Report on the Two-Week FDP on “Interdisciplinary Advances in Bioinformatics and Computational Biology,” organized by the Department of Bioengineering, Faculty of Engineering & IT under the aegis of HRDC, held from 6th –19th November 2025

1 message

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The Two-Week Faculty Development Program (FDP) on “Interdisciplinary Advances in Bioinformatics and Computational Biology,” conducted in blended mode from 6th to 19th November 2025 by the Department of Bioengineering, Faculty of Engineering & IT, under the aegis of HRDC, Integral University, Lucknow, successfully brought together eminent experts who delivered lectures on cutting-edge developments across bioinformatics, computational biology, AI-enabled drug discovery, genomics, and multi-omics.

The first day commenced with two insightful lectures. The opening session was delivered by Dr. Mohammad Imran Siddiqui, Chief Scientist, CSIR-CDRI, Lucknow, on “Current Trends in Computer-Assisted Drug Discovery Research.” He highlighted recent methodological transformations in computational drug design, including improvements in molecular docking accuracy, deep learning–driven QSAR modeling, enhanced free-energy perturbation approaches, and the application of generative AI models for designing novel chemical scaffolds. He further emphasized how modern workflows integrate structure-guided design with cloud computing platforms and large-scale virtual screening pipelines to accelerate the drug discovery process.

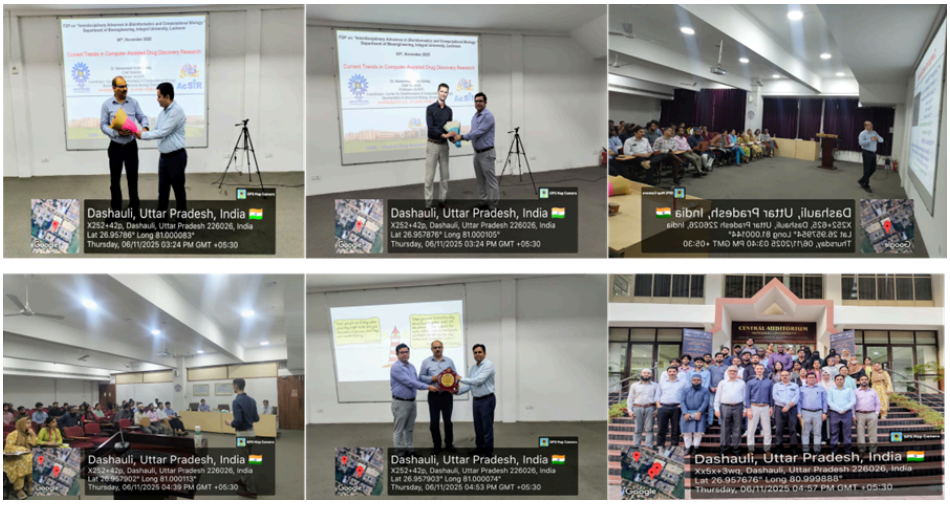

Image: Glimpses of Day-1 of the FDP program.

This was followed by an engaging session by Dr. Christoph Sprung, Germany, a freelance lecturer, trainer, and consultant with extensive international experience. He addressed the audience on innovative and interactive learning methodologies, focusing on modern pedagogical strategies that promote active participation, learner engagement, and problem-based knowledge acquisition. His talk offered valuable insights into global best practices and emphasized the role of interactive teaching tools in enhancing the efficiency and depth of scientific learning.

On the second day, Dr. Feroz Khan, Senior Principal Scientist from CSIR-CIMAP, delivered a lecture on “Introduction to AI/Machine Learning Methods in Drug Discovery.” He elaborated on recent progress in ML-based prediction models, transformer architectures for molecular representation, graph neural networks (GNNs), and explainable AI frameworks used for identifying drug targets and optimizing lead molecules. On the same day, Dr. Muthu Kumar M, Principal Scientist, ICAR-CISH, Lucknow, presented an informative session on “Multi-omics Data Analysis and Integration in Unravelling Complex Gene Networks,” where he described integrative omics approaches combining transcriptomics, metabolomics, proteomics, and epigenomics to decode regulatory networks. He highlighted cutting-edge tools such as single-cell multi-omics integration, network-based clustering, and machine learning–guided feature selection for identifying key biomarkers.

