JIS Institute of Advanced Studies and Research (JISIASR) Kolkata
JIS University

NEWSLETTER

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Message from the Managing Director, JIS Group

Mr. Taranjit Singh

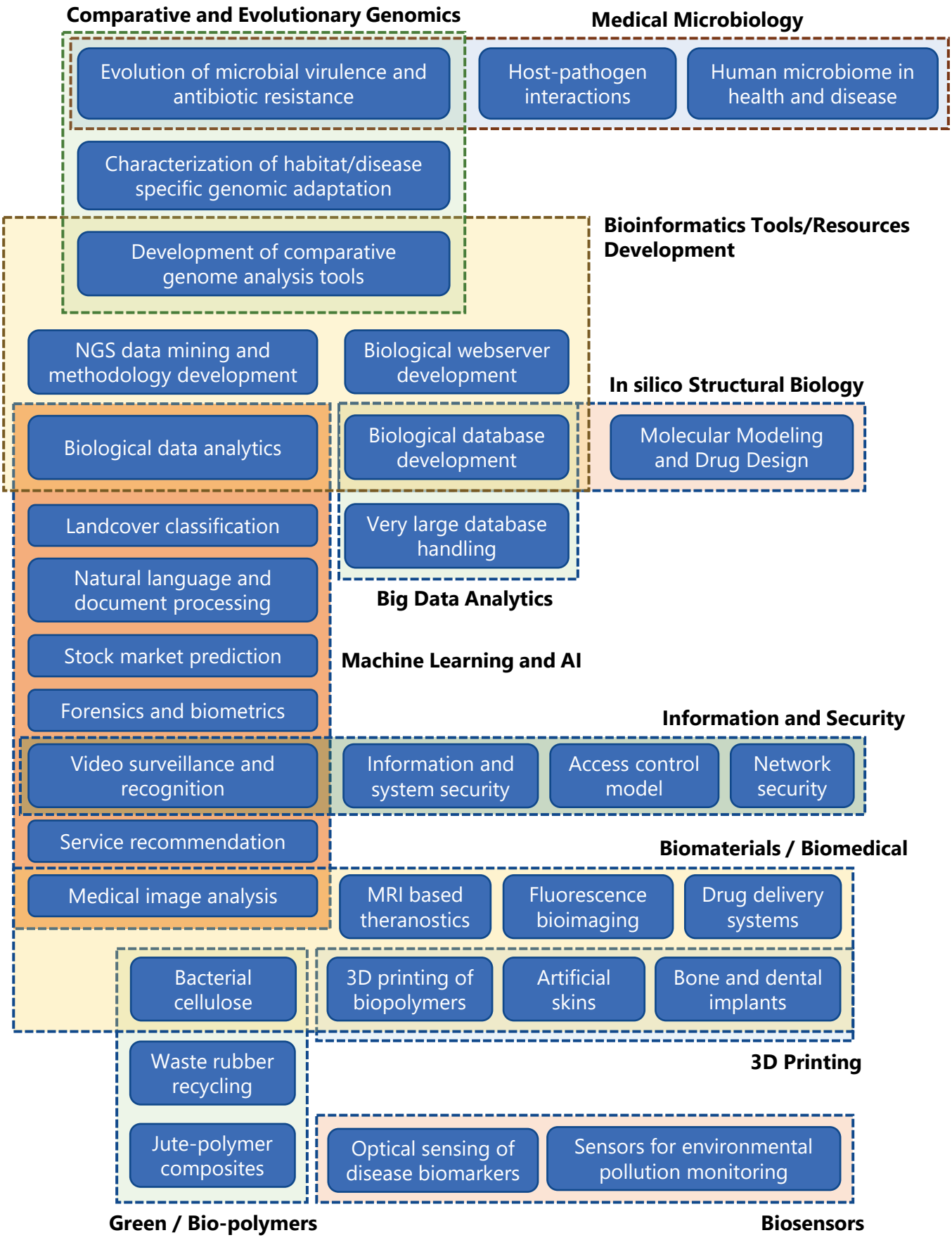
I am immensely pleased to know that JIS Institute of Advanced Studies and Research, JIS University is going to publish Bi-annual Newsletter highlighting the academic and research and Development, being carried out by the faculty members and the students of the Institute. I am also extremely happy to find the faculty members and the scholars of the Institute have performed commendably well in their research efforts, which has been reflected by their publication, sponsored research projects, laboratory development and patents. Although the three centres of the Institute started their journey in 2019 August, I appreciate the efforts of the faculty members in reaching great heights even during the last two years of Covid pandemic. The Institute is going to start two more new Centres – on Nano-medicines and Advanced Management Studies in 2022-23. Additionally, I am happy to inform you all that we are aiming to relocate our institute with larger facilities by this year. I wish the Institute greater success in the years to come.

