Annual Report 2022-23

जीव विज्ञान संस्थान

INSTITUTE OF LIFE SCIENCES

(An Autonomous Institute of the Department of Biotechnology, Ministry of Science & Technology, Govt. of India)

Hindustan Times

Indian scientists successfully conduct animal trial of drug for malaria

Feb 23, 10:42 AM IST • 1 min read

In a major breakthrough, scientists of Bhubaneswar-based Institute of Life Sciences claimed to have achieved a successful trial of an anti-fungal drug that has the potential to bring down malaria mortality. A scientist, who is part of the research said targeting parasite heme with Griseofulvin prevented cerebral and severe malaria. The findings of the research have been peer-reviewed and published in ?Nature? journal. The scientists are now gearing up for human trials of the drug.

ILS scientists 'Most Influential Scientific Minds'

PNS ■ BHUBANESWAR

The Institute of Life Sciences (ILS) Bhubaneswar scientists, Drs Sanjeeb Sahoo, Amaresh C Panda and Director (Additional Charge) Pulok Kumar Mukherjee are among the 'World's Most Influential Scientific Minds in 2022.'

Prof Mukherjee, Director, IBSD and Director (Additional charge), ILS is working on traditional medicine-inspired drug discovery and development from Indian medicinal plants with major emphasis on their validation, formulation, and standardization, metabolomics profiling, safety, and related issues. He is also a fellow of National Academy of Agriculture Science (FNAAS), National Academy of Science, India (FNASc) and the Royal Society of Chemistry, UK (FRSC). Dr Sahoo is featured on the career-long impact and single-year impact list in the sub-category of 'Pharmacology & Pharmacy' and 'Nanoscience & Nanotechnology' under the category of 'Clinical Medicine' for last three years, including 2022. In 2018, he also made it to the top 4,000 scientists released by a US-based firm Clarivate Analytics. His research group at ILS mainly focuses on the nanotechnology-based targeted drug delivery to the tumor tissues where by using the techniques, cancer cells can be killed. Dr Panda was featured in the subfield 'Developmental Biology' and 'Biochemistry & Molecular Biology' under the field of 'Biomedical Research'. Dr Panda's research group at ILS is working to understand the role of poorly characterized circRNAs in muscle regeneration and insulin biosynthesis.

For tribal communities of Odisha

ILS scientists find new health-promoting probiotic bacteria

PNS ■ BHUBANESWAR

The Institute of Life Sciences (ILS), Bhubaneswar has put forward a novel research initiative in addressing health, nutrition and wellbeing of tribal communities of Odisha. Around three years back, under the leadership of former ILS Director late Dr Ajay Parida, the Department of Biotechnology, Government of India, supported the ILS flagship programme on tribal health and nutrition. Under this programme, multiple scientists of ILS are supervising different aspects of studies that could improve the health and wellbeing of tribes. In one of its studies, the ILS team planned to explore the use of beneficial microorganisms to improve the health status of these people.

Probiotics are good microbes that provide health benefits to humans and animals when taken live in adequate amounts. These helpful organisms are known to be useful in the prevention and control of multiple health-associated problems like diarrhoea, obesity and many immunological disorders. Realising the unique food habits, culture and ecosystems of tribes of Odisha, the ILS scientists planned to isolate and characterise potential probiotics.

In this regard, Dr Shantibhusan Senapaiti's group from ILS has isolated multiple probiotics and characterised those. Recently, the group has published the whole genome sequence and other probiotic properties of one of the helpful bacteria and the work has been published in the "World Journal of Microbiology and Biotechnology". Dr Jayalaxmi Dash and Manisha Sethi, the lead authors of this publication, have mentioned that for probiotics, t sequencing completed a have been s NCBI databa

ILS Dire principal inve ILS-flagship

Pulok Kumar Mukherjee has expressed his happiness over the achievement and mentioned to extend this effort in a more elaborate manner to develop functional foods by using these probiotics in future.

As the origins of these probiotics are from the Odisha tribes, Dr Senapati expects that the healt promotin

THE NEW INDIAN EXPRESS

Odia scientist gets international award

Mishra presented his discovery on the drugs targeting breast cancer, such as DZNepA, MLN4924, which is going into pre-clinical trials.

By Express News Service

BHUBANESWAR: Sandip K Mishra, a senior scientist at the Institute of Life Sciences (ILS) in Odisha's capital, has been conferred this year's BJ Kennedy Distinguished Research Excellence Award in Dubai in recognition for his work on molecular oncology. Mishra presented his discovery on the drugs targeting breast cancer, such as DZNepA, MLN4924, which is going into pre-clinical trials, at an international conference on material science, chemistry and bio- ce held in Dubai on June 17. He also mentioned about his recent developments on the ppressor molecules.

ILS CELEBRATES ENVIRONMENT DAY

Bhubaneswar: The ILS observed the World Environment Day 2023 with two lectures focusing on good health and awareness of plastic waste in environment. Dr Megha,

Sourav Ghosh

Institute of Life Sciences, Bhubaneswar

"Being chosen as one of the finalists for the Inspiring Science Award 2023 is a great honour and privilege. I express my sincere gratitude to the ISA team and TNQ Technologies for appreciating our research. This accomplishment wouldn't have been possible without the relentless efforts of my colleagues. A very special thanks to our supervisor, Dr Arun Nagaraj, for his constant support and efforts to make this happen. Finally, I acknowledge the Institute of Life Sciences, Bhubaneswar and DBT for the infrastructure and funding."

Submitted Entry:

Malaria parasite heme biosynthesis promotes and griseofulvin protects against cerebral malaria in mice

Cover Page Image Courtesy: -Virus-Host Interactions Lab, DBT-ILS

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INSTITUTE OF LIFE SCIENCES

Padmashree Dr. Ajay Kumar Parida (1963-2022)

Dr. Ajay Parida, a leading plant biotechnologist, charismatic leader, dedicated researcher, and mentor, passed away on 19th July 2022 at the age of 58. He will be remembered as a renowned plant biotechnologist and dynamic administrator. Dr. Parida was awarded the Padma Shri Award by the President of India, in 2014 for his outstanding contribution in the field of Science and Technology. His father, Mr. Dibakar Parida, was a primary school teacher at a school in village Arabal (Jajpur district) and his mother, Saralata, was a homemaker. He left home at the age of five to study at Narla Primary School in Kalahandi District, Odisha under the supervision of his paternal uncle and aunt. His keen interest in studies won him many accolades in his early years of education. He graduated with an Honours in Botany from Utkal University (Narasingh Choudhury College, Jajpur, Odisha) in 1982 and received a government scholarship to complete his post-graduation in Botany from Ravenshaw College (then affiliated to Utkal University) in 1984. He qualified the CSIR-UGC examination and received a fellowship to pursue doctoral studies under Professor Soom Nath Raina's (Laboratory of Cellular and Molecular Cytogenetics, Botany Department, Delhi University) supervision. His Ph.D. thesis reported the genome analysis of Vicia species, genetic analysis in micro-propagated plants, and genome size variation in callus cultures of the diploid vis-a-vis synthetic auto-tetraploids. He was awarded a Ph.D. degree in 1992.

Dr. Parida joined M.S. Swaminathan Foundation in 1993. He served as Executive Director of the foundation from 2009 to 2017. During his tenure at the Foundation, his major goal was to develop location-specific crop varieties that can overcome the adverse impact of climate change in order to promote stability and sustainability of the major farming systems. He performed extensive studies on mangroves, and wild varieties of cultivated cereals, legumes, and other crops and was instrumental in identifying abiotic stress tolerance genes. His vision included utilizing advanced biotechnological interventions to uplift the well-being of rural and tribal populations. Dr. Parida has won several national-level accolades for his research excellence and was elected as the President of the Agriculture Science and Forestry section of the Indian Science Congress in 2012 and President of the Biological Sciences Session of the National Academy of Sciences India in 2014.

Dr. Parida joined as the Director of ILS, Bhubaneswar in 2017. With his dynamism, he motivated his peers to perform beyond the set limitations and take up new challenges to excel at the national and international levels. He encouraged multidisciplinary and collaborative projects and encouraged the scientific fraternity at ILS to collaborate and develop multidisciplinary programs of national and local relevance for the betterment of society. He was instrumental in the upgradation of the institute's infrastructure and the establishment of a world-class research environment. Under his directorship, the institute has grown exponentially in terms of research excellence, societal and scientific outreach and gained recognition as a renowned institute of excellence in life science research. Coming from a plant biotechnology background, his vision was to establish a genomics-oriented program for underutilized as well as popular plants/crops in India. Under his guidance, his team was able to achieve commendable milestones in the field of plant genomics. Dr. Parida's lab was the first to report the transcriptomes for little millet (Panicum sumatrense) and Phargmites karka, two indigenous, climate-resilient plants and a source of novel genes/pathways that promote plant growth in adverse conditions. His team has also been involved in generating genomic resources for important and underutilized pulses of India, like the Moth bean (Vigna aconitifolia), popular medicinal plants like Moringa oleifera, and widely consumed cucurbits like Ivy gourd.

Odisha is a state with the second largest tribal population in India, including 13 particularly vulnerable tribal groups. The tribal groups are vulnerable to hereditary diseases, malnutrition, anemia, stunting, wasting, hemoglobinopathy, and communicable diseases. Under the dynamic leadership of Dr. Parida, DBT-ILS launched a flagship program on “Tribal Health and Nutrition” that adopts a multi-omics approach to characterize the genomic diversity, immune profile, clinical biochemistry, microbiome profile, and vector-borne pathogen load. The project's overall goal is to integrate all the variables that interact and predict the genotypic, molecular, and environmental determinants that govern the predisposition/resistance to disease. This program also aims to create a traditional knowledge base of dietary crop diversity and local bioresources of nutritional, therapeutic, and economic value. With his charismatic and dynamic leadership, Dr. Parida played a main role in the initiation and execution of this interdisciplinary institutional program, which is of great relevance to the state and nation.

The year 2019-2020 is perhaps one of the darkest years in the lives of many people in the world due to the loss of many lives because of the devastating COVID-19 pandemic. The state of Odisha was no exception to the overwhelming

effects of COVID-19. It was a time when the government was looking for organizations and institutions to step up and contribute to their fight against COVID-19. Dr. Parida was proactive to utilize the institute resources for the diagnosis of COVID-19 patient samples of the state of Odisha. He took up the responsibility and quickly assembled an efficient team of scientists, staff, and students to perform COVID-19 testing and research at ILS Bhubaneswar. Under his leadership, ILS reached the zenith of COVID-19-related activities. Over 1.5 lakh samples were tested, and around 25 circulating strains of SARS-CoV2 were isolated to aid in COVID-19-related research activities. ILS was among the first few institutes in India to quickly establish an in-vitro cell culture model and Syrian Golden Hamster animal model for facilitating anti-SARS-CoV2 drug discovery and research activities against COVID-19. ILS also set up a biorepository to preserve new strains of the virus and patient samples and also became an integral part of the Indian SARS-CoV2 genomics consortium (INSACOG) involved in the sequencing of SARS-CoV2 circulating strains for the surveillance of evolving mutants and prevalence of infection. Dr. Parida led the entire operation, coordinating with various establishments that were a part of Odisha State Health Services and INSACOG. He celebrated every achievement of his people and remained cheerful through the toughest of times. Dr. Parida's media presence at this time helped provided the common mass of Odisha with much-needed reassurance. His addresses in local news channels were succinct and answered important questions that many people had about the guidelines to be followed and precautions to be taken to survive the pandemic. He encouraged the masses to get vaccinated and was the first to take the jab in the ILS community. His dedication to society and its well-being always took priority and his charismatic and approachable personality made him a household name in Odisha.

Dr. Parida was a man with many sides. He was known as an excellent administrator, a patient mentor, a helpful colleague, and a dear friend. He was a down-to-earth person who valued hard work above everything. For him, it didn't matter if you failed but he expected your inner efforts. He led by example and encouraged many of us to have faith in ourselves and deliver our best in everything we did. He may be gone too soon, but he lived a big life. He will always be a part of ILS and a source of inspiration.

Clockwise from top left: Dr. Ajay Parida (R) with his Ph.D guide Prof. S N Raina. Dr. Parida with his colleagues at Aberystwyth, Wales during a Post Doctoral stint in 1990. Dr. Parida receiving the Padma Shree Award from former President Shri Pranab Mukherjee in 2014. Dr. Parida with his research scholars and staff at ILS.

From the Director's Desk

I am happy to report the significant progress made by ILS during the last year.

The scientists have been able to perform well in their respective areas, which has enabled ILS being ranked 6th in Nature Index this year. The thematic research areas at ILS, namely Infectious Diseases Biology, Cancer Biology and Plant Biotechnology group have all performed extraordinarily well. Noteworthy amongst them are the research achievements of Dr. Arun Nagaraj and his group, who made some significant strides in understanding the significance of the de novo heme pathway and hemozoin formation in disease severity and progression to cerebral pathogenesis. They also demonstrated that the antifungal agent Griseofulvin protects against cerebral malaria. Necessary measures are being taken to rapidly translate this discovery into clinics. Dr. Soma Chattopadhyay and her group also made significant progress in repurposing Telmisartan against Chikungunya and identified novel host factors that play crucial roles in the viral lifecycle for developing potential therapeutic interventions. Dr. Shantibhusan Senapati and his team have isolated and characterized a novel probiotic bacteria from the gut microbiome of the tribal population of Odisha, with an aim to develop tribal population-specific probiotic formulations to promote tribal health. Dr. Sandip Mishra and his team have made great strides in repurposing Artemisin for breast cancer therapy and worked out the detailed molecular mechanisms that abate tumor growth. The list is not exhaustive and the activities of ILS comprises many more exciting research that are ongoing towards fruition. Our scholars also received several awards and one noteworthy to mention is shortlisting of Dr. Sourav Ghosh as a Top 8 finalist in India for the TNQ inspiring science awards.

During the year, ILS hosted several events of national and local relevance to meet the goals of science outreach and societal program. ILS has conducted several conferences and symposia. Prof. Harold E Varmus, distinguished Nobel Laureate, visited ILS and delivered a lecture on "A half-century of cancer research". His address was attended by faculties, students from neighbouring institutions such as NISER, IIT, ICMR- RMRC. The student community interacted with Prof. Varmus in a one-on-one session. Several workshops were conducted which attracted students and faculty participants from all across India. Besides this, scholars and faculty at ILS have participated in a number of programs all over India including the India International Science Festival at Bhopal, Madhya Pradesh, and the ISE-SFEC 2023 at Imphal, Manipur. ILS has been at the forefront of conducting programs for the benefit of rural and tribal societies. This year we conducted several programs with

tribal farmers and entrepreneurs in Nabarangpur, Cuttack, and more recently, Koraput district. These programs were supported by the Aspirational district and Biotech KISAN programs of DBT. These programs primarily focus on boosting the income of farmers by imparting knowledge and training to harness their local resources. IBSD – ILS Bio resource laboratory has been established to work further in the area of natural product's drug discovery platform.

ILS has been a part of the INSACOG network and has been carrying out genomic surveillance activities for more than two years. Around 15000 COVID positive samples from the states of Odisha, Bihar, Jharkhand, Chhattisgarh, and Maharashtra have been sequenced so far. Under this initiative, we have reported various circulating mutants of SARS-CoV-2 and isolated them to establish their cultures, which will be made available to the research community to aid in the discovery of antiviral agents against COVID-19. Under the mission COVID Suraksha, DBT-BIRAC has supported ILS to establish a Small Animal Challenge Platform and Immunogenicity Assay Platform to provide services on a fee-for-service mode for facilitating the discovery and development of therapeutic agents against SARS-CoV2. ILS has successfully established the Syrian hamster and ACE2 transgenic mice model with two well-characterized isolates of SARS-CoV-2 which reproduce the lung pathology similar to that observed in COVID-19 patients. The animal challenge platform has provided services to six clients from the pharmaceutical industry & government-funded organizations and twelve projects from DBT-ILS colleagues. ILS is also undertaking several research activities to; discover/repurpose novel agents against SARS-CoV2; identify determinants that govern differential susceptibility and severity; identify epigenetic modulations during SARS-CoV2 lifecycle; characterize mechanisms that drive the manifestation of post-COVID syndromes; and high-resolution proteomics to identify unique proteome signatures associated with

progression towards severity.

At the scholastic level, nineteen scholars have been awarded Ph.D. this year with several of their research findings being published in reputed journals of high impact. Many aspiring researchers all over the country have chosen ILS for their dissertations and have completed short and long-term projects as part of their curriculum.

A detailed report of the work carried out by each scientist along with the publications has been represented here. The inputs and suggestions received from the ILS Society, Governing Body, and the Scientific Advisory Committee are taken into account. I express my sincere thanks to Dr. Rajesh Gokhale, Secretary, Department of Biotechnology, Govt. of India for his constant encouragement and support. My sincere thanks are due to the chairpersons and members of the Human Ethical Committee, Animal Ethical Committee, and the Institutional Biosafety Committee for their guidance from time to time.

It was my pleasure to work as an interim Director on additional charge at ILS. I greatly admire and remember the contribution made by Dr. Ajay Parida, former Director of ILS. My best wishes to all in the ILS family to work together and continue the momentum and the journey to excellence.

Prof. Pulok Kumar Mukherjee
FRSC, FNAAS, FNASc

DBT - ILS Flagship Program

Tribal Health and Nutrition: An integrative omics research initiative to uplift the health and well-being of tribal communities of Odisha

Overview

The state of Odisha ranks second in terms of tribal population in India. Epidemiology shows that Odia tribal populations are highly vulnerable to hereditary diseases. Also, the tribal population of Odisha is not homogenous in terms of their history, language, culture, and social organization. Until now there is no study performed to understand the genetics behind predisposition/ resistance, mutational heterogeneity, common mutations in the causal genes, and molecular studies in the context of the disease load in the tribal groups. Given the prevailing situation and emerging challenges for ensuring sustainable food, health, and nutrition security and overall human well-being, the Institute of Life Sciences (ILS), Bhubaneswar proposes a comprehensive program on "Tribal Health and Nutrition" with an overall goal of contributing towards providing a comprehensive outcome through (i) identifying potential locally used bioresources, (ii) understanding genomic diversity and differentiation, (iii) linking immune-metabolic variations to prevalent diseases and (iv) understanding gut microbiome diversity and their contribution to and/or influence on human nutrition and diseases, in ethnically distinct, well-differentiated and geographically distributed tribal populations of the state of Odisha.

Genomic Profiling of Tribal Population in Odisha

Pan India genotyping studies have suggested that these tribal population groups are vulnerable to hereditary disorders due to high consanguineous marriage practices. Most of these tribal groups belong to the Ancestral South Indian (ASI) group without any Ancestral North Indian (ANI) ancestry. Although several genotyping studies have been published the genetic diversity and ancestry of the Odisha tribal population is largely unexplored. Therefore, in this study, we wanted to understand the genomic diversity and the ancestry of the major tribal groups from Odisha. We collected and sequenced (whole exome + UTR) ~765 individuals from 13 major ethnic tribes residing in Sundargarh, Nabarangpur, Malkangiri, Koraput, Keonjhar, and Kandhamal. The genetic diversity analysis using PCA and admixture depicted Juang, Halaba, Bhatra, Gond, and Koya as isolated pure populations with little or no admixture of other genetic groups. A total of 7 million variants were identified and after filtering of MAF<0.5 and dbSNPs 100,000 to 1,75,000 unique variants were identified in sequenced tribes. Further analysis to identify the common variants present in the Odisha tribal populations and their functional association for disease predisposition, pharmacogenetics, and GWAS loci is in process.

Immune Profiling and Clinical Biochemistry in Tribal Population in Odisha

The Immuno-phenotyping component of the Flagship project "Tribal Immune-Metabolic-Pathogen Profile" is driven with the aim of deciphering the steady state innate and adaptive immune response in discrete tribal populations of Odisha. This objective is based on the principle that the genetic background, environment, diet, pathogen load, etc. plays a significant role in dictating the immune state and response of an individual and the whole community. We also performed routine laboratory biochemical analysis of the blood samples to understand the liver & kidney function and lipid profile to determine the overall well-being. A 29-marker kit was used to examine for innate and adaptive immune cells that were characterized by their surface markers. Control PBMC were first subjected to a deep immune profile to standardize for Mass Cytometry and for the standard operating protocol (SOP) for acquisition and analyses wherein duplicates and repeats were done to establish repeatability. The preliminary control PBMC analyses established that a million-cell density was mandatory with a run time of around 15 minutes for 10,000 live cellular events and was very highly repeatable. These results established two major factors influencing the analyses; the variability in numbers of the immune cells and extreme caution in processing. We did observe a bias towards a type II immune response in almost all tribal groups indicating exposure to antigens (worms) that drive type II response. We did not observe any unique pattern with respect to clinical biochemistry in comparison to urban controls, however, we do observe some abnormality in liver enzymes and electrolyte levels in some tribal populations.

Gut microbial diversity in Odisha's tribal population

The microbiome composition of Odisha tribes is largely unexplored. In an attempt to understand the gut microbiome of different tribes from Odisha, we have collected their fecal samples (~ 700) from Sundergarh, Nabarangpur, Keonjhar, Malkhangiri, Knadhamal, and Khorda (Bhubaneswar, control semi-urban samples) districts of Odisha. Presently, the study has analyzed the gut microbiome of 472 individuals representing 11 ethnic tribes, including Munda, Oraon, Paroja, Bhatra, Gond, Santal, Bhuyain, Juang, Koya, Bonda, and Kharia. Employing a 16S metataxonomic approach, the gut microbiota of these tribes was compared with that of 41

urban individuals. Through this approach, DNA was extracted from fecal samples and subjected to 16S rRNA gene sequencing, specifically targeting the V1-V9 regions, utilizing the advanced Oxford Nanopore platform. The findings of our study revealed the dominance of Firmicutes, Bacteroidetes, Proteobacteria, and Spirochaetes within the gut microbiomes of the tribal communities. Moreover, we have identified 23 core bacterial genera and 24 core bacterial species shared among the three different communities. Nevertheless, the overall composition of gut bacteria exhibited distinctive patterns influenced by the topographical region.

Isolation, characterization, and use of probiotics from Odisha tribal sources

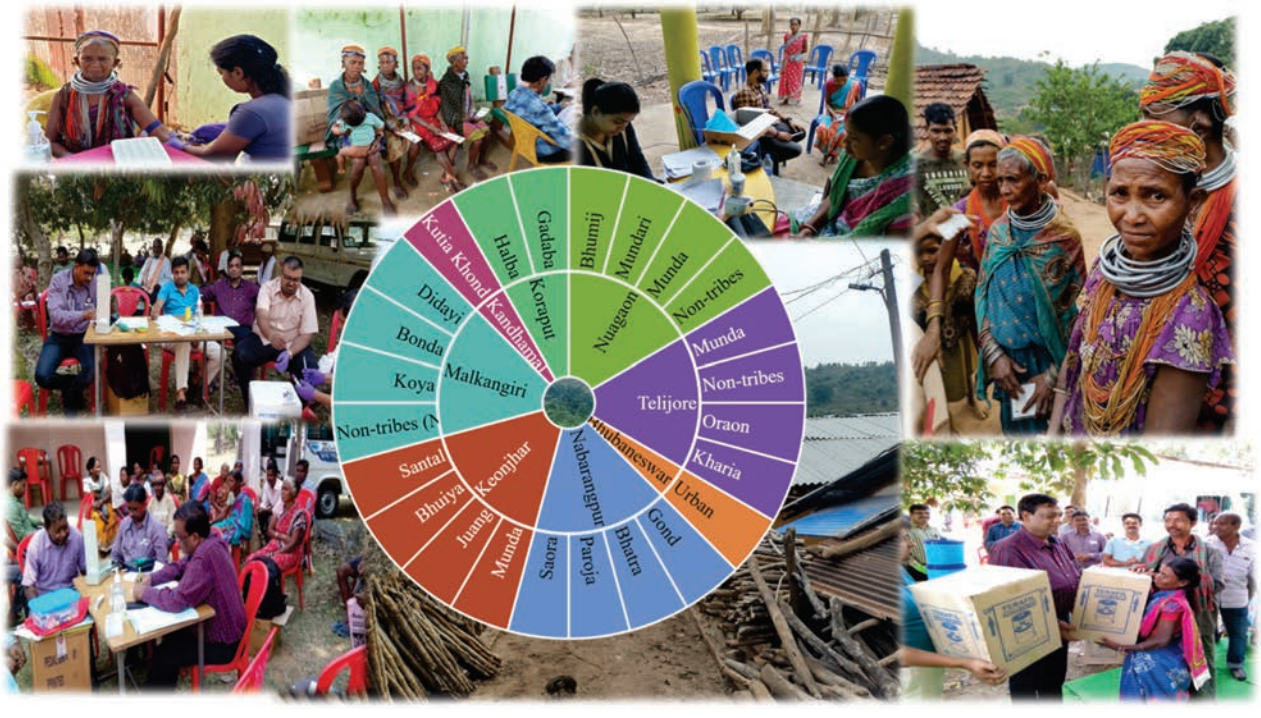
From Odisha tribal people's gut microbiota, we have isolated, characterized, and sequenced (WGS submitted in NCBI GenBank database) four potential probiotic bacteria that might help in the development of a community-specific probiotic cocktail for these people. The isolates are identified as Ligilactobacillus salivarius F14, Lactiplantibacillus plantarum ILSF15, Levilactobacillus brevis ILSH3, and Ligilactobacillus ruminis ILSF66. Biochemical, functional, and genomic characterization of Ligilactobacillus salivarius F14 from the gut of tribes of Odisha has shown its potential antimicrobial and immunomodulatory ability (Dash J et al. World J Microbiol Biotechnol. 2023 Apr 27;39(7):171). We are in the process of evaluating the health-promoting effects of all four isolates in various preclinical models.

