dr. Babu’s foundational device assembly techniques with Dr. Gómez Urbano’s specialized knowledge of electrolyte chemistry, the paired researchers successfully transitioned their experimental energy storage devices from relying on electrolyte-sourced lithium to utilizing advanced lithium squarate-based sacrificial salts. This synergistic approach drastically enhanced the electrochemical performance and stability of anode-free lithium-ion capacitors. Beyond their immediate experimental milestones in the laboratory, the researchers established a robust, long-term bilateral network across Germany and India.

## Project Contributions & Activities

- Development of a holistic multi-objective optimization mathematical model and algorithmic framework for sustainable urban last-mile delivery.
- Establishment of a robust Indo-German research network spanning faculty and early-career researchers at ISI Hyderabad and the Catholic University of Eichstätt-Ingolstadt.
- Preparation of future joint research proposals focused on applying the mathematical models to real-world urban logistics and e-commerce data.



*Prof. Fontaine's talk at ISI Hyderabad during his visit to India*



*Dr Sujit at Catholic University of Eichstätt-Ingolstadt as part of his PECFAR fellowship*

**Project:** Advanced Biofabrication and 4D Bioprinting Strategies for Regenerative Medicine**Paired Fellows****S. DHAKSHINAMOORTHY**

SASTRA Deemed  
University, Thanjavur

**Pirmin Fontaine**

Technical University  
Darmstadt

## Project Summary & Key Achievements

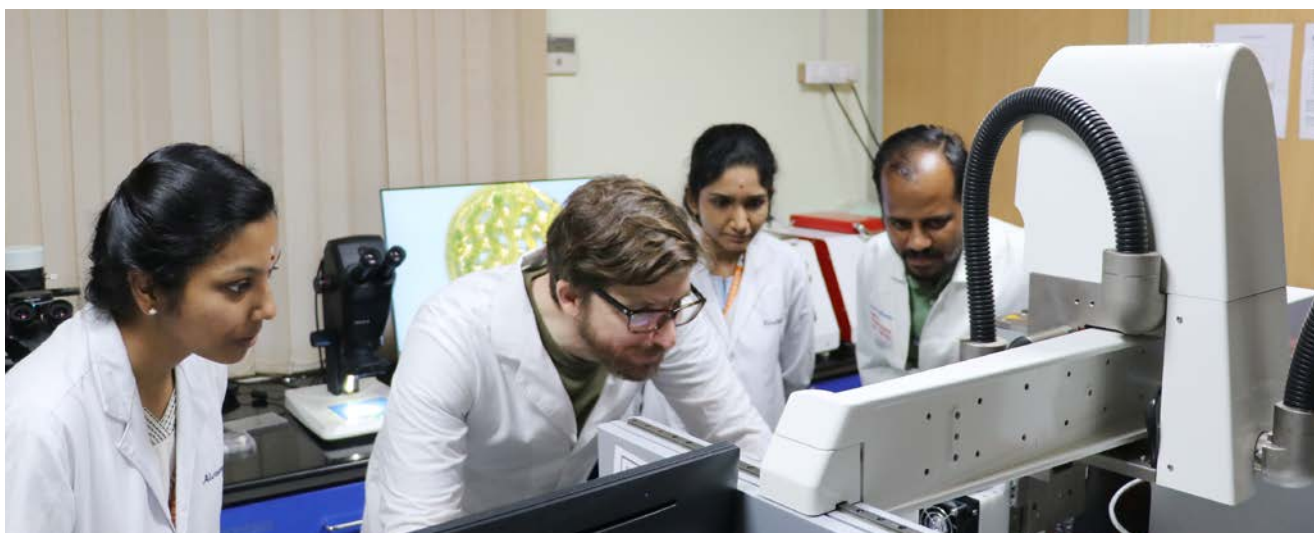
The primary objective of this collaborative initiative is to evaluate recently developed scaffolds and bioprinted constructs across both laboratories, thereby establishing a framework for preclinical studies to accelerate clinical translation. Furthermore, the partnership seeks to identify novel research avenues within additive manufacturing. By synthesizing complementary expertise, the teams aim to generate foundational data to support future joint research grant applications. Specifically, the research focuses on formulating advanced strategies for the 4D bioprinting of nerve conduits and the biofabrication of heart valves. Dr. S. Dhakshinamoorthy visited the Technical University Darmstadt to perform 3D printing and bioreactor experiments with Prof. Andreas Blaeser's research group. During his tenure, Dr. Dhakshinamoorthy also delivered invited talks and explored collaborations at numerous premier institutions across Germany, including TU Dresden, TU Munich, and the University of Erlangen-Nuremberg, while also engaging

with industry partners like Black Drop Biomedical. In reciprocal visits, Prof. Andreas Blaeser conducted a research stay at SASTRA Deemed University, focusing on 3D-bioprinting, multicellular spheroids, microfluidics, and piezoelectric scaffolds. Furthermore, Prof. Blaeser delivered expert lectures at the FABRICATE Congress and across several Indian Institutes of Technology (IIT Madras, Mumbai, Delhi, Goa), ultimately facilitating the preparation and signing of a joint PhD program between IIT Madras and TU Darmstadt.

The paired researchers successfully addressed key challenges in scaling up tissue-engineered scaffolds and advanced the co-development of next-generation biomaterials, including piezoelectric scaffolds, bioactive glasses, and novel polymer blends for vascular and cardiac applications. Beyond foundational research, this dynamic partnership fostered extensive cross-continental academic and industrial networking.

## Project Contributions & Activities

- Co-development of next-generation biomaterials and preparation of collaborative high-impact research publications.
- Initiation of joint grant proposals, including IGSTC 2+2 and SPARC, targeting advanced biofabrication research and organ-on-chip systems.
- Preparation and signing of a joint PhD program between Technical University Darmstadt and IIT Madras.
- Extensive scientific outreach encompassing over a dozen invited lectures and industrial engagements across premier Indian and German institutions.



*Prof. Andreas Blaeser's visit to SASTRA Deemed University: Shared insights on bioprinting research, initiated collaborative planning, and conducted hands-on training for Ph.D. students on spheroid culture and organ-on-chip systems*



*At the Technical University of Darmstadt, Dr. Dhakshinamoorthy collaborated with Prof. Andreas Blaeser on piezoelectric analysis of 3D printed scaffolds, dynamic culture studies, 3D spheroid development for disease modeling, and advancement of organ-on-chip platforms.*

**Project:** Understanding Polariton-Induced Chemistry through Cavity-Polariton Spectroscopy

### Paired Fellows



**Kalaivanan Nagarajan**

Tata Institute of  
Fundamental Research  
(TIFR), Mumbai



**Marcus Seidel**

Deutsches  
Elektronen-Synchrotron  
(DESY), Hamburg

## Project Summary & Key Achievements

The collaborative research initiative aims to achieve a fundamental, molecular-level understanding of the polaritonic states formed during the strong coupling process. While traditional experiments typically rely on optical cavities to characterize polaritonic states via split cavity modes, this joint project seeks to directly characterize coupled molecules to precisely evaluate the impact of strong coupling on their potential energy surfaces. To overcome existing analytical limitations, the researchers are developing alternative spectroscopic methodologies to track chemical reactions under Vibrational Strong Coupling (VSC) conditions. A primary focus of the work plan involves utilizing a tunable hollow-core fiber setup that matches molecular transition energies, enabling direct probing of the coupled molecules. Ultimately, this interdisciplinary effort—bridging physics, chemistry, and materials science—addresses critical mechanistic knowledge gaps while establishing a robust foundation for continuous international collaboration and future academic exchange programs.

Dr. Kalaivanan Nagarajan undertook a research visit to Deutsches Elektronen-Synchrotron (DESY) in Hamburg, Germany, where he collaborated with Dr. Marcus Seidel. During his stay, Dr. Nagarajan focused on designing

experimental setups using hollow-core waveguides to study molecules under vibrational strong coupling, aiming to directly probe hybrid polaritonic states. Concurrently, Dr. Nagarajan engaged in extensive scientific networking, delivering expert research talks to the Laser Development Group at DESY and the Theoretical and Materials Group at the Max Planck Institute. Dr. Seidel complemented these efforts by providing advanced expertise in ultrafast and high-power lasers, facilitating a joint investigation into the interaction between vibrational transitions and Fabry-Perot cavity optical modes to further understand polariton-induced chemistry.

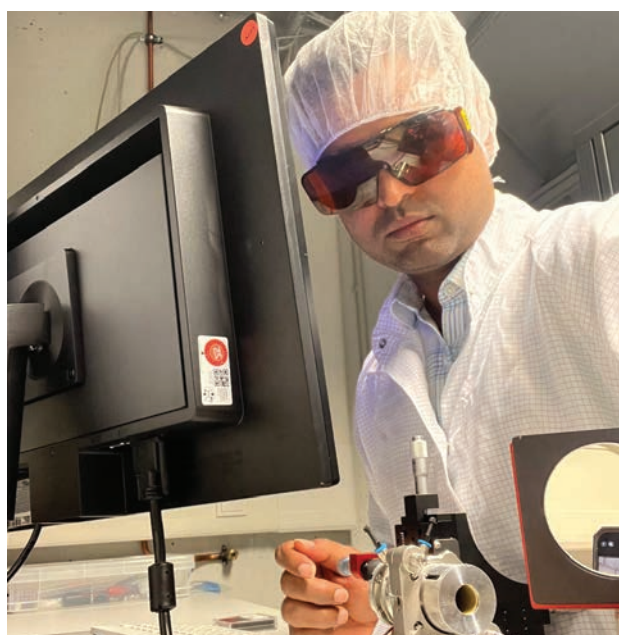
By focusing on how polaritons can modify chemical reactivity, the paired researchers laid a robust foundation for understanding the potential energy surface modifications caused by strong light-matter coupling. Their collaborative synergy not only facilitated critical knowledge transfer but also directly inspired new research directions at the intersection of chemistry and photonics. Ultimately, this partnership has strengthened the long-term institutional linkage between TIFR Mumbai and DESY Hamburg, accelerating future efforts to design novel polaritonic materials and devices.