Message from the Director, JISIASR

Prof. Ajoy Kumar Ray

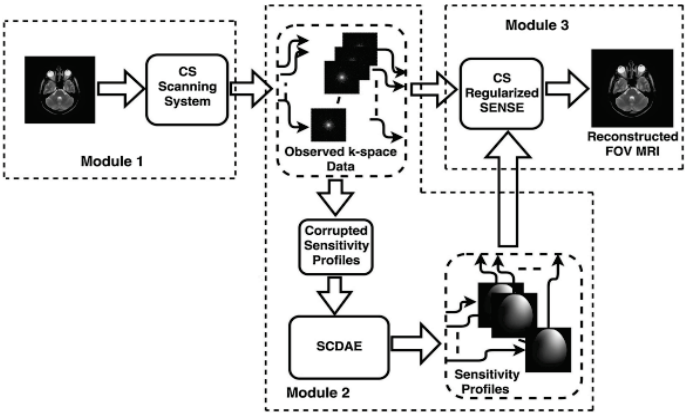
JIS Institute for Advanced Studies and Research (JISIASR) Kolkata started its journey in 2019 with three centres – Centre for Data Science, Centre for Health Science and Technology and Centre for Interdisciplinary Sciences. While the three centres intimately collaborate with each other, the institute altogether aims to work closely with the industries and R&D Laboratories across the country and also at the global level. The experts from the industries and academia participate both in teaching and research programs in the Institute. Our fully-structured job oriented courses, collaboration with leading industries across the globe, highly qualified faculty members from IITs and other eminent institutions in India, USA and Europe and most importantly our laboratory infrastructure aims to attract a pool of high-quality graduate students to join our Masters and PhD programs, and learn state-of-the-art technologies. I strongly believe that our strong repertoire of bright faculty members and motivated Masters and PhD students will eminently place our institute in the technology education map of India in the near future via active support and collaboration with the prominent industries and academic institutions across the globe.

RESEARCH Domains



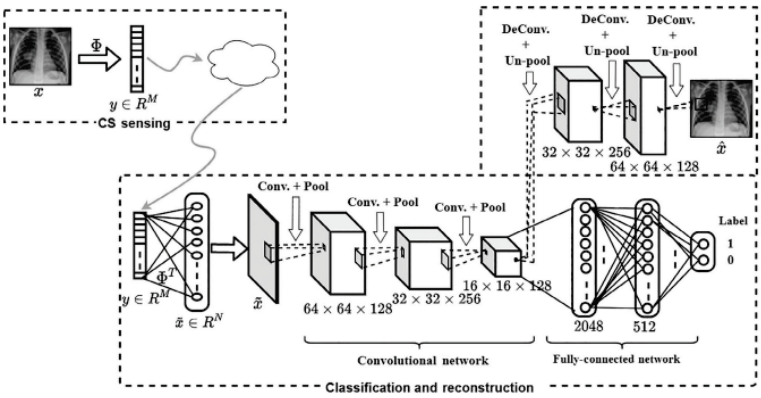
RESEARCH Highlights

Compressed sensing regularized calibration-less parallel magnetic resonance imaging via deep learning