Arboviral Infections in Tribal Populations

As per the records the selected tribal pockets experience sporadic episodes of arboviral infections, hence as a part of the program, the blood samples were subjected to laboratory investigation as per the protocol recommended by the World health organization (WHO) to determine the prevalence of a few arboviral infections such as Dengue, Japanese encephalitis, and Chikungunya through ELISA and RT-PCR. Our findings indicate a major prevalence of Japanese Encephalitis infection in southern and northeastern tribal regions of Odisha

Scientists

Prof. Pulok K Mukherjee, Dr. Sunil K Raghav, Dr. Punit Prasad, Dr. Satish Devadas, Dr. Shantibhusan Senapati, Dr. Gulam Hussain Syed, Dr. Arun Nagaraj, Dr. Tushar K Beuria, Dr. Soma Chattopadhyay, Dr. Rupesh Dash.



Research Initiatives in Response to COVID-19 Pandemic

Indian SARS-CoV2 genomics consortium (INSACOG): Sentinel surveillance

Since the start of the epidemic in early 2020, several initiatives have been taken towards controlling the spread of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) by understanding the nature of new genomic variants. Although self-quarantine, communities with lockdowns, and tracing with those contact individuals effectively control the spread of the pandemic, they seem to be much less useful in the long term. A probable solution to this was clinical surveillance, which employs whole-genome sequencing of SARS-CoV-2 to closely monitor the viral load and emergence of new circulating variants among community dwellers. To achieve this goal INSACOG project was started in 2020 with 10 centres to perform sequencing surveillance of SARS-CoV-2 genomic variants at national level to detect mutated virus strains which might have been introduced from abroad or which might have emerged within the country. Currently there are more than 60 centres all over India that are trained to perform sequencing and analysis of SARS-CoV-2 emerging strains. ILS was responsible for analysing clincial samples from 4 states, Odisha, Chattisgarh, Jharkhand and Bihar. ILS has sequenced >15,000 SARS-CoV-2 genomes till date. The emerging lineage data was shared to state ministry on real time basis for defining the public health strategies and defining quaratine measures (Fig.1). In addition, the data was submitted to IHIP (ICMR portal), IBDC-RCB and GISAID portal. Moreover, several research projects were initiated at ILS which resulted into several peer reviewed publications and biorepository of clincial samples and virus cultures for predominanat lineages. The consotium partners of the INSACOG project would be highly beneficial for surveillance of any disease outbreak in the country in future.

National wastewater surveillance system for COVID-19

In addition to sentinel surveillenace of clinical samples, there was a need for a robust strategy that could warn us against the early outbreak of the pandemic in a community setting. The active replication of the SARS-CoV-2 virus has been reported in enterocytes of the human intestine due to the expression of angiotensin-converting enzyme 2 (ACE2) receptor. This causes shedding of viral ribonucleic acid (RNA) particles in feces of both symptomatic and asymptomatic patients, which will eventually increase the viral load in wastewater and sewer systems. Hence monitoring the prevalence of viral particles in given wastewater catchment will provide an early warning indicator of virus spread in communities. Following are the objectives designed for this project: 1 – To assess the SARS-CoV-2 viral load in wastewater samples from Sewage treatment plants (STPs) using RT-qPCR, 2 – Whole genome sequencing and analysis of RT-qPCR positive samples for analyzing new genomic variants, and 3 – Sequence informatics: Identification and reporting of new genomic variants of SARS-CoV-2. ILS is one ten institutes that has participated in this project with focus on monitoring Bhubaneswar city for the SARS-CoV2 surveillance.

Sewage surveillance in Bhubaneswar

ILS intiated this project focussing on hospital and municipality STPs. The sampling sites were selected based on its geographical distribution throughout Bhubaneswar (Fig.2). There were 6 hospitals, 3 municipality and 1 ILS STPs. Sewage sample collection, processing, RNA extraction, and RT-qPCR were carried out as a harmonized protocol across different participating intstitutes. RNA copies per liter or viral titer was calculated based on standard curve. The average RNA copies/Litre of wastewater for different sample ranges between 4300 to 20500. SARS-CoV2 genome sequencing for samples with high viral load revealed Variants of Interest (VOIs), Variants of Concern (VOCs), such as XBB.1.16.3, XBB.1.16, XBB2.3.11, GE.1, XBB.2.3.3, XBB.2.3.4, XBB1.22.1, XBB.1.16.6, etc. The project will continue to conduct routine sewage surveillance to detect and monitor VOIs/VOCs, and other genomic variants for better preparedness and response to potential pandemic situations.

Proteomics study to explore the signature molecules associated with severe pathogenesis of SARS-CoV-2 infection

The global impact of SARS-CoV-2 has been devastating, leading to a pandemic and resulting in a wide range of symptoms, from asymptomatic to severe manifestations. This project, headed by Dr. Amol R. Suryawanshi and funded by ICMR, New Delhi, intends to keep the focus on the clinical spectrum and severity of COVID-19. Therefore, the aim of this study is to perform a comprehensive proteomics study to explore the signature molecules associated with the severe pathogenesis of SARS-CoV-2 infection using biofluid samples of patients of the various clinical spectrums and severity of the disease. To address this, we have collected various biofluid samples such as blood serum/plasma and urine from COVID-19 patients and annotated the same based on their varying disease severity. These samples were used for quantitative proteomics approaches to identify the signature proteins involved in COVID-19. Our preliminary results could identify a few proteins however the same need to be verified. Functional characterization of a few of these is currently in progress. In the future, we will carry out a comparative proteomics study using urine/ plasma exosomes from patients and controls as exosomes play a crucial role in

intercellular communication and are involved in various physiological and pathological processes, including viral infections. Overall, this study will identify signature molecules and decipher their role in the molecular mechanism of SARS-CoV-2 infection.

Figure 1: Emergence of SARS-CoV-2 lineage in ILS sequenced samples of COVID-19

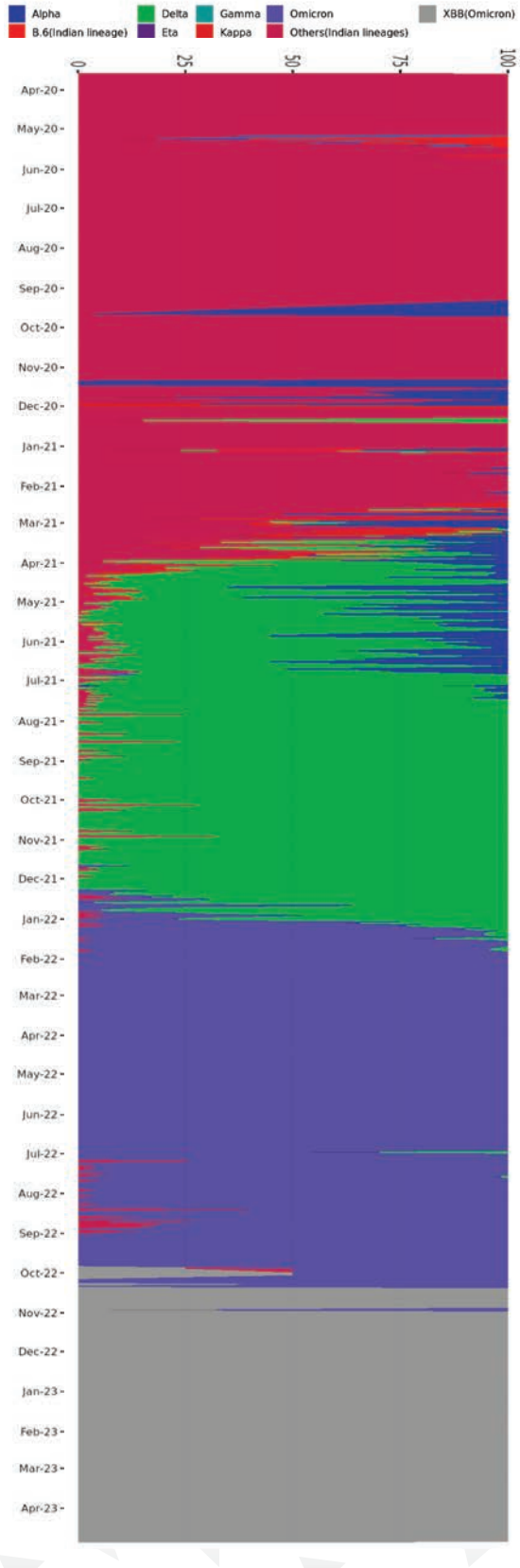
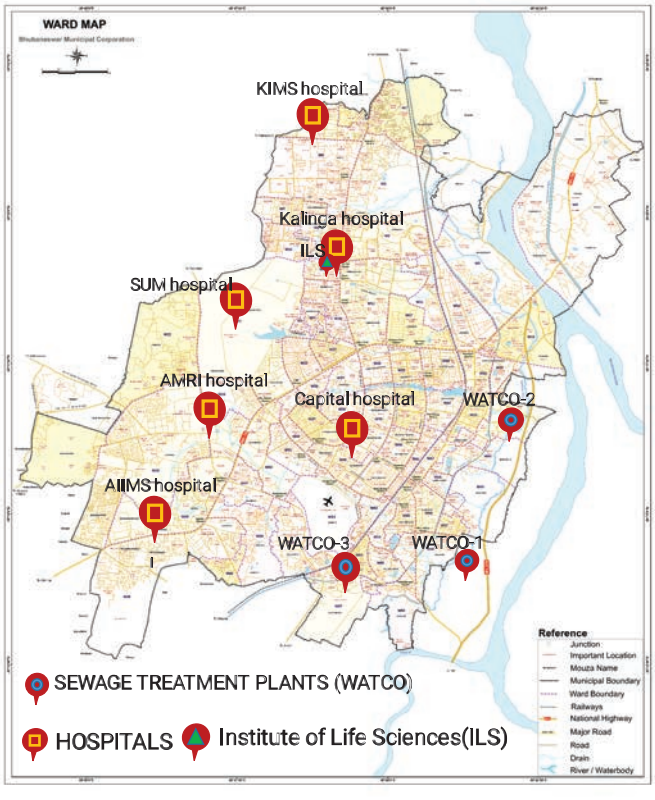


Figure 2: Bhubaneswar City Map showing sites of sewage samples collection



DBT-ILS Societal Development Projects

DBT – ILS has been working with the tribal farmers of Nabarangpur district for last 5 years. This report includes the work performed under the Biotech – KISAN hub project awarded to DBT-ILS to extend the societal activities in the Koraput district of Odisha. Both Nabarangpur and Koraput districts are aspirational districts of Odisha. ICAR-CIFA, ICAR-CTCRI and ICAR-CHES are our major partners in this project. DBT-ILS – Bio incubation center has been responsible for promoting farm and non-farm-based entrepreneurship development in these districts. We also received technical support as well as seeds and planting material from ICAR-NRRI, Cuttack; ICAR-IIHR, Bengaluru, ICAR-IIMR, Hyderabad and MS Swaminathan Research Foundation (MSSRF), Jeypore. The main objectives of this project are the following:

(1) Biotech – KISAN hub project by DBT biofortified rice, maize, millet and tuber crops,

(2) Promotion of advanced methods of aquaculture, goatary, poultry and

(3) Crop diversification through promotion of low water requiring crops and vegetables.

The following programs were conducted during the last financial year as fulfillment towards the objectives

From left to right: Distribution of manual on poultry farming, inspection of a poultry farm, inspection of a goatary in Nabarangpur.

Clockwise: Distribution of planting material, lemongrass cultivation, the inauguration of oil extraction unit, production of essential oil in Tigiria block of Cuttack district

Training programme on Integrated Agriculture for Women Empowerment on 11th May 2022 at Jeypore, Koraput.

The main objective of the program was to motivate the women farmers to use technology and recently developed seeds and agricultural methods for better yield and income generation from agriculture. This training program was attended by 80 women farmers from Koraput and Nabarangpur, two aspirational districts of Odisha. The program also focused on eradicating malnutrition through dietary diversification facilitated by local produce.

Training programme on horticulture, tuber crops cultivation and fisheries on 15th and 16th September 2022

The objective of the program was to provide technical knowledge on horticulture and training on ways to maximize income from these crops. This training program was co-organized by ICAR-CTCRI, IACR-CHES, ICAR-CIFA, Bhubaneswar and MSSRF, Jeypore. The first day was dedicated to horticulture and tuber crop cultivation and was attended by 75 farmers from Nabarangpur and Koraput districts. Quality vegetable seeds developed by ICAR-IIHR, Bengaluru and tuber crop planting material was distributed to the farmers. The second day was dedicated to fisheries and Dr. Kamal Lochan Mishra, IAS, DM & Collector Nabarangpur was the chief guest. Dr Mishra delivered a motivating speech on technological advances in the field of horticulture and fisheries in Nabarangpur district.

Kisan Mela at Mandei festival and on farm training from 11th to 13th December 2022

Mandei is the annual festival of Nabarangpur district that attracts a large number of visitors. DBT-ILS organized a kisan mela and awareness campaign on biofortified crops at the festival through distribution of booklets and demonstration of farming techniques and quality seeds. This was followed by a visit of 60 selected farmers to the fields of Shri Hashmukh Chavda on 12th December 2022. Dr. Arabinda Padhee, IAS Principal Secretary, Agriculture & Farmers' Empowerment Government of Odisha, Dr Kamal Lochan Mishra, IAS, DM & Collector, Nabarangpur and Ms. Anya Das, IAS, Chief Development Officer -cum-Executive Officer attended the event to encourage the farmers.

Capacity building training programme on production and post-harvest technology in horticultural and tuber crops from 16.01.2023 to 20.01.2023

DBT Biotech-KISAN hub collaborators ICAR-CHES, ICAR-IIHR, ICAR-CTCRI and DBT-ILS jointly organized a five-day 'Capacity building training programme on production and post-harvest technology in horticultural and tuber crops' for the farmers of Koraput and Nabarangpur district of Odisha from 16.01.2023 to 20.01.2023. A similar program was also conducted from 22nd to 26th March 2023.

Innovative Aquaculture Practices from 22nd to 24th March 2023

A three day's training program on Innovative Aquaculture Practices was jointly conducted by ICAR-CIFA, NFDB and DBT-ILS from 22nd to 24th March 2023 at NFDB- NFFBB, Bhubaneswar campus. Fifty two farmers went through a training program on quality fish seed production, economic benefit of improved variety, biofloc, and nursery and grow out pond management, disease management and soil and water quality management in Aquaculture. They also went on field exposure visit to the progressive farmers in Puri district. A similar program for one day was conducted on 13th March at ICAR-CIFA.

In brief, DBT-ILS has conducted 08 training programs benefiting 556 farmers and cultivation of 200 acres of vegetables and tuber crops. Most of the biofortified crops will be cultivated in the Kharif season.

In addition DBT-ILS has a rural farmer's training centre at Tigiria of Cuttack district. This training centre also has a demonstration unit for extracting essential and aromatic oils.

Multi-Institutional Scientific Projects

Marine Biotechnology

More than 50% of the marketed drugs today are derived from natural sources. Marine bio- resources including marine microbes and plants are one of the biggest natural resources for developing new therapeutic products. Limited information is available on the plant diversity of coastal Odisha and to date, these marine bio-resources are unexploited for their therapeutic potential. In this project, we have evaluated and characterized the diversity of algae, lower plants (seaweeds), and mangroves of Odisha's coastal area. Five varieties of Seagrass and four of Seaweeds were collected from Chilika lake of Odisha and were screened for their anti-cancerous and anti-viral effects. Amongst these, Enteromorpha intestinalis extracts were found to have both anti-cancerous and anti-viral activity. Extracts from Halodule pinifolia and Halophila ovalis were found to have anti-cancerous and anti-viral activities, respectively. In the future, bioactive molecules will be isolated from these extracts and large-scale image-based screening of the same for anti-cancer, anti-viral and anti-autoimmune and anti-inflammatory properties will be performed.

Network program on Genetic enhancement of Minor Pulses

The project is a network program funded by the Department of Biotechnology, Govt. of India, and involves 13 research institutes and Universities across the country. The overall objective of the program is to generate genomic resources, pre-breeding materials, QTL identification for various agronomically important traits and Yellow mosaic virus resistance in 6 pulses of India: Vigna radiata (Mung bean), Vigna aconitifolia (Moth bean), Vigna mungo (Black gram/Urad bean), Vigna unguiculata (Cowpea), Macrotyloma sp. (Horsegram) and Vigna umbellata (Rice bean). ILS, Bhubaneswar is the overall coordinating institute with Dr. Nrisingha Dey as the current Principal Investigator (Previously headed by Late Dr. Ajay Parida). The program is divided into four Sub Projects, each with a coordinator to collect reports and report progress. We have achieved around 90% of assigned targets which includes reference grade genome assemblies of Mung bean, Moth bean, Urad bean, Rice bean and Cowpea, transcriptomes of Moth bean, Urad bean, Rice bean, and Cowpea. The project partners have accomplished GWAS for important traits like thousand seed weight (TSW) in Cowpea, identified 10 stable QTNs in cowpea, and conducted biochemical analysis of different varieties in minor pulses. The project also included mapping the genome of yellow mosaic virus (YMV) and developing polymorphic SSR database for a variety panel of Mungbean, cowpea, and horsegram.

Himalayan Bioresources Management Project

There are primarily two projects under this head: 1) Traditional medicine from Himalayan Bioresources, and 2) Evaluation of genetic diversity of underutilized species of Western Himalayan Bioresources based on molecular and genomic characterization. In the first project, the objective is to document the medicinal plants, plant extracts, and natural formulations that traditional healers use in regular practice in northeast India including Shillong, Assam, Manipur, and Nagaland regions. Then these extracts/formulations will be screened for their medicinal properties using different in vitro and in vivo animal model systems. Scientists at Institute of Life Sciences are screening these extracts for immune-modulatory, anti-viral, and anti-bacterial effects. Researchers at Jadavpur University are screening these extracts for their effect on metabolic disorders. The idea is to find potential extracts/compounds for developing drug targets.

The second project on genetic enhancement of crops from the Himalayan region was envisaged with the aim to develop viable genomic resources in the form of molecular markers, genome assemblies, and RNA-Seq data for both popular as well as underutilized species of the Western Himalayan region of India. The project is designed such that one part of it involves the screening of different varieties of popular medicinal plants like turmeric and ginger, for varying amounts of important secondary metabolites such curcumin and gingerol. The work has been carried out by the partners at IBSD, Imphal and they have selected a few varieties of each plant for studying the transcriptomics of biosynthesis and accumulation of these bioactive compounds. At ILS, we have been tasked with RNA-Seq-based gene expression analysis for the selected varieties of ginger and turmeric with contrasting levels of metabolites to identify the biosynthesis pathways that are different in the high yielding versus low-yielding varieties. In addition, we have also started the process of sequencing and assembling the whole genome of *Bunium persicum* (Kaalazeera), an underutilized, medicinal plant of the Western Himalayan region of India. This project will enhance the genomic repositories for these plants and also ensure the availability of the resources for translational research.

Technological innovations for the development of functional foods from ethnic fermented foods of the Indian Himalayas

Under Himalayan Bioresource Mission, DBT-ILS is a partner institute for the study entitled “Technological innovations for the development of functional foods from ethnic fermented foods of the Indian Himalayas”.

It's a three-year project that got initiated on 20th March, 2023. Dr. S Senapati (PI) and Dr. T K Beuria (CO-PI) of DBT-ILS have taken the responsibility to evaluate the nutraceutical and health-promoting benefits of starter cultures(s) of selected Himalayan fermented foods produced by other partner institutes of this project.

Mission program on Pediatric Rare Genetic Disorders (PRaGeD)

This Program is a PAN-India initiative funded by the Department of Biotechnology, Ministry of Science and Technology, Government of India. CDFD-Hyderabad is coordinating and ILS is the part of the project involved in genetic analysis of the undiagnosed rare paediatric disorders and functional characterization of mutations using zebrafish model. PRaGeD aims to create awareness, achieve genetic diagnosis, discover & characterize new genes/mutations, provide counselling, and to develop new therapies for pediatric rare genetic diseases in India.
PRaGeD website: http://praged.cdfd.org.in/

So far, Dr. Ramchander team recruited 32 families affected with rare paediatric genetic disorders from the clinical collaborators AIIMS-Bhubaneswar and SCB Medical College & Hospital, Cuttack. Multiplex ligation-dependent probe amplification (MLPA) analysis of 18 probands revealed 3 cases with duplications and 3 cases with both deletions and duplications. About 12 cases negative for in-house testing were sent to CDFD for further analysis (whole exome/genome sequencing). Dr Swain will carry out functional characterization of mutations associated with rare genetic disorders using zebrafish as a model.

Apart, we have conducted an awareness program on Rare Disease Day (Feb 28, 2023) and about 500 school/college students/general public visited ILS were enlighten about the paediatric rare genetic disorders that are prevailing in our population and bought importance of our mission program.

Mission program on Pediatric Rare Genetic Disorders (PRaGeD)

Principal Investigators (from ILS): Dr. PV Ramchander & Dr. Rajeeb K Swain
Co-Investigators: Dr. Joseph John & Dr. Amit Kumar Satapathy, AIIMS, Bhubaneswar
Dr. Swarupa Panda & Dr. Roma Rattan, SCB Medical College & Hospital, Cuttack.

INFECTIOUS DISEASE BIOLOGY

Image Courtesy: -Virus-Host Interactions Lab, DBT-ILS

Infectious Disease Biology

Dr. V. Arun Nagaraj	Malaria Parasite Biology
Dr. Debabrata Biswas	Bacterial Host-Pathogen Interaction
Dr. Gulam H Syed	Virus-Host Interactions
Dr. Narottam Acharya	Genome Instability and Diseases
Dr. Santosh Chauhan	Cell Biology of Diseases
Dr. Satish Devadas	T-cell Biology
Dr. Soma Chattopadhyay	Molecular Virology
Dr. Sunil K Raghav	Immunogenomics & Systems Biology
Dr. Tushar K Beuria	Cell Division in Bacteria

Malaria Parasite Biology

Dr. V. Arun Nagaraj
Scientist-E

Focus of the Lab:

Malaria imposes a serious burden on global health. According to the World Health Organization (WHO), 247 million cases and 619,000 malaria deaths occurred in 2021. Since 2015, there has been a considerable increase in the global incidence posing a major threat to rolling back malaria. This is because of the emergence of resistance against artemisinin and its partner drugs, leading to a delay in the parasite clearance and failure of artemisinin-based combination therapies (ACTs). This is further worsened by the insecticide resistance in mosquito vector, change in vector behavior, global warming, and the lack of an effective malaria vaccine. Moreover, India accounts for ~80% of the malaria cases in the WHO South-East Asia region. Our research is focused on (i) Deciphering the molecular mechanisms of malaria pathogenesis, transmission, and host-immune evasion and (ii) Developing new therapeutic intervention strategies and highly-sensitive diagnostic tools for malaria. The research objectives pursued are of societal relevance and are aligned with the global and national targets set by WHO, PATH, Malaria No More, National Vector Borne Disease Control Programme (NVBDCP), Indian Council of Medical Research (ICMR), etc., for eliminating and eradicating malaria. Our work on parasite heme synthesis and its association with food vacuole integrity, hemozoin formation, and cerebral pathogenesis mentioned in the previous annual report was published in Nature Communications, 2022. The potential of griseofulvin (FDA-approved antifungal drug) as a repurposed adjunct drug with ACTs to prevent the mortality of cerebral and severe malaria is currently under the consideration of BIRAC for preclinical toxicity studies and Phase I trial in humans. The patents filed are entering the national phase in PCT countries and India.

Collaborators:

- Dr. Braja Kishore Singh, IBSD, Imphal
- Dr. Prativa Kumari Behera, IGH, Rourkela
- Dr. Amol Ratnakar Suryawanshi, ILS, Bhubaneswar
- Dr. Anshuman Dixit, ILS, Bhubaneswar
- Dr. Praveen Bharti, NIMR, New Delhi
- Ipca Laboratories Ltd., Mumbai
- Arjuna Natural Pvt Ltd., Kochi
- Prado Pvt Ltd., Pune

SRFs:

- Sourav Ghosh
- P.M. Vaishalli
- Rahul Das
- Rajib Kundu
- Aditi Chatterjee

JRF:

- Samoel Lareb

Research Associate:

- Dr. Nalini Singh

Laboratory Technician:

- Sujata Lakhra

Research Activities:

Significance of amino acid transporter 1 in the malaria parasite

Membrane transporters play a pivotal role in the life cycle of the malaria parasite and approximately 3% of the parasite genome encodes for transporters. We performed a detailed in vivo characterization of parasite amino acid transporter 1 (AAT1) and examined its association with cerebral pathogenesis. Using *Plasmodium berghei* (Pb), a rodent parasite model for human malaria, we showed that AAT1 is localized to the parasite food vacuole that is involved in hemoglobin degradation and hemozoin formation. Targeted deletion of AAT1 led to a swollen food vacuole phenotype with the accumulation of host hemoglobin-derived peptides. AAT1-deleted parasites produced less hemozoin, and the hemozoin crystals displayed a thin morphology compared with wild-type parasites. The knockout (KO) parasites showed reduced sensitivity to chloroquine and amodiaquine leading to recrudescence. Importantly, mice infected with the AAT1KO parasites were completely protected from cerebral malaria and displayed reduced neuronal inflammation and cerebral complications. Genetic complementation of the KO parasites restored the food vacuole morphology with hemozoin levels similar to that of wild-type parasites, causing cerebral malaria in the infected mice. AAT1KO parasites also showed a significant delay in male gametocyte exflagellation. These findings highlighted the significance of AAT1 1 in food vacuole functionality and its association with malaria pathogenesis and gametocyte development. This study was published in

Microbiology Spectrum, 2023. Further studies on the frequency and distribution of mutations in AAT1 of clinical isolates are required to understand its contribution toward antimalarial activity and resistance.