## Project Contributions & Activities

- Development of advanced experimental frameworks utilizing hollow-core fiber setups for cavity-polariton spectroscopy.
- Delivery of targeted scientific lectures by the Indian PI to the Laser Development Group (DESY) and the Theoretical and Materials Group (Max Planck Institute) to foster institutional networking.
- Initiation of long-term collaborative pathways for the design of novel polaritonic materials with applications in photonics and materials science.



*Dr. Siedel performing experiments at the lab in DESY*



*Dr. Nagarajan during an experiment at DESY*



# IGSTC-CONNECT PLUS

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Alexander Von Humboldt (AvH) foundation and the Department of Science & Technology (DST) organizes Indo-German Frontiers of Engineering Symposia (INDOGFOE) which are a series of interdisciplinary, binational conferences. Funding support on the Indian side is provided by the Department of Science & Technology, Government of India and on the German side by the Federal Ministry of Education and Research (BMBF).

The activity brings together outstanding, early-career German and Indian engineers and natural scientists from industries, universities, and other research institutions to introduce their areas of research and technical work, thereby, facilitating an interdisciplinary transfer of knowledge and methodology that aims to lead to the

development of cooperative networks of young scientists from both countries.

To encourage long-term collaboration among participants of INDOGFOE, the AvH Follow-up Programme CONNECT allocates residence allowances for working visits of participants in INDOGFOE partner countries for up to a total of 30 days per conference. To further support working visits for successful CONNECT applicants from India and Germany, this Letter of Intent (Loi) designates and appoints IGSTC to implement, administer and manage the IGSTC-CONNECT Plus Programme. Under this programme, IGSTC will support international travel expenses for successful Indian and German CONNECT participants, thus promoting the scientific exchange and networking.

## IGSTC-CONNECT Plus Fellow



**Prof. David Florysiak**

IU International University of Applied Sciences, Munich

### Host

Dr. Siddhartha Santra, IIT Bombay

### Area of Work

Quantum Computing and Financial Services Transformation

## Project Summary

The collaborative project, "Quantum Computing and Financial Services Transformation," initiated by Prof. Dr. David Florysiak (IU Internationale Hochschule) and Prof. Siddhartha Santra (IIT Bombay) following the 2024 INDOGFOE symposium, aims to systematically evaluate the transformative potential of quantum computing (QC) within the financial services industry. By bridging theoretical quantum physics with real-world financial applications, the collaboration leverages Prof. Santra's deep knowledge of quantum optimization algorithms alongside Prof. Florysiak's extensive background in

quantitative finance and regulatory frameworks. The project's core objectives involve developing a comprehensive taxonomy of computing problems across main financial domains, matching these with appropriate quantum algorithms, and conducting rigorous benchmarking to establish performance differentials. This joint effort seeks to estimate the necessary return-on-investment (ROI) for QC to outperform classical technologies, enabling the identification and ranking of specific financial sectors most likely to be disruptively advanced by near-to-mid-term quantum hardware.



# SMALL IMMEDIATE NEED GRANTS (SING)



The Small Immediate Need Grants (SING) program provides fast-tracked financial support of up to €10,000 to ignite emerging Indo-German research collaborations. Designed for researchers and industry professionals, the program utilizes a streamlined, single-window approach to rapidly fund ad-hoc opportunities in innovation, rapid prototyping, technology demonstration, and industrial R&D. Furthermore, it supports leveraging scientific events to exchange intellectual concepts that can pave the way for long-term bilateral technology development.

The featured SING projects for this reporting cycle showcase significant translational achievements. Dr. Punnadath Preetham E and Prof. Bernd Lepines successfully developed and evaluated an oral bivalent vaccine against *Aeromonas hydrophila* and *Edwardsiella tarda* for Nile tilapia, utilizing fucoidan as a novel

C-type lectin receptor adjuvant to boost mucosal immunity. Punit Kumar and Prof. Michael Bonitz integrated Quantum Hydrodynamics and Quantum Kinetic Theory to create a 1D simulation framework for analyzing shock-wave dynamics in dense quantum plasmas, with direct applications in inertial confinement fusion. Additionally, Dr.-Ing. Beatrice Richieri and Prof. Ankit Agarwal established a robust hydrological monitoring initiative, deploying continuous water-level instrumentation in the Yamuna River to advance probabilistic groundwater flood mapping and risk assessment. Finally, Hridayesh Prakash and Prof. Andreas Weigert developed in vitro co-culture models to investigate the role of sphingolipid signaling pathways in restoring gut immune homeostasis, demonstrating how ceramide-mediated epithelial injury drives pro-inflammatory macrophage activation in Inflammatory Bowel Disease (IBD).



**Punnadath  
Preetham E**

Cochin University of  
Science and Technology

#### Host

Bernd Lepines, Ludwig Maximilian University,  
Munich

#### Area of Work

Targeting C-type lectins in fish to increase  
the immunogenicity of vaccines.

## Project Overview and Work Performed

During the fellowship, Dr. Preetham focused on evaluating the adjuvant efficacy of an inactivated *S. agalactiae* vaccine and analyzing mucosal immune responses in vaccinated tilapia. A major achievement of this work was the improvement of a bivalent vaccine against *Aeromonas hydrophila* and *Edwardsiella tarda* by using fucoidan, a C-type lectin receptor (CLR), as a novel adjuvant. The experimental results indicated that oral vaccination with this lectin elicited a strong immune response, significantly increasing both specific and nonspecific immunity in the fish. Additionally, the fucoidan-adjuvanted vaccines demonstrated a relatively higher Relative Percent Survival (RPS). As part of the research,

advanced glycan array screening was also conducted in collaboration with the Gene Centre in Munich.

The joint experimental work led to the submission of a collaborative research paper, titled 'Efficacy of a novel oral bivalent vaccine with fucoidan as adjuvant against *Aeromonas hydrophila* and *Edwardsiella tarda* infections in Nile tilapia aquaculture,' to the *Aquaculture* journal in June 2025. Additionally, the fellowship facilitated critical industrial networking with W42 Industrial Biotechnology GmbH, whose CEO, Dr. Ansgar Stratmann, extended support for the commercialization aspects of the developed vaccines.

## Collaborative Potential and Future Plans

The fellowship laid a strong foundation for sustained Indo-German cooperation. To advance the commercialization of these aquaculture vaccines, the researchers established an academic-industrial consortium and are preparing an application for the IGSTC 2+2 grant alongside exploring other funding avenues. Future collaborative efforts also include a joint workshop at Hannover University planned for April 2026 and a forthcoming joint DBT-DFG grant proposal centered on broader 'One Health' approaches.



*Prof. Preetham during the Industrial visit to Dr. Ansgar Stratmann, CEO, W42 Industrial Biotechnology GmbH, Dortmund*

**Punit Kumar**University of Lucknow  
India**Host**Michael Bonitz, Kiel University  
Germany**Area of Work**

Novel simulation methodology for studying shock waves in quantum plasmas with potential applications in inertial confinement fusion (ICF)

## Project Overview and Work Performed

The project aimed to advance the understanding of shock-wave dynamics in dense quantum plasmas through the integration of Quantum Hydrodynamics (QHD) and Quantum Kinetic Theory (QKT). During the award period, a one-dimensional QHD simulation framework was successfully developed, incorporating key quantum effects such as Bohm potential and Fermi pressure. Systematic investigations were carried out to examine shock propagation characteristics, including shock speed, front steepening, and instability formation across plasma conditions relevant to inertial confinement fusion (ICF). The studies provided new insights into shock-front evolution, instability formation, and quantum corrections that distinguish quantum plasma behaviour from classical

hydrodynamic predictions. An important outcome of the collaboration was the establishment of a framework for integrating German-developed quantum kinetic simulation approaches with Indian expertise in quantum hydrodynamic modelling, thereby enabling more comprehensive investigations of correlated quantum plasmas. The work also generated scientific outputs in the form of a peer-reviewed journal publication and conference presentations, further strengthening the visibility and impact of the Indo-German collaboration. These achievements have established a strong foundation for future research in inertial confinement fusion, warm dense matter, astrophysical plasmas, and emerging areas aligned with the Indian National Quantum Mission.

## Collaborative Potential and Future Plans

The collaboration has laid the foundation for long-term Indo-German research in quantum plasma physics through the planned integration of advanced G1-G2 quantum kinetic simulation tools with quantum hydrodynamic models. Future activities include joint publications, student exchanges, and collaborative proposals under Indo-German funding programmes, with applications extending to inertial confinement fusion, warm dense matter, semiconductor quantum materials, and quantum technologies.



*Dr. Punit with his host Prof. Michael Bonitz and other colleagues at Kiel University, Germany*



### Beatrice Richieri

Friedrich-Alexander-Universität  
Erlangen-Nürnberg (FAU),  
Germany

### Host

Ankit Agarwal, IIT Roorkee, India

### Area of Work

Transferring knowledge of probabilistic groundwater flood maps for improved risk assessment

## Project Overview and Work Performed

The project focused on transferring expertise in probabilistic groundwater flood mapping and risk assessment while exploring new collaborative opportunities in hydrological modelling and water resource management. Extensive scientific discussions were conducted during the IAHS Conference at IIT Roorkee, complemented by field visits to the Vyasi Hydropower Plant and the Yamuna River basin. The collaboration broadened its scope to include investigations of hydropeaking-induced surface water-groundwater interactions and long-term hydrological monitoring strategies. A major achievement was the establishment of a hydrological monitoring initiative through the deployment

of continuous water-level measurement instrumentation in the Yamuna River, creating a valuable dataset for future collaborative research activities. The project also strengthened scientific exchange through multiple presentations at the IAHS Conference and fostered the development of new research concepts in groundwater flooding, riverbank filtration, managed aquifer recharge, and sustainable water management. These activities significantly enhanced Indo-German cooperation in hydrological sciences while creating new opportunities for addressing climate resilience, flood-risk management, and water-resource sustainability through collaborative research.

## Collaborative Potential and Future Plans

The partnership has evolved into a broader strategic collaboration involving FAU and IIT Roorkee, with plans for joint proposals on groundwater flooding, hydropeaking, managed aquifer recharge, and riverbank filtration. The collaboration will also support doctoral research, long-term field monitoring, researcher mobility, and future applications to IGSTC and other international funding programmes, strengthening Indo-German cooperation in hydrology and climate resilience research.