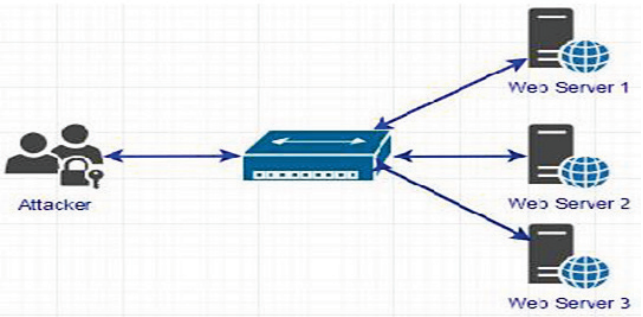
- Estimation of coil-wise sensitivity maps using a deep learning based stacked convolutional denoising autoencoder makes SENSE based parallel MR imaging systems calibration-less.
- In a calibration-less SENSE based pMRI system, regularizing data acquisition through compressed sensing enables significant reduction in scanning time.
- The use of interferometric modulation in radio frequency coils during data acquisition in pMRI systems enhances anatomical features in the respective coils' FOVs and reduces neighbouring coils interference.
- Reconstruction of MR images performed on Graphics Processing Unit (GPU) helps to reduce the reconstruction time of the desired image.

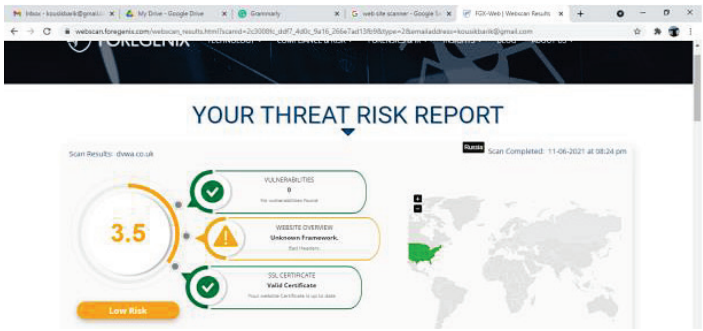
Deep learning on compressed sensing measurements in pneumonia detection



- Utilization of X-ray as the best imaging modality to identify pneumonia.
- Design of an efficient deep learning framework to detect pneumonia by using compressed sensing measurements of X-ray images to assist the medical practitioners located at distant places.
- Development of an energy efficient and bandwidth preserving far-end pneumonia detection system by using compressed sensing measurements of X-ray images.
- Reconstruction of full-scale X-ray images from their corresponding compressed sensing measurements.

Penetration Testing Analysis with Standardized Report Generation

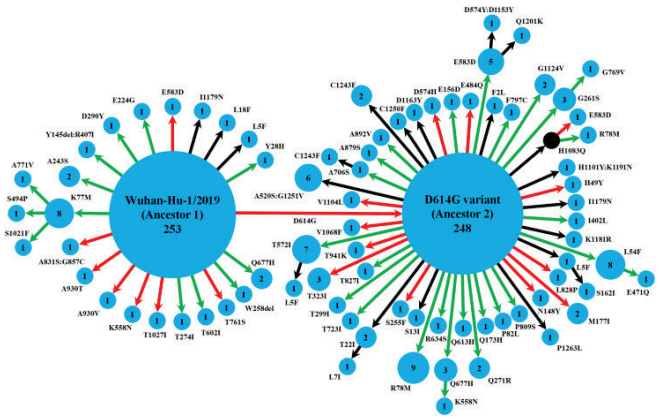




- Design and development of a lab setup for Open Web Application Security Project vulnerability tool and vulnerable web applications via penetration testing analysis with standardized report generation.
- Exploring the necessity of penetration test reports to the understanding of domain knowledge experts, decision-making bodies, and board members of the top executives of an organization for making further decisions on improving the robustness of their network and web applications

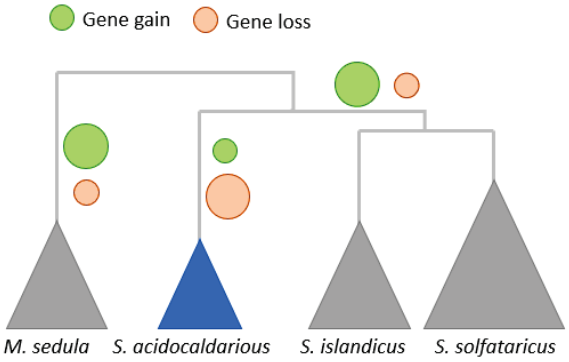
RESEARCH Highlights

Spike protein mutational landscape in India during the complete lockdown phase: Could Muller's ratchet be a future game-changer for COVID-19?