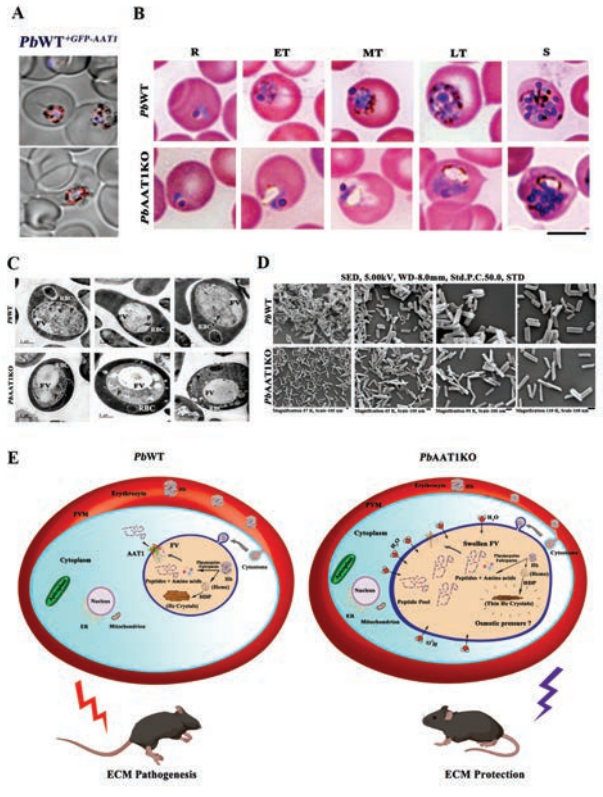


Figure 1. Significance of Plasmodium amino acid transporter 1. A) Food vacuole localization of AAT1. **B)** Swollen food vacuoles in AAT1KO parasites. **C)** SEM images of thin hemozoin crystals isolated from AAT1KO parasites. **D)** TEM images of AAT1KO parasites. **E)** Model depicting the role of AAT1 in food vacuole functionality and its association with cerebral pathogenesis.

Screening of plant extracts from North-East to identify phytochemicals with antimalarial activity

We evaluated the antimalarial and antioxidant activities and performed detailed phytochemical analyses of *Toona ciliata* MJ Roem aqueous methanolic leaf extract (TcMLE). Although many plants from the Meliaceae family possess diverse biological activities, *Toona ciliata* has not been studied yet for its antimalarial activity. In vitro studies in *Plasmodium falciparum* (Pf) 3D7 and artemisinin-resistant PfCam3.IR539T strains were performed by [3H]-hypoxanthine uptake assays. In vitro, cytotoxicity in HeLa and HEK293T cell lines was evaluated using MTT assays. A hemolysis assay was performed using RBCs. Phytochemical analysis by GC-MS and in vitro antioxidant studies by DPPH and ABTS assays were performed. In vivo, antimalarial studies in Pb-infected mice were carried out using Rane's test and Peters' 4-day test.

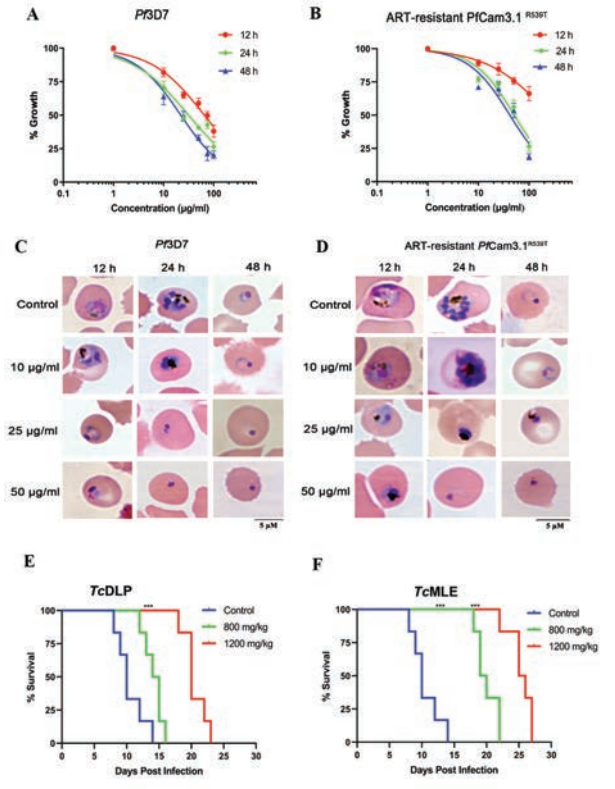


Figure 2. Antiplasmodial and antimalarial activities of TcMLE. A) Growth inhibition in Pf3D7. **B)** Growth inhibition in PfCam3.IR539Tstrain. **C)** Giemsa-stained images of TcMLE-treated Pf3D7 parasites. **D)** Giemsa-stained images of TcMLE-treated PfCam3.IR539T parasites. **E)** Survival curves of Pb-infected mice treated with Tc dry leaf powder (DLP). **F)** Survival curves of Pb-infected mice treated with TcMLE.

TcMLE showed significant in vitro antioxidant activity and had phytochemicals reported for antimalarial activity. In vitro, studies showed prominent antiplasmodial activity against the Pf3D7 strain (IC50 ~22 µg/ml) and PfCam3. IR539T strain (IC50 value ~43 µg/ml). In vitro cytotoxicity studies, in vitro hemolytic assays, and in vivo acute toxicity studies further suggested that TcMLE is nontoxic. In vivo antimalarial studies using Rane's test showed a significant decrease in parasitemia by ~70% at 1200 mg/kg doses and delayed the mortality of mice by ~10-14 days. Peters' 4-day test also showed a similar pattern. The present study demonstrated the antimalarial potential of TcMLE and delivered a platform for further studies to identify the active components of TcMLE and discover new antimalarials.

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
5	2	1	1 2 (Submitted)	2	1	1

Bacterial Host-Pathogen Interaction

Dr. Debabrata Biswas
Scientist-C

Focus of the Lab:

The lab will be involved in studying host-pathogen interactions of bacterial pathogens in context with diseases prevalent in India. The focus will be to study the various host molecules targeted by the virulence factors of these bacteria with the aim to develop host-directed preventives or adjunct therapeutic strategies and thus, counter the rising incidence of antimicrobial resistance in India. This will involve in vitro, and in vivo molecular analyses of the immune responses generated by the host cells during specific pathogenic invasions. Further, target-specific drug repurposing and phytopharmaceuticals will be studied to design novel therapeutic approaches more suitable for the Indian society, in terms of manufacturing capabilities and economical accessibility for the patients.

Collaborators:

- Dr. Soma Chattopadhyay, DBT-ILS
- Dr. Sanjeeb K. Sahoo, DBT-ILS
- Dr. Sunil Raghav, DBT-ILS
- Dr. Mamoni Dash, DBT-ILS
- Prof. Gopal Kundu, KIIT
- Dr. Subhasis Chattopadhyay, NISER
- Dr. Nirmal Goswami, CSIR-IMMT
- Prof. Rana Singh, JNU

JRF:

- Devashish Barik

Laboratory Technician:

- Sanjeeb Dhir

Research Activities:

Exploring indigenous bioresources for novel anti-bacterial substrates and immunomodulatory molecules

Antimicrobial resistance is gaining the form of "silent pandemic" and hence, there is a need for novel therapeutic and preventive strategies that would reduce the extensive usage of antibiotics while increasing the efficiency of present drugs. It would serve to eventually reduce the exposure of antibiotics for the pathogens and help prevent generation of newer variety of drug resistant bugs. Further, strategies making the resistant varieties susceptible to the existing set of antibiotics

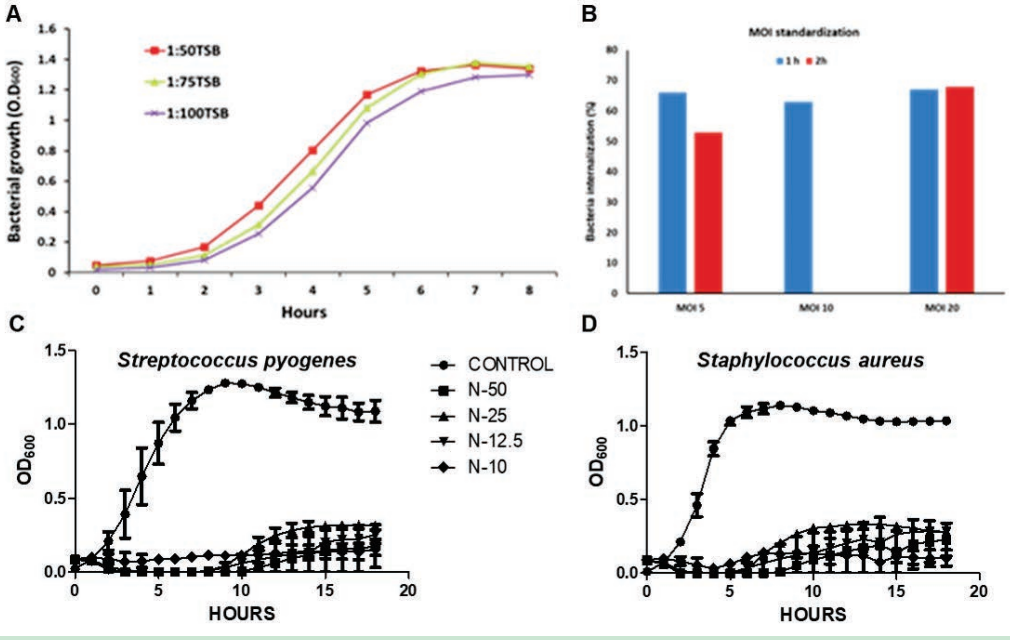


Figure. A. Group A streptococcus bacteria was inoculated into fresh media (Tryptic Soy Broth/TSB) from overnight culture at different ratios (overnight culture:fresh media) and growth curves were plotted. **B.** RAW2647.7 cells were infected with bacteria at different Multiplicity of Infection/MOI (MOI 5,10, and 20) and bacteria internalized were enumerated by serial dilutions and CFU (colony forming units) counting. **C.** Growth inhibition over time for *Streptococcus pyogenes* in presence of different concentrations (µg/ml) of Naringenin was plotted. **D.** Growth inhibition over time Staphylococcus aureus in presence of different concentrations (µg/ml) of Naringenin was plotted.

could form another significant approach to fight this "pandemic". With these objectives in focus, we have been investigating novel phyto-extracts and known but repurposed drugs to understand their anti-bacterial properties. Work is in progress to investigate combination therapies of known phytopharmaceutical compounds like naringenin (a known flavonoid that has a role as expectorant) against poly-microbial infections. Novel extracts of bioresource origin are also being investigated for their anti-bacterial potential. The lab was setup from scratch and all experimental work is done using core institutional funding. Initially, Group A Streptococcus (GAS) growth was standardized in TSB media and an inoculum ratio of 1:50 from the overnight primary culture was selected for future work (Fig. A). To develop in vitro infection model, the Multiplicity of Infection or MOI of macrophage cell line, RAW264.7 cells are determined for Streptococcal bacteria, where it was found that a MOI of 5:1 (5 bacteria for every macrophage cell present) is optimal for further study (Fig. B). Using various concentrations of naringenin [N-10 to N-50], a minimum inhibitory concentration of 10 µg/ml was found to be effective against both streptococcal (Fig. C) and staphylococcal (Fig. D) bacteria which inhibited their growth significantly. The compounds showing preventive potential against bacterial growth will then be screened using specific bacterial disease models (in vitro and in vivo) to establish their efficacy individually as well as in combinations, towards preventing infections and alleviating host immunity.

Virus Host Interactions

Dr. Gulam H Syed
Scientist-E

Focus of the Lab:

The overall goal of the lab is to decipher the molecular mechanisms that drive viral disease pathogenesis and identify host factors that facilitate viral dissemination. Identification of the pro-viral host factors and the molecular basis of viral diseases will enable the development and design of potential therapeutic strategies to curb viral infections and disease manifestation. Viruses have evolved strategies to exploit cellular machinery and evade defense mechanisms. We are attempting to characterize the interactions between viruses and cellular organelles like the mitochondria, ER, & peroxisomes, and the cytoskeleton and secretory machinery to identify molecular mechanisms that facilitate viral lifecycle and disease manifestations.

Collaborators:

- Dr. Anshuman Dixit, ILS, Bhubaneswar
- Dr. Amol Suryavanshi, ILS Bhubaneswar
- Dr. Soumendra Rana, IIT Bhubaneswar
- Dr. Manjula Kalia, RCB, Faridabad
- Dr. Subrat Palo, RMRC, Bhubaneswar
- Dr. S. Kabi, SUM Hospital, Bhubaneswar
- Dr. S. Mohanty, SCB Medical College, Cuttack

Research Associates/ Women Scientists/ N-PDFs:

- Dr. Shamim Akhtar Sufi (PDF)

SRFs:

- Mohd Faraz Alam
- Avula Kiran
- Subhasish Samantaray
- Sayani Das

JRFs:

- Abhisek Soumyadarsan Sahoo
- Khushboo Parveen
- Samaresh Mandal

Laboratory Technician:

- Biswajita Prusty

Research Activities:

Characterizing the cytoskeletal remodeling to identify vital anti-viral targets with pan-Flaviviral potential

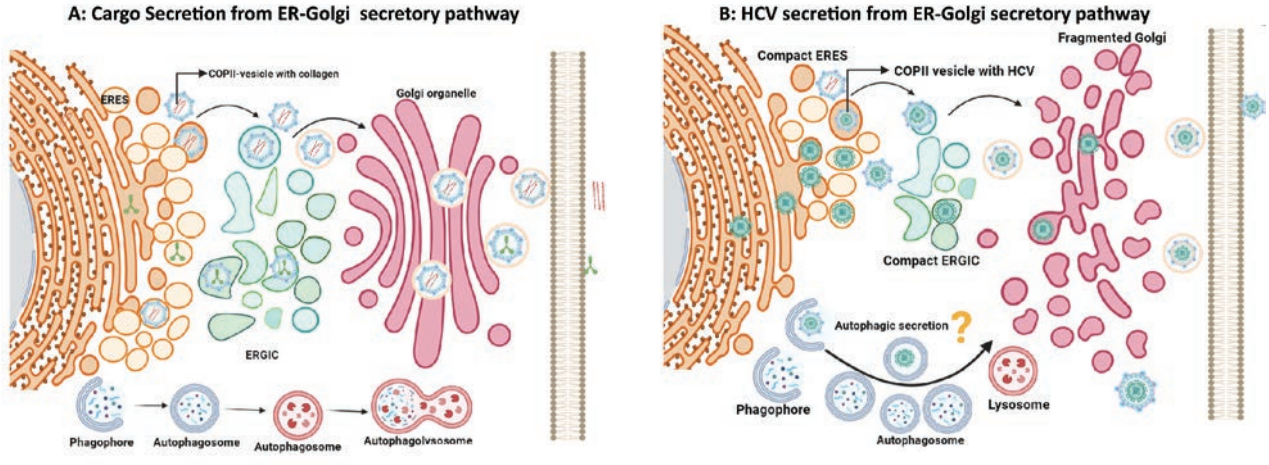
Flaviviruses comprise a group of arboviruses in the Flaviviridae family that have emerged as a formidable threat to our society with their comprehensive array of lethal human diseases. All the viruses exploit the host cellular transport and cytoskeletal machinery for their entire life cycle ranging from viral entry, replication, assembly, and egress. To utilize or hijack the major cellular machinery the viruses have evolved strategies to remodel the cytoskeleton and regulate its function. We are pursuing this study to characterize the host cytoskeletal modifications associated with flaviviral infection to understand the virus-triggered alterations to the host cytoskeleton components such as the actin, microtubules, intermediate filaments, and their modulators. We will analyze their subcellular localization, morphology, and post-translational modifications during the course of infection. Our observations reveal that flaviviruses promote alterations to the morphology of the actin filaments associated with the cellular membrane. We also observe changes in tubulin acetylation and detyrosinated tubulin levels favoring tubulin stability during the later time points post-infection. However, during the entry the virus particles strongly interact with tyrosinated tubulin suggesting the requirement of dynamic microtubules to aid virus entry.

In-silico analysis suggests that the flavivirus protease NS3 interacts with the tubulin tyrosine ligase, an enzyme that maintains the cellular levels of tyrosinated tubulin. We are characterizing the molecular mechanisms underlying the tubulin PTMs to identify host factors essential for the flaviviral lifecycle. We are also pursuing multiomics studies in this area to identify novel players involved in cytoskeleton modifications during viral infections and identify targets with pan-flaviviral potential.

Unravelling the mechanisms associated with hepatitis C virus (HCV) morphogenesis and secretion.

Previous studies have established that HCV exists as a hybrid of virus and lipoprotein, termed the 'lipoviral' particle (LVP). These LVPs are about 100-150 nm in diameter and represent atypical secretory cargoes of the endoplasmic reticulum (ER). In this study, we are attempting to identify the host factors that are exclusively required for HCV morphogenesis and secretion. Recent studies have suggested that the secretion of large cargoes from the ER requires specific modulation of the COP-II vesicle size in proportion to the cargo size. We observe that HCV downregulates the expression of COP-II coat proteins and reduces the levels of global protein secretion. This year, we characterized the importance of the proteins involved in the early

secretory pathway of the endomembrane system to determine their role in the HCV lifecycle. We observed that silencing the proteins that maintain ER-exit sites (ERES) and ER-Golgi intermediate compartments (ERGIC) compromised HCV replication, assembly, and egress, suggesting the role of transitional ER in multiple aspects of the HCV lifecycle. We identified the TRK-fused gene, a protein enriched in ERES to facilitate large cargo secretion, specifically required for HCV release, and ERGIC-53 which plays a role in glycoprotein secretion, is required to aid HCV entry.



Schematic representation of cargo secretion from ER to Golgi organelle followed by cell exit in normal hepatocytes **(A)** and in HCV-infected cells **(B)** HCV induces the compactness of ER-exit sites and ER-Golgi intermediate compartments, and fragmentation of Golgi organelle, which may result in inhibition of global protein secretion but facilitates HCV release.

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
7	0	3	1 1 (Submitted)	2	1	1

Genome Instability and Diseases

Dr. Narottam Acharya
Scientist-F

Focus of the Lab:

DNA polymerases (Pol) are the enzymes required for DNA synthesis in all DNA transaction pathways; malfunction or absence of these is shown to be associated with human diseases. Our main focus is to understand the in vivo role of these DNA polymerases in determining cellular phenotypes using certain cancer cells, and pathogenic and non-pathogenic yeasts as our model systems. Under normal physiological conditions, these DNA polymerases are accurate and highly processive. Cells possessing a low fidelity or a less processive DNA polymerase often exhibit a higher rate of mutagenesis, growth defects, and altered phenotypes. Due to the lack of effective antifungals and approved vaccines, in recent years, fungal infections have become a major public health concern worldwide. Therefore, yet another focus of the laboratory is identifying novel antifungal drug targets, screening drugs against some of those targets, and developing attenuated whole-cell vaccines against pan-fungal infections.

Collaborators:

- Dr. Dileep Vasudevan, ILS, BBSR
- Dr. B. Ravindran, ILS, BBSR
- Dr. Ranjan Nanda, ICGEB, New Delhi
- Dr. Roland Klassen, University of Kassel, Germany

Research Associates/Women Scientists/N-PDFs:

- Dr. Shweta Thakur
- Dr. Abinash Dutta

SRFs:

- Satya Ranjan Sahu
- Swagata Bose
- Jugal Kishore Sahu
- Bhabasha Utkalaja
- Ipsita Priyadarshini
- Sushree Subhashree Parida

JRF:

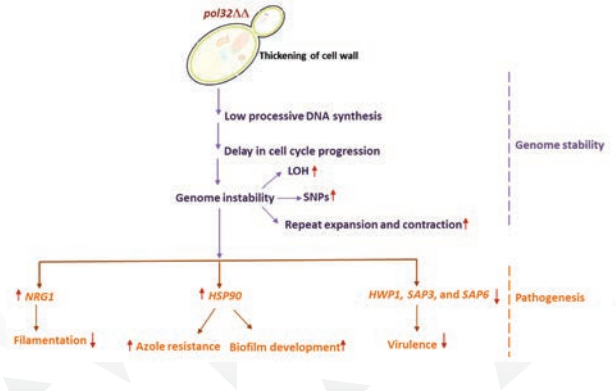
- Samanwita Das

Laboratory Technician:

- Sitendra Panda

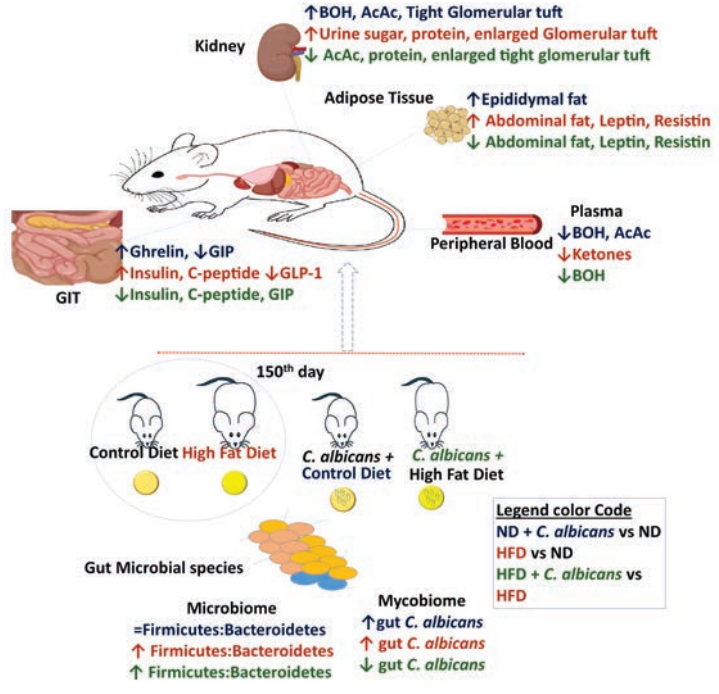
Research Activities:

Study 1 : Genomic diversity in the form of copy number alteration, ploidy variation, and loss of heterozygosity as an adaptive mechanism to adverse environments is frequently observed in *C. albicans*. Such genomic variations also confer a varied degree of fungal virulence and drug resistance, yet the factors propelling these are not completely understood. DNA polymerase delta (Pol) is an essential replicative DNA polymerase in the eukaryotic cell and is yet to be characterized in *C. albicans*. Therefore, this study was designed to gain insights into the role of Pol, especially its non-essential subunit Pol32, in the genome plasticity and life cycle of *C. albicans*. PCNA, the DNA clamp, recruits Pol to the replication fork for processive DNA replication. Unlike in *Saccharomyces cerevisiae*, the PCNA interaction protein (PIP) motif of CaPol32 is critical for Pol's activity during DNA replication. Our comparative genetic analyses and whole genome sequencing of POL32 proficient and deficient *C. albicans* cells revealed a critical role of Pol32 in DNA replication, cell cycle progression, and genome stability as SNPs, indels, and repeat variations were largely accumulated in pol32 null strain. The loss of pol32 in *C. albicans* conferred cell wall deformity; Hsp90 mediated azoles resistance, biofilm development, and a complete attenuation of virulence in an animal model of systemic candidiasis. Thus, although Pol32 is dispensable for cell survival, its function is essential for *C. albicans* pathogenesis; and we discuss its translational implications in antifungal drugs and whole-cell vaccine development.



Study 2 : *Candida albicans* survives as a commensal fungus in the gastrointestinal tract, and its excessive growth causing infections in immune-suppressed individuals is widely accepted. However, any mutualistic relationship that may exist between *C. albicans* and the host remains outstanding. Here we showed that long-term feeding of *C. albicans* does not cause any noticeable

infections in the mice model. Our 16S and 18S rDNA sequence analyses suggested that *C. albicans* colonizes in the gut and modulates microbiome dynamics which in turn mitigates the high-fat diet-induced uncontrolled body weight gain and metabolic hormonal imbalances. Interestingly, adding *C. albicans* to a non-obesogenic diet stimulated the appetite-regulated hormones and helped the mice maintain healthy body weight. In concert, our results suggest a mutualism between *C. albicans* and the host, therefore, contrary to the notion, *C. albicans* is not always an adversary but rather a bonafide admirable companion of the host. Finally, we discuss its potential translational implication as a probiotic, especially in obese people or people dependent on high-fat calorie intakes to manage obesity-associated complications.



Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
5	1	3	2	2	1	1

Cell Biology of Diseases

Dr. Santosh Chauhan
Scientist-E (On Lien)

Focus of the Lab:

A. Autophagy, inflammation, and inflammatory diseases.
In this theme, our lab works on two of the important cell-autonomous innate immune processes, autophagy and inflammation. We study the molecular mechanisms by which autophagy maintains cellular homeostasis and plays important roles in the resolution of various diseases. Furthermore, we study how autophagy and inflammation crosstalk to control infection, immunity, and innate immune homeostasis . Our goal is to enhance the fundamental knowledge regarding these two processes and use that knowledge to discover new therapeutic interventions for the betterment of human health.