Group photo at the IAHS Conference in IIT Roorkee



### Hridayesh Prakash

Amity Centre for Translational Research, Amity University, India

### Host

Andreas Weigert, Goethe University Frankfurt, Germany

### Area of Work

Tweaking Sphingolipids for Restoring Gut Immune Homeostasis in Inflammatory Bowl Diseases: Proof of concept proposal

## Project Overview and Work Performed

This project investigated the role of sphingolipid signalling pathways in restoring gut immune homeostasis and mitigating inflammatory bowel disease (IBD). Collaborative experimental studies were initiated using in vitro co-culture systems comprising intestinal epithelial cells and human monocytes/macrophages to model disease-associated inflammatory responses. The research demonstrated that ceramide- and TNF-mediated epithelial injury can drive inflammatory macrophage activation and stimulate the production of key pro-inflammatory cytokines, including TNF and IL-6. These findings provided important mechanistic insights into the interplay

between intestinal epithelial damage and immune-cell programming, while generating preliminary evidence supporting sphingolipid-based interventions as a promising strategy for restoring gut immune homeostasis. The project successfully established collaborative experimental platforms combining expertise in sphingolipid biology, immunology, and translational medicine, thereby strengthening the scientific foundation for future therapeutic investigations. In addition to advancing the understanding of IBD pathogenesis, the work reinforced long-term Indo-German collaboration and highlighted the translational potential of sphingolipid-based approaches for chronic inflammatory disorders.

## Collaborative Potential and Future Plans

Building on the initial proof-of-concept findings, the partners plan to expand the research into advanced co-culture systems, organ-on-chip platforms, and animal models of IBD to validate therapeutic potential. The collaboration is expected to yield joint publications and larger bilateral funding proposals, including initiatives focused on sphingolipid signalling in inflammation, international research training programmes, and long-term Indo-German partnerships in translational immunology and inflammatory disease research.



Dr. Prakash at Goethe University





# WORKSHOPS



The IGSTC Bilateral Workshops program provides a strategic platform to organize joint Indo-German scientific events, facilitating the cross-fertilization of ideas and the establishment of knowledge networks to address critical global challenges. During the 2025-2026 reporting cycle, the program supported diverse, high-impact workshops that translated interdisciplinary dialogue into tangible institutional linkages. In healthcare and biological sciences, the InDeMed workshop in Dresden catalyzed a Letter of Intent between TU Dresden and AIIMS New Delhi to advance AI, extended reality, and robotics in medicine, while the InDeVet workshop in Leipzig established the Indo-German Veterinary Network for AI-driven animal health diagnostics. The Ageing, Workplace and Mental Health event in Mannheim addressed the complex bio-social challenges of cognitive ageing and occupational wellbeing. Environmental resilience and sustainability were heavily featured, with UPFLOO (Potsdam) and

DPG-WaSPUR (Hamburg)—which yielded an MoU between HafenCity and CEPT University—focusing on water-sensitive urban planning and flood risk management. Further advancing green technologies, RaCoPBuS: NET in Roorkee explored radiative cooling for net-zero buildings, SHINE 2025 in Hamburg targeted innovative membrane technologies for micropollutant removal, Cat4SusChem in Mohali drove partnerships in sustainable catalysis and green hydrogen, and the Receptor Modelling workshop in Chennai focused on data-driven air quality management and low-cost environmental sensing. Finally, emerging digital infrastructure was addressed through the QTCCS workshop in Thanjavur, which laid the groundwork for joint research in post-quantum cryptography and quantum sensing, and the MAITRE workshop in Berlin, which proposed a comprehensive Indo-German evaluation framework for trustworthy and explainable AI applications.

# InDeVet: Indo-German Veterinary Partnership: Fostering Innovation in AI-Powered Diagnostics, One Health and Animal Welfare

28-30 April 2025 | Leipzig, Germany



*InDeVet Workshop Group Photo*

**Siddhartha Narayan Joardar**  
West Bengal University of Animal and  
Fishery Sciences (WBUAFS), Kolkata

**Ahmed Abd El Wahed**  
Institute of Animal Hygiene and  
Veterinary Public Health, Leipzig University

## Overview

The InDeVet Workshop brought together leading experts from India and Germany to strengthen bilateral collaboration in veterinary sciences, with a particular focus on Artificial Intelligence (AI)-enabled solutions for animal health, disease surveillance, diagnostics, and

One Health approaches. The workshop served as a strategic platform for fostering institutional partnerships and developing a long-term collaborative roadmap in veterinary research and innovation.

## Technical Deliberations

The technical sessions explored emerging applications of AI in veterinary diagnostics, predictive disease monitoring, pandemic preparedness, animal welfare, and digital health systems. Discussions focused on opportunities for collaborative research, data-driven approaches for animal health management, development of shared databases, harmonisation of data standards, and mechanisms for scientific exchange. Deliberations also highlighted the role of advanced analytics and digital technologies in addressing transboundary animal diseases and strengthening global health preparedness.

The workshop witnessed participation from 38 experts representing universities, research institutions, government agencies, and industry from both countries. Indian participants included representatives from

the West Bengal University of Animal and Fishery Sciences (WBUAFS), ICAR-Indian Veterinary Research Institute (IVRI), ICAR-National Dairy Research Institute (NDRI), ICAR-National Institute of Animal Nutrition and Physiology (NIANP), Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Bihar Animal Sciences University (BASU), Gujarat Biotechnology Research Centre (GBRC), CSIR-Institute of Genomics and Integrative Biology (IGIB), and the National Academy of Veterinary Sciences (India) [NAVS]. German participation included Leipzig University, Freie Universität Berlin, the University of Veterinary Medicine Hannover (TiHo), the Friedrich-Loeffler-Institut (FLI), and industry stakeholders, reflecting a strong interdisciplinary and cross-sectoral engagement.

## Outcomes

The workshop culminated in the establishment of the Indo-German Veterinary Network (InDeVet) as a framework for sustained scientific cooperation. Key outcomes included the formation of a Steering Committee, nomination of institutional focal points, initiation of a regular Indo-German seminar series, and plans for joint publication and

AI animal health databases. Participants identified opportunities for collaborative research proposals, researcher mobility, and joint training initiatives. The workshop laid a strong foundation for advancing AI-driven veterinary research and fostering long-term Indo-German partnerships in animal health and One Health domains.

# UPFL00: Unconventional Perspectives on Flood Risk Opportunities and Motivating Narratives

5-7 May 2025 | Potsdam, Germany



*UPFL00 Workshop group photo*

**A.K. Keshari**  
Indian Institute of Technology Delhi

**Bruno Merz**  
GFZ Helmholtz Centre for Geosciences

## Overview

The workshop on Unconventional Perspectives on Flood Risk: Opportunities and Motivating Narratives (UPFLOO) brought together researchers, practitioners, policymakers, and industry representatives from India and Germany to explore innovative approaches for understanding and managing flood risks in a rapidly changing climate. Recognising that conventional engineering solutions alone are insufficient to address increasing flood vulnerabilities, the workshop focused on

integrating scientific evidence, social dimensions, communication strategies, and stakeholder engagement into flood resilience planning. The event provided a multidisciplinary platform for exchanging knowledge on flood forecasting, risk assessment, resilience-building, and adaptive governance while fostering stronger Indo-German cooperation in water and climate-related research.

## Technical Deliberations

Technical sessions examined recent developments in hydrological modelling, flood forecasting systems, remote sensing applications, geospatial analytics, and climate risk assessment. Discussions explored the growing importance of integrating social sciences and behavioural perspectives into flood risk management frameworks, particularly in enhancing public awareness and preparedness. Participants highlighted the need for more effective communication of risk information and the development of narratives that motivate community action and policy responses. The workshop also addressed the role of digital technologies, data-driven decision support systems, and nature-based solutions in strengthening resilience against extreme weather events and flood-related disasters.

The workshop witnessed participation from a diverse group of institutions including the Indian Institute of Technology Delhi, Indian Institute of Technology Gandhinagar, Indian Institute of Technology Kharagpur, Indian Institute of Technology Roorkee, Indian Institute of Remote Sensing, Defence Geoinformatics Research Establishment, Central Soil and Materials Research Station, and government agencies involved in water resources and disaster management. German participation included representatives from GFZ Helmholtz Centre for Geosciences, University of Potsdam, Technical University of Berlin, RWTH Aachen University, Helmholtz Centre for Environmental Research, Research Institute for Sustainability, and other leading research organisations and industry stakeholders.

## Outcomes

The workshop strengthened existing Indo-German partnerships in flood risk research and established new avenues for interdisciplinary collaboration. Participants identified opportunities for joint research proposals, collaborative publications, researcher mobility programmes, and knowledge-sharing initiatives focused on climate adaptation and disaster resilience. The deliberations also highlighted the

potential for developing integrated frameworks that combine scientific modelling, risk communication, and community engagement to improve flood preparedness and resilience. The workshop laid the foundation for future collaborative efforts aimed at addressing emerging water and climate challenges through innovative and socially responsive approaches.

# Quantum Technologies – Computing, Connectivity and Security (QTCCS)

5–7 May 2025 | Thanjavur, India



QTCCS Workshop group photo

**Padmapriya Pravinkumar**  
SASTRA Deemed University

**Georgy Astakhov**  
Helmholtz-Zentrum Dresden-Rossendorf  
(HZDR)

## Overview

The Indo-German Workshop on Quantum Technologies – Computing, Connectivity and Security (QTCCS) brought together leading researchers, industry experts, policymakers, and technology innovators from India and Germany to strengthen bilateral cooperation in the rapidly emerging field of quantum technologies. Organized by SASTRA Deemed University in collaboration with Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Germany, and supported by IGSTC,

the workshop served as a strategic platform for exploring collaborative research opportunities in quantum computing, quantum communication, quantum sensing, metrology, and cybersecurity. Participants from premier institutions and technology companies engaged in scientific exchanges aimed at accelerating innovation and fostering long-term Indo-German partnerships in the quantum domain.

## Technical Deliberations

The workshop featured extensive discussions on next-generation quantum technologies spanning computing, connectivity, and secure communications. Presentations highlighted advances in telecom-wavelength single-photon emitters, quantum key distribution (QKD), post-quantum cryptography (PQC), quantum random number generators, quantum sensing, quantum metrology, and quantum hardware development. Emerging approaches in quantum-centric supercomputing, quantum annealing, QUBO optimization, quantum machine learning, and fault-tolerant quantum computing were also explored. Significant attention was devoted to diamond-based quantum processors, NV-center engineering, cryogenic electronics, Rydberg atom systems, and hybrid quantum-classical architectures. Industry representatives shared perspectives on practical deployment challenges, standards development, interoperability, and the future quantum

internet, emphasizing the importance of translating foundational research into scalable and secure technological solutions.