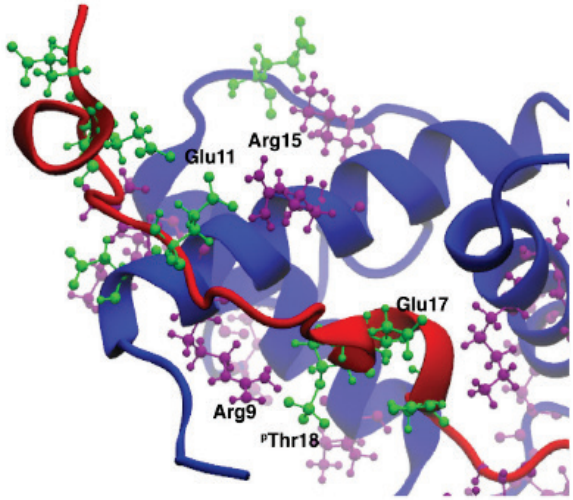
- The present study analyses spike protein variants from the sequenced genomes of Indian isolates available till June 7, 2020. This helped us to understand the location-specific evolutionary patterns and driving forces behind the emerging SARS-CoV-2 infection and its potential epidemiological footprints in different parts of India during the nationwide lockdown in four consecutive phases.
- We detected a strong correlation between the average stability of complexes formed by the circulating spike protein variants with the host receptor (S-R complex) and the disease severity of a given location, suggesting the S-R complex stability as a potential marker to assess the severity of the disease.

Interplay of various evolutionary modes in genome diversification & adaptive evolution of the family Sulfolobaceae



- Comparative pan-genomics along with concomitant evolutionary analyses of 30 genomes of the family Sulfolobaceae revealed asymmetric genome evolution.
- Pan-genomics coupled with gene gain–loss analysis explored the inherent pattern of genome streamlining, followed by waves of differential gene gains, which resulted as genome expansion in some species while reduction in others in comparison to the ancestral state.
- Analysis of these gene gain–loss patterns among the three major metabolic pathways revealed that the CCM and sulfur metabolism potential of its members coevolved with the genome diversification pattern.

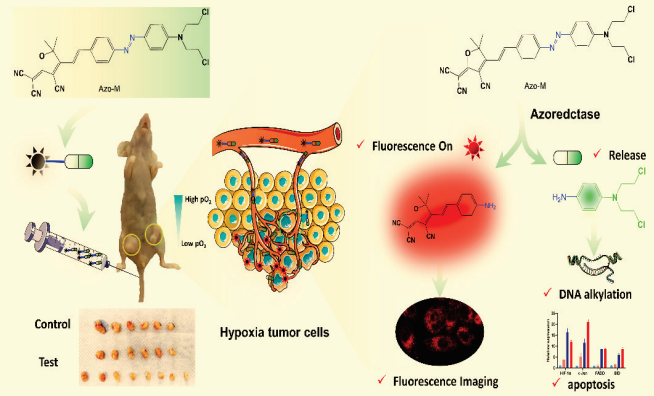
Structural modulation of p53TAD1-TAZ2 complex upon mutations and post-translational modification



- The tumour suppressing p53 is a target for genetic alterations in human cancer. However, the influence of post-translational modifications (PTMs) on the activity of p53 is still under extensive experimental and computational study.
- There are numerous PTM sites in p53, which are reported to regulate its binding affinities with other proteins. Of the many, Thr18 at transactivational domain (TAD) of p53 is reported to amplify p53 activity upon phosphorylation. The MD simulation inferred that phosphorylated and mutated Thr18 redistributed the charge environment of the interface, thereby modulating the stronger interactions with TAZ2 to enhance the binding efficiency.
- The results of this computational study further explain the importance of the Thr18 as a PTM site in atomistic detail, hence shedding further light to the understanding of how PTMs are imperative for p53 activity to protect the cellular world.