B. Understanding the mechanisms of oncogenesis and cancer progression.
In this theme, our lab works on understanding the new mechanisms and cell biology of cancer origin

Collaborators:

- Dr. Punit Prasad, ILS, Bhubaneswar
- Dr. Tor Erik Rusten, University of Oslo, Norway
- Thomas A Kufer, University of Hohenheim, Stuttgart, Germany

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- Kollori Dhar
- Shivaram Krishna
- Rina Yadav
- Santosh Kumar Das
- Sameekshya Satpathy

JRFs:

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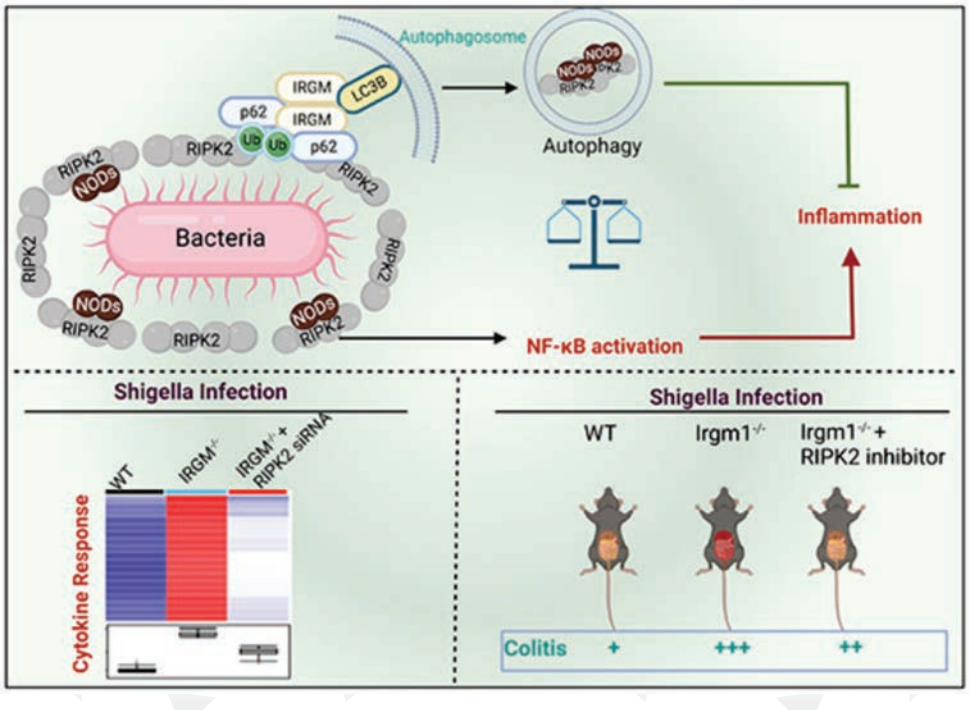
- Ramya Singh Bal

Research Activities:

Understanding the role of IRGM in innate immunity

The NOD1/2-RIPK2 is a key cytosolic signaling complex that activates NF-κB pro-inflammatory response against invading pathogens. However, uncontrolled NF-κB signaling can cause tissue damage leading to chronic diseases. The mechanisms by which the NODs-RIPK2-NF-κB innate immune axis is activated and resolved are remains to be poorly understood. In our new study, we demonstrate that bacterial infection induces the formation of RIPK2 oligomers (RIPosomes) that are self-assembling entities recruited over the bacteria to induce NF-κB response (EMBO J 2022). Next, we show that



autophagy proteins, IRGM and p62/SQSTM1 physically interact with NOD1/2, RIPK2, and RIPosomes to execute their selective autophagy and limit the NF-κB activation (EMBO J 2022). IRGM suppresses multiple RIPK2-dependent pro-inflammatory programs induced by Shigella and Salmonella. Consistently, the therapeutic inhibition of RIPK2 ameliorates Shigella infection- and DSS-induced gut inflammation in Irgm1KO mice (EMBO J 2022). Thus, this study identifies a unique mechanism where the innate immune proteins and autophagy machinery are recruited together over the bacteria for defense and maintaining immune homeostasis.

In this work, we demonstrate that pathogenic bacteria induce the formation of endogenous RIPosomes in the proximity of the bacteria to activate the NF-κB cytokine response. Further, we found that NODs, RIPK2, and RIPosomes are targets of selective autophagy. The autophagy scaffolding proteins, IRGM, and p62 physically interact with NODs, RIPK2, and RIPosomes, and using the canonical autophagy machinery coordinate their selective degradation to limit cytokine responses. In agreement, the global transcriptomic analysis revealed that during Salmonella and Shigella infection, IRGM suppresses multiple RIPK2-dependent pro-inflammatory pathways including NF-κB and interferon (IFN) response. Consistently, in animal studies, inhibition of RIPK2 using GSK583 ameliorated shigellosis- and dextran sodium sulfate (DSS)-induced gut inflammation, and pathology in Irgm1KO mice. Together, this study delineates new cell-autonomous mechanisms of NODs-RIPK2-dependent pro-inflammatory response and its resolution by selective autophagy. Further, our study also suggests that inhibition of RIPK2 could be a good therapeutic strategy for the suppression of gut inflammation associated with IRGM depletion, a risk factor in the progression of Crohn's disease.

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
2	0	0	0	8	0	2

T-Cell Biology

Dr. Satish Devadas
Scientist-F

Focus of the Lab:

The primary focus of our lab is to understand the dynamics of an exaggerated adaptive immune response in pathology and compare and contrast it with its status in physiological conditions. The characterization of T cells (CD4+ and CD8+) in physiologically relevant conditions provides an insight into the course of the immune response during autoimmune diseases such as Rheumatoid Arthritis, SLE as well as metabolic disorders such as Type 2 Diabetes Mellitus. To that end, T helper and cytotoxic subsets have been examined in the above diseases and have been shown to have altered characteristics, including insensitivity to death. Our attempts to generate these aberrant T cells ex vivo have not been successful as the appropriate pathological milieu cannot be replicated ex vivo. Subsequently, animal models to resemble the above human diseases have been used to study primary cells, animal models, and human immune pathology models to ask biologically and clinically relevant questions.

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- Dr. Rajlaxmi Sarangi, KIMS, Bhubaneswar
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SRFs:

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- Gargee Bhattacharya
- Shubham kumar Shaw
- Rohila Jha

Laboratory Technician:

- Mr. Prakash Kumar Barik

Research Activities:

Study 1 : Rheumatoid Arthritis (RA) is an autoimmune inflammatory disorder, characterized by extensive bone erosion and synovial infiltration by immune cells. Previous studies have reported a predominance of aberrant CD4+ T cell subsets such as Th1 and Th17 in the synovia, responsible for precipitating RA pathology. Our

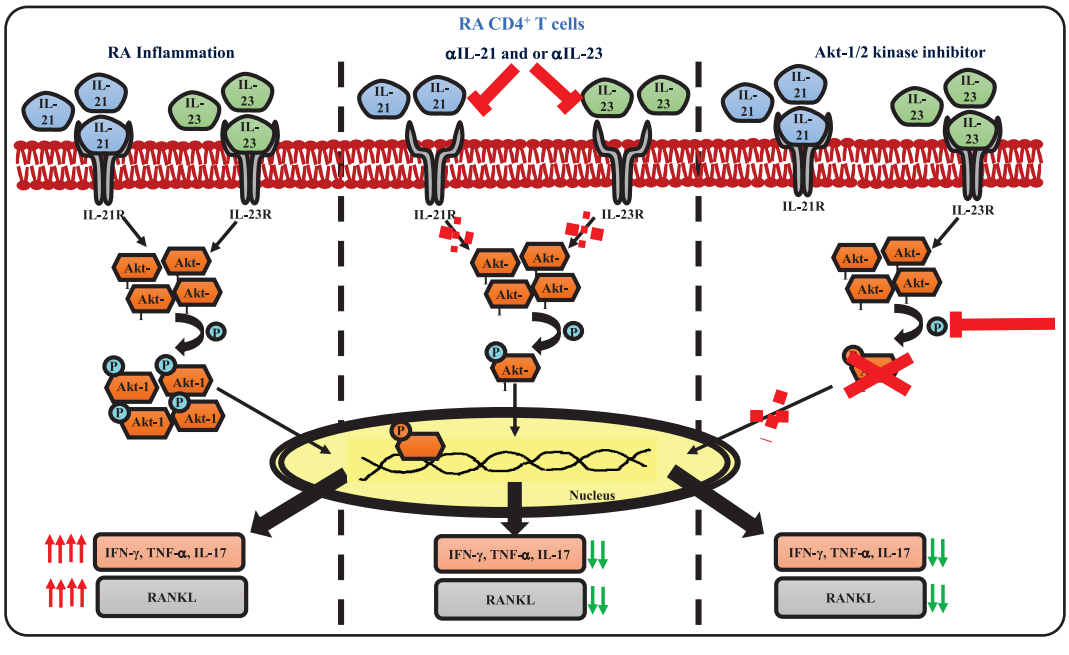

Figure 1: Model depicting the Role of C D 4 + in Rheumatoid Arthritis

study focuses on understanding an aberrant CD4+ T cell phenotype in RA and here we report significant elevation of inflammatory cytokines TNF-α, IFN-γ, GMCSF, IL-17, and mRANKL expression on RA CD4+ T cells as opposed to that of healthy volunteers. Subsequently, we addressed the possibility of a common cytokine signalling pathway responsible for amplifying both, inflammatory cytokines and RANKL expression, and here, we identified IL-21 and IL-23 as two key cytokines as critical regulators of inflammation and RANKL expression in RA CD4+ T cells.

Our ex vivo human Th17 studies also validated the above findings and we hypothesize a common pathway responsible for regulation of inflammatory cytokines and RANKL expression. Collectively, these findings identify the IL-21/23 axis in RA CD4+ T cells as a key regulator dictating two critical processes i.e. exaggerated inflammation and higher osteoclastogenesis, and we aim to dissect their downstream signalling pathway, crucial for the identification of critical targets for therapeutic approaches.

Study 2 : Metabolic disorders such as Type 2 Diabetes Mellitus (T2DM) are characterised by higher than normal levels of blood glucose, altered insulin secretion, glucose intolerance, and hyperglycemia. In recent years it has been shown that TNF-α plays a major role in the progression of T2DM and that the disease is associated with the activation of inflammatory pathways. But the source of these inflammatory cytokines In T2DM and its correlation with glucose is yet to be ascertained.

Our study aims to characterize CD4+ T cells in T2DM by their inflammatory cytokines, transcription factors, and surface markers. Our preliminary studies on DM peripheral blood for various intracellular proteins showed high expression of multiple pro-inflammatory cytokines such as IFN-γ, TNF-α, and IL-17. Interestingly, we found that these CD4+ T cells were co-expressing the pro-inflammatory cytokines. We also report that clinical parameters like HbA1c can be correlated with pro-inflammatory cytokines. Based on these studies, we aim to identify & target specific cytokine or cytokine mix responsible for transforming the physiologically relevant T cells to their aberrant counterparts, leading to inflammation.

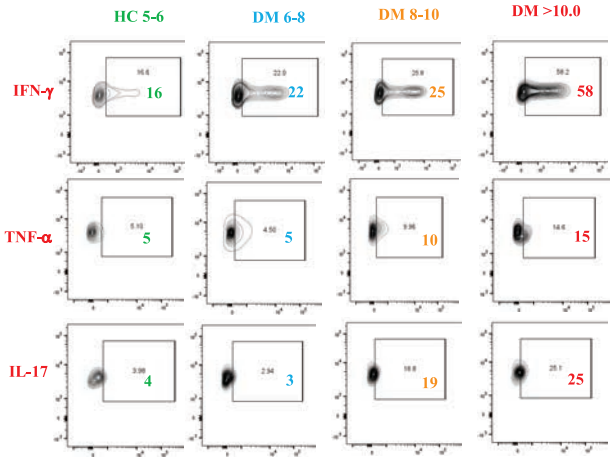

Figure 2: Pro-inflammatory cytokines from T cells in T2DM can be related to HbA1c

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
5	0	3	1 1 (Submitted)	2	1	1

Molecular Virology

Dr. Soma Chattopadhyay
Scientist-F

Focus of the Lab:

Chikungunya virus (CHIKV) causes self-limiting febrile illness, which often progresses to severe chronic incapacitating polyarthralgia. CHIKV is highly prevalent in India and is an impending global human health hazard owing to the lack of vaccines and specific antivirals so far. Our group aims to understand CHIKV biology by defining the functions of the non-structural proteins (non-structural protein-1-4) of CHIKV during replication, identifying the cellular proteins required for viral life cycle, and understanding the molecular mechanism of disease progression and pathogenesis, which will assist in developing anti-viral molecules. Our group also works on identifying crucial host factors, understanding their role in viral infection and develop controlling strategies to combat

Research Activities:

MBZM-N-IBT, a Novel Small Molecule, Restricts Chikungunya Virus Infection by targeting nsP2 Protease Activity In Vitro, In Vivo, and Ex Vivo

The growing emergence of Chikungunya virus (CHIKV) infection has raised a major public health concern globally with significant socio-economic burden, especially due to the absence of vaccines or specific antiviral therapy against CHIKV. These necessitate to

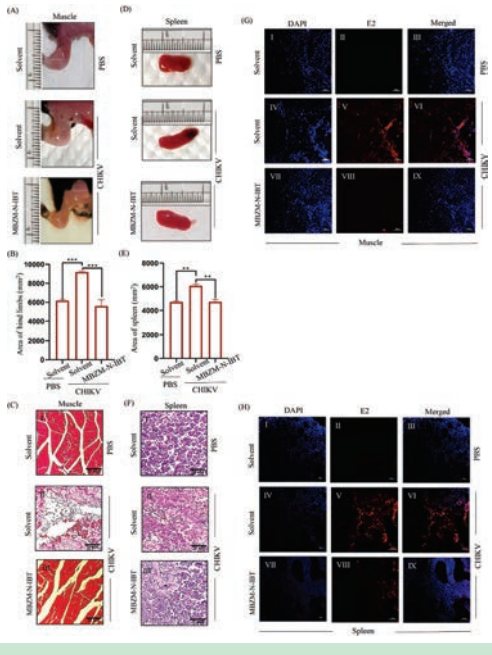

Figure 1: MBZM-N-IBT decreases the swelling of muscle and spleen and improves their histopathology in CHIKV-infected mice. **(A)** Image panels indicating evident hind limb muscle swelling of mock, infected, and treated groups of mice. **(B)** Bar diagram showing the quantitation of limb swelling. **(C)** Image panels showing the hematoxylin and eosin (H&E)-stained muscle section. **(D)** Image panels depicting gross swelling of spleen (splenomegaly) of mock, infected, and treated groups of mice. **(E)** Bar diagram showing the quantitation of splenomegaly. **(F)** Image panels showing the H&E-stained spleen section. **(G)** Image panels showing the CHIKV-E2 stained muscle sections. **(H)** Image panels showing the CHIKV-E2 stained spleen tissue sections.

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- Santoshini Dash
- Udvas Ghorai
- Rajmohan Jena

develop effective anti-CHIKV tactics. Our earlier investigation showing the in vitro anti-CHIKV potential of a novel compound namely 1-[(2-methylbenzimidazol-1-yl) methyl]-2-oxo-indolin-3-ylidene] amino] thiourea (MBZM-N-IBT) inspired us to further validate its efficacy. In the present study, the effect of MBZM-N-IBT was assessed in vitro in RAW 264.7 cells, in vivo in C57BL/6 mice as well as ex vivo in human peripheral blood mononuclear cells (hPBMCs). MBZM-N-IBT was found to abrogate CHIKV infection efficiently in RAW 264.7 cells (IC50 = 22.34 µM) with significant inhibition in viral protein levels. Additionally, the compound interfered in the early stage of CHIKV life cycle with efficacy in the post-entry step as the protease activity of CHIKV-nsP2 was hindered. Moreover, significant downregulation of all the major mitogen-activated protein kinases (MAPKs), NF-κB, cyclooxygenase (COX-2) and cytokines upon the drug treatment supports the anti-inflammatory property of the compound. Interestingly, MBZM-N-IBT abrogated CHIKV infection and inflammation significantly leading to reduced clinical score and complete survival of C57BL/6 mice. Furthermore, MBZM-N-IBT reduced infection in hPBMC derived monocyte-macrophage populations ex vivo showing its possibility to be a potent anti-CHIKV molecule. This novel compound MBZM-N-IBT has been demonstrated to be a potential anti-CHIKV molecule in vitro, in vivo, and ex vivo and fulfilled all the criteria to investigate further for translational application.

The Wnt/β-Catenin Pathway is crucial for Chikungunya Virus and SARS-CoV-2 infection.

Non-structural protein-2 (nsP2) plays an imperative role in CHIKV infection. Apart from the viral proteins, several host proteins are involved in efficient viral infection hence, we sought to identify cellular factors that interacts with viral proteins during CHIKV as well as SARS-coV-2 infection. Vero cells were infected with CHIKV. Co-immunoprecipitation showed that β-Catenin protein was precipitated with the CHIKV-nsP2 protein. To determine whether β-Catenin is crucial for viral infection, an investigation was carried out with CHIKV and SARS-CoV-2. To assess whether the Wnt/β-catenin pathway is dysregulated in CHIKV infection, the levels of active-β-catenin, GSK-3β and Cyclin D were investigated. Vero cells were infected with CHIKV at a multiplicity of infection (MOI) of 2 and harvested at 6 hpi. The protein levels were estimated by Western blot. The protein levels of active-β-catenin, and Cyclin D were decreased significantly whereas GSK-3β was upregulated following CHIKV infection compared to mock as shown in Figure 2A-D.

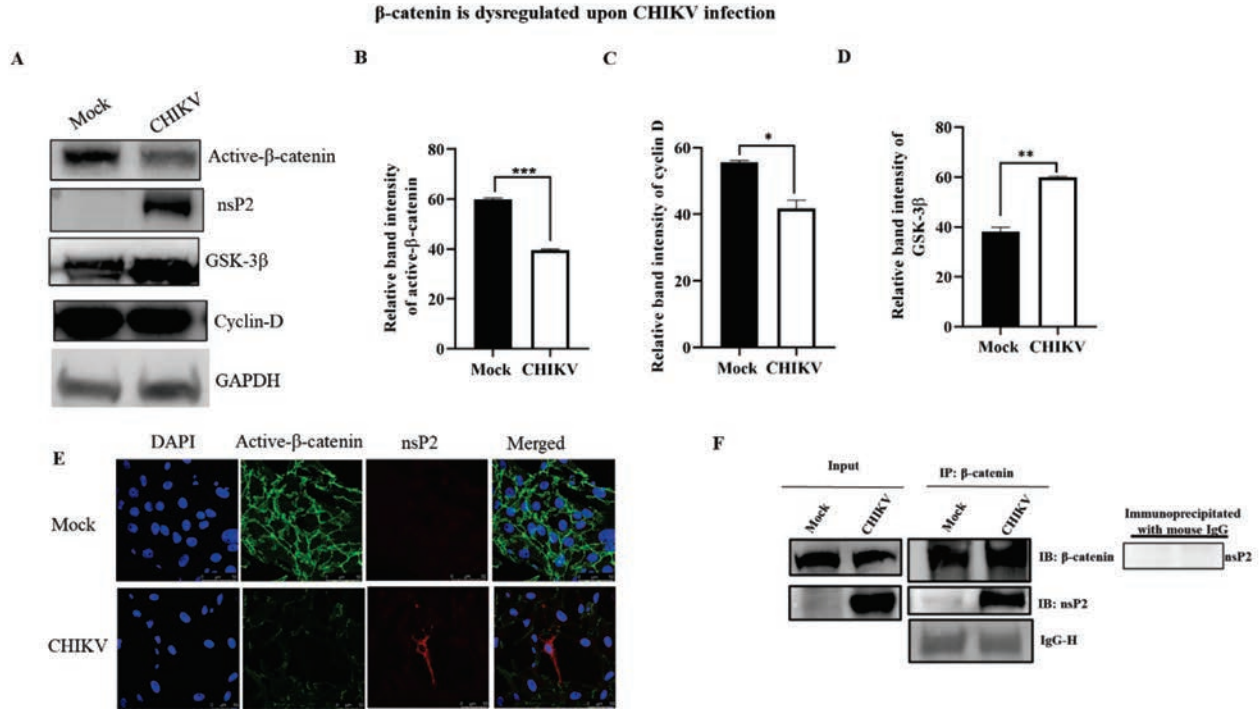

Figure 2: The Wnt/β-catenin pathway is dysregulated upon CHIKV infection. The Vero cells were mock or CHIKV infected and harvested at 6 hpi. (A) Western blot was performed using the nsP2, active-β-catenin, GSK-3β, Cyclin-D, and GAPDH antibodies. (B-D) Bar diagrams showing relative band intensities of active-β-catenin, Cyclin-D and GSK-3β, post infection. (E) Mock or infected Vero cells were stained with the active-β-catenin and nsP2 antibodies. Nuclei were counterstained with DAPI. Scale bar = 50 µM. The Vero cells were infected with CHIKV and harvested at 6 hpi. The cell lysates were co-immunoprecipitated with the β-catenin antibody. (F) Western blot analysis depicting the levels of nsP2, and β-catenin in the whole cell lysate (left) and co-immunoprecipitation analysis showing the interaction of the CHIKV-nsP2 and β-catenin proteins (middle). Right panel represents the negative control, where normal mouse IgG was used to immunoprecipitate the protein complex and probed with the nsP2 antibody.

Moreover, immunofluorescence analyses were carried out to confirm the active-β-catenin level after CHIKV infection and the results exhibited a decrease in active-β-catenin level after CHIKV infection compared to mock (Figure 2E). Next, the interaction between β-catenin and nsP2 was examined. At 6 hpi, CHIKV infected Vero cells were collected, and subjected to co-immunoprecipitation, and Western blot analysis. It was found that β-catenin immunoprecipitated the CHIKV-nsP2 protein. Here, IgG was used as a negative control (figure 2F). Collectively, these results indicate that the Wnt/β-catenin pathway is impaired following CHIKV infection and CHIKV-nsP2 interacts with β-catenin. Additionally, the recent pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) led to the loss of lives at an unprecedented scale. All the viruses exploit a plethora of tactics to modulate the host signaling to aid their survival. In this investigation, host factors that could be a more effective strategy were explored. β-catenin, a key component of the Wnt/β-catenin pathway, was found to be crucial for SARS-CoV-2 replication. After SARS-CoV-2 infection and iCRT14 (a specific inhibitor of β-catenin treatment) (10, 25 and 50 µM), a dose-dependent decrease in cytopathic effect (CPE) was observed, along with significant reductions in viral copy numbers and in the level of the nucleocapsid protein (data not shown). These results indicated the crucial role of the β-catenin protein for SARS-CoV-2 infection. We would like to understand the mechanism of β-catenin to inhibit viral infection and explore the role of Wnt pathway as a whole for CHIKV and SARS-CoV-2 infection. This will help us to design therapeutics in future to combat these infections.

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
11	2	3	1 1 (Submitted)	7	0	1

Immunogenomics & Systems Biology Group

Dr. Sunil K. Raghav
Scientist-F

Focus of the Lab:

Dendritic cells (DCs) are the major antigen presenting cells (APCs) that educate T-cells to differentiate into different subtypes like Th1, Th2 Th17 or Tregs to prevent from immune-pathology. IMGSB group at ILS is trying to understand the transcriptional control of immune response generation in DCs to identify the potential molecular targets that can be perturbed to immune-modulate T-cell function. In last few years, the group found that nuclear receptor co-repressors NCoR1 and SMRT fine-tune the immune-tolerance and inflammation in DCs through metabolic perturbations and thereby frequency of Tregs and Th1/Th17 development that can be targeted to skew T-cell function.

Research Activities:

Study 1 : Dendritic cells (DCs) undergo rapid metabolic reprogramming events to induce signal-specific immune responses. The transcriptional control of energy metabolism in tolerogenic-DCs remains elusive. We have recently reported that NCoR1 ablation in DCs leads to immune-tolerance by altering the balance of naïve T helper cells towards T-regs. Here, in this study, comprehensive metabolic profiling identified that these tolerogenic DCs meet their anabolic requirements through enhanced glycolysis and OXPHOS, supported by fatty acid oxidation driven oxygen consumption. Mechanistically, AKT, mTOR, and HIF-1α-axis mediated glycolysis and CPT1a-driven β-oxidation were found to be enhanced in the NCoR1 depleted DCs. In addition, reduced pyruvate and glutamine oxidation, with a broken TCA cycle, and PPAR-γ induced β-oxidation maintain the tolerogenic state of the cells. Additionally, we showed how the tolerogenic cytokines IL-10 and IL-27 and the overall transcriptional signature of immunological tolerance were considerably compromised by the combined inhibition of HIF-1α and CPT1a using KC7F2 and Etomoxir, respectively. Interestingly, the combined treatment also polarized the naïve CD4+ T cells towards Th1 in ex-vivo and in-vivo experiments using OT-II mice. This combination further aided in clearance of

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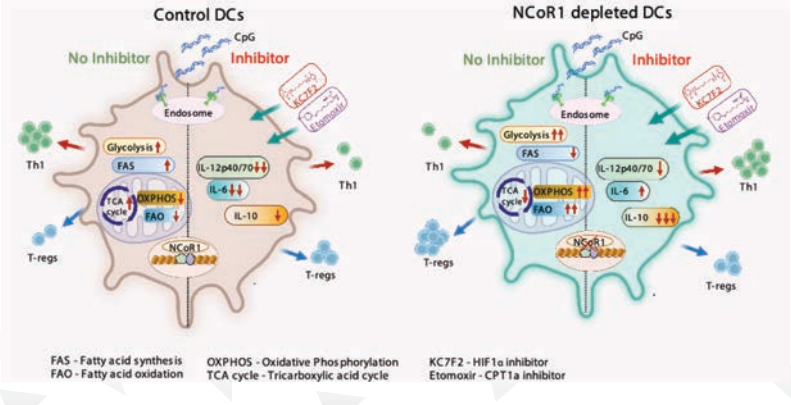

Figure 1: Summary illustration showing the metabolic perturbations upon NCoR1 depletion in DCs and how they impact T cell

Mycobacterium tuberculosis (Mtb) burden in BMcDC1s ex-vivo and in CD103+ lung DCs in NCoR1DC-/- mice in-vivo. Furthermore, the spleen of these infected mice also showed treatment-induced increased Th1-mediated IFN-γ responses. To validate the findings in the human system, we demonstrated that dexamethasone-

derived primary human tolerogenic moDCs showed significantly reduced NCoR1 expression, which in turn suppressed the CD4+ T-cell proliferation and Th1 phenotype in lieu of T-regs. Further, the combined treatment approach in moDCs, rescued the decreased T-cell proliferative capacity and the Th1 phenotype. Our findings for the first time demonstrate that NCoR1 mediated control of glycolysis and fatty acid oxidation fine-tune immune tolerance versus inflammation in murine and human DCs (Figure 1)

Study 2 : Tight control of gene regulation in dendritic cells (DCs) is important to mount pathogen specific immune responses. Apart from transcription factor binding, dynamic regulation of enhancer activity through global transcriptional repressors like Nuclear Receptor Co-repressor 1 (NCoR1) plays a major role in fine-tuning of DC responses. However, how NCoR1 regulates enhancer activity and gene expression in individual or multiple Toll-like receptor (TLR) activation in DCs is largely unknown. In this study, we did a comprehensive epigenomic analysis of murine conventional type-I DCs (cDC1) across different TLR ligation conditions. We profiled gene expression changes along with H3K27ac active enhancers and NCoR1 binding in the TLR9, TLR3 and combined TLR9+TLR3 activated cDC1. We observed spatio-temporal activity of TLR9 and TLR3 specific enhancers regulating signal specific target genes. Interestingly, we found that NCoR1 differentially controls the TLR9 and TLR3-specific responses. NCoR1 depletion specifically enhanced TLR9 responses as evident from increased enhancer activity as well as TLR9 specific gene expression, whereas TLR3-mediated antiviral response genes were negatively regulated. We validated that NCoR1 KD cDC1 showed significantly decreased TLR3 specific antiviral responses through decreased IRF3 activation. In addition, decreased IRF3 binding was observed at selected ISGs leading to their decreased expression upon NCoR1 depletion. Consequently, the NCoR1 depleted cDC1 showed reduced Sendai Virus (SeV) clearance and cytotoxic potential of CD8+ T-cells upon TLR3 activation. NCoR1 directly controls the majority of these TLR specific enhancer activity and the gene expression. Overall, for the first time we revealed NCoR1 mediates transcriptional control towards TLR9 as compared to TLR3 in cDC1 (Figure 2).