The workshop attracted participants from leading academic and research institutions including SASTRA Deemed University, Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Technical University of Munich, University of Stuttgart, Physikalisch-Technische Bundesanstalt (PTB), IIT Madras, IIT Roorkee, IISER Thiruvananthapuram, Raman Research Institute, Anna University, and SETS. Industrial participation included IBM India Research Lab, IQM, XeedQ GmbH, ParTec AG, Infineon Technologies AG, and Womanium, reflecting strong engagement from both the research and industrial ecosystems. The diverse representation enabled productive discussions on technology development, commercialization pathways, standards, and workforce development required to build a robust quantum innovation ecosystem.

## Outcomes

The workshop reinforced the strategic importance of Indo-German collaboration in advancing quantum science and technology. Participants identified opportunities for joint research projects in quantum communication, post-quantum cryptography, quantum sensing, advanced materials, and quantum computing platforms. Recommendations included strengthening shared research infrastructure, developing standardized protocols for quantum-classical integration, promoting workforce training in quantum technologies, and enhancing academia-industry partnerships to

accelerate technology deployment. Several collaborative pathways emerged, including joint validation of quantum cryptography and random number generation technologies, cooperative development of quantum photonic structures, and future proposal submissions under IGSTC and India's National Quantum Mission (NQM). The workshop concluded with a strong commitment from participants to build a connected Indo-German quantum research ecosystem capable of addressing future technological and cybersecurity challenges while advancing innovation in quantum technologies.

# Ageing, Workplace and Mental Health: A Multipronged Approach to Addressing a Complex Bio-Social Challenge

25–27 June 2025 | Mannheim, Germany



*Ageing, Workplace and Mental Health Workshop group photo*

**Jamuna Rajeswaran**

National Institute of Mental Health  
and Neurosciences, Bengaluru

**Christian Schmahl**

Central Institute of Mental Health,  
Mannheim

## Overview

The workshop on Ageing, Workplace and Mental Health addressed one of the most significant societal challenges of the twenty-first century—the intersection of ageing populations, workforce participation, and mental wellbeing. Bringing together experts from psychology, psychiatry, neuroscience, public health, biotechnology,

and social sciences, the workshop provided an interdisciplinary platform for examining the biological, psychological, and social determinants of healthy ageing.

The discussions emphasised the importance of evidence-based interventions, workplace adaptations, and public health strategies to promote wellbeing across the lifespan.

## Technical Deliberations

The technical sessions explored cognitive ageing, mental health in ageing populations, workplace wellbeing, neurobiological mechanisms underlying age-related disorders, and public health approaches for improving quality of life. Participants discussed advances in neurocognitive assessment, epidemiological studies, mental health interventions, and emerging technologies that support diagnosis, treatment, and rehabilitation. Particular attention was given to the impact of workplace environments on mental health and productivity, as well as strategies for fostering resilience and social inclusion among older adults.

The workshop brought together experts from the National Institute of Mental Health and Neurosciences, Indian Institute of Technology Hyderabad, healthcare organisations, public health institutions, universities, and German research centres specialising in psychiatry, psychosomatic medicine, and ageing research, including the Central Institute of Mental Health (Mannheim), Heidelberg University, TU Berlin, Clinic for Psychiatry and Psychotherapy, Charite University and Movisens GmbH. The multidisciplinary composition of participants facilitated meaningful dialogue across clinical, scientific, technological, and policy domains.

## Outcomes

The workshop strengthened Indo-German collaboration in ageing and mental health research by fostering new academic partnerships and interdisciplinary networks. Participants identified opportunities for collaborative research projects, comparative studies, researcher exchanges, and

capacity-building initiatives. The event also highlighted the importance of integrating scientific evidence into policy development and healthcare practice, thereby contributing to future strategies aimed at supporting healthy ageing and mental wellbeing in diverse populations.

# Metrics for Measurement of Artificial Intelligence for Trustworthy, Reliable and Explainable Applications (MAITRE)

14–16 July 2025 | Berlin, Germany



MAITRE Workshop group photo

**Partha P. Chakrabarti**  
Indian Institute of Technology Kharagpur

**Sascha Eichstädt**  
Physikalisch-Technische Bundesanstalt  
(PTB)

## Overview

The Indo-German Workshop MAITRE brought together experts from metrology institutes, academic institutes, and industry from India and Germany. The workshop served as a vital platform to address the measurement of Artificial Intelligence (AI) through the development of commonly

accepted and internationally comparable quality metrics. Participants focused on exploring measures to quantify and improve the explainability, transparency, and robustness of AI methods, with a particular emphasis on Explainable AI (xAI) across various trustworthy applications.

## Technical Deliberations

The technical programme featured comprehensive presentations and discussions on explainability, security, safety, testing AI, and the applications of generative AI and Large Language Models (LLMs). Discussions examined novel developments such as "concept unlearning" for AI classification, downscaling Large Language Models (LLMs) for specific resource-efficient applications, and translating regulatory requirements using AI risk navigators for conformity assessment. Participants also explored data-efficient AI methods, securing AI against side-channel attacks, and utilizing AI for digital public infrastructure and predictive maintenance.

The deliberations highlighted the critical need for globally relevant metrics that go beyond task-specific benchmarks to assess trust, reliability, and the performance of emerging "agentic" AI. Specific frameworks and initiatives were also showcased,

including the Feature Association Map for eXplainability (FAMeX) and the Centre for European Research in Trusted AI (CERTAIN).

The workshop brought together 30 leading experts (12 from India and 18 from Germany). Indian participation included representatives from the Ministry of Electronics and Information Technology (MeitY), Indian Institute of Technology (Kharagpur, Delhi, and Jodhpur), Ashoka University, Calcutta University, Tata Consultancy Services, and Hewlett Packard Enterprise. German participants represented the Physikalisch-Technische Bundesanstalt (PTB), Fraunhofer Heinrich Hertz Institute, Fraunhofer-Institut IPA, Technical University Berlin, Technical University Dresden, QuantPI GmbH, Industrianlagen- Betriebsgesellschaft mbH (IABG), CIATA, TÜV AI Lab, Korsch AG, Infineon, GE HealthCare, and DFKI.

## Outcomes

A major recommendation from the experts was the establishment of a comprehensive Indo-German framework for evaluating AI in critical sectors such as manufacturing, healthcare, and public services. This framework aims to foster low-cost innovation, enable affordable healthcare solutions, and improve public service delivery. Participants agreed to

prepare a joint proposal for a set of inter-linked research and development projects to implement this framework. Furthermore, the workshop established plans for future joint events to sustain collaboration and initiated preparations for a joint activity at the 2026 Global AI Summit hosted by India.

# RaCoPBuS: NET: Leveraging Radiative Cooling Potential of Building Surfaces: Stepping Towards Net-Zero Emissions Target

14-16 July 2025 | Roorkee, India



RaCoPBuS: NET Workshop group photo

**Ravita Lamba**  
Indian Institute of Technology Roorkee

**Kedar Mehta**  
Technische Hochschule Ingolstadt

## Overview

The workshop on Leveraging Radiative Cooling Potential of Building Surfaces: Stepping Towards Net-Zero Emissions Target (RaCoPBus: NET) brought together experts from India and Germany to explore innovative approaches for reducing cooling energy demand in buildings and urban environments. As countries strive to achieve ambitious climate goals and net-zero commitments, the workshop provided a

timely platform for discussing sustainable cooling technologies, climate-responsive architecture, and energy-efficient building systems. The event facilitated knowledge exchange between researchers, architects, engineers, urban planners, and industry professionals working on solutions to mitigate urban heat stress and improve energy performance in the built environment.

## Technical Deliberations

The workshop featured technical sessions covering thermal comfort, solar cooling technologies, building energy simulation, district cooling systems, urban heat mitigation, and radiative cooling materials. Participants discussed advances in passive and active cooling strategies, climate-adaptive building design, thermal performance enhancement, and geospatial approaches for analysing urban heat islands. Special emphasis was placed on integrating renewable energy systems, innovative materials, and data-driven modelling techniques into sustainable building design. Discussions also highlighted the role of radiative cooling technologies in reducing dependence on conventional air-conditioning systems and contributing to climate resilience and decarbonisation efforts.

The workshop brought together participants from leading academic institutions and industry organisations, including the Indian Institute of Technology Roorkee, Indian Institute of Technology Delhi, Indian Institute of Technology Kanpur, National Institute of Technology Agartala, School of Planning and Architecture Vijayawada, Sardar Vallabhbhai National Institute of Technology Surat, SRM Institute of Science and Technology, and architecture and design firms from India. German participation included experts from Technische Hochschule Ingolstadt, Technische Hochschule Nürnberg, Technische Hochschule Deggendorf, Julius-Maximilians University Würzburg, Catholic University of Eichstätt-Ingolstadt, and industrial stakeholders working in sustainable energy and cooling technologies.

## Outcomes

The workshop resulted in the identification of several opportunities for future Indo-German collaboration in sustainable buildings and climate-responsive infrastructure. Participants expressed interest in developing joint research proposals under bilateral funding programmes, establishing academic exchange mechanisms, and undertaking collaborative supervision of postgraduate

students. Discussions also explored the possibility of institutional partnerships, pilot demonstration projects, and the integration of advanced geospatial and energy modelling methodologies into future research initiatives. The workshop laid a strong foundation for long-term cooperation aimed at developing innovative solutions for energy-efficient and climate-resilient built environments.

# Indo-German Medical Partnership Workshop – InDeMed: AI, Extended Reality, and Robotics in Healthcare – Emerging Pathways from Diagnosis to Therapy

16–18 July 2025 | Dresden, Germany



*InDeMed Workshop group photo*

**Anita Dhar**  
All India Institute of Medical Sciences,  
New Delhi

**Stefanie Speidel**  
National Center for Tumor Diseases,  
Technische Universität Dresden



## Overview

The Indo-German Medical Partnership Workshop (InDeMed) brought together leading clinicians, researchers, engineers, and technology innovators from India and Germany to explore emerging applications of Artificial Intelligence (AI), Extended Reality (XR), and Robotics in healthcare. The workshop served as a high-level platform for strengthening bilateral collaboration in

digital health technologies and advancing translational research at the intersection of medicine and engineering. Through scientific presentations, panel discussions, and interactive exchanges, participants explored how next-generation technologies can transform healthcare delivery, diagnosis, treatment, and medical training.