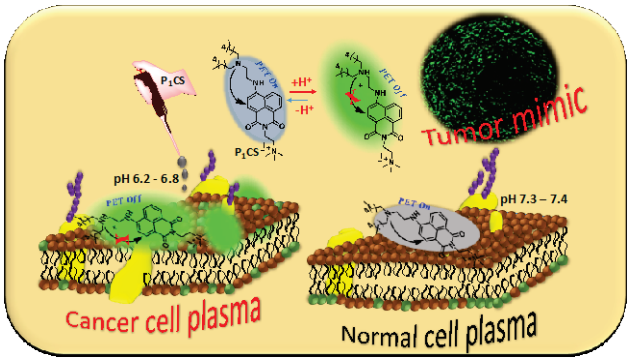
RESEARCH Highlights

Direct readout hypoxia tumor suppression in vivo through NIR-theranostic activation



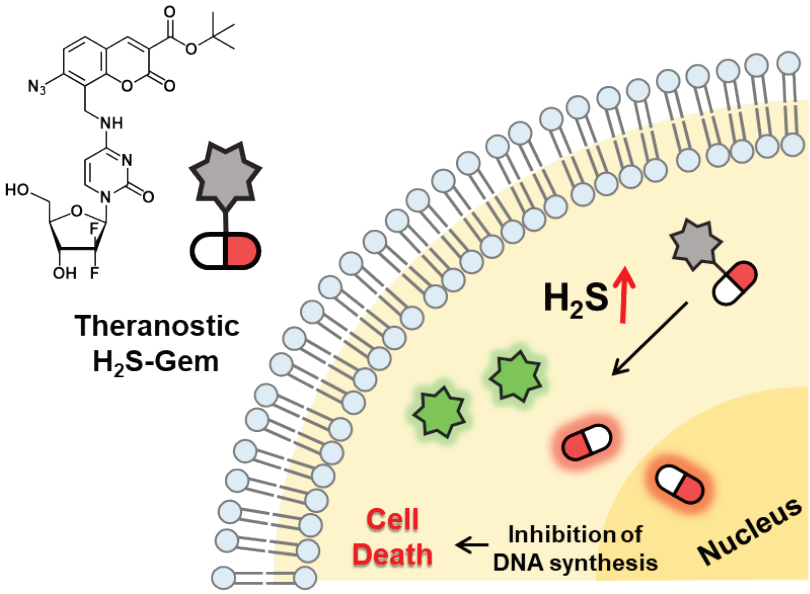
- The low oxygen (pO2 ≤ 20 mm Hg) pressure in hypoxia directly influences the efficacy of today's anticancer modalities are used in cancer treatment. As an example, low oxygen in hypoxia becomes radiation-resistant due to insufficient reactive oxygen species formation in radiotherapy; thus, it can't create lethal damage to the cancerous DNA.
- Hypoxia-driven HIF-1α/β and free radical species induce angiogenesis factors to overcome radiation therapy.
- In the tumor-bearing xenograft mice model, it has been observed that Azo-M reduced 2-fold of tumor volume/weight without physical weight loss of mice. It is unique value addition in hypoxia directive activation of theranostic to create personalized medicine in due course.

Amphiphilic fluorescent probe self-encored in plasma to detect pH fluctuations in cancer cell Membranes



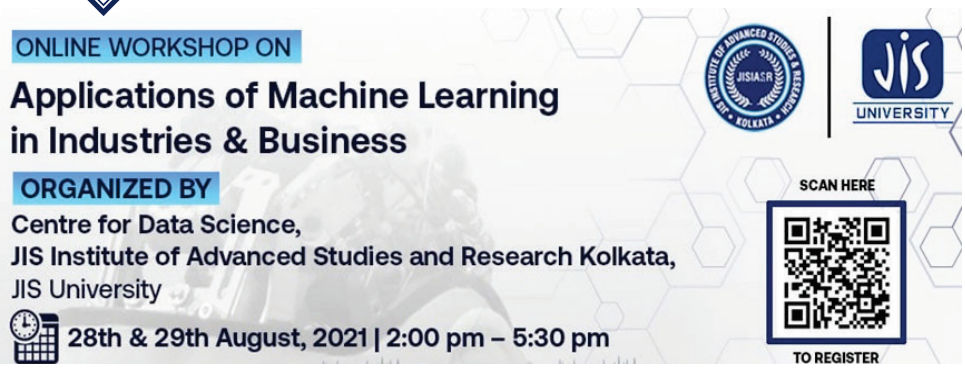
- An amphiphilic pH probe (P1CS is able to label cell-plasma membrane based on the pH of the cell plasma. It easily distinguishes cancer cells from normal cells based on pH fluctuation in the plasma region. It may allow labeling of the peripheral region of the tumor to dissect the tumor during the surgical operation