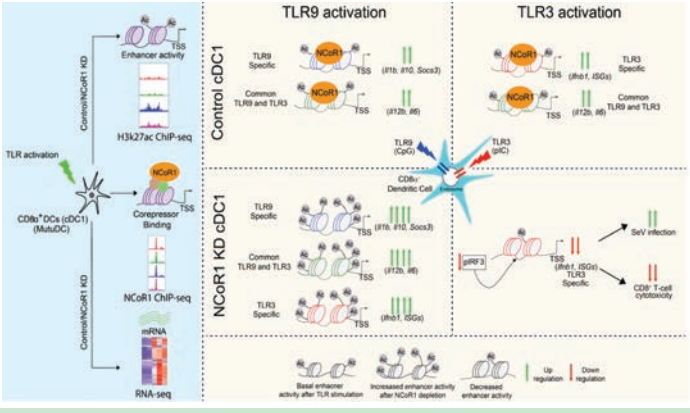

Figure 2: Model depicting epigenomic regulation of TLR9 responses by NCoR1 as compared to TLR3 mediated transcriptional regulation.

Achievements in 2022-2023

Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
6	0	1	2	7	0	2

Cell Division in Bacteria

Dr. Tushar Kant Beuria
Scientist-E

Focus of the Lab:

Widespread antimicrobial resistance among bacterial pathogens is a serious threat to public health. The development and use of antibiotics helped to prevent and control bacterial infections, but at the same time, their misuse led to the development of antibacterial resistance, resulting in higher infection and mortality rates. As more bacteria become resistant to currently available antibiotics, the discovery of new antibiotics and identification of new targets is more urgent than ever. Although cell division is a major driver of bacterial colonization and pathogenesis, it's targeting with antibacterial compounds is still in its infancy. FtsZ, a prokaryotic homolog of tubulin, assembles at the mid-cell and forms protofilaments/ bundles to initiate the division process. During the process it recruits other cell division proteins to form a dynamic ring called the Z-ring or divisome complex. This complex constricts and divides cells into two identical daughter cells. The placement of the divisome complex at the mid-cell is guided by two systems, namely, the nucleoid occlusion and Min systems. The nucleoid occlusion inhibits the formation of the Z-ring over the nucleus, whereas, the min system inhibits the formation of the Z-ring at the poles. Further, during cell division, the old cell wall is replaced by the new cell wall. Thus, it is important to understand the mechanism that coordinates bacterial division with cell wall synthesis. Our group aims to understand the assembly of the divisome complex, its relation with the Min system, and its coordination with new cell wall formation.

Collaborators:

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- Mitali Madhusmita Kar

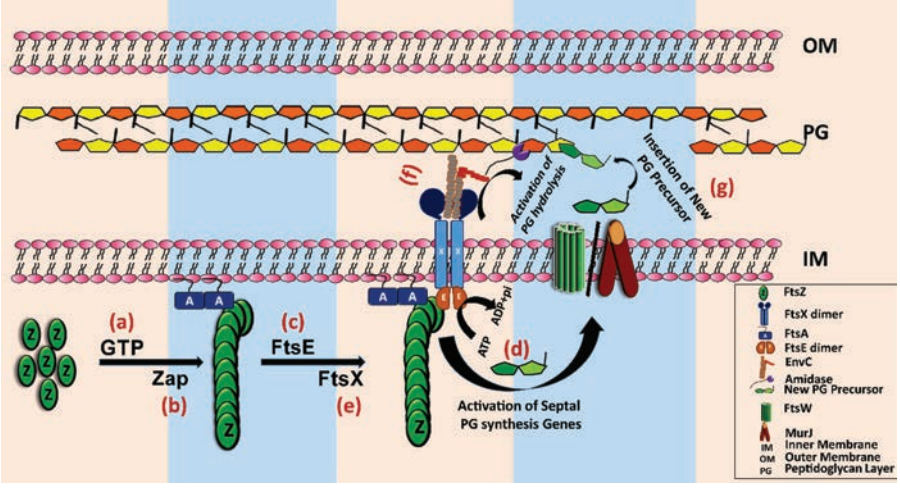
Research Activities:

Role of the Min system in bacterial division and motility

Cell division in bacteria is a highly controlled and regulated process. FtsZ, a bacterial cytoskeletal protein forms the skeleton of a ring-like structure known as the Z-ring at the mid-cell and recruits other cell division proteins. There are several proteins that are known to involve in the Z-ring formation. A successful division of bacteria requires the correct positioning of the Z-ring. The Min system plays an important role in positioning the Z-ring to the mid-cell. It oscillates between both poles and inhibits the formation of the Z-ring at the poles and thus maximizes its possibility to be placed at the mid-cell. The Min system, comprising of MinC, MinD, and MinE proteins. MinD and MinE proteins are essential for Min oscillation, whereas, MinC interacts with MinD and thus oscillates along with them. MinC is a Z-ring assembly inhibitor that interacts with FtsZ and destabilizes FtsZ polymers and thus destabilizes the Z-ring formation at poles. The presence of MinD enhances the inhibitory effects of MinC by several folds. In the absence of the Min system, Z-rings can form at the poles and divide the cells asymmetrically to produce a bigger cell containing both the nucleoids and a small cell containing no nucleoid called mini-cells (Fig. 1). The interaction of the Min-system with FtsZ is well known. Recent studies indicate that Min proteins also play roles in bacterial motility, colony formation, and bacterial pathogenesis. However, the functions of the Min system in other cellular processes are not well known. In our study, we found that MinD interacts with proteins participating in diverse cellular processes such as protein secretion, chaperoning, and bacterial adhesion. We have also shown that the Min system is important for bacterial motility. Our current focus is to understand the role of the Min system in other cellular processes.

Finding the role of ABC transporter homolog FtsEX complex in coordinating bacterial division and cell wall constriction

In *E.coli*, septal PG hydrolysis is partially controlled by the FtsEX protein complex, which is a homolog of the ATP binding cassette (ABC) transporter (type VII family). In the cytoplasm, FtsE hydrolyzes ATP and causes a structural change in periplasmic protein EnvC through FtsX. This event leads to the activation of amidases A and B, which in turn initiates PG hydrolysis at the mid-cell. More recently, FtsX was shown to interact with FtsA for the recruitment of late-cell division proteins, which suggests that besides PG hydrolysis, FtsX also performs a role in divisome assembly. Similarly, FtsE, the cytoplasmic domain of the FtsEX complex, localizes to the mid-cell through its interaction with the C-terminal core domain of FtsZ, an interaction that is independent of FtsX. FtsE interacts with the core domain of FtsZ, which suggests that FtsE may also play a regulatory role during cell division. The peptidoglycan (PG) layer, a crucial component of the tripartite *E.coli* envelope, is required to maintain cellular integrity, protecting the cells from mechanical stress resulting from intracellular turgor pressure. Thus, coordinating the synthesis and hydrolysis of PG during cell division (septal PG) is crucial for bacteria. The FtsEX complex directs septal PG hydrolysis through the activation of amidases; however, the mechanism and regulation of septal PG synthesis are unclear. We have shown that overexpression of FtsE leads to higher septal PG synthesis, which is independent of FtsX, and suggests that while FtsE regulates PG synthesis and the FtsEX complex regulates PG hydrolysis during bacterial division.



Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
5	0	2	0	2	0	1

CANCER BIOLOGY

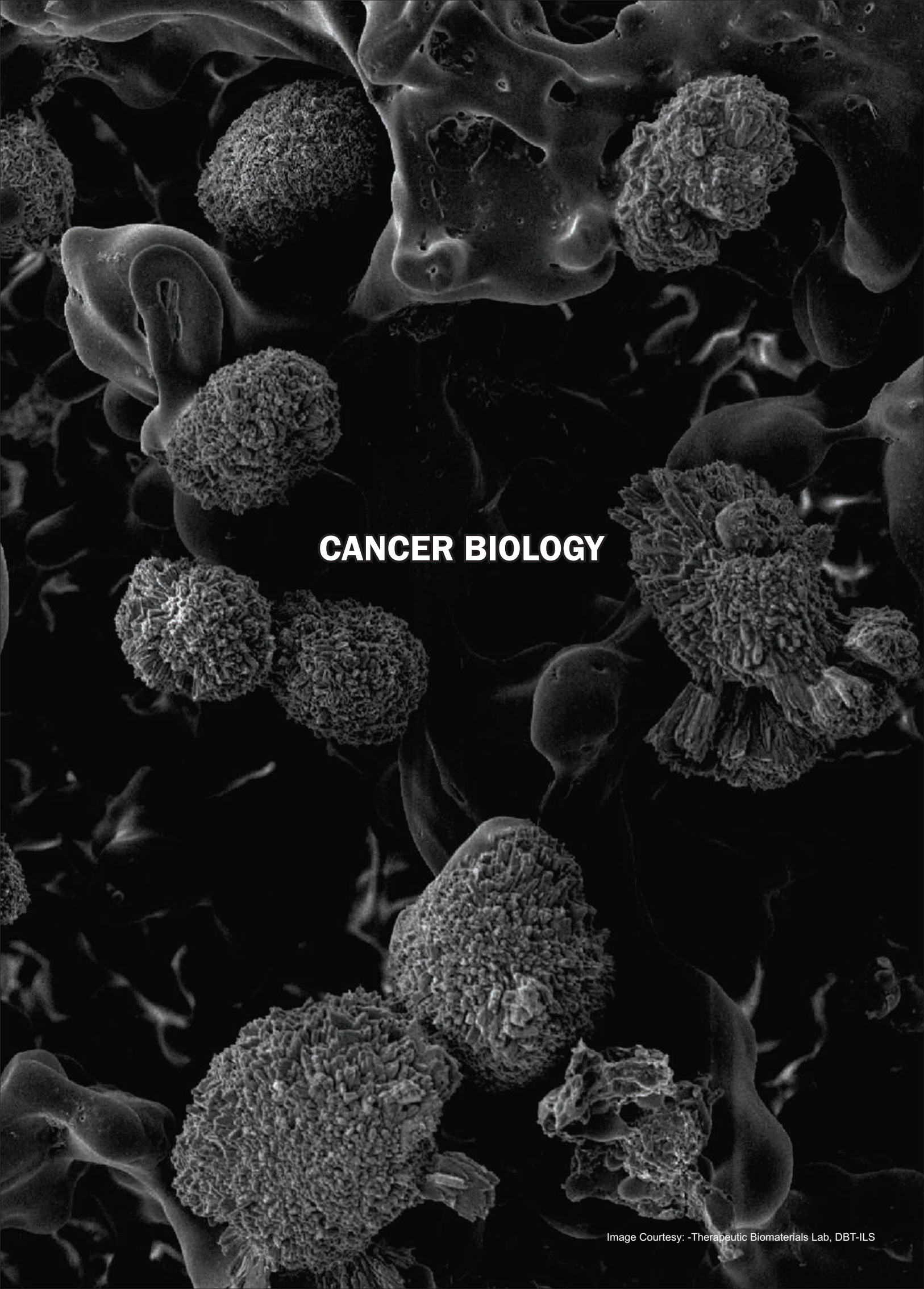


Image Courtesy: -Therapeutic Biomaterials Lab, DBT-ILS

Cancer Biology

Dr. Anshuman Dixit	Computational Biology and Bioinformatics
Dr. Gunjan Mandal	Tumor Immunology
Dr. Punit Prasad	Chromatin and Epigenetics
Dr. Rupesh Das	Understanding the Molecular Mechanism Behind Chemoresistance
Dr. Sandip K Mishra	Breast Cancer Pathogenesis
Dr. Sanjeeb K Sahoo	Nanomedicine for Targeting Cancer
Dr. Shantibhusan Senapati	Tumour Microenvironment and Animal Models
Dr. Soumen Chakraborty	Leukemia Biology

Computational Biology and Bioinformatics

Dr. Anshuman Dixit
Scientist-E

Focus of the Lab:

Head and neck squamous cell carcinoma (HNSCC) is the sixth most common malignancy and one of the predominant causes of cancer-related casualties worldwide. The majority of HNSCC cases are those of oral squamous cell carcinoma (OSCC). The major research questions in OSCC are related to the development of strategies for early detection, prevention of relapse, targeted chemotherapy, and the emergence of drug resistance. Studies have shown that molecularly targeted therapies result in better outcomes. Therefore, one of our areas of interest is to develop chemotherapeutic strategies for better clinical outcomes. Additionally, we aim to identify small molecule modulators for the protein/RNA targets related to chemoresistance.

Collaborators:

- Dr. Rajeeb Swain, DBT-ILS, Bhubaneswar
- Dr. S. K. Mishra, DBT-ILS, Bhubaneswar
- Dr. G. H. Syed, DBT-ILS, Bhubaneswar
- Dr. Tushar K Beuria, DBT-ILS, Bhubaneswar
- Dr. Anasuya Roychaudhury, IIT, Bhubaneswar.
- Dr. Luna Samanta, Ravenshaw University, Cuttack.
- Dr. S. Routray, AIIMS, Bhubaneswar
- Prof. Enketeswara Subudhi, School of Pharmaceutical Sciences, Siksha 'O' Anusandhan University, Bhubaneswar

SRFs:

- Shaheerah Khan
- Pratima Kumari
- Pooja Archana Sahani

JRF:

- Bineet Kumar Mohanta

Project JRF:

- Madhusmita Sethy

Research Activities:

Identification of molecular targets and their ligands for OSCC therapeutics

Eighty thousand oral cancer cases are reported every year in India, of which the majority are Oral squamous cell carcinoma (OSCC). The lack of targeted therapies and the emergence of chemoresistance are the main reasons for the therapy failure in OSCC. The development of targeted therapies against OSCC is anticipated to have significant clinical implications.

Last year we reported the identification of potential targets (SERPINE1, PLAU, CKS2, CCNA2, BOP1), and their ligands were identified using molecular docking. We did a stability analysis on the ligand-protein complexes by long molecular dynamics simulation (300 ns). We found some of the complexes viz. BOP1–saquinavir, Serpine1-labetolol, CCNA2-diacetolol and PLAU–NADH showing excellent stability with their respective molecular targets as shown by root mean square deviation (RMSD), root mean square fluctuation (RMSF), and hydrogen bonding analysis (Fig. 1).

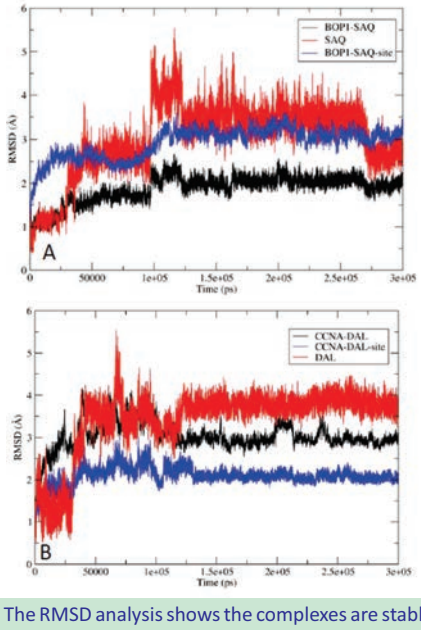


Figure 1. The RMSD analysis shows the complexes are stable. The RMSD of protein and ligand is shown in red and blue respectively. (A) RMSD for BOP1-Saquinavir complex. (B) RMSD for PLAU-NADH complex.

We have planned in-vitro studies using oral cancer drug sensitive and drug resistant cell lines to test the efficacy of selected molecules.

Identification of molecules against molecular targets in OSCC

The superfamily of G-protein coupled receptor (GPCR) includes more than 800 proteins having 7 membrane-spanning helices that participate in diverse physiological and pathological functions. They play a critical role in numerous cellular and physiological processes including cell proliferation, differentiation, neurotransmission, development, and apoptosis. GPCRs have been proven to be the most successful class of druggable targets in the human genome. Close to half of

the marketed drugs exert their clinical effects via GPCRs.

Several findings reported that among several Orphan GPCRs, GPR158 is one of the newly characterized family C Glutamate receptors has roles in different cancers. The GPR158 expression is stimulated by androgen. GPR158 stimulates the AR expression, implying a potential to sensitize tumors to low androgen conditions during ADT (Androgen deprivation Therapy) via a positive feedback loop. Studies report elevation of GPR158 levels stimulates prostate cancer cell (PCa) proliferation and progression. It is important to note that PCa is the second leading cause of cancer-related mortality. GPR158 expression was increased at the invading front of the prostate tumor in the genetically defined conditional Pten knockout mouse model and colocalized with elevated AR expression in the cell nucleus. Kaplan-Meier analysis of datasets showed that increased GPR158 expression in tumors is associated with lower disease-free survival. Our findings strongly suggest that pharmaceuticals targeting GPR158 activities could represent a novel and innovative approach to the prevention and management of cancer, especially advanced PCa such as castration-resistant PC (CRPC). We used a structure-based molecular docking approach to model drug repurposing and data-mining analysis of the drug-gene-cancer association. Through the presented approach, we selected the most promising molecules and FDA-approved drugs for further development and analyzed them in the context of available experimental data. We have planned for the validation of the predictions using molecular dynamics simulation and in-vitro experiments (Fig. 2).

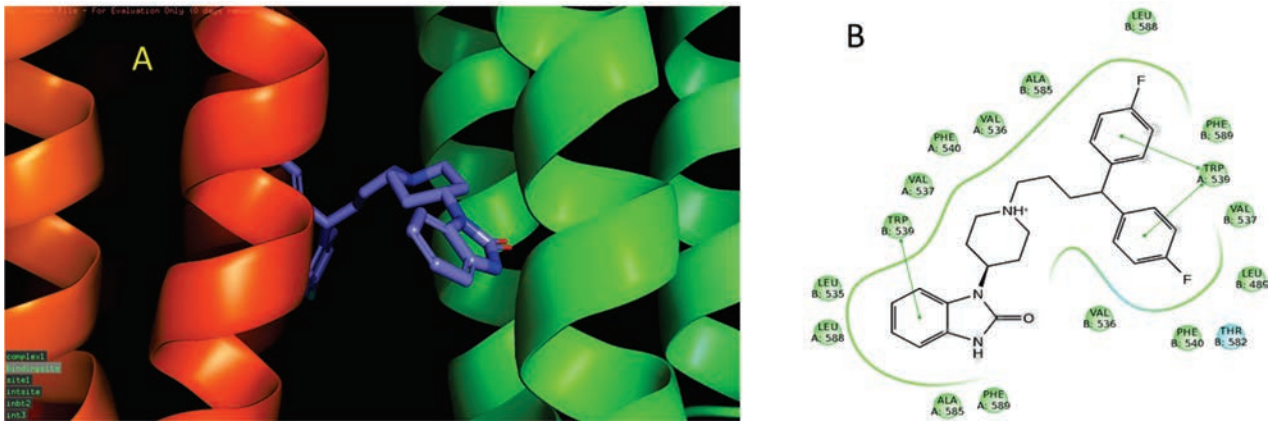


Figure 2. The docking of pimozide in GPR-158. (A) Ligand position between helices. (B) Close-up view of the interactions.

Achievements in 2022-2023

Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
7	0	1	1	4	1	0

Tumor Immunology

Dr. Gunjan Mandal
Scientist-B

Collaborators:

- Dr. Jose Conejo-Garcia, Duke School of Medicine, USA.
- Dr. Subir Biswas, Tata Memorial Centre-ACTREC, Mumbai.

Laboratory Technician:

- Suchismita Pradhan

Focus of the Lab:
The long-term goal of the Tumor Immunology lab is comprehensive understanding of how the cells in the tumor microenvironment direct the nature of spontaneous immune pressure in different solid cancers, with a special focus on cancers that specifically affects women. The two major focus of our laboratory are 1) to unveil mechanisms that thwart effectiveness of spontaneous antibody-mediated anti-tumor responses as well as immunoglobulin-based cancer immunotherapies; and 2) Developing cancer vaccines that will be effective to boost an effective immune response which will be unanimously effective across Indian population.

Research Activities:

Study 1 :

Genesis of the study: Traditionally the field of tumor immunology has neglected B cell-mediated humoral immune responses for last few decades and has been T cell centric, until the field took a U-turn whereby converging independent evidence supports that humoral responses by tumor-infiltrating B-cells (TIL-B cells) are associated with immune protection in multiple human solid tumors. During my training at Moffitt Cancer Center I have contributed to seminal discoveries that IgA is the most dominant class of immunoglobulin in human endometrial and ovarian cancer, and underscored the mechanism of IgA-mediated antigen specific and non-specific anti-tumor responses. Apart from IgA antibodies, IgG antibodies were also observed to be spontaneously produced at a large quantity in both gynecological cancer types studied. However, in many cancers, for example in breast cancer, IgG antibodies are the predominant class of immunoglobulin produced at tumor beds. Although, the effects of spontaneous IgG production by TIL-B cells are theoretically assumed to be protective, nevertheless at many occasions higher intratumor IgG levels do not correlate with superior survival. Therefore, we want to understand the mechanism of how primary cancer tissues bypass the anti-tumor functions of the spontaneous IgG antibodies produced naturally by TIL-B cells at tumor beds. Our central hypothesis is that epithelial cancer tissues evolve mechanisms that sequesters antitumor antibodies and thereby revokes the canonical anti-tumor functions of antibodies produced by tumor infiltrating plasma cell B lymphocytes.

Past research leads: The epithelial and ovarian endometrial cancer tissues in humans are found to be heavily coated with spontaneously produced IgG antibodies. Surprisingly, majority of these antibodies are against otherwise self-proteins probably through breaking of tolerance locally in the tumor microenvironment due to overexpression or unique glycosylation patterns of those proteins in the tumor. Is has been previously observed that although these spontaneously produced antibodies are effective in abrogating tumor growth in vivo and also induce anti-tumor signaling pathways, promote effector functions such as ADCC/ADCP by NK-cells and macrophages, their extensive production and coating tumor tissues do not necessarily correlate with better overall survival. This indicates that mechanisms exist in malignant cells or in the tumor microenvironments of solid tumors that bypass effector functions of anti-tumor antibodies.

Current Year Progress: Preliminary screening of TCGA data shows that fetal neonatal receptor (FcRn), which can naturally bind to Fc of IgG antibodies, is expressed by cancer cells in many epithelial and non-epithelial malignancies. Based on this, we hypothesized that FcRn expression in cancer tissues dampens natural effectiveness of antitumor IgG antibodies spontaneously produced in cancer beds. Therefore, targeting FcRn may be an excellent future therapeutic option to rescue the effectiveness of spontaneous antibody response and also in ensuring IgG-based immunotherapies.

Future Plans: We will combine collections of samples from patients with ovarian, endometrial, lung, colon and breast cancer with some healthy control surgical

specimens with the help of our clinician collaborators at AIIMS Bhubaneswar, and commercially available tissue microarrays (TMA) along with some murine tumor models to test our hypothesis that non-canonical expression of FcRn in tumor tissues help them to redirect anti-tumor functions of IgG antibodies spontaneously produced at tumor beds by TIL-B cells (Fig.1). The questions that we want to pursue are- 1) What is the frequency and functional relevance of FcRn expression at tumor beds?, and 2) Does ablation of FcRn rescues effectiveness of the humoral immune response in vivo? We anticipate that a large number of epithelial cancer tissues will show a significant proportion of IgG antibodies are occupied with FcRn. This is expected to be associated with worse outcome, decreased NK and myeloid cell infiltration, and decreased T cell activation at tumor beds. Accordingly, we anticipate that in vivo FcRn blockade will rescue effector activities of tumor-reactive IgG antibodies spontaneously produced by TIL-B cells. Together, these results will provide a new mechanistic frame to understand the role of antibody responses in protective immunity against advanced tumors, and why spontaneous production of anti-tumor antibodies do not always correlate survival of patients.

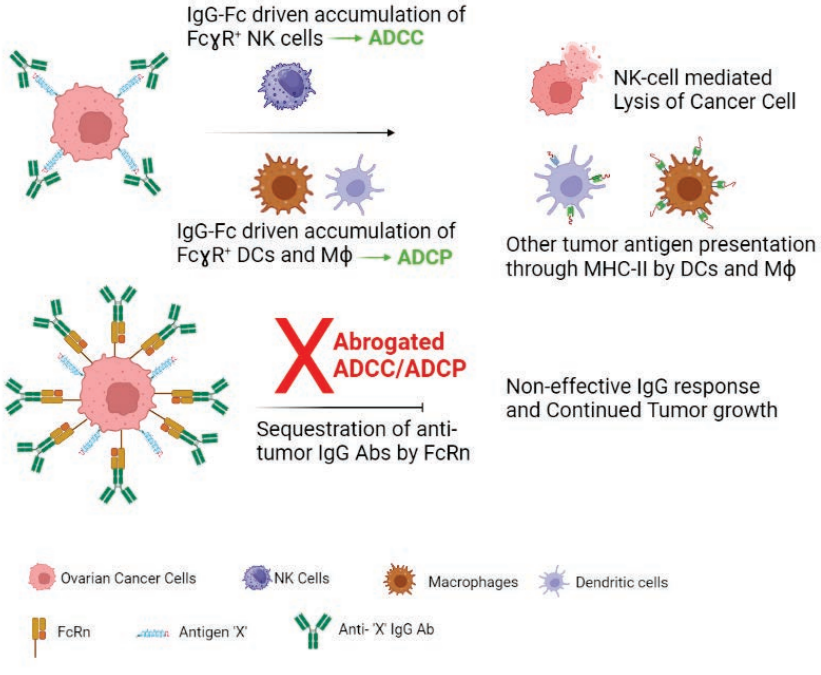


Figure 1: Schema of the hypothesis of how FcRn thwarts anti-tumor effects of IgG antibodies.