## Technical Deliberations

The technical programme featured presentations on AI-driven healthcare solutions, robotic-assisted surgery, extended reality technologies for clinical training, intelligent diagnostic systems, and digital surgical innovations. Discussions examined the integration of AI into clinical workflows, advances in robotic surgery, data-driven healthcare systems, and emerging applications of virtual and augmented reality in diagnosis and treatment. Participants also explored challenges related to clinical implementation, regulatory considerations, ethical frameworks, and future pathways for translating research outcomes into patient-centred healthcare solutions.

The workshop brought together more than fifty experts from leading institutions across India and Germany. Indian participation included representatives from the All India Institute of Medical Sciences (with branches in New Delhi, Kalyani, Raipur, and Bhubaneswar), Lady Hardinge Medical

College, VMMC & Safdarjung Hospital, ESIC Medical College Faridabad, Medica Superspecialty Hospital Kolkata, SS Innovation International Pvt. Ltd., and GE Healthcare (India). German participants represented Technische Universität Dresden, the National Center for Tumor Diseases Dresden, University Hospital Dresden, Hannover Medical School, University Hospital Essen, RWTH Aachen University Hospital, Otto-von-Guericke University Hospital Magdeburg, Technical University of Munich, University Hospital Heidelberg, the German Cancer Research Center (DKFZ), Helmholtz-Zentrum Dresden-Rossendorf (HZDR), NVIDIA Corporation, Brainlab AG, and GE Healthcare International. Alongside research groups specialising in medical robotics, digital health, artificial intelligence, and surgical innovation, this multidisciplinary participation fostered meaningful interactions between healthcare professionals, researchers, and technology developers.

## Outcomes

A major milestone of the workshop was the signing of a Letter of Intent between Technische Universität Dresden and the All India Institute of Medical Sciences, New Delhi, marking the beginning of a strategic partnership in healthcare innovation and medical research. Participants identified multiple opportunities for collaborative research

projects, researcher exchanges, joint doctoral training, and technology development initiatives. The workshop strengthened Indo-German cooperation in digital healthcare and established a roadmap for future collaboration in AI-enabled medicine, extended reality technologies, and robotic healthcare systems.

# SHINE 2025

## Sustainable Handling of Innovative Membrane Technologies for Environmental Protection

22–25 September 2025 | Hamburg, Germany



SHINE workshop group photo

**Bhaskar Jyoti Deka**  
Indian Institute of Technology  
Roorkee, India

**Volkan Filiz**  
Helmholtz-Zentrum Hereon, Germany

## Overview

The workshop on Sustainable Handling of Innovative Membrane Technologies for Environmental Protection (SHINE 2025) brought together leading researchers, technology developers, and industry experts from India and Germany to explore advances in membrane science and engineering for sustainable environmental applications. The workshop served as a platform for

strengthening bilateral cooperation in water treatment, resource recovery, pollution mitigation, and advanced separation technologies. By fostering dialogue between academia, research organisations, and industry, the event promoted the exchange of knowledge on innovative materials, emerging technologies, and sustainable solutions to pressing environmental challenges.

## Technical Deliberations

The technical programme was organised around key thematic areas including membrane distillation, novel and hybrid membrane materials, micropollutant removal, sustainable separation processes, industrial wastewater treatment, and advanced water purification systems. Discussions highlighted recent advances in block copolymers, metal-organic frameworks, nanocomposite membranes, and environmentally sustainable membrane manufacturing approaches. Participants explored strategies for addressing contaminants such as pharmaceutical residues, dyes, PFAS compounds, and antibiotic-resistant microorganisms. The sessions also examined opportunities for integrating predictive modelling, metagenomic analysis, and advanced process engineering into next-generation environmental technologies.

The workshop attracted participation from a broad spectrum of institutions including the Indian Institute of Technology Roorkee, Indian Institute of Technology Bombay, Indian Institute of Technology Patna, Indian Institute of Technology (Indian School of Mines) Dhanbad, Indian Institute of Science Bengaluru, Gauhati University, CSIR-Indian Institute of Petroleum, CSIR-Central Salt and Marine Chemicals Research Institute, and industrial stakeholders from India. German participation included the University of Hamburg, Helmholtz-Zentrum Hereon, Leibniz Institute of Surface Engineering, Evonik Industries, Solventum, and several research organisations and technology companies working in membrane science and environmental engineering.

## Outcomes

The workshop facilitated the identification of common research priorities and generated several opportunities for future collaboration in advanced membrane technologies and environmental protection. Participants discussed potential joint projects focusing on sustainable water treatment, resource recovery, micropollutant removal, and membrane-based industrial

applications. The event also initiated discussions on student and researcher exchange programmes, shared research infrastructure, and pilot-scale demonstrations of innovative membrane systems. These outcomes are expected to strengthen Indo-German cooperation and accelerate the translation of scientific advances into practical environmental solutions.

# Cat4SusChem: Catalysis for Sustainable Chemical Synthesis and Energy Technologies

## Towards Industrial Relevance

23–26 September 2025 | Mohali, India



Cat4Suschem workshop group photo

**Bhaskar Jyoti Deka**  
Institute of Nano Science and  
Technology (INST), Mohali

**Volkan Filiz**  
Leibniz Institute for Catalysis (LIKAT),  
Rostock

## Overview

The workshop on Catalysis for Sustainable Chemical Synthesis and Energy Technologies: Towards Industrial Relevance (Cat4SusChem) brought together leading scientists, technology developers, industrial researchers, and policymakers from India and Germany to strengthen bilateral collaboration in catalysis, sustainable chemistry, and clean energy technologies. The workshop addressed critical scientific and technological challenges associated with achieving carbon neutrality and

advancing sustainable industrial processes. Through a combination of keynote lectures, technical presentations, panel discussions, and industry interactions, participants explored emerging catalytic technologies capable of accelerating the transition towards a low-carbon and circular economy. The event also provided a unique platform for fostering academia–industry partnerships and identifying pathways for translating laboratory-scale innovations into industrially relevant solutions.

## Technical Deliberations

The workshop focused on advanced catalytic materials and processes for green chemical synthesis, renewable energy conversion, and carbon management. Technical sessions covered a broad spectrum of topics including green hydrogen production and storage, carbon capture, utilization and storage (CCUS), biomass valorization, photocatalysis, electrocatalysis, fuel cells, and sustainable chemical transformations. Participants discussed recent advances in membrane reactors, molecular-sieving carbon membranes, multi-metallic electrocatalysts, graphitic carbon nitride-based photocatalysts, and nanostructured catalytic materials. Significant attention was given to catalyst design, reaction engineering, process intensification, and advanced characterization techniques supported by computational modelling and data-driven approaches.

The role of digital technologies, including artificial intelligence, digital twins, automated operando studies, and machine-learning-enabled catalyst discovery, emerged as a recurring theme throughout the workshop. Industrial perspectives from organisations such as Bharat Petroleum Corporation Limited (BPCL), BASF, Siemens Energy, and ArcelorMittal highlighted the practical challenges and opportunities associated with scaling sustainable technologies for commercial deployment.

The workshop witnessed participation from a distinguished group of academic, research, and industrial institutions from both countries. Indian participants represented organisations including the Institute of Nano Science and Technology (INST), Institute of Chemical Technology Mumbai, Indian Institute of Technology Roorkee, Indian Institute of Technology Hyderabad, Indian Institute of Chemical Technology Hyderabad, Jamia Millia Islamia, Indian Institutes of Science Education and Research at Berhampur, Kolkata, and Tirupati, as well as Bharat Petroleum Corporation Limited and BASF India. German participation included experts from the Leibniz Institute for Catalysis (LIKAT), Fraunhofer Institute for Ceramic Technologies and Systems (IKTS), University of Bayreuth, Humboldt University of Berlin, Helmholtz-Zentrum Berlin, Fraunhofer Institute for Environmental, Safety and Energy Technology (UMSICHT), German Biomass Research Centre (DBFZ), Siemens Energy, BASF Germany, Deutsches Elektronen-Synchrotron (DESY), ArcelorMittal, and technology enterprises working in catalysis and sustainable energy. The participation of both academia and industry ensured strong discussions on technology translation and industrial relevance.