Cell-specific activation of gemcitabine by endogenous H2S stimulation and tracking via simultaneous fluorescence turn-on



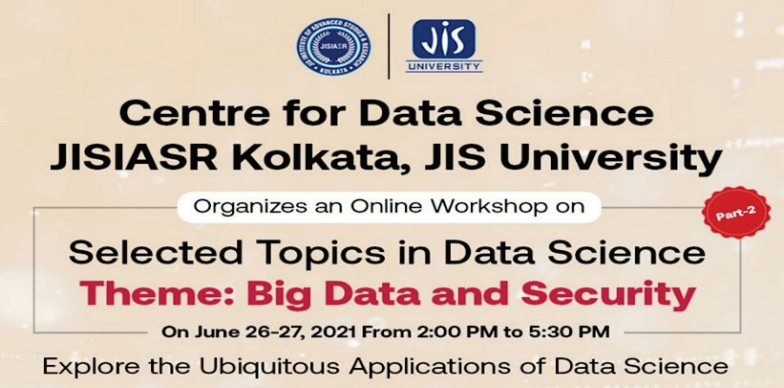
- The theranostic prodrug is activated in cancer cells and released the anticancer drug gemcitabine without harming surrounding normal cells. This strategy is useful to release payload to the colon cancer cells, cervical cancer cells and etc.

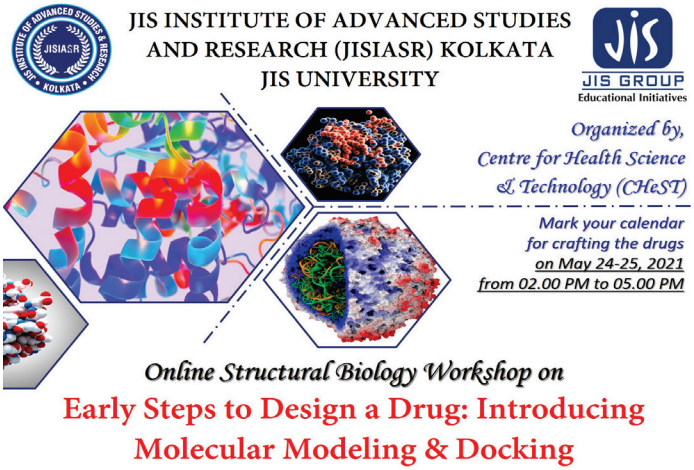
WORKSHOPS Organized



- Glimpse of the various applications of machine learning in the industry and business.
- Role of Artificial Intelligence in different video processing applications.
- State-of-the-art research focuses in the domain of financial data analysis using machine learning.
- Challenges in big data analysis and solutions to crack them.

- Highlighting the necessity and challenges of Security, management and prevention of unauthorized access to the vast amount of data shared over the internet.
- Role of Machine learning in cyber security.
- Hands-on sessions to deal with real-life crime data.
- Focus on access control and RSA algorithms.