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
1	1	2	0	0	0	0

Chromatin And Epigenetics

Dr. Punit Prasad
Scientist-E

Focus of the Lab:

My group addresses two major biological questions: 1. What epigenetic mechanisms regulate normal and abnormal myelopoiesis? 2. What is the role of microbiome in normal and diseased states of an individual? Although the two aspects appear to be diverse, research advancements have clearly shown that the relationship between microbiome alterations and epigenetic changes is associated with lifestyle, disease, and geographical locations. The primary focus of my group is to understand the role of a class of epigenetic factors, the multi-subunit ATP-dependent chromatin remodelling complexes (CRCs), in normal and malignant myelopoiesis. Our lab has established methods to delineate the role of chromatin remodelers and their auxiliary subunits in normal myelopoiesis and acute myeloid leukemia (AML) using both in vitro and ex vivo differentiation models. Our recent study highlights the role of SMARCD1, an auxiliary subunit of the SWI/SNF complex in negatively regulating myelopoiesis of leukemic cells through epigenetic mechanisms (Blood Advances, 2022). The second aspect of my work involves understanding microbiome alterations in different ethnic groups and in diseases such as COVID-19 and AML. Our recent study shows the abundance of Mycobacterium and Mycoplasma in the nasopharynx of COVID-19 patients suggesting that opportunistic pathogens may lead to post-COVID complications. This story appeared on the cover page of Molecular Omics 2022 journal.

Collaborators:

- Dr. Santosh Chauhan, CCMB, Hyderabad
- Dr. Soma Chattopadhyay, DBT-ILS, Bhubaneswar
- Dr. Sunil K Raghav, DBT-ILS, Bhubaneswar
- Dr. Shantibhusan Senapati, DBT-ILS, Bhubaneswar
- Dr. Priyanka Samal, SUM Hospital, Bhubaneswar
- Dr. Asima Das, KIMS, Bhubaneswar
- Dr. Jyotshnamayee Panda, KIMS, Bhubaneswar

SRFs:

- Krushna Chandra Murmu
- Jhinuk Basu (CSIR-SRF)
- Swati Madhulika (DST-INSPIRE)

JRFs:

- Monalisa Ghosh
- Smruti Shree Mohanty (DBT-JRF)
- Soumendu Mahapatra

Research Associate:

- Dr. Swati Chauhan

Project Students:

- Rashmita Mishra
- Sheetal Dash

Laboratory Technicians:

- Tareni Prasad Mallick
- Kartik Jana

Research Activities:

Human leukemia 60 (HL60) promyelocytic cell line: A model to study normal and abnormal myelopoiesis

In vitro cell line model systems are essential in supporting the research community due to their low cost, uniform culturing conditions, homogeneous biological resources, and easy experimental design to study the cause and effect of a gene or a molecule when compared with primary cells. Human leukemia 60 (HL60) is an in-vitro hematopoietic model system that has been used for decades to study normal myeloid differentiation and leukemia biology. Studies from different groups show the different culturing conditions of HL60 cells based on American Type Culture Collection (ATCC) or European Collection of Authenticated Cell Cultures (ECACC) recommendations. Here, we show that IMDM supplemented with 20% FBS is an optimal culturing condition and induces effective myeloid differentiation compared with RPMI supplemented with 10% FBS when HL60 is induced with 1α,25-dihydroxyvitamin D3 (Vit D3) and all-trans retinoic acid (ATRA). The chromatin organization is compacted, and the repressive epigenetic mark H3K27me3 is enhanced upon HL60-mediated terminal differentiation. Differential gene expression analysis obtained from RNA sequencing in HL60 cells during myeloid differentiation showed the induction of pathways involved in epigenetic regulation, myeloid differentiation, and immune regulation. Using high-throughput transcriptomic data (GSE74246), we show the similarities (genes that did not satisfy $|log2FC|>1$ and $FDR<0.05$) and differences ($FDR <0.05$ and $|log2FC|>1$) between granulocyte-monocyte progenitor(GMP) vs HL60 cells, Vit D3 induced monocytes (vMono) in HL60 cells vs primary monocytes (pMono), and HL60 cells vs leukemic blasts at the transcriptomic level. We found

striking similarities in biological pathways between these comparisons, suggesting that the HL60 model system can be effectively used for studying myeloid differentiation and leukemic aberrations. The differences obtained

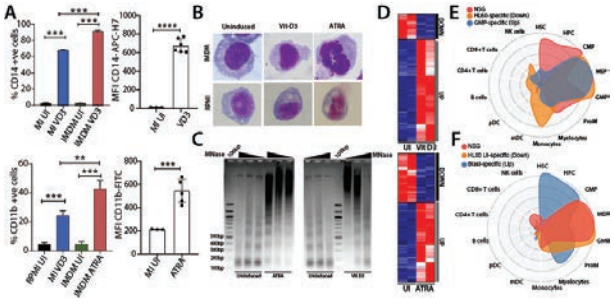


Figure 1: Overview of HL60 cell line as a potential model to study myelopoiesis. (A) FACS data of HL60 cells cultured in RPMI and IMDM shows different levels of CD11b and CD14 expression with maximal induction in IMDM conditions. (B) Representative May-Grünwald Giemsa-stained images of HL60-induced and uninduced cells show distinct nuclear morphology in HL60 cells cultured in IMDM condition. (C) Micrococcal nuclease assay showing rthe eduction in chromatin accessibility in HL60 cells indued with ATRA or Vit D3. (D) Differential gene expression profile of HL60 cells when induced with Vit D3 and ATRA compared with uninduced. (E-F) CellRadar image representing the overall relatedness between granulocyte-macrophage progenitors (GMP)-uninduced HL60 cells and primary AML blast-uninduced HL60.

could be attributed to the fact that the cellular programs of the leukemic cell line and primary cells are different. We validated several gene expression patterns for different comparisons with CD34+ cells derived from cord blood for myeloid differentiation and AML patients. In addition to the current knowledge, our study further reveals the significance of using HL60 cells as in vitro model system under optimal conditions to understand its potential as normal myeloid differentiation model as well as a leukemic model at the molecular level.

Long-read 16S rRNA sequencing reveals unique gut microbiota composition in hospitalized patients suffering from SARS-CoV2 infection

The COVID-19 pandemic, stemming from the SARS-CoV-2 viral infection has an unprecedented impact on global health. The SARS-CoV2 virus affects respiratory tract and often manifests with gastrointestinal symptoms, such as diarrhea, nausea, and vomiting. Recent studies reveal the significance of gut microbiota, which play a pivotal role in immune system homeostasis and gut-lung axis in COVID-19 patients. In this study, we investigated the composition of the gut microbiota in both hospitalized and non-hospitalized COVID-19 patients compared with normal healthy controls.

Using Oxford Nanopore technology, we sequenced full-length 16S rRNA gene for 26 hospitalized patients, 12 non-hospitalized patients, and 36 healthy individuals. We identified a total of 4446 operational taxonomic units (OTUs) and 1711 deferential OTUs in three groups (hospitalized patients, non-hospitalized patients, and healthy controls). Our analysis revealed significant alterations in the diversity of gut microbiota (alpha diversity) and a 79% variation in their composition (beta diversity). We observed significant dysbiosis (microbial imbalance) in the gut microbiota of hospitalized patients compared to non-hospitalized patients and healthy controls. This dysbiosis was characterized by an increased abundance of opportunistic pathogens commonly associated with SARS-CoV-2 infection. Interestingly, the gut microbiota of non-hospitalized patients and healthy controls were similar, dominated by Bacteroidetes and Firmicutes. We identified several opportunistic pathogens, including *Yersinia enterocolitica, Serratia marcescens, Bordetella parapertussis, Klebsiella pneumoniae,* and *Enterobacter cloacae*, which were highly abundant in the gut microbiota of COVID-19 hospitalized patients and correlated with the symptoms of COVID-19 patients. In conclusion, our study indicates that SARS-CoV-2 infection promote bacterial dysbiosis and growth of opportunistic pathogens in the gut microbiota of symptomatic COVID-19 patients. In contrast, asymptomatic patients' gut microbiota closely resembles that of healthy individuals. These findings suggest that the virulence of SARS-CoV-2 may contribute to the expansion of opportunistic pathogens in the gut microbiome, potentially leading to worse outcomes in COVID-19 patients.

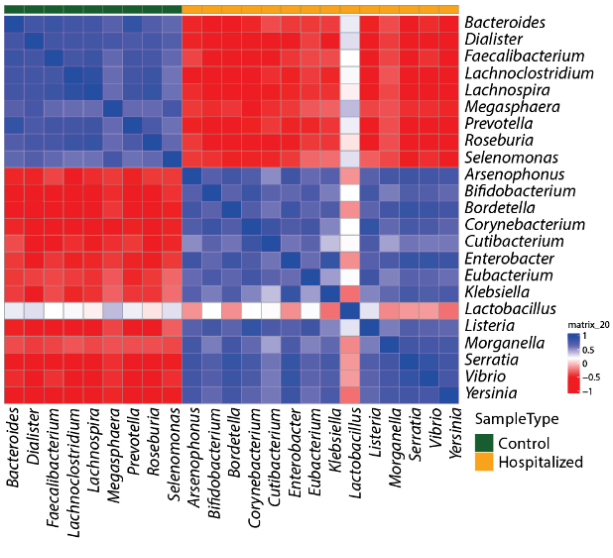


Figure 2: Differential OTUs in the gut of hospitalized COVID-19 patients compared with healthy controls.

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
9	0	0	1	2	0	1

Understanding the Molecular Mechanism behind Chemoresistance

Dr. Rupesh Dash
Scientist-E

Focus of the Lab:
Oral squamous cell cancer (OSCC) is the most prevalent cancer in India, with a mortality rate of approximately 86,000 per year. The conventional treatment modalities for advanced OSCC are surgery, followed by chemotherapy and radiotherapy. Cisplatin alone or in combination with 5FU (5-fluorouracil) and docetaxel (TPF) is the most commonly used chemotherapy regimen for OSCC. Chemoresistance is one of the important factors responsible for treatment failure in OSCC, which can culminate in continued tumor growth and metastasis. The causative factors responsible for chemoresistance are yet to be identified. The long-term objective of our group is to restore cell death in chemoresistant OSCC, and our immediate objective to identify the causative factors responsible for chemoresistance.

Collaborators:
- Dr. Ranjan Nanda, ICGEB, New Delhi
- Dr. Dulal Panda, IIT-Bombay, Mumbai
- Dr. Amaresh Chandra Panda, DBT-ILS, Bhubaneswar
- Dr. Mahesh Sultania, AIIMS, Bhubaneswar
- Dr. Saroj Das Mazumdar, AIIMS, Bhubaneswar
- Prof. S. NAGINI, Annamalai University, Chidambaram

SRFs:
- Sibashis Mohanty
- Shamima Ansari

JRFs:
- Abinash Behera
- Bidisha Sahoo
- Rohit Mishra

Laboratory Technician:
- Chinmay Rout

Research Activities:

CRISPR based kinome screening identified MINK1 as major player for 5FU resistance in OSCC Genesis of the study

Kinases, which transfer a reversible phosphate group to proteins, play important role in regulating several phenotypes of carcinogenesis including growth, proliferation, angiogenesis, metastasis and evasion of antitumor immune responses. However, previously their role in development of 5FU resistance in OSCC is hardly explored.

Past Research Leads: Using a CRISPR/Cas9 based kinome knockout screening, Misshapen-like kinase 1 (MINK1) is identified as an important mediator of 5FU resistance in OSCC. Analysis of clinical samples demonstrated significantly higher MINK1 expression in the tumor tissues of chemotherapy non-responder as compared to chemotherapy responders. The nude mice and zebrafish xenograft experiments indicate that knocking out MINK1 restores 5FU mediated cell death in chemoresistant OSCC.

Current Year Progress: An antibody-based phosphorylation array screen revealed MINK1 as a negative regulator of p53. Mechanistically, MINK1 modulates AKT phosphorylation at Ser 473, which enables p-MDM2 (Ser 166) mediated degradation of p53. We also have performed MINK1 kinase activity to screen potential small molecule inhibitors of MINK1. Our data suggests that lestaurtinib inhibits MINK1 activity in nanomolar range. Lestaurtinib successfully restores the 5FU sensitivity in 5FUistant 5FU resistant OSCC lines. Cell viability, spheroid assay and cell death data suggest that the selected sub lethal dose of lestaurtinib (50nM) can efficiently restore 5FU mediated cell death in chemoresistant OSCC lines. Enhanced expression of p-H2AX and cleaved PARP was observed only in combination group with lestaurtinib and 5FU indicating programmed cell death. Boyden chamber assays data suggests that combinatorial treatment of lestaurtinib and 5FU significantly reduces the relative number of migrated cells (data not shown). To check the in vivo efficacy of this novel combination, nude mice xenograft model was performed using patient derived cells (PDC2). The in vivo data suggest that the combination of lestaurtinib (20mg/kg) and 5FU (10mg/kg) profoundly reduced the tumor burden as compared to treatment with either of the single agents (Fig. 1A-C). Immunohistochemistry data suggest significant reduction in CD44 and Ki67 expression along with increased expression of cleaved caspase 3 in combination group (Fig. 1D).

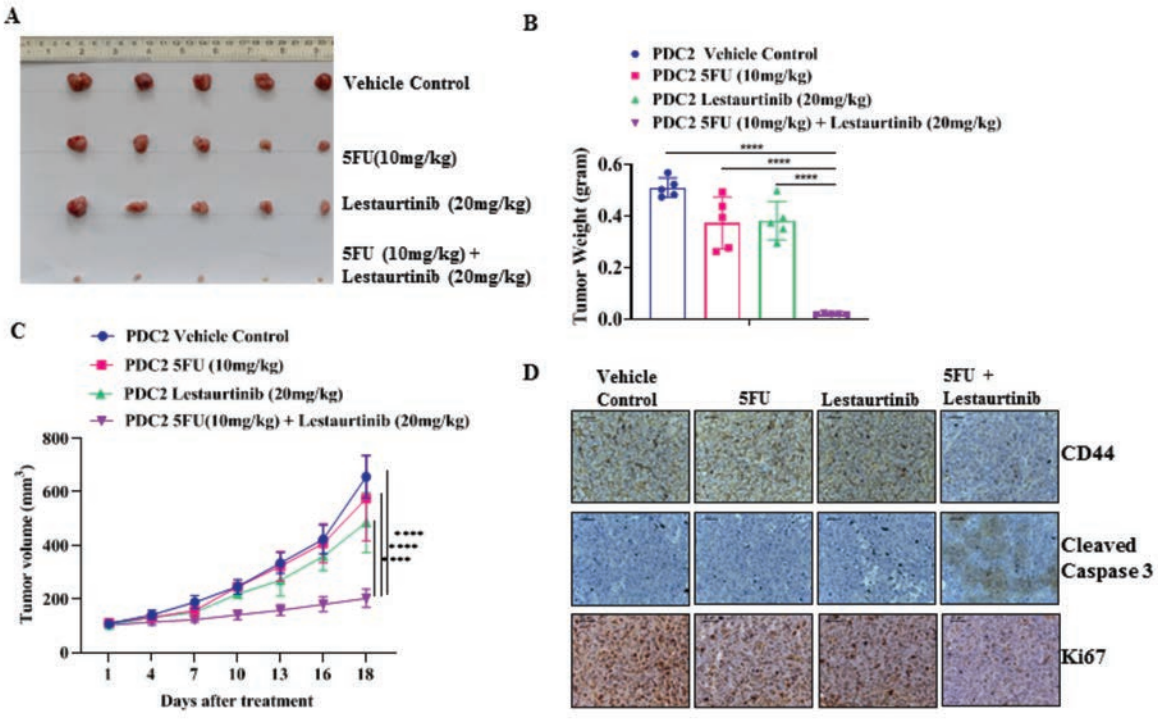


Figure 1: A) Patient-derived cells (PDC2) were earlier established from tumor of chemotherapy (TPF) non-responder patient. PDC2 were implanted in the right upper flank of athymic male nude mice, after which they were treated with 5FU and/or Lestaurtinib at indicated concentrations. At the end of the experiment mice were euthanized, and tumors were isolated and photographed (n = 5). B) Bar diagram indicates the tumor weight measured at the end of the experiment (mean ± SEM, n = 5). Two-way ANOVA. C) Tumor growth was measured at the indicated time points using digital slide caliper and plotted as a graph (mean ± SEM, n = 5). Two-way ANOVA. D) After completion of treatment, tumors were isolated, and paraffin-embedded sections were prepared as described in Methods to perform IHC with indicated antibodies.

Achievements in 2022-2023

Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
4	0	2	1	2	0	1

Breast Cancer Pathogenesis

Dr. Sandip K. Mishra
Scientist-F

Focus of the Lab:

Our lab focuses on Estrogen receptors and their families including Estrogen related receptors targeting the Breast cancer pathway. ER and ERRβ being the key factors in our research, we are working to explore their various targets and their impact on breast cancer. Besides, our lab also identified few downstream targets of ERRβ such as GPCR XEDAR and SIRT1 which have their vital roles in Breast cancer. In the current report we have briefly mentioned about two of the genes; XEDAR and SIRT 1 and their significance in Breast cancer.

Research Activities:

ERR beta mediated regulation of XEDAR in Breast Cancer

XEDAR is able to cause cell death in a caspase-8-dependent and FADD-dependent way even though it lacks a death domain. XEDAR may be controlled by ERRβ, a gene that also functions as a tumour suppressor, based on our hypothesis that it can cause cell death.

In this study, we established that XEDAR is an ERRβ downstream target. The expression of XEDAR is directly controlled by ERRβ. Similarly, through controlling the epithelial-mesenchymal transition (EMT) pathway, XEDAR overexpression reduced the capacity of MCF7 cells to migrate and invade both in vitro and in a zebra fish model. Overall, our research showed that ERRβ interfere with breast cancer cell ability to proliferate and spread through the regulation of XEDAR and modification of EMT.

By hindering the production of XEDAR and, in turn, the process of EMT, ERRβ may prevent the oncogenesis and metastasis of breast cancer cells. This information may be crucial in identifying potential targets for the treatment of breast cancer.

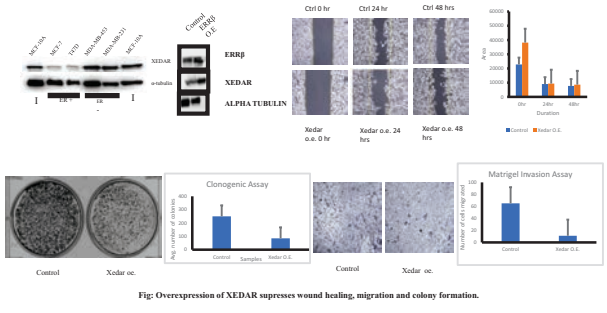


Fig: Overexpression of XEDAR supresses wound healing, migration and colony formation.

Figure 1: Overexpression of XEDAR leads to decreased migration and colony formation

Collaborators:

- Prof. Eric W.F. Lam, Imperial College of London, UK
- Prof. Gopal Kundu, KIIT University, Bhubaneswar
- Dr. Amit Kumar Adhya, AIIMS, Bhubaneswar
- Dr. A.K. Rath, Hemlata Hospital, Bhubaneswar
- Prof. Dillip Parida, AIIMS, Bhubaneswar
- Dr. Manwar Ali, AIIMS, Bhubaneswar
- Dr. Anshuman Dixit, DBT-ILS, Bhubaneswar
- Dr. Umakant Subudhi, CSIR-IIMT, Bhubaneswar

SRFs:

- Surya Prakash
- Monalisa Parija
- Sanghamitra Dash

JRFs:

- Pritish Rout
- Rakesh Pradhan
- G Kumari

Laboratory Technician:

- Shashi Bhusana Sahoo

ERR beta mediated regulation of SIRT1 in Breast Cancer

We studied the role of SIRT1 in breast cancer proliferation, migration and colony formation. In the present study, we showed that upon the inhibition of SIRT1, the migration is significantly reduced and it is also evident with our results that SIRT1 inhibitors inhibit cell proliferation in breast cancer cells. The colony formation ability of breast cancer cells also reduced in the presence of SIRT1 inhibitors. These results collectively suggest the tumor activator role of SIRT1 in breast cancer cells. Our results were in agreement with the previous studies that SIRT1 is a tumor activator. Therefore, our study suggests that SIRT1 is an oncogene in breast cancer and SIRT1 inhibitors can be considered as therapeutic drugs for the treatment of breast cancer.

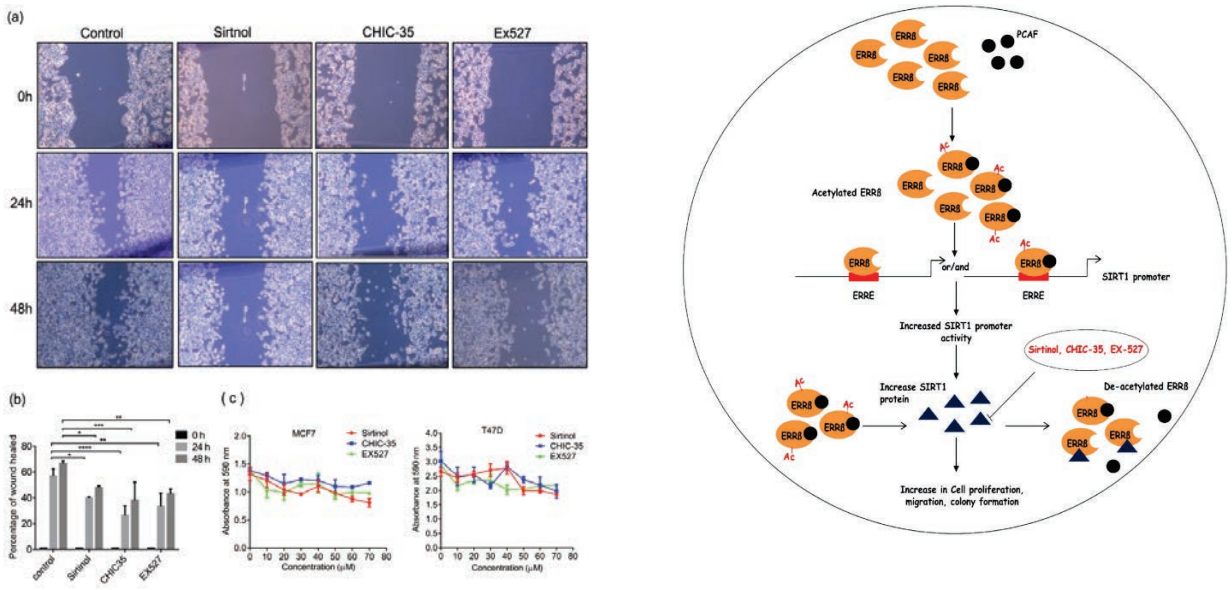


Figure 2. Effect of SIRT1 inhibitors on migration and proliferation of breast cancer cells

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
1	0	2	0	4	0	6

Nanomedicine for Targeting Cancer

Dr. Sanjeeb K. Sahoo
Scientist-F

Focus of the Lab:

Current cancer therapies are effective in inhibiting bulk tumor growth. But are unable to address the key problem of metastasis and relapse which can be attributed to two major factors; Cancer Stem Cells (CSCs) and tumor microenvironment. Recently, phytochemicals are becoming increasingly popular for their "privileged scaffolds" which renders them to interact and target several oncogenic pathways simultaneously. But phytochemicals have poor pharmacokinetics that limits its application. Nanotechnology with its unique physicochemical properties can help to resolve the above problem. So, our group is mostly engaged in development of novel phytochemical based nanomedicine (phytonanomedicine) for targeting cancer through inhibiting CSCs and modulating TME.

Collaborators:

- Dr. Rupesh Dash, DBT-ILS, Bhubaneswar
- Dr. Rajeeb Kumar Swain, DBT-ILS, Bhubaneswar
- Dr. Punit Prasad, DBT-ILS, Bhubaneswar
- Dr. Shantibhusan Senapati, DBT-ILS, Bhubaneswar
- Dr. Sunil K Raghav, DBT-ILS, Bhubaneswar

SRFs:

- Priyanka Mohapatra
- Pratikshya Sa
- Auromira Khuntia
- Sneha Dutta
- Sonali Sahoo

Research Associate:

- Dr. Shashank Shekhar Swain

Laboratory Technician:

- Somalisa Behera
- Sunita Nayak

Research Activities:

Piperlongumine based nanomedicine impairs glycolytic metabolism in triple negative breast cancer stem cells through modulation of GAPDH &FBP1

Triple-negative breast cancer (TNBC) is an aggressive disease that exhibits a higher rate of chemoresistance, metastasis, and relapse compared with other subtypes of breast cancer. Accumulating evidences suggests that TNBC has higher population of Cancer Stem cells (CSCs) in comparison to non-TNBC subtypes which is responsible for treatment failure in breast cancer. Therefore, it is important to understand the mechanism behind poor prognosis in TNBC to develop effective therapies. Several studies demonstrate that CSCs associated with breast cancer are also highly glycolytic and their metabolic reprogramming helps them in maintaining self-renewability, stemness and chemoresistance. In this context, we explored a phytochemical Piperlongumine (PL) which is isolated from roots of long pepper (Piper longum L.) and has been reported to have potent anti-cancer effects. But in spite of its potent activity, clinical translation is impeded due to poor pharmacokinetics which results in lower accumulation at tumor site. Hence, to enhance its biological activity, we have developed PL loaded poly (lactic-co-glycolic acid) nanoparticles (PL-NPs) and investigated the effect of PL on glycolytic metabolism of CSCs and inhibiting overall tumor progression. In this study, we hypothesized that PL can inhibit self-renewability, metastasis, in TNBC by inhibiting glycolytic metabolism through modulation of GAPDH &FBP1. From in vitro results it was observed that both PL and PL-NPs exhibits anti-CSCs effect by efficiently inhibiting glycolysis in CSCs through directly targeting glycolytic gene GAPDH and upregulating negative regulator of glycolysis FBP1. The results were better than that the established glycolytic inhibitor 2-Deoxy-D-glucose (2-DG) with PL-NPs showing better effect.

