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INDIAN INSTITUTE OF TECHNOLOGY MANDI

Institute Colloquium

Community Transformation via Democratized Diagnostic Technologies for the Underserved



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Abstract

Resource-limited settings commonly lack the necessary infrastructure that are crucial for operating advanced diagnostic technologies for disease detection. High upfront costs for diagnostic equipment and their maintenance are largely prohibitive against percolating their impact to the grass root level. The alternative low-cost options, challenged due to their intrinsic limited efficacy, may still be out of reach for many primary healthcare facilities due to budget constraints. Even if equipment is available, there might be a shortage of skilled personnel to operate and interpret the results effectively. While new technologies are continuously being introduced to mitigate these challenges, the community healthcare workers may have limited access to training for making those functional. Remote areas also experience challenges in maintaining a steady supply of diagnostic kits, reagents, and other consumables. This can lead to interruptions in service and unreliable diagnostic capabilities. As a remedial measure, the emerging diagnostic technologies need to be integrated with the existing healthcare ecosystem that may be outdated or incompatible with such developments. Addressing these challenges requires a multi-faceted holistic ecosystem-based approach, including skill developments, and innovative solutions tailored to the specific needs of the underserved.

A slew of ultra-low-cost disruptive technologies developed by our team were introduced with the mission of addressing the above crisis, in an effort to democratize disease diagnostics for the underserved. Going beyond the traditional laboratory-centric scientific advancements, we attempted to establish an extensive outreach to the underprivileged based on our technology-driven solutions, fulfilling the United Nations Sustainable-Technology Goal: “Good Health and Well-Being” for all. A bouquet of such technologies enabled bringing in presumably the most advanced high-tech research outside the sophisticated labs. Our specific innovations, such as highly-accurate nucleic acid-based rapid tests for infectious diseases, non-invasive screening tools for early-stage oral pre-cancer and cancer, and smartphone-based tests for maternal and child healthcare, thus attempted to resolve a seemingly insurmountable barrier in the complexity of disease detection technologies through innovations that are resilient to harsh conditions. This resulted in high-quality low-cost early and rapid diagnosis, with uncompromised efficacy in extreme rugged-conditions where most of the high-end medical devices would invariably fail. Underprivileged rural people, who earlier did not have much scope of early disease diagnosis, could thus get the direct benefit of timely health screening. Fostering entrepreneurship, we further pioneered clusters of technology-enabled e-health clinics in remote villages where structured clinical facilities do not exist. This resulted in a silent socio-economic transformation where certified community health-workers deliver technology-empowered healthcare-support to the last-mile. Further, by empowering marginalized women as frontline health workers in a sustainable ecosystem and bringing them in the ambit of rural employment generation, our endeavours attempted to usher new perspectives of establishing gender equality by promoting healthy and economically-supportive livelihood for all.

Speaker Profile

Suman Chakraborty (https://en.wikipedia.org/wiki/Suman_Chakraborty) is Institute Chair Professor in the Mechanical Engineering Department of the Indian Institute of Technology Kharagpur, India and Sir J. C. Bose National Fellow as bestowed by the Department of Science and Technology, Government of India. He has been the Head of the School of Medical Science and Technology and the Dean of Research and Development of the Institute. His current areas of research include microfluidics, nanofluidics, micro-nano scale transport, with particular focus on biomedical applications including novel diagnostic technologies for affordable healthcare. Prof. Chakraborty is a recent winner of the National Award for Teachers presented by the Honourable President of India, and prestigious international accolades including the TWAS Awards bestowed by the World Academy of Science in the domain of Engineering & Computer Science, Freeman Scholar Award from the American Society of Mechanical Engineers (ASME) and the coveted Infosys Prize (in category of Engineering & Computer Science). Based on his outstanding research contributions, he has also featured in the list of top 100 Researchers across all disciplines in Asia in 2023 by the Asian Scientist Magazine and the top-ranked researcher in Mechanical & Aerospace Engineering in India as per research.com. He has been the recipient of the Santi Swaroop Bhatnagar Prize in the year 2013, which is among the highest Scientific Awards from the Government of India. He has been elected as a Fellow of the American Physical Society, Fellow of the Royal Society of Chemistry, Fellow of the ASME – 3 of the leading International Academic Bodies. He is also a Fellow of all the Indian National Academies of Science and Engineering. He has been the recipient of the G. D Birla Award for Scientific Research, National Academy of Sciences India – Reliance Industries Platinum Jubilee Award for Application Oriented Research, Rajib Goyal Prize for Young Scientists, Indo-US Research Fellowship, Scopus Young Scientist Award given by Elsevier for high citation of his research in scientific/technical Journals, and Young Scientist/ Young Engineer Awards from various National Academies of Science and Engineering, and recipient of Outstanding Teacher Award from the Indian National Academy of Engineering. He has also been an Alexander von Humboldt Fellow, and a visiting Professor at various leading Universities abroad. He has a large volume of impactful publications in top International Journals (550+) with high citations (17000+) as well as patents/ licensed technologies and a unique expertise in technology development for the under-served population and community health-care.