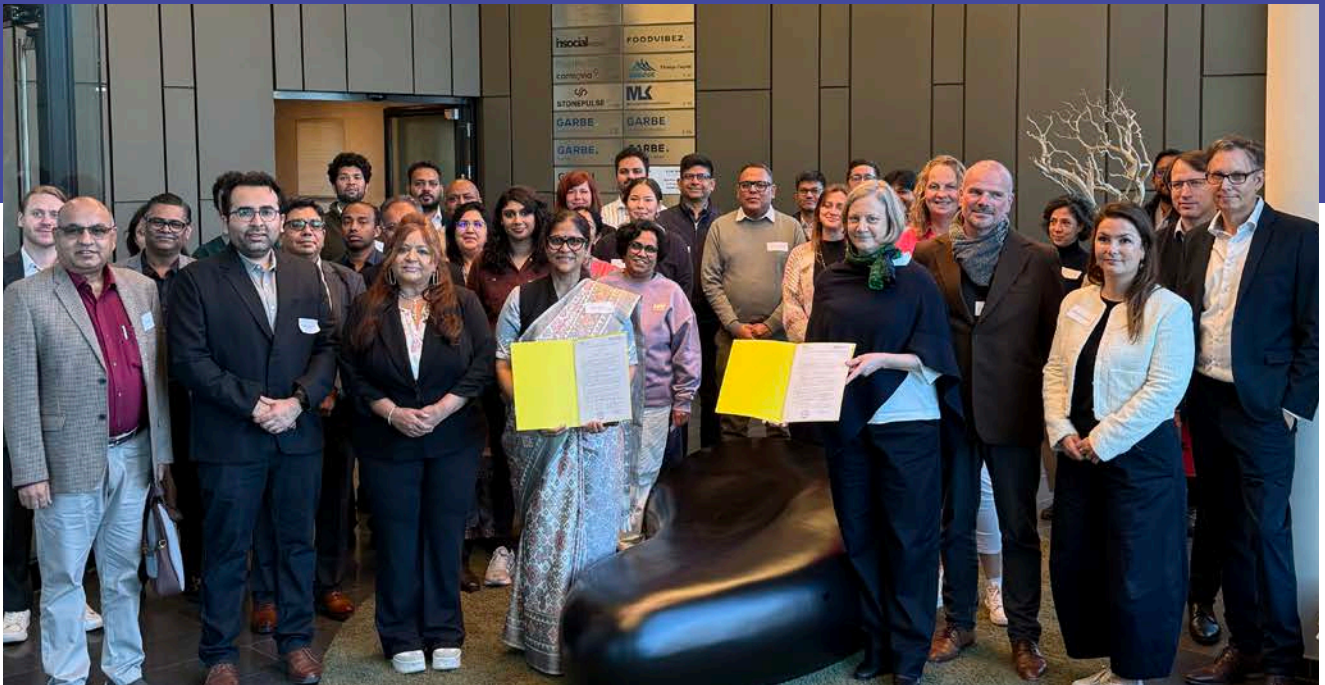
## Outcomes

The workshop reinforced the strategic importance of Indo-German collaboration in addressing global energy, environmental, and sustainability challenges through catalysis and green chemistry. Participants identified several opportunities for future joint research projects focusing on green hydrogen technologies, carbon capture and utilization, sustainable fuels, biomass valorization, and circular chemical processes. There was broad consensus on the need to strengthen academia-industry partnerships, expand researcher and student exchange programmes, and establish shared research infrastructure to accelerate technology development and

commercialization. The workshop also highlighted the growing role of artificial intelligence and data-driven approaches in catalysis research and recommended increased cooperation in digitalization and process optimization. A significant outcome was the interaction between German delegates and scientists at BPCL's Corporate Research and Development Centre (CRDC), Greater Noida, where initial areas of joint research interest were identified for future collaboration. The workshop concluded with a shared commitment to developing scalable, industrially relevant solutions that contribute to carbon neutrality, sustainable manufacturing, and the global transition towards a green economy.

# DPG-WaSPUR: Digital Public Goods for Water Sensitive Planning and Urban Flood Resilience

24–25 September 2025 | Hamburg, Germany



**Mona Iyer**  
CEPT University

**Jörg Rainer Noennig**  
HafenCity University Hamburg

## Overview

The workshop on Digital Public Goods for Water Sensitive Planning and Urban Flood Resilience (DPG-WaSPUR) brought together urban planners, geospatial scientists, policymakers, digital technology experts, and water management professionals from India and Germany to explore innovative approaches for creating resilient and water-sensitive cities. Recognising the growing challenges posed by urbanisation, climate change, and extreme

weather events, the workshop focused on leveraging digital public goods, open data ecosystems, and collaborative planning frameworks to strengthen urban resilience. The event provided an interdisciplinary platform for fostering dialogue between research institutions, planning agencies, and governance bodies while promoting international cooperation in sustainable urban development.

## Technical Deliberations

The workshop was organised around four thematic pillars: Spatial Planning and Frameworks, Spatial Data Infrastructures, Planning Policy and Regulations, and Digital Tools and Techniques. Technical sessions highlighted emerging approaches in digital urban governance, geospatial analytics, remote sensing, urban flood modelling, and digital twin technologies. Interactive discussions examined how open data systems, digital public goods, and participatory planning processes can support evidence-based decision-making and enhance urban resilience. Round-table discussions and collaborative sandpit sessions encouraged participants to co-develop innovative concepts for integrating technology, planning, and governance into future water-sensitive urban development strategies.

The workshop witnessed participation from a diverse range of institutions including CEPT University, National Remote Sensing Centre, Indian Institute of Remote Sensing, Indian Institute of Technology Roorkee, National Institute of Urban Affairs, Ahmedabad Urban Development Authority, GIFT City, and other organisations involved in urban planning and water management in India. German participants represented HafenCity University Hamburg, Technical University Hamburg, Leibniz Institute of Ecological Urban and Regional Development, University of Tübingen, Technische Universität Dresden, environmental agencies, municipal authorities, and research organisations specialising in urban resilience and digital planning.

## Outcomes

A major highlight of the workshop was the signing of a Memorandum of Understanding between HafenCity University Hamburg and CEPT University, establishing a framework for long-term academic and research cooperation. Participants identified opportunities for joint research proposals, collaborative development of digital tools, student and

faculty exchanges, and future summer schools focused on urban resilience and digital public goods. The workshop also generated several interdisciplinary project concepts aimed at advancing water-sensitive planning and flood resilience, creating a strong foundation for sustained Indo-German collaboration in this critical area.

# Indo-German Joint Scientific Workshop on Receptor Modelling, Applications and Technical Solutions

27-29 October 2025 | Chennai, India



Receptor modelling workshop group photo

**S. M. Shiva Nagendra**  
Indian Institute of Technology  
Madras, India

**Uwe Schlink**  
Helmholtz Centre for Environmental  
Research (UFZ), Germany



## Overview

The Indo-German Joint Scientific Workshop on Receptor Modelling, Applications and Technical Solutions provided a multidisciplinary platform for advancing research and innovation in air quality management, exposure assessment, and environmental monitoring. Bringing together scientists, engineers, policymakers, startups, and industry representatives from India and

Germany, the workshop facilitated discussions on emerging scientific methodologies and technological solutions for addressing air pollution challenges. The event highlighted the importance of integrating environmental science, health research, digital technologies, and citizen engagement into sustainable air quality management frameworks.

## Technical Deliberations

The workshop featured thematic sessions on receptor modelling, exposure monitoring, low-cost sensing technologies, health risk assessment, and data-driven environmental management. Participants discussed advances in artificial intelligence and machine learning-based data fusion, oxidative potential assessment, environmental sensing networks, and behavioural approaches to exposure analysis. Interactive group discussions explored scientific, social, entrepreneurial, and application-oriented perspectives on air quality management, with particular emphasis on bridging the gap between research outcomes and practical implementation.

The workshop brought together participants from the Indian Institute of Technology Madras, Indian Institute of Technology Delhi, National Institute of Technology Tiruchirappalli, academic institutions, startups, environmental consultancies, and government agencies. German participation included experts from the Helmholtz Centre for Environmental Research, Leibniz Institute for Tropospheric Research, and other organisations working in atmospheric science, environmental health, and air quality monitoring. The broad institutional representation facilitated interdisciplinary dialogue and strengthened networks across academia, industry, and policy domains.

## Outcomes

The workshop resulted in the establishment of new Indo-German research partnerships and the identification of collaborative opportunities in air quality monitoring, environmental sensing, and data analytics. Participants agreed to explore joint pilot studies on hyperlocal air quality assessment, co-development of low-cost sensing

technologies, and creation of open-access environmental data platforms. The workshop also generated plans for regular technical exchanges and future collaborative initiatives aimed at translating scientific advances into scalable solutions for sustainable urban air quality management.





# IGSTC RESEARCH & INNOVATION DIALOGUE SERIES

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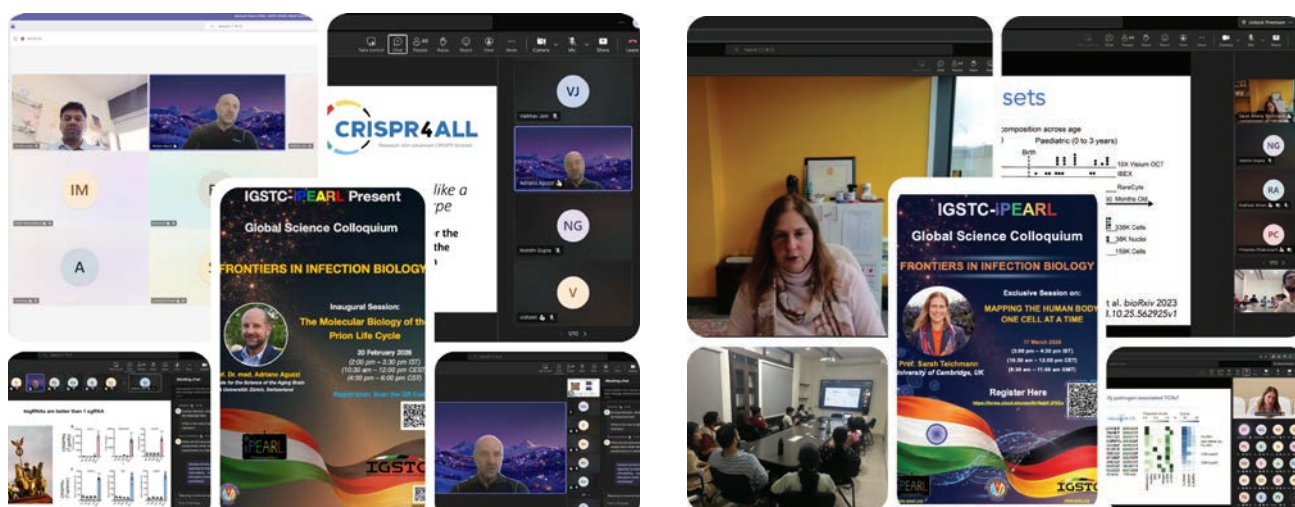
INNOVATION



The IGSTC Research & Innovation Dialogue Series is a monthly virtual colloquium initiative by Indo-German Science & Technology Centre aimed at strengthening Indo-German collaboration in science, technology, and innovation. The series will bring together researchers, industry leaders, innovators, and policymakers from India and Germany to exchange ideas, showcase emerging research, and explore collaborative opportunities across diverse domains. Through sustained dialogue

and knowledge sharing, the initiative seeks to serve as a dynamic platform supporting IGSTC's vision of being a key driver of Indo-German technology partnerships. A list of the talks is shared below. IGSTC in collaboration with BITS Pilani, Hyderabad Campus (iPEARL Labs, PI: Prof Nishith Gupta) organises Global Science Colloquiua's in the theme of Infection Biology jointly. Future talks in AI for catalysis, sustainable water management and infection biology are further planned in coming months.

| Date        | Title                                         | Speaker                                                                                                                | Theme                                | No. of Participants |
|-------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------|
| 20 Feb 2026 | The Molecular Biology of the Prion Life Cycle | <b>Prof. Dr. med. Adriano Aguzzi</b><br>Institute for the Science of the Aging Brain & Universität Zürich, Switzerland | Infection Biology (IGSTC-iPEARL GSC) | 65                  |
| 17 Mar 2026 | Mapping the Human Body, One Cell at a Time    | <b>Prof. Sarah Teichmann</b><br>University of Cambridge, UK                                                            | Infection Biology (IGSTC-iPEARL GSC) | 77                  |









# IGSTC OUTREACH

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## IGSTC Partners Meet 2025

As part of its strategic outreach and bilateral network strengthening, the Indo-German Science & Technology Centre (IGSTC) successfully organized the Partner's Meet 2025 on 8th April 2025 in Bremen, Germany. Held on the eve of the IGSTC Governing Body meeting, this event served as a vibrant platform that brought together 55 participants, including scientists, researchers, and project partners from the six bilateral initiatives funded under the 2+2 Call 2023. The meet was formally inaugurated by Ms. Soumya Gupta, Consul General of India in Hamburg. Focusing on the vital thematic areas of "Waste to Wealth" and "Sustainable Packaging," Ms. Gupta's address highlighted the profound relevance of IGSTC's 2+2

programs in translating laboratory research into scalable, sustainable solutions capable of addressing global challenges and further cementing the Indo-German cooperative alliance.