Further, in in vivo studies we explored the overall effect of PL and PL-NPs on TNBC in two different preclinical models, zebrafish, and nude mice xenograft models and it was observed that PL-NPs showed better anti-tumor effect in both the xenograft model in comparison to native PL. In summary, the results of our study demonstrate that PL inhibits glycolysis in CSCs through inhibition of GAPDH and upregulation of FBP1 and PL based nanomedicine significantly enhances the inhibition of glycolysis resulting in overall tumor regression in zebrafish and orthotropic nude mice xenograft models.

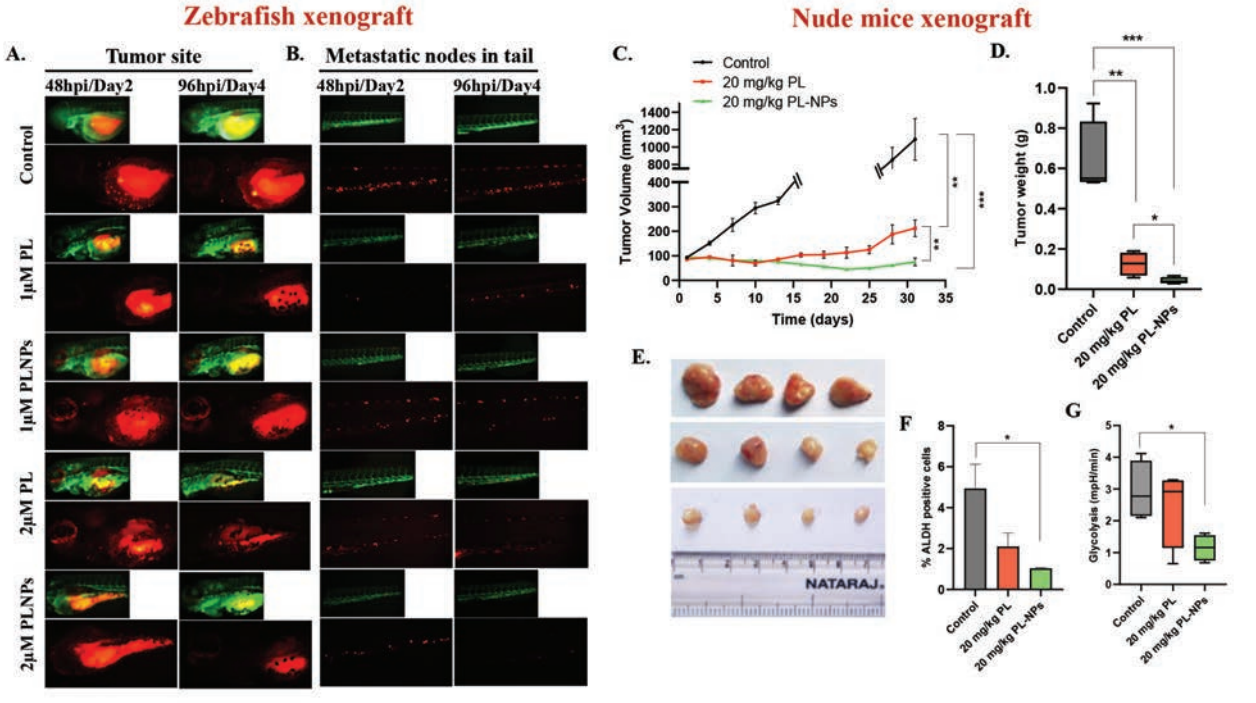


Figure 1. Anti-tumor efficacy of PL-NPs in zebrafish xenograft and orthotropic nude mice model. A, Tumor growth was assessed by fluorescence measurement on 4dpi compared with 2dpi of the subsequent treatment groups. B, Metastatic potential was assessed by measurement of number of metastatic cell clusters in tail region at 4dpi compared with 2dpi of the subsequent group. Quantification was preformed using ImageJ software (n=16; data as mean ± SD). C, Tumor growth curve from day 0 to 31 days (n=4; data as mean± SEM). D&E, Average tumor weight and representative image of tumor at experimental endpoint respectively (n=4; data as mean± SEM). F, Aldefluor assay for ALDH activity in dissociated tumor cells retrieved after digesting tumors from treated xenografts (n=3; data as mean± SEM). G, Measurement of glycolysis in dissociated tumor cells of treated xenografts (n=3; data as mean ± SEM) **P < 0.01 and ***P <0.001, indicates statistically significant difference.

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
6	0	2	1	7	1	1

Tumour Microenvironment and Animal Models

Dr. Shantibhusan Senapati
Scientist-E

Focus of the Lab:

Different components of the tumour microenvironment (TME) play major roles in cancer progression, regulation of which controls therapeutic outcomes. Our lab has two major focus areas: (1) to understand the crosstalk between pancreatic cancer cells and other cancer-associated normal cells such as fibroblasts and immune cells; (2) to analyse the effect of microbes on progression and/or response to conventional therapies of different cancers. In addition to our core research on cancer biology, our group is also involved in the institutional flagship program on "tribal health and nutrition". In this project, our group is involved in isolation, characterisation, and use of novel probiotic strains. The COVID-19 pandemic has created a devastating public health problem around the world. To combat this disease the whole scientific community has come forward to use their expertise. In this scenario, along with other ILS scientists, my group is participating in various COVID-19-related research studies. In particular, my group is involved in the establishment and use of SARS-CoV2 animal challenge models.

Collaborators:

- Dr. Prakash K Sasmal, AIIMS, Bhubaneswar
- Dr. Anasuya Roychowdhury, IIT, Bhubaneswar
- Dr. Taruna Madan Gupta, ICMR-NIRRH, Mumbai
- Dr. Punit Prasad, DBT-ILS, Bhubaneswar
- Dr. B. Ravindran, DBT-ILS, Bhubaneswar

SRFs:

- Debasish Mohapatra
- V Suresh
- Aliva Minz
- Manisha Sethi
- Deepti Parida

JRFs:

- Swayambara Mishra
- Amlan Priyadarshee Mohapatra
- Salona Kar

Research Associate:

- Dr. Amruta Mohapatra

Laboratory Technician:

- Madan Mohan Mallick

Research Activities:

Whole genome mining and characterization of a probiotic strain- Levilactobacillus brevis ILSH3 from Handia: A tribal fermented beverage of Odisha, India

Isolating novel probiotic strains from different traditional fermented foods has aided many useful probiotic strains to this field. In this context, the current study aimed to characterize one of the bacterial isolates isolated from a tribal fermented beverage of Odisha- Handia. Its probiotic attributes, antimicrobial property, immunomodulatory property were investigated by in vitro studies as well as LC-MS was done to study the presence of presumptive metabolites in its CFS. Whole genome sequencing was done for its molecular identification and investigation of probiotic potential. The results of in vitro studies as per ICMR-DBT guidelines indicated the presence of probiotic properties – tolerance to acid and bile, antimicrobial property, BSH activity, and pathogen exclusion ability in H3 organism. The whole genome analysis identified H3 as L brevis ILSH3 further supporting its safety and probiotic potential. The detection of metabolites such as- lactic acid, homoserine having antimicrobial and immunomodulatory property and betaine having protective effect against liver injury, supported its probiotic potency. Collectively all the results indicated that L brevis ILSH3 has the potency to be used as a potential probiotic and hence it can be further explored in detail against different diseases to support its use in health sector in future.

Elucidating the molecular, cellular and functional heterogeneity in normal and malignant pancreatic fibroblast cells

Presence of excessive extracellular matrix and stromal cells is a hallmark feature of Pancreatic Ductal Adenocarcinoma (PDAC). Cancer associated fibroblasts (CAFs) constitute a significant mass of the PDAC stroma and they contribute mainly to the stromal fibrosis. In recent times, with the advent of high-end technology and with deeper insights into CAF biology, different subtypes of CAFs in PDAC are recognized and the CAF is also acknowledged for its significant contribution in determining the tumor progression, disease severity, immune evasion, and therapy outcomes. Although up to some extent the heterogeneity of CAFs in human and mice PDAC have been identified, but the origin of

different CAF subtypes and their function in tumor microenvironment (TME) is yet to be elucidated in detail. To this extent, we have hypothesized that, "the CAF heterogeneity may arise from the heterogeneity already underlying the normal pancreatic fibroblasts (PFs) and certain types of CAFs might significantly confer tumorigenic and/or metastatic and/or therapy refractory properties to pancreatic cancer cells than others". To address this hypothesis, initially we have adapted a novel method to enrich mouse pancreatic fibroblast cells and conducted single cell analysis of these cells to understand the heterogeneity in normal mouse pancreas located at different anatomical locations (lobes). Our ongoing and future studies by using cells and organoids isolated from spontaneous mouse pancreatic tumours and human PDAC patients will help us in validating our preliminary findings and dissect the molecular and cellular mechanisms associated with this event.

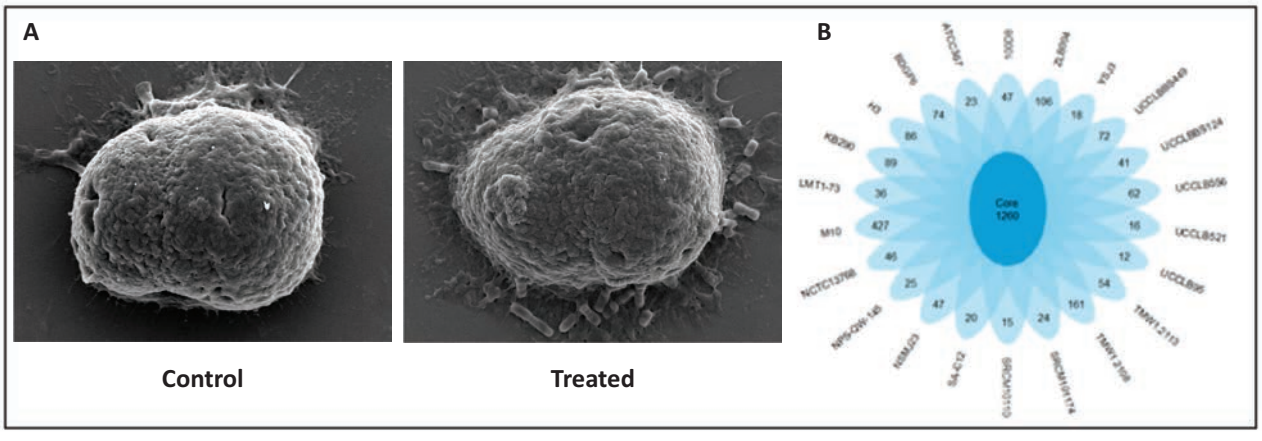


Figure 1. : (A) SEM image of only Caco2 cell (control) and L brevis ILSH3 adhered to Caco2 cells. (B) Pan genome analysis showed presence of 86 unique genes in L brevis ILSH3 genome

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
9	1	4	2	6	0	2

Leukemia Research

Dr. Soumen Chakraborty
Scientist-F

Focus of the Lab:

My laboratory works on the molecular aspects of hematological malignancies, emphasizing Chronic Myeloid Leukemia (CML) and Acute Myeloid Leukemia (AML). We aim to understand the role of miRNAs, RNA-binding proteins, and oncogenes, known or novel, in the progression of the disease. As CML is a perfect model for studying leukemia-initiating cells, we also attempt to understand the molecular mechanisms that distinguish CML stem cells from normal hematopoietic stem cells. We also aim to understand the consequences of cellular mechanisms potentiated by the post-translational modifications (phosphorylation, acetylation, and sumoylation) of the proto-oncogene, Ecotropic Viral Integration Site I (EVI1) in solid tumor/leukemia and stem cells. The research findings will lead to the development of biomarkers and targeted molecular therapies that will help detect and eliminate the disease before it leads to progression.

Collaborators:

- Dr. N.C. Pattnayak, Lab Care and Diagnostics, Cuttack
- Dr. G. Biswas, Sparsh Hospital and Critical Care, Bhubaneswar
- Dr. S. Biswas, Sparsh Hospital and Critical Care, Bhubaneswar
- Dr. S. Mohapatra, AIIMS, Bhubaneswar
- Dr. A. Panigrahi, AIIMS, Bhubaneswar

SRFs:

- Bibhudev Barik
- Sayantan Chanda
- Shristi Lama

Lab attendant:

- Raghunath Patra

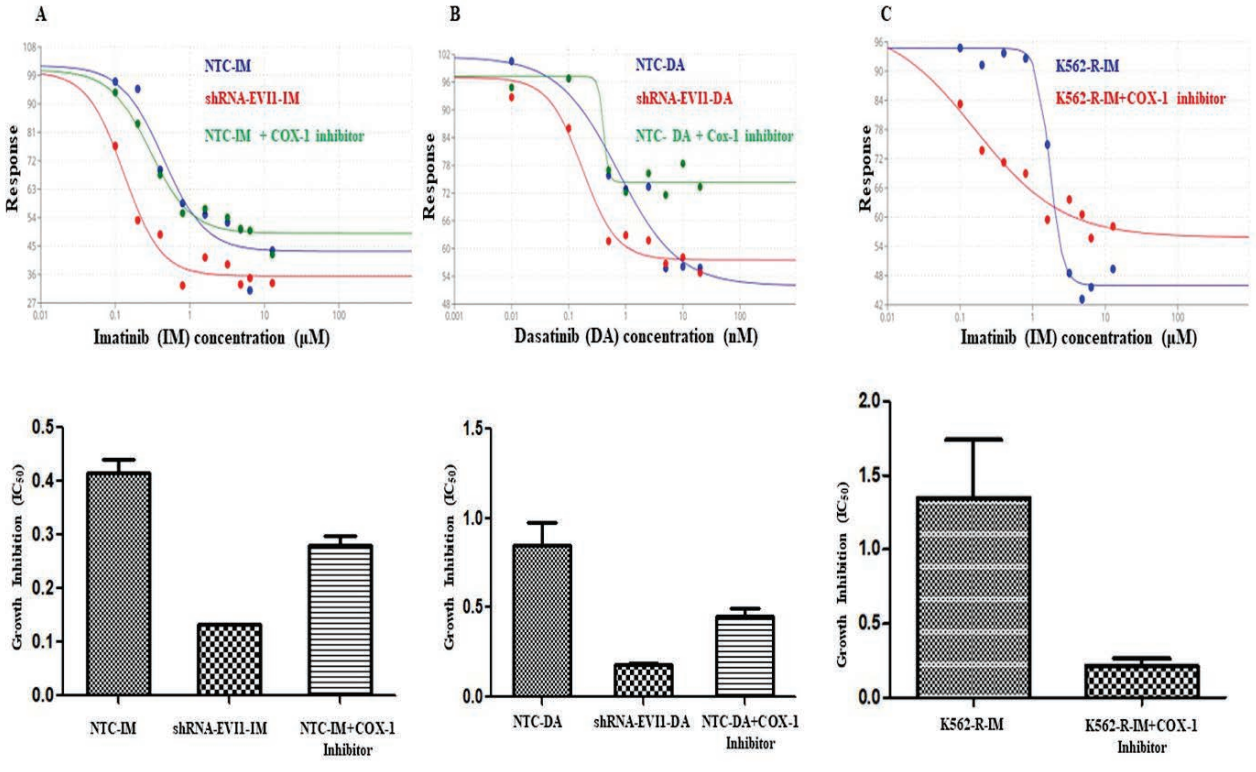
Research Activities:

PTGS1 (COX-1) inhibitor enhances the effect of imatinib and dasatinib on CML cells

Earlier, we reported that EVI1 upregulates the drug-metabolizing gene PTGS1 (Cox-1) and knockdown of EVI1 from CML K562 cells exhibited a lower IC50 value compared to the wild-type K562 when treated with imatinib or dasatinib. FR122047, a cell-permeable trisubstituted thiazole compound that acts as a potent and selective inhibitor of Cox-1 (PTGS1), is reportedly orally active and displays analgesic properties in animal models. Control shRNA K562 and EVI1 knockdown K562 cells were treated with various concentrations of imatinib along with (0.01 µM) or without (DMSO control) Cox-1 inhibitor. K562 cells treated with both imatinib and Cox-1 inhibitor showed an IC50 of 0.2796±0.02432 µM, whereas treatment with only imatinib showed a higher IC50 of 0.4160±0.03536 µM. Thus, the IC50 value of K562 cells treated with imatinib and Cox-1 inhibitor is almost identical to when EVI1 knocked down K562 cells were treated with imatinib (Fig. 4A). We observed a somewhat similar effect when dasatinib was used. K562 cells treated with dasatinib and Cox-1 inhibitor had an IC50 of 0.4518±0.6404 nM, whereas treatment with dasatinib alone showed almost a double IC50 value of 0.8525±0.1698 nM. The IC50 value of EVI1 knockdown shRNA K562 cells with dasatinib was found to be 0.1811±0.01032 nM (Fig. 4B). Furthermore, on treating K562 resistant (K562-R) cells with 0.01 µM of Cox-1 inhibitor along with imatinib showed an IC50 of 0.2130±0.07227 µM, which was about six-fold lesser than the IC50 (1.350±0.5514 µM) of K562-R cells treated with only imatinib (Fig. 4C). Thus, targeting two alternate signaling pathways may benefit CML cases expressing a high level of EVI1.

Cloning, sequencing, and expression of a splice variant of Myocyte Enhancer Factor 2C (MEF2C) in CML

MEF2C cDNA from CML cell lines (~1302bp and ~1292bp in KCL22 and K562, respectively) and archived chronic/blast phase patient samples were amplified with specific primers, and the PCR products were cloned in p-GEMT cloning vectors. The colonies were sequenced and aligned with respect to the reference sequence of MEF2C. The positive clones with two variants (β and γ domain deletion) were observed in K562 cells and a nine-base-pair GGTAACACA deletion at exon four from KCL22 cells. Some patient samples also showed the nine-base pair deletion. However, sequencing of the MEF2C genomic region from the cell lines and patient samples showed the presence of 9 bases. The role of the spliced variant warrants further investigation.



Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
2	0	2	0	2	0	1

PLANT AND MICROBIAL BIOTECHNOLOGY

Plant and Microbial Biotechnology

Dr. Namisha Sharma	Plant Virology
Dr. Nrisingha Dey	Plant Molecular Biology and Gene Regulation
Dr. Seema Pradhan	Plant Genomics and Abiotic Stress Response
Dr. Sourav Das	Microbial Predator-Prey Interaction
Dr. Subrata K Das	Microbial Genomics

Plant Virology Lab

Dr. Namisha Sharma
Scientist-B

Focus of the Lab:
In our lab, we focus on generating virus resistance in important crop plants of India. The main aim is to investigate the interactions among the plant-viral proteins and target these interactions for the discovery of novel regulatory module(s). Further, the role of miRNAs and lncRNAs-mediated regulation of epigenetic modifications in their corresponding targets during virus infection is also being explored. This involves developing molecular markers and standardization of gene editing methods in important crop plants.

Collaborators:
- Dr. Nrisingha Dey, ILS, Bhubaneswar
- Dr. Sanjeeb Sahoo, ILS, Bhubaneswar
- Dr. Soma Chattopadhyay, ILS, Bhubaneswar
- Dr. Seema Pradhan, ILS, Bhubaneswar

Laboratory Technician:
- Sanjeeb Dhir

Research Activities:

Elucidating the miRNA-encoded peptide-mediated regulation of miR159 during Tomato leaf curl New Delhi virus infection in tomato

Tomato is an economically important vegetable crop as it is a rich source of vitamins, minerals, and antioxidants. However, its yield is highly governed by several environmental factors, with both abiotic and biotic components. Tomato leaf curl disease (ToLCD) is one of the most destructive diseases of tomato and can lead to severe yield losses of up to 100% if infected in the young plant. The causative organism of this disease is Tomato leaf curl New Delhi virus (ToLCNDV). Previously, it has been shown that during ToLCNDV infection a naturally tolerant tomato cultivar (cv., H-88-78-1) generates a relatively enhanced level of small RNAs in comparison to a naturally susceptible cultivar (Punjab Chhuhara). In plants, microRNAs (miRNAs) are known to be involved in several biotic and abiotic crosstalk including plant developmental pathways. Recently, the miR159-Myb33 module was found to activate Sw5a, a resistance gene that recognizes the viral AC4 protein of ToLCNDV to trigger a hypersensitive response, thereby restricting the virus spread (Sharma et al., 2021). However, transcriptional regulation of this miRNA is not experimentally established yet.

Apart from producing miRNAs, recent studies have shown that the pri-miRNA contains short open reading frames (ORFs) located at the 5' upstream region of pre-miRNA that encode short regulatory peptides called miRpeps. These miRNA-encoded peptides have a positive role in enhancing the transcription of corresponding pri-miRNAs, which subsequently amplify the expression of the specific mature miRNAs. It has been hypothesized that these miRpeps might act directly or indirectly as trans-acting factors to activate the expression of MIR genes. However, there is no study regarding the roles of miRpeps during biotic stress in plants.In our study, we found that primary miR159 encodes a peptide namely, miRpep159. Firstly, the upstream region of pre-miR159 was analyzed using ORFinder, and 5 possible transcription initiation sites were predicted. Further, to determine which of the putative ORFs is functional, the overexpression constructs of each ORF with a GUS reporter gene along with the promoter region were designed and overexpressed transiently in Nicotiana leaves. The GUS assay provided a clue that ORF3 is an active ORF and might be regulating the expression of miR159. Further, the GUS assay was performed using ORF3 in the absence and presence of ToLCNDV. The GUS staining was enhanced in the presence of ToLCNDV thus validating that ToLCNDV infection enhances the expression of ORF3 which might upregulate the expression of miR159 upon ToLCNDV infection.

As miRpeps alter the expression and accumulation of mature miRNAs, it is possible that the application of putative miRpep159 might affect the expression of miRNA159 and consequently, the associated phenotype of ToLCNDV infection. Thus, a solution of a synthetic peptide of miRpep3 was exogenously applied to tomato plants (0.1 to 0.25µM), then the plants were checked for the relative expression of miRNA159 in the presence and absence of miRpep3 under control as well as ToLCNDV infected conditions. Further, the phenotype of ToLCNDV infection in plants upon application with putative miRpep3 was analyzed. We found that in the presence of miRpep3, the expression of miR159 was enhanced. Further, miRpep2 was used as negative control and no

expression variation in miR159 was found in plants treated with miRpep2. Thus, validating that miRpep3 regulates the expression of miR159. In the future, silencing of this miRpep using virus-induced gene silencing will be carried out. Further, genome-edited lines will be generated against this peptide which might have enhanced resistance against virus.

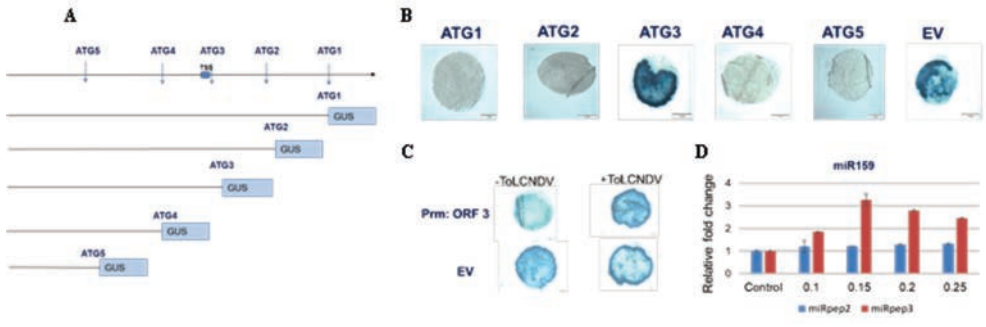


Figure 1: miRNA encoded peptide regulated the expression of miR159. A, ORF finder predicted 5 ORFs within the 1kb upstream region of pre-miRNA159. B, in-fusion expression of the GUS reporter gene with the upstream promoter region of predicted ORFs was analysed in Nicotiana benthamiana leaves. The histochemical GUS staining showed that the construct carrying ORF3 of 42bp was active in planta. C, the GUS staining was higher when ORF3 was infiltrated along with ToLCNDV. D, Expression profile of miR159 in tomato plants treated with synthetic peptide of miPEP3 (0.1 to 0.25µM).

Achievements in 2022-2023

Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
0	0	1	0	2	1	4

Plant Molecular Biology and Gene Regulation

Dr. Nrisingha Dey
Scientist-F

Focus of the Lab:

Our lab has successfully developed a new synthetic promoter from the newly characterized sub-genomic transcript (Sgt) promoter of the Horseradish Latent Virus (HRLV). This promoter named FHS4 is efficient in driving a high level of genes when expressed both in transient and transgenic plant system and have the potential to be an important biotechnological commodity. Alongside we have accomplished the genome-wide identification of the MYB transcription factors family in pearl millet (*Pennisetum glaucum*). 279 PgMYB genes found are identified in pearl millet. Functional analysis of selected PgMyb was done under different stress conditions along with functional characterization being our future aspect.