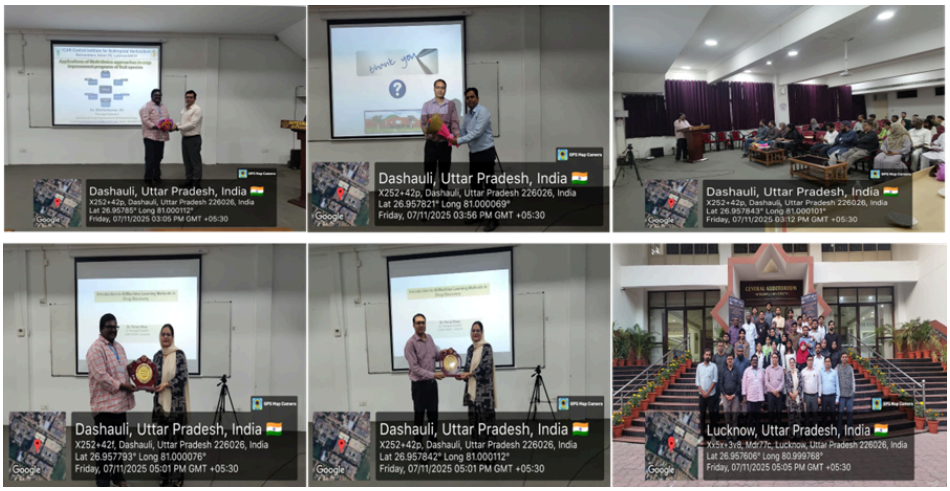

Image: Glimpses of Day-2 of the FDP program.

The third day featured a lecture by Dr. Gopal Lal Khatik, Associate Professor, NIPER Raebareli, on “Role of Computer-Aided Drug Design in Lead Identification and Optimization.” He discussed newly emerging computational pipelines combining fragment-based drug design, 3D-QSAR enhancements, ensemble docking, and molecular dynamics–driven refinement of hits. He described how high-throughput algorithms and cloud-enabled simulations are transforming early-stage discovery.

Image: Glimpses of Day-3 of the FDP program.

On the fourth day, Dr. Sayanti Guha Majumdar (Scientist–Bioinformatics, ICAR–Indian Sugarcane Research Institute, Lucknow) delivered an insightful session on “Harnessing Bioinformatics for Agricultural Innovation and Crop Improvement: Genomic Selection.”

She discussed how modern bioinformatics tools, integrated with genomics, transcriptomics, and advanced statistical models, are transforming crop improvement programs. Her presentation highlighted genomic selection (GS), marker-assisted breeding, multi-omics integration, and AI/ML-driven predictive models for identifying high-yielding, stress-tolerant, and disease-resistant crop varieties.

She also emphasized applications of GS in complex crops like sugarcane, challenges such as polyploidy and SNP dosage ambiguity, and the emerging role of machine learning, deep learning, and R-based genomic prediction models. The talk underscored how bioinformatics is accelerating the development of climate-resilient, nutritionally improved, and sustainable crop varieties for future agricultural needs.

Image: Glimpses of Day-4 of the FDP program.

The fifth day comprised two sessions. The first session was delivered by Dr. Amir Ahmad, Senior Research Scientist, Interim Translational Research Institute, Hamad Medical Corporation, Hamad Medical City, Doha, Qatar. He addressed the audience on emerging inflammatory diseases and their preventive research strategies, highlighting recent advances in understanding inflammatory pathways, biomarker discovery, early detection approaches, and translational research frameworks aimed at mitigating chronic inflammatory conditions. His talk provided valuable insights into global research trends and preventive therapeutic strategies.

The second session featured Dr. Shakti Kumar from SGPGIMS, Lucknow, who delivered a lecture on “Microbiome Genomics: Concept and Analysis of a Health Indicator.” He discussed breakthroughs in metagenomics, shotgun sequencing approaches, microbiome-based diagnostics, and machine learning models used to interpret microbial signatures for disease prediction. His presentation emphasized the growing significance of microbiome research in precision medicine and health monitoring.

Image: Glimpses of Day-5 of the FDP program.

On the sixth day, Dr. Shishir Kumar Gupta from CBMR, Lucknow, delivered an engaging lecture on “AI and Multi-Omics Integration for Decoding Complex Disease Mechanisms.” He explained how multi-omics layers—genomics, transcriptomics, proteomics, epigenomics, and metabolomics—collectively reveal the hidden complexity of biological systems. His talk highlighted modern AI- and machine-learning–based integrative methods such as MOFA, iClusterPlus, DeepOmix, and MOGONET, which enable biomarker discovery, disease-subtype classification, and improved patient stratification. He also demonstrated applications of AI in healthcare, including early disease diagnosis, ML-enabled feature selection, biomarker prediction, and multi-omics–driven clinical decision support. Case studies on rheumatoid arthritis, IPF, sarcoidosis, and tuberculosis illustrated how data-driven models can transform precision medicine.

Image: Glimpses of Day-6 of the FDP program.