The core of the event featured technical presentation sessions where each project team outlined their ongoing research activities, systemic challenges, and future milestones. The milestone gathering was graced by the Co-Chairs and members of the IGSTC Governing Body, alongside Dr. Leif Steuernagel from TU Clausthal (Scientific Committee member for Call 2023), emphasizing the Centre's institutional commitment to high-quality collaborative oversight.



## S & T Roundtable in Chandigarh

The Bilateral Roundtable in Chandigarh served as a high-level forum dedicated to exploring strategic pathways for strengthening science, technology, and innovation cooperation between India and Germany. The prestigious event was graced by Prof. Renu Vig, Vice Chancellor of Panjab University, alongside an eminent delegation of institutional leaders, including Prof. Sudip Mandal (Dean R&D, IISER Mohali), Prof. Ashwani Pareek (Executive Director, NABI), Prof. Shantanu Bhattacharya (Director, CSIR-CSIO), Prof. Rohit Sharma (Dean, International Relations, IIT Ropar), and Prof. Akash Deep (Director, INST).

Dr. Kusumita Arora, Director, IGSTC, articulated a clear vision for future engagement, highlighting emerging bilateral opportunities and purpose-driven collaboration. Focus areas during the session centered on fostering joint research initiatives, accelerating academic exchanges, and deepening industry-academia linkages, further underscoring IGSTC's vital catalytic role in enabling impactful and sustainable bilateral partnerships across the region.



## IGSTC Strategic Conclaves 2026

### IGSTC Strategic Conclave on Mobile Health & Telemedicine

The IGSTC Strategic Conclave on Mobile Health & Telemedicine was organized on 23 February 2026 at Vigyan Bhawan, New Delhi, under the IGSTC 2+2 framework with the objective of advancing Indo-German collaboration in digital healthcare technologies and connected care ecosystems. The conclave brought together over 100 participants representing government departments, healthcare institutions, defense medical services, academic organizations, startups, and healthcare technology industries from India and Germany. Participating institutions included DST, DGHS, DGAfMS, BIRAC, ICMR, AIIMS New Delhi, IIT Kharagpur, IIT Delhi, IIT Madras, IISc Bangalore, IIIT Delhi, BITS Pilani, NBRC, CSIR-IGIB, Apollo Hospitals, Brainlab AG, Heidelberg University, TU Dresden, DWIH, DAAD, Freudenberg Medical, GE Healthcare, and NVIDIA.

The opening session included addresses by Dr. Kusumita Arora, Director, IGSTC; Mr. Pavan Choudhary, Chairman, Medical Technology Association of India (MTAI); Dr. Sunita Sharma, DGHS; Surg Vadm Dr. Arti Sarin, DGAfMS; Dr. Jitendra Kumar, BIRAC; and Dr. Arindam Bhattacharyya, DST. The plenary session

featured distinguished speakers including Dr. M. Srinivas (AIIMS New Delhi), Prof. Suman Chakraborty (IIT Kharagpur), and Mr. Vinicius Dessoy Maciel (Brainlab AG), who highlighted advancements in telemedicine, AI-assisted diagnostics, wearable technologies, and digital healthcare systems.

The technical agenda comprised thematic sessions and panel discussions on Data Security & Interoperability, Regulatory Harmonization, Wearables & Internet of Medical Things (IoMT), AI/ML in Diagnostics and Healthcare, and AI Frontiers in Diagnostics. Discussions emphasized the role of connected healthcare ecosystems in enabling home-based healthcare, chronic disease management, post-operative rehabilitation, and remote patient monitoring. The conclave also highlighted the importance of regulatory harmonization between Indian and European frameworks, clinical validation pathways, and secure interoperable healthcare systems. A key outcome was the identification of collaborative opportunities under the IGSTC 2+2 framework in AI-enabled diagnostics, telemedicine, wearable healthcare systems, and digital health infrastructure.

## Agenda, Speakers & Key Outcomes

### Opening Session | 09:00 – 10:10

#### Speakers

Dr. Kusumita Arora (IGSTC);  
Mr. Pavan Choudhary (MTAI);  
Dr. Sunita Sharma (DGHS);  
Surg Vadm Dr. Arti Sarin (DGAFMS);  
Dr. Jitendra Kumar (BIRAC);  
Prof. Abhay Karandikar (DST);  
Dr. Arindam Bhattacharyya (DST)

#### Key Focus / Outcomes

Established the macro-vision for Indo-German collaboration in healthcare technology, emphasizing digital healthcare ecosystems, telemedicine, defence healthcare systems, innovation-driven diagnostics, and policy support for translational medical technologies.

### Plenary Session | 10:40 – 12:10

#### Chair

Dr. Sai Praveen Haranath (Apollo Hospitals)

#### Speakers

Dr. M. Srinivas (AIIMS New Delhi);  
Prof. Suman Chakraborty (IIT Kharagpur);  
Mr. Vinicius Dessoy Maciel (Brainlab AG)

#### Key Focus / Outcomes

Discussions focused on telemedicine for mother & child healthcare, advanced medical devices & diagnostics, and the role of AI-enabled software systems in cancer care and patient-centric digital healthcare transformation.

### Panel Discussion: Data Security & Interoperability and Regulatory Harmonization | 12:10 – 13:00

#### Moderator

Dr. Taruna Madan Gupta (ICMR)

#### Panelists

Prof. Amit Mehndiratta (IIT Delhi & AIIMS Delhi);  
Prof. Jayanta Mukhopadhyay (IIT Kharagpur);  
Dr. Neelima Mishra (NIB);  
Prof. Shomik Ray (IIPH);  
Prof. Subhra Chakraborty (Former Director, NIPGR);  
Dr. Agastya Bhati (IIT Madras)

#### Key Focus / Outcomes

Deliberations emphasized interoperability challenges in healthcare systems, AI deployment on low-cost devices, international clinical data-sharing constraints, regulatory harmonization, and balancing innovation with data sovereignty and patient privacy frameworks.

### Session: Wearables, IoT & Medical Devices 14:00 – 15:25

#### Chair

Dr. A. Balaji Ganesh (Emsensing Technologies Pvt Ltd)

#### Keynote

Dr. Mona Duggal (ICMR-NIRDHDS)

#### Speakers

Mr. Falgun Jani (Freudenberg Medical);  
Dr. Vinayak B. Kamble (IISER Trivandrum);  
Dr. Eveline Prochaska (TU Dresden);  
Mr. Vishwanath Nayak (GE Healthcare);  
Prof. Sudipta Saha (LHMC);  
Mr. Krishnanga Kalita (PathScan)

#### Key Focus / Outcomes

Discussions highlighted the evolution of wearable medical technologies, IoMT-enabled connected care ecosystems, AI-integrated diagnostic imaging, affordable digital healthcare devices, and opportunities for home-based healthcare systems for chronic, elderly, and post-operative care.

### Session: AI / ML in Diagnostics & Healthcare 15:25 – 16:40

#### Chair

Dr. Proloy Das (NBRC)

#### Keynote

Dr. Christoph Reich (Heidelberg University)

#### Speakers

Prof. Himanshu Sinha (IIT Madras);  
Prof. Tavpritesh Sethi (IIIT Delhi);  
Dr. Vishal Gandhi (BioRX Ventures);  
Dr. Manish Modani (NVIDIA);  
Dr. Sandeep Bhalla (ECHO India);  
Prof. D. Roy Mahapatra (IISc Bangalore)

#### Key Focus / Outcomes

Emphasized AI/ML-enabled distributed healthcare systems, wearable sensor integration, edge AI for continuous patient monitoring, tele-mentoring systems, point-of-care diagnostics, and scalable digital health frameworks for last-mile healthcare delivery.

### Panel Discussion: AI Frontier in Diagnostics | 16:55 – 17:40

#### Moderator

Mr. Venkat Rao Vallapaneni (ROPODS)

#### Panelists

Prof. Sanket Goel (BITS Pilani);  
Dr. Bhupesh Taneja (CSIR-IGIB);  
Prof. Pushpendra Singh (IIIT Delhi);  
Prof. Farheen Siddiqui (Jamia Hamdard);  
Dr. Neha Rastogi (Agatsa); Dr. Jay Nagi (BluAI Inc.)

#### Key Focus / Outcomes

Discussions explored AI-enabled diagnostic hardware, lab-on-chip systems, wearable ECG technologies, commercialization barriers in digital diagnostics, and translation of genomic datasets into affordable point-of-care healthcare solutions for rare diseases.

## Summary & Concluding Remarks | 17:40 – 18:35

### Speakers

Dr. Ramanuj Banerjee (Indian Embassy, Berlin);  
 Ms. Viktoria Apitzsch (German Embassy, New Delhi);  
 Dr. Avinash Chekuru (TU Dresden-Saxony);  
 Dr. Sai Praveen Haranath (Apollo Hospitals);  
 Dr. A. Balaji Ganesh (Emsensing Technologies);  
 Dr. Taruna Madan Gupta (ICMR);  
 Dr. Proloy Das (NBRC);  
 Mr. Venkat Rao Vallapaneni (ROPODS)

### Key Focus / Outcomes

Summarized strategic recommendations on connected healthcare ecosystems, AI-enabled diagnostics, wearable healthcare technologies, telemedicine, translational partnerships, and Indo-German collaboration for scalable and patient-centric digital health innovation.