- Introducing Homology Modelling
- Predicting protein structure from sequence and model validation – Hands on
- Ab-initio prediction of protein structure: An introduction
- Docking - an essential step for drug designing: Introduction with Hands on
- How do I model a molecule? – Hands on
- Prerequisites of simulation - Hands on
- Drug designing - from computational biologist's perspective

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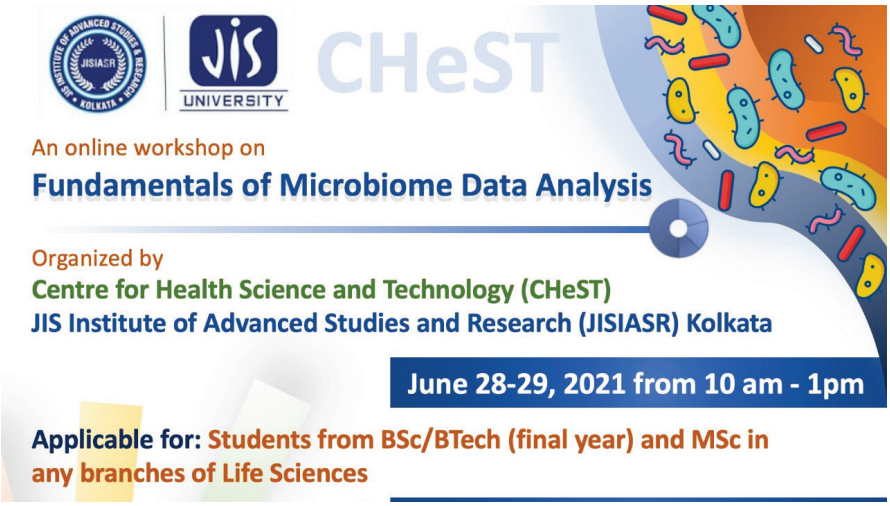
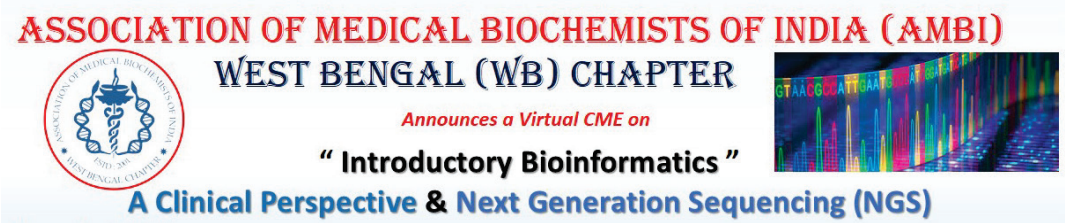
- Processing of data from raw files.
- Clustering to taxonomic classification.
- Functional assignments and comparative metagenomics.
- Identification of biomarkers
- No prior knowledge of metagenomic sequences analysis or specific programming skill is required to attend the workshop.