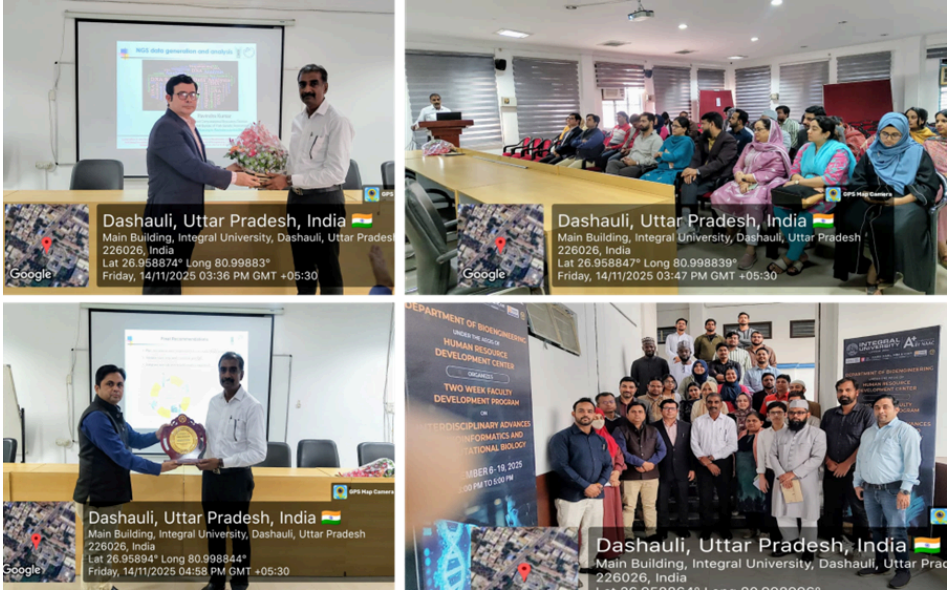

Image: Glimpses of Day-7 of the FDP program.

The seventh day featured Dr. Ravindra Kumar from ICAR-NBFGR, Lucknow, who delivered a session on “NGS Data Generation and Analyses.” He elaborated on the latest sequencing platforms, long-read technologies such as Oxford Nanopore and PacBio HiFi sequencing, hybrid genome assemblies, variant calling improvements, and workflow automation using containerized bioinformatics pipelines.

On the eighth day, Dr. Kinshuk R. Srivastava from CSIR-CDRI delivered a talk on "Integrating AI and Data Science for Next-Generation Therapeutic Discovery & Development." He highlighted emerging advances such as AI-driven retrosynthesis prediction, large chemical language models, in silico ADMET profiling, and federated learning for pharmaceutical big data security.

Image: Glimpses of Day-8 of the FDP program.

On the ninth day, Dr. Sathish Kumar Mudedla (Senior Scientist, Medicinal and Process Chemistry Division, CSIR-CDRI) delivered an online session on “Integrating AI with Quantum Chemistry for Drug Discovery.”

During his talk, he discussed how artificial intelligence, cheminformatics, molecular docking, molecular dynamics, and free-energy methods are accelerating modern drug design. He highlighted

AI-based generative models, molecular representation strategies, and recent advances in de novo ligand design, including case studies such as the AI-designed FLT-3 inhibitor PCW-A1001.
Dr. Mudedla also explained how quantum mechanical (QM) calculations, machine-learning-derived force fields, and hybrid QM/MM simulations provide mechanistic insights into catalytic pathways, transition-state stabilization, and enzyme function. His presentation emphasized how integrating AI with quantum chemistry enables faster, more accurate modeling of drug-target interactions and supports next-generation therapeutic discovery.

Image: Glimpses of Day-9 of the FDP program.

The final day was marked by the lecture of Dr. Aman Chandra Kaushik from CSIR-CIMAP on “AI-Driven Integrative Approaches in Drug Discovery and Functional Genomics.” His talk covered recent innovations such as multi-modal datasets integration, gene expression prediction models, AI-enhanced functional annotation, and predictive pipelines for therapeutic target discovery.
The session of each day followed a structured format in which speakers provided in-depth discussions aligned with their specialized research domains, followed by interaction with participants, a vote of thanks, and the presentation of a memento as a token of appreciation.
A total of forty faculty members from various national and international institutions-including Qassim University (KSA), AKS University Satna, Kanpur Institute of Technology, Shobhit University Saharanpur, Era University Lucknow, Miranda House, University of Delhi, Goel Institute of Technology and Management Lucknow, Khawaja Moinuddin Chishti Language University, Lucknow, NIMS University Jaipur, SRMU Lucknow, the Faculty of Pharmacy, Integral University, along with participants from the Department of Bioengineering-actively took part in the program. During the course of the FDP, two quizzes based on the lectures delivered by the distinguished speakers were conducted, followed by a feedback form circulated at the end. Participants who successfully completed both quizzes and submitted the feedback form became eligible to receive the certificate of achievement.

Image: Glimpses of Day-10 of the FDP program.

The program significantly contributed to enhancing the knowledge base of the participating faculty members by exposing them to contemporary advancements in the field, which will undoubtedly enrich the teaching–learning process and benefit students across related disciplines. The FDP concluded with sincere expressions of gratitude to all speakers, participants, and organizers, whose collective efforts ensured the successful and impactful completion of the two-week event.

Warm Regards

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