IGSTC Strategic Conclave on Mobile Health & Telemedicine group photo

## IGSTC Strategic Conclave on Integrated Water Resource Management (IWRM)

The IGSTC Strategic Conclave on Integrated Water Resource Management (IWRM) was organized on 24 February 2026 at Vigyan Bhawan, New Delhi, under the IGSTC 2+2 framework with the objective of strengthening Indo-German collaboration in sustainable water technologies and integrated water governance. The conclave brought together over 100 participants comprising policymakers, senior scientists, academic experts, industry leaders, startups, and international stakeholders from India and Germany. Participating institutions included DST, GIZ, IIT Kanpur, IIT Madras, IIT Guwahati, IIT Roorkee, IISc Bangalore, CEPT University, TERI, BITS Pilani, CSIR-CSMCRI, TU Dresden, RWTH Aachen University, Christian-Albrechts-Universität zu Kiel, UFZ Helmholtz, HafenCity University Hamburg, and Helmholtz-Zentrum Dresden-Rossendorf (HZDR). The conclave served as a strategic platform for identifying scalable and implementation-oriented solutions for water security, wastewater management, climate resilience, and circular water economy approaches.

The inaugural session was addressed by Dr. Kusumita Arora, Director, IGSTC; H.E. Dr. Philipp Ackermann, Ambassador of Germany to India; Prof. Ligy Philip, IIT Madras; Mr. Rajendra Singh; Dr. Vikrant Tyagi, GIZ; and Dr. Arindam Bhattacharya, DST. The technical programme comprised

plenary lectures, thematic sessions, keynote talks, and panel discussions focusing on Membrane Science & Sensor Technology, Resource Recovery, Wastewater Technologies, and Technologies for Hard-to-Abate Industrial Effluents. Distinguished speakers included Prof. Vinod Tare (IIT Kanpur), Prof. Indumathi Nambi (IIT Madras), Prof. Jürgen Stamm (TU Dresden), Prof. Thomas Wintgens (RWTH Aachen), Prof. Natascha Oppelt (Christian-Albrechts-Universität zu Kiel), Prof. Mona Iyer (CEPT University), Dr. Katrin Pollmann (HZDR), and Prof. Thorsten Reemtsma (UFZ Helmholtz).

The conclave highlighted the strategic importance of Indo-German cooperation in developing future-ready water technologies and governance frameworks. Discussions emphasized AI/ML-enabled digital twins for flood forecasting and urban resilience, advanced membrane systems, decentralized water budgeting, wastewater reuse and groundwater recharge, industrial effluent treatment, resource recovery from wastewater streams, and nature-based treatment systems. A major outcome of the conclave was the identification of collaborative pathways under the IGSTC 2+2 framework for pilot-scale demonstrations, translational research partnerships, and deployment-oriented R&D initiatives in water sustainability and circular water economy systems.

## Agenda, Speakers & Key Outcomes

### Opening Session | 09:00 – 09:50

#### Speakers

Dr. Kusumita Arora (Director, IGSTC);  
 Prof. Ligy Philip (IIT Madras);  
 Mr. Rajendra Singh (Conservationist);  
 Dr. Vikrant Tyagi (GIZ);  
 H.E. Dr. Philipp Ackermann  
 (German Ambassador to India & Bhutan);  
 Dr. Arindam Bhattacharyya (DST)

#### Key Focus / Outcomes

Integrated and collaborative water governance frameworks; Indo-German cooperation for sustainable water resilience.

### Plenary Session | 10:20 – 11:50

#### Chair

Dr. Neelima Alam (DST)

#### Speakers

Prof. Vinod Tare (IIT Kanpur);  
 Prof. Indumathi Nambi (IIT Madras);  
 Prof. Jürgen Stamm (TU Dresden)

#### Key Focus / Outcomes

River rejuvenation, wastewater reuse, net-zero transitions, Urban Digital Twins, and nature-based solutions.

### Session: Membrane Science & Sensor Technology | 11:50 – 14:05

#### Chair

Mr. Sajid Hussain (TWIC)

#### Speakers

Mr. Anshuman (TERI);  
 Dr. Anirban Roy (BITS Pilani);  
 Prof. S. Senthilmurugan (IIT Guwahati);  
 Dr. Bhaskar Jyoti Deka (IIT Roorkee);  
 Dr. Hiren Rawal (CSIR-CSMCRI);  
 Mr. Varun Sridharan (Green Environment India);  
 Prof. Thomas Wintgens (RWTH Aachen)

#### Key Focus / Outcomes

ZLD systems, membrane technologies, sensor systems, resource recovery, automation, and intelligent wastewater treatment.

**Session: Resource Recovery | 14:05 – 15:10****Chair**

Mr. Krishan Tyagi (GIZ)

**Speakers**

Prof. Natascha Oppelt  
(Christian-Albrechts-Universität zu Kiel);  
Dr. Manoj Samuel (CWRDM);  
Mr. Binayak Das (Adelphi);  
Mr. Avinash Kumar (Hashtag Percapita);  
Dr. Vibha Tripathi (SWAJAL);  
Prof. Munish Chandel (IIT Bombay)

**Key Focus / Outcomes**

Circular water economy, decentralized water budgeting, wastewater reuse, groundwater recharge, and resource recovery.

**Session: Wastewater Technologies  
15:25 – 16:30****Chair**

Prof. Manoj Kumar Tiwari (IIT Kanpur)

**Speakers**

Dr. Nilesh Purey (GIFT City);  
Prof. Mona Iyer (CEPT University);  
Dr. Katharina Borgmann  
(HafenCity University Hamburg);  
Prof. Joerg Noening  
(HafenCity University Hamburg);  
Prof. L.N. Rao (IISc Bangalore);  
Prof. Regina Nogueira  
(Leibnitz University Hannover);  
Dr. Kathrin Pollmann (HZDR);  
Dr. Tuhin Banerjee (Exposome Research)

**Key Focus / Outcomes**

AI/ML-enabled wastewater systems, flood forecasting, PFAS removal, nature-based treatment systems, and resilient urban water planning.

**Session: Technologies for the 'Hard-to-Abate' | 16:30 – 17:35****Chair**

Mr. Nitin Bassi (CEEW)

**Speakers**

Prof. Thorsten Reemtsma (UFZ Helmholtz);  
Dr. P. Shanmugam (CSIR-CLRI);  
Dr. Sourja Ghosh (CSIR-CGCRI);  
Prof. Tushar Jana (University of Hyderabad);  
Dr. Arya Vijayanandan (IIT Delhi);  
Prof. D. Roy Mahapatra (IISc Bangalore);  
Dr. Raman Sharma (NEERI-CSIR)

**Key Focus / Outcomes**

Complex industrial effluents, PFAS treatment, AI-enabled CETPs, ceramic membrane systems, and industrial wastewater circularity.

## Summary & Concluding Session | 17:35 – 18:30

### Speakers

Dr.-Ing. Ursula Schließmann (Fraunhofer IGB);

Ms Cecilia Tall (Embassy of Sweden);

Dr. Neelima Alam (DST);

Sajid Hussain (TWIC);

Krishan Tyagi (GIZ);

Manoj Kumar Tiwari (IIT Kanpur);

Nitin Bassi (CEEW)

### Key Focus / Outcomes

Strategic recommendations on Digital Twins, wastewater reuse, advanced monitoring systems, and Indo-German translational partnerships.



*IGSTC Strategic Conclave on Integrated Water Resource Management Group photo*

## Participation in THIT Conference & Expo 2026, Hyderabad

An IGSTC delegation actively participated in the Transforming Healthcare with IT (THIT) Conference & Expo 2026, organized by Apollo Hospitals in Hyderabad on January 30–31, 2026. The premier event convened a diverse spectrum of healthcare professionals, technologists, policymakers, and startups to deliberate on the future of digital health, AI, medical devices, and patient-centric telemedicine solutions. IGSTC hosted a dedicated exhibition booth

that drew significant interest from attending researchers, clinicians, and industry innovators. The delegation leveraged this platform to showcase IGSTC's funding mechanisms and Indo-German collaborative programs, focusing specifically on translational research and healthcare technologies to catalyze new avenues for bilateral scientific and industrial cooperation.



Along with organizing its own meetings and roundtables, IGSTC regularly participates in various science, technology, and industry events. Taking part in these different activities helps the Centre continuously promote collaboration between India and Germany.

By connecting directly with researchers, innovators, and industry leaders at these platforms, IGSTC ensures that the opportunities for working together keep growing and reaching more people.

## List of Publications arising out of IGSTC programs for the Year 2025-26

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3. Sarma, Ritam; Kapil, Sajan; Joshi, Shrikrishna N; (2025) 'A comparative analysis of trochoidal toolpath with traditional toolpaths used in wire arc-based directed energy deposition process'. *Progress in Additive Manufacturing*, 10.0(2.0), pp. 1587-1604. Springer International Publishing Cham
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11. Bishnolia, Manish; Yadav, Poonam; Singh, Sumeet Kumar; Manhar, Nirmal; Rajput, Sonu; Khurana, Amit; Bhatti, Jasvinder Singh; Navik, Umashanker; (2025) 'Methyl donor ameliorates CCl<sub>4</sub>-induced liver fibrosis by inhibiting inflammation, and fibrosis through the downregulation of EGFR and DNMT-1 expression'. *Food and Chemical Toxicology*, 196.0, pp. 115230. Elsevier
12. Mukherjee, Bimalendu; Mandal, Mukti; Suresh, Raghavv Raghavender; Kar, Shantanu; Parida, Binaya Kumar; Chakraborty, Somsubhra; Dutta, Gorachand; (2025) 'A non-enzymatic highly stable electrochemical sensing platform based on allylamine capped copper nanoparticles for the detection of the soil nitrate content'. *Analyst*, 150.0(5.0), pp. 936-952. Royal Society of Chemistry
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*Note: The above list is originated from Google Scholar/Web of Science*



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