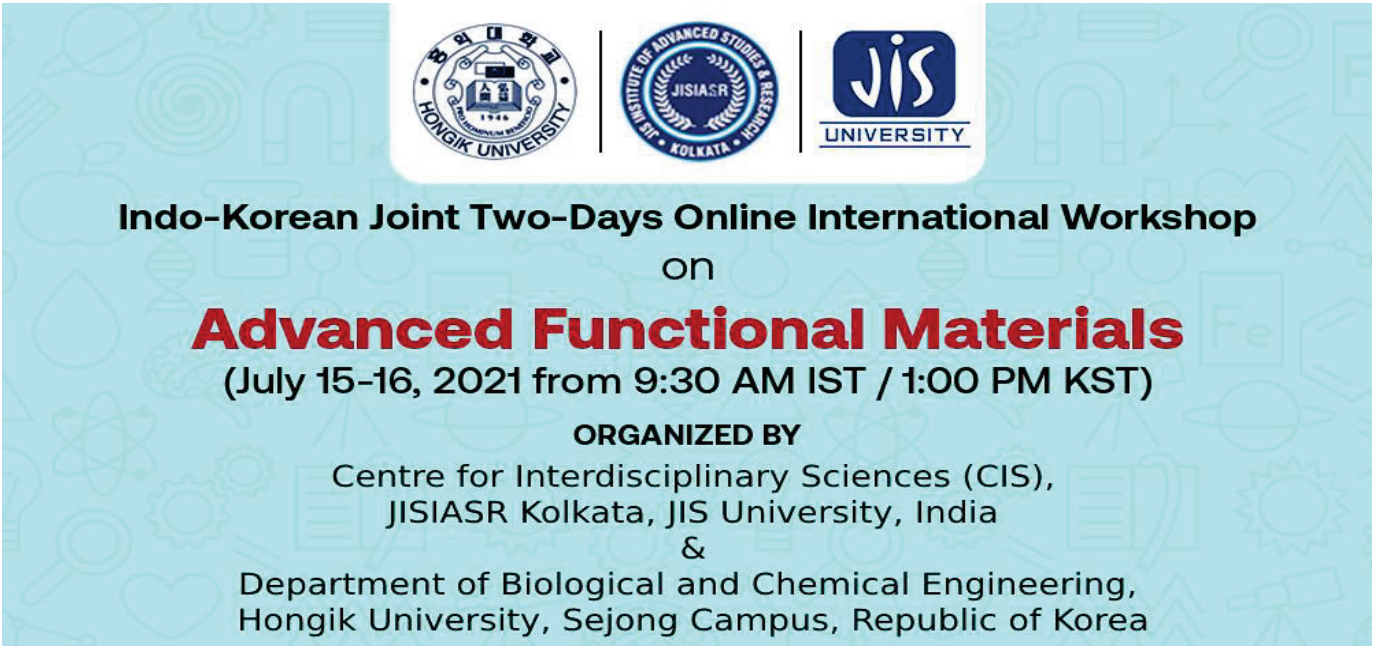
WORKSHOPS Organized



Organized in collaboration with Centre for Health Science and Technology JISIASR Kolkata

- Introduction to bioinformatics
- Biological databases
- Analysis of nucleotides and proteins
- Restriction mapping and primer designing
- Structural bioinformatics
- Next-Gen-Sequencing data analysis
- Introduction to clinical bioinformatics
- Applications of machine learning in clinical research

This CME is jointly organized by Association of Medical Biochemists of India (AMBI) West Bengal chapter and CHeST, JISIASR Kolkata for the health-care professionals working at the medical colleges in West Bengal. More than 30 doctors/biochemists enrolled for this virtual CME on the topic of Introductory Bioinformatics. This is an initiation of unique collaborative educational exchange program between the Nil Ratan Sircar Medical College & Hospital (NRSMC&H) and the JISIASR Kolkata.



Considering the present challenging situation when the entire world is worse affected by devastating pandemic, this two-day workshop organized by two leading institutes from India and South Korea has tried to provide a platform to the young students and researchers to learn, interact, and communicate with the leading scientists and academicians over a common theme based on advanced materials and its applications. Detailed interaction and discussion between scientists and end-users were took place through this joint effort. Around 150 participants from all over the world have attended the workshop.

Few of the research themes included for this workshop –

- Biomaterials
- Polymers and 3D Printing
- Functional Organic Materials
- Nanomaterials
- Energy Materials
- Materials for Biosensing and Medical Applications.

Distinguished LECTURES

Annual Distinguished Lecture Series 2021

on the contribution of medical biotechnology and bioinformatics toward a better world
Organized by,
Centre for Health Science and Technology (CHeST), JISIASR Kolkata

Speakers: *(left to right)*

Prof. Daniel Huson
University of Tübingen, Germany

Prof. Padmanabhan Balaram
Indian Institute of Science, Bengaluru, India

Prof. Alok Bhattacharya
Ashoka University, India

Prof. Evgeni Sokurenko
University of Washington, Seattle, USA

Prof. Dipankar Chatterji
Indian Institute of Science, Bengaluru, India

Prof. Steffen Backert
Friedrich Alexander University, Germany






Distinguished Lecture

on "Next Generation Antibiotics"
Organized by,
Centre for Interdisciplinary Sciences (CIS), JISIASR Kolkata

Prof. Ada E. Yonath
Nobel Laureate in Chemistry, 2009
Department of Structural Biology
Weizmann Institute of Science, Israel

Prof. Yonath is a crystallographer best known for her pioneering work on the structure of the ribosome. In the 1970s, she began a project that culminated in 2000 in her successful mapping (together with other researchers) of the structure of ribosomes, which consist of hundreds of thousands of atoms, using x-ray crystallography. Among other applications, this has been important in the production of antibiotics.

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