Collaborators:

- Dr. Anshuman K. Dixit, ILS, Bhubaneswar
- Dr. Mrunmay K. Giri, KIIT, Bhubaneswar

SRFs:

- Jeky Chanwala
- Soumya Shree Nayak
- Tsheten Sherpa
- Sandhya Suranjika
- Khushbu Kumari

JRFs:

- Deepak Jha
- Priti Barla

Research Associate:

- Dr. Nalini Singh

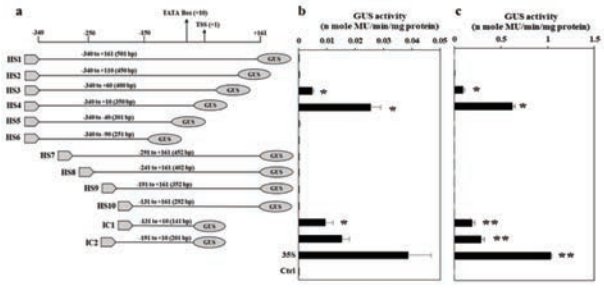
Laboratory Technician:

- Abhimanyu Das
- Rahim Kumar Nayak

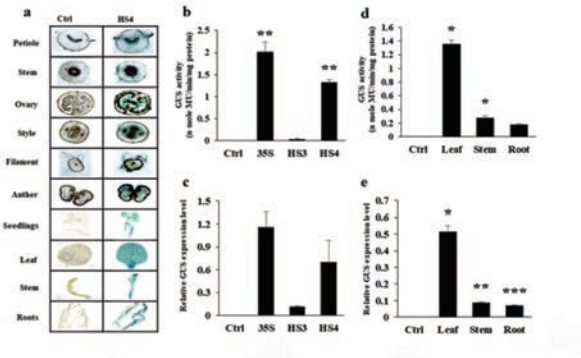
Research Activities:

Synthetic sub-genomic transcript promoter from Horseradish Latent Virus (HRLV)

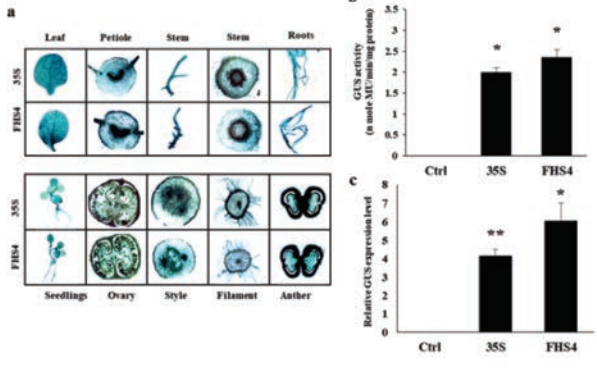
Plant pararetroviruses are a rich source of novel plant promoters widely used for biotechnological applications. Here, we comprehensively characterized a unique sub-genomic transcript (Sgt) promoter of Horseradish Latent Virus (HRLV) and identified a fragment (HS4; -340 to +10; 351bp) that showed the highest expression of reporter genes in both transient and transgenic assays as evidenced by biochemical, histochemical GUS reporter assay and transcript analysis of uidA gene by qRT-PCR. Phylogenetic analysis showed that the HSgt promoter was closely related to the sub-genomic promoter of the Cauliflower Mosaic Virus (CaMV19S). We found that the as-1 element and W-box played an important role in the transcriptional activity of the HS4 promoter. Furthermore, the HS4 promoter was also induced by salicylic acid. Alongside, we enhanced the activity of the



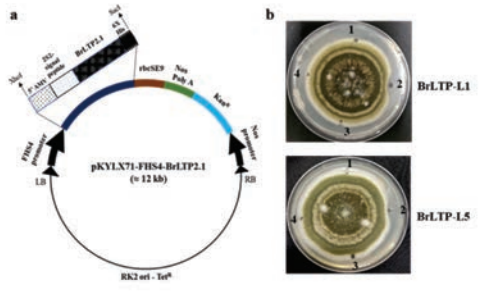
Deletion analysis of HRLV-Sgt promoter sequence



Transgenic analysis of HS4 promoter in *Nicotiana tabacum*



Transgenic analysis of FHS4 promoter in *Nicotiana tabacum*

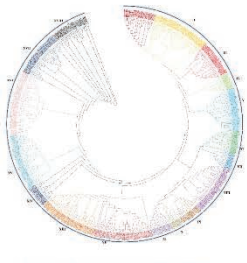


Antifungal assay against *Alternaria alternata* of BrLTP2.1 anti-microbial peptide driven by FHS4 promoter

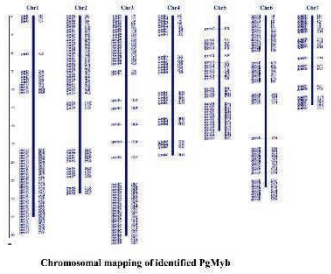
HS4 promoter by coupling the enhancer region from Figwort Mosaic Virus (FMV) promoter to the upstream region of it. This hybrid promoter FHS4 was around 1.1 times stronger than the most commonly used promoter, 35S (Cauliflower Mosaic Virus full-length transcript promoter), and was efficient in driving reporter genes in both dicot and monocot plants. Subsequently, transgenic tobacco plants expressing an anti-microbial peptide BrLTP2.1 (Brassica rapa lipid transport protein 2.1), under the control of the FHS4 promoter, were developed. The in vitro anti-fungal assay revealed that the plant-derived BrLTP2.1 protein driven by an FHS4 promoter manifested increased resistance against an important plant fungal pathogen, Alternaria alternata. Finally, we concluded that the FHS4 promoter can be used as an alternative to the 35S promoter and has a high potential to become an efficient tool in plant biotechnology.

Functional analysis of transcription factor families in pearl millet (Pennisetum Glaucum)

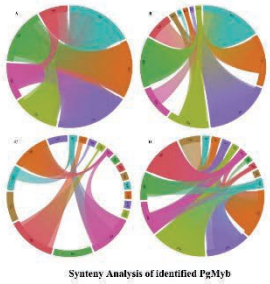
Pearl millet is an important C4 cereal plant that possesses an enormous ability to survive under extreme climatic conditions. It is nutritionally enriched and also naturally tolerant to drought and heat. However, climate change and other stresses limit plant growth and crop productivity. During the past decade, there has been substantial progress in identifying several TF family members that play an important role in growth, development as well as in stress responses. The significant role of TF members belonging to WRKY, MYB, bZIP, and NAC families has been established under diverse environmental stresses. Phytohormones such as ABA, SA, MeJA, and GA play a pivotal role in strengthening plant defense responses against biotic and abiotic stresses. Owing to their importance, we performed genome-wide screening and mined 97 WRKY, 155 NAC, 57 GRAS, and 279 MYB TFs in pearl millet. In-silico analysis revealed the presence of stress-specific cis-regulatory elements and conserved motifs. The relative expression analysis of candidate MYB TFs showed their probable involvement in the abiotic stress responses of pearl millet. PgMYB2, PgMYB88, and PgMYB263 were upregulated under dehydration, salinity, and heat stress. Similarly, the transcript accumulation of PgMYB9 and PgMYB151 was reduced under abiotic stress treatments. The differential expression profile of PgMYBs upon exogenous phytohormone treatments indicated a possible involvement of PgMYBs in phytohormone stress signaling for inferring plants' tolerance. Furthermore, candidate genes were selected for functional characterization and identification of their downstream signal transduction pathways to delineate their role in the natural adaption of pearl millet. In addition, the characterized genes can be used for advanced molecular breeding and genome editing to improve the characteristics of millet.



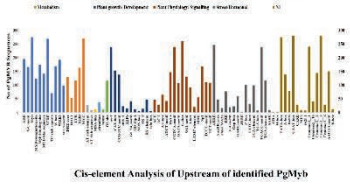
Phylogenetic Analysis of identified PgMyb



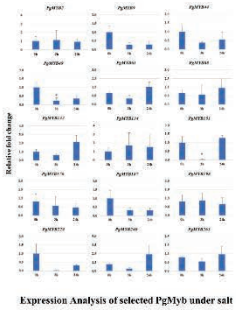
Chromosomal mapping of identified PgMyb



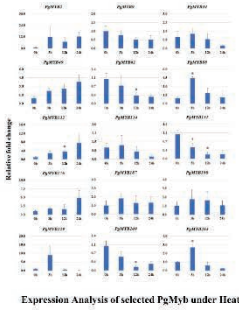
Synteny Analysis of identified PgMyb



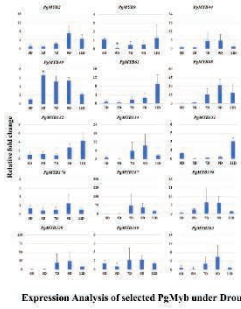
Cis-element Analysis of Upstream of identified PgMyb



Expression Analysis of selected PgMyb under salt



Expression Analysis of selected PgMyb under Heat



Expression Analysis of selected PgMyb under Drought

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
3	0	1	1	0	0	0

Plant Genomics and Abiotic Stress Response

Dr. Seema Pradhan
Scientist-C

Focus of the Lab:
Our lab works on deciphering the molecular networks that regulate plants' response to adverse climatic conditions. We have the following broad objectives in this area:

- Role of plant-unique transcription factors in drought and salinity stress tolerance in susceptible legumes
- Non-coding elements that could influence plants' response to abiotic stresses
- Application of molecular markers like SSRs and SNPs for QTL mapping and subsequent crop improvement
- Applying an integrated "omics" approach to identify the molecular mechanism of abiotic stress response in plants
- Establishment of a gene/genome editing platform for functional applications in plant system
- To develop climate-resilient crops

Collaborators:

- Dr. Nrisingha Dey, ILS Bhubaneswar
- Dr. Soma Chattopadhyay, ILS, Bhubaneswar
- Dr. Sunil K Raghav, ILS, Bhubaneswar
- Dr. Namisha Sharma, ILS, Bhubaneswar

JRF:

- Samiksha Behera

Laboratory Technician:

- Biswajit Parida

Research Activities:

Genomics of Moth bean, a drought tolerant legume crop

Genesis: Moth bean (*Vigna aconitifolia*) is an underutilized legume crop in India. Unlike many other legumes, moth bean is especially resistant to drought stress and is an ideal crop for an arid environment. Therefore, we were interested in understanding the genomic basis that imparts such properties to the plant.

Past research leads: There are studies where researchers have screened the varieties of moth bean for beneficial agronomic traits. They have identified accessions that are YMV-resistant and drought-tolerant. However, there are no reports of gene expression profiles or whole genome assembly in this plant.

Current Year Progress: We have assembled the whole genome of Vigna aconitifolia var. RMO-435 using long reads generated on the PacBio Sequel platform and paired-end HiC reads generated on the NovaSeq platform. The primary assembly with hifiasm gave us 447 contigs which were scaffolded into 340 scaffolds after integrating the HiC reads. The assembly comprised of 409 Mb genome sequence, with an N50 of 30Mb. Quality assessment with BUSCO showed the assembly to be of good quality (Fig 1). We annotated the genome to predict more than 30,000 genes, which were used as a reference to generate a gene expression profile for various tissues of moth bean (Fig 2).

Future Plans: RNA-Seq will be used to generate a gene expression profile for moth bean in response to drought stress and characterize genes for their role in such response. We will also re-sequence a selected panel of accessions of Vigna sp. to identify valuable SNPs to be developed as molecular markers for marker-assisted selection

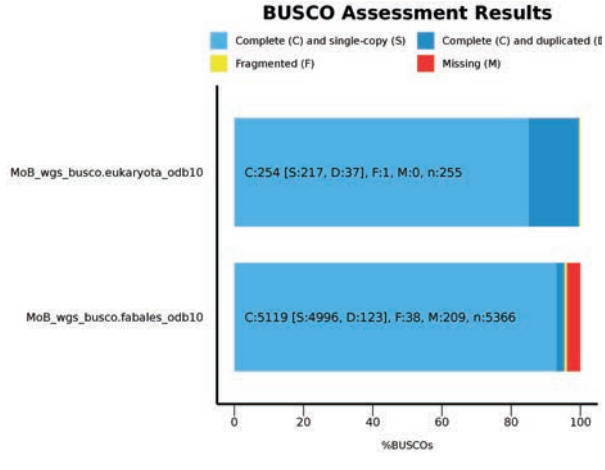


Figure 1: BUSCO assessment of genome assembly with eukaryota and fabales databases (MoB= Moth Bean)

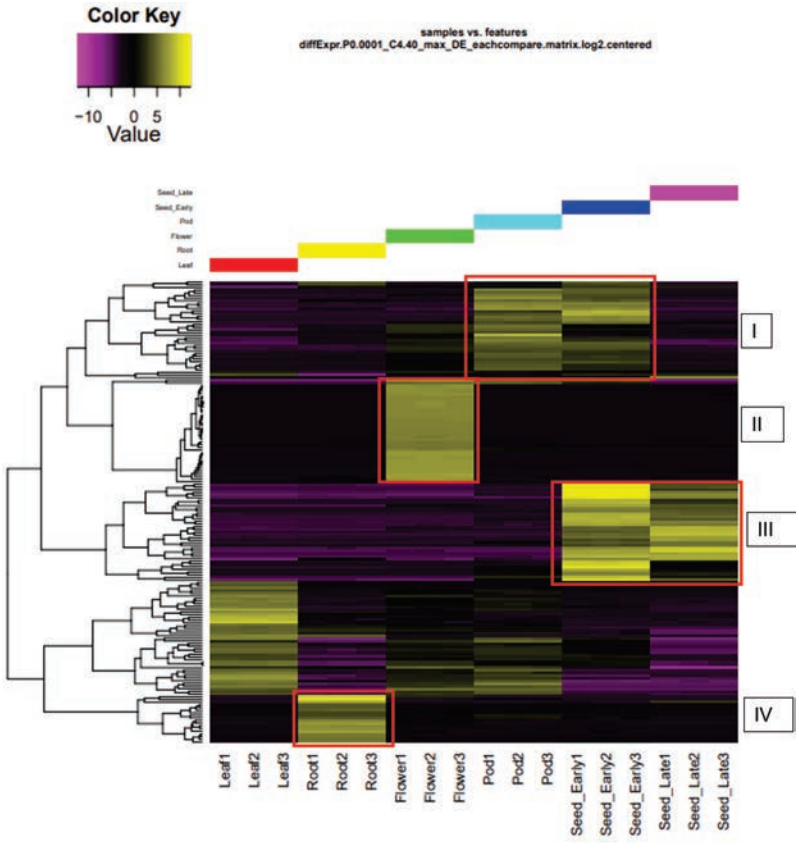


Figure 2. Differential expression profile for various tissues of Moth bean. (a) A representative expression profile for the highly up-regulated genes in tissues of moth bean. The blocks represent genes specifically upregulated in the tissue; block I= Pod and early stages of developing seeds, blockII= flower, blockIII= developing seed, blockIV= root.

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
0	0	0	0	1	1	0

Microbial Predator-Prey Interaction

Dr. Sourav Das
DST INSPIRE Faculty

Focus of the Lab:
A chief concern in agricultural practices is the introduction of pathogenic and disease-causing microbial agents through treated wastewater (TWW) irrigation, run-off, or manure fertilization. All prior attempts to alleviate contamination focused on the treatment of the crop, yet the growing appreciation for the soil microbial food web brings into focus its possible role in mitigating human pathogens transfer from the recycled water to the soil and crop. However, to the best of our knowledge, no study has yet attempted to systematically elucidate the response of the microbial food web to TWW irrigation. The current focus of our lab is on describing/deciphering a possible way to "How microbial predation could benefit agricultural practices through the combination of soil microcosm and controlled experiments utilizing the soil-on-chip microfluidic platforms". This will allow us to follow predator(protists/amoeba)-prey(bacteria), more specifically, protist-bacteria interactions in soil and controlled environments with the long-term goal to utilize the developed techniques to describe the microbial food web in the soil and its potential benefit to agricultural practices.

Collaborators:
- Dr. Tushar K. Beuria (Mentor), ILS, Bhubaneswar
- Dr. Himanshu Sharma, IIT Kanpur
- Dr. Prasoon Kumar, NIT Rourkela
- Dr. Osnat Gillor, ZIWR, BGU, Israel
- Dr. Jogeswar Satchidananda Purohit, CIC, Delhi University
- Dr. Rahul Kumar, Amity University, Ranchi

Project Assistant:
- Mohammed Anas

Research Activities:

Studying the ecological dynamics of microbial predator-prey interactions in soil for agriculture benefits

Wastewater (WW) is an unavoidable by-product of a growing population and human action and its recycling is important to alleviate freshwater scarcity. Consumption of vegetables irrigated with raw WW was shown to increase the risk of bacteria, protozoa, viruses, and helminthic infections. Hence, treating WW and using it for irrigation is practiced in many countries. One of the main health concerns obstructing secondary TWW from the irrigation of freshly eaten crops is contamination by various pathogenic microorganisms. Recent studies suggested irrigating crops with secondary TWW without contamination risk. Most crops gave higher yields when irrigated with TWW compared to potable water (PW), and the use of TWW reduced the need for chemical fertilizers, resulting in net cost savings for the farmers.

Pathogen transfer from TWW to the crops via soil-root interface or leaves internalization although possible in lab microcosm experiments, are rarely observed in field experiments.

Escherichia coli, a fecal indicator, and pathogenic microbe, although detected in TWW up to 105 CFU 100 mL-1 was seldom detected in the irrigated soil or crop. These results are mystifying because enteric microbes were shown to survive for prolonged periods in soil and forced the question "Why then, did the enterics not survive in the agricultural soil?

This could be because of their incompetence towards soil endogenous species, and inadaptability to the soil environment. Moreover, we hypothesize that the enterics may not survive due to predation, mainly by protists/amoeba (i.e. microbial eukaryotes), and therefore cannot be detected in the soil and crop.

Current Year Progress: We isolated Free-living amoeba (FLA) from various soil and followed predation dynamics in two prey types: Escherichia coli and Enterococcus mundtii. Predation was simulated in an unstructured environment using synthetic secondary TWW at various temperatures (25, 30, 35°C) mimicking changing climatic conditions and varying TWW ions such as phosphate (1.5 – 190 ppm), sulphate (0.08 – 100 ppm), and ammonium (0.5 – 190 ppm). This overall mimics the relative ionic strength and conductivity applied by irrigation effluent. We found that the predation efficiency of the FLA strains against E. coli increased significantly up to temperature 30°C and phosphate and sulphate concentrations up to 40 and 60 ppm respectively. We suggest that increased phosphate and sulphate strength applied by effluent irrigation may benefit FLA micro-predators, while ammonia may increase the E. coli resistance to predation.

The improved bacterial predation by FLAs could accelerate remineralization along with nutrient turnover in soil, shape the rhizobacterial communities and enhance plant growth and productivity. Our results demonstrate the importance of understanding the effects of environmental conditions on soil trophic interactions and their potential benefits for agricultural practices.

Future Plans: We are now planning to perform the predation experiments under structured microcosms and quantify the predation efficiency. We also intend to design and fabricate soil-on-a-chip micromodels to identify and visualize the potentially important role of FLAs post-TWW irrigation in simulated soils. Finally, this along with field data will be used to generate mathematical models for improving secondary TWW utilization in agricultural settings.

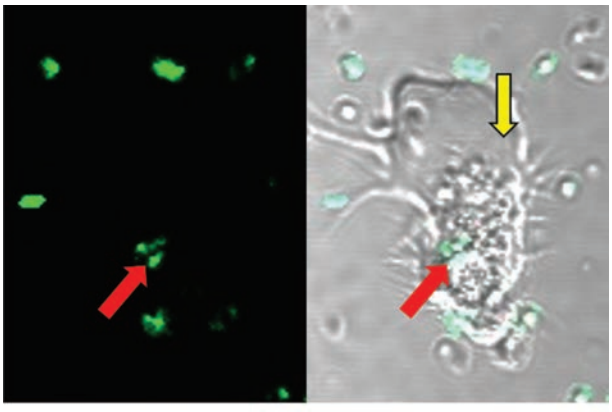


Figure shows FLA Acanthamoeba sp. predating GFP E. coli under elevated phosphate concentration
GFP E.coli *FLA Acanthamoeba sp.*

Microbial Biotechnology and Genomics

Dr. Subrata K Das
Scientist-F

Focus of the Lab:

We are working on microbial ecology, genomics, and translational research. In this regard, several useful microbes with biotechnological potential have been isolated and characterized for the bioprospecting of novel genes and metabolic pathways. Following the polyphasic approach, 25 new microbes have been discovered in unmanaged ecosystems. Our future goal on the genome-scale reconstruction of the metabolic model with these microbes for the functional analysis of pathways involved in the Bio-Geochemical cycle, synthesis of metabolites, pharmaceuticals, and ecological adaptation.

Collaborator:

- Dr. Surajit Basak, NICED, Kolkata

SRFs:

- Tanmoy Debnath
- Ritu Rani Archana Kujur

Laboratory Technician:

- Rakesh Parimanik

Research Activities:

Evaluation of "Whole-cell livestock vaccine for respiratory diseases"

My research has developed a "Whole-cell livestock vaccine for respiratory diseases" using the Bordetella bronchiseptica strain HT200. This vaccine candidate can be used effectively for the treatment of Kennel cough in dogs and the respiratory disease caused by this organism in other animals like pigs, cats, etc. (Fig. 1). In this regard, Institute of Life Sciences, Bhubaneswar and Indian Immunological Limited, Hyderabad are working together to achieve the purpose and agreed to execute definitive agreements viz. Manufacturing, Quality, and Commercial Licensing Agreements, etc. An agreement on a memorandum of understanding for Licensing and commercialization of "Whole-cell livestock vaccine for respiratory diseases" developed in my laboratory at ILS has been signed between Institute of Life Sciences, Bhubaneswar, and Indian Immunological Limited, Hyderabad. Institute of Life Sciences will provide the know-how and Bordetella bronchiseptica strain HT200 to Indian Immunologicals Limited to evaluate its suitability as a vaccine candidate. In addition, IIL will develop a process for producing vaccines followed by immunogenicity and potency evaluation by a challenge in small laboratory animals and target species i.e., dogs. Indian Immunologicals Limited will put all its efforts into developing a stable vaccine formulation and commercially launch the product. Further, both organizations agreed to work together if any multicomponent product developed by Indian Immunologicals Limited, Hyderabad, through the know-how transferred by the Institute of Life Sciences, Bhubaneswar.

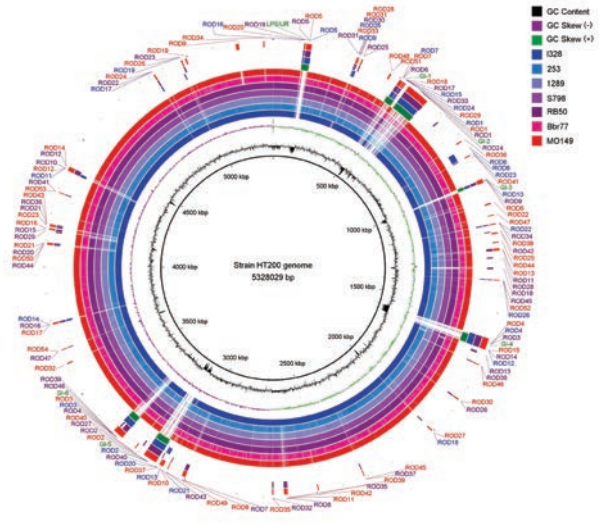
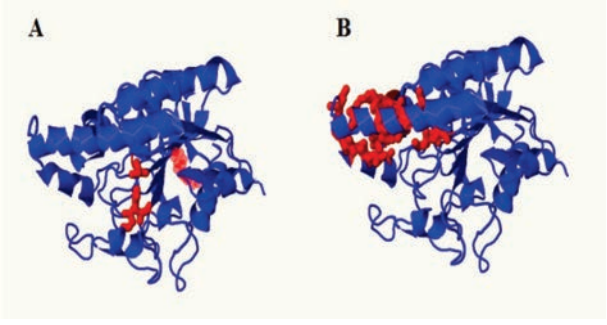


Figure 1: Circular genome map of B. bronchiseptica strain HT200 compared with strains I328, RB50, and MO149, respectively. RODs represent regions of differences in strain HT200 compared with strains I328 (blue), RB50 (dark purple), and MO149 (red).

Structural insights of lipase from Halopseudomonas maritima

A Gram-negative, aerobic bacterium, Halopseudomonas maritima, isolated from the sea sand produces lipase and is proposed to be a novel species. The triacylglycerol lipase produced by this bacterium exhibits the most significant structural similarity to the lactonizing lipase from Pseudomonas aeruginosa. The lipase protein has the α/β fold of the bacterial lipase family. Halopseudomonas maritima RR6T lipase shares the highly conserved pentapeptide Gly-Xaa-Ser-Xaa-Gly domain (where 'X' represent 'H') (Fig. 2). The active site of lipase protein contains the catalytic triad (Ser113,

Asp260, and His282). Ser113 is present between the β strand and α helix and identified as a nucleophilic elbow within the conserved pentapeptide motif.



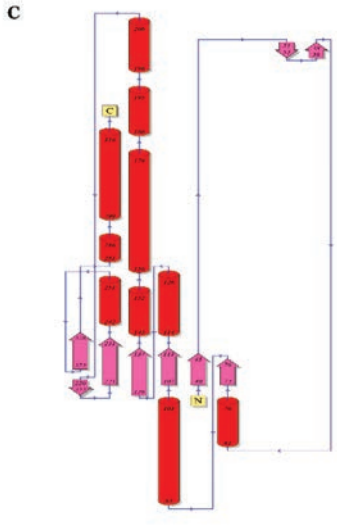


Figure 2. Overall fold of the lipase monomer. (A) Residues found to be part of the active site are highlighted in red; (B) Large pockets detected in the location of active sites are shown in wireframe mode, colored red, and (C) the schematic diagram illustrates the topology of lipase. The β-strands (pink arrows) are arranged into β-sheets and the relative disposition of the α-helices (red cylinders)

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
9	2	0	2	1	0	0

Image Courtesy: -Structural Biology and Vascular Biology Labs, DBT-ILS

Interdisciplinary Biology

Dr. Amaresh C Panda	RNA Biology
Dr. Amol R Suryawanshi	Clinical Proteomics
Dr. Dileep Vasudevan	Structural Biology
Dr. Mamoni Dash	Therapeutic Biomaterials
Dr. P. V. Ramchander	Human/Medical Genetics
Dr. Rajeeb K Swain	Vascular Biology

RNA Biology Laboratory

Dr. Amaresh C. Panda
Scientist-D

Focus of the Lab:

Recent advancements in RNA sequencing technologies and innovative bioinformatics software revealed the expression of novel RNA molecules without any free ends which are termed as circular RNAs (circRNAs). Hundreds of studies in the last decade demonstrated that circRNAs are a large class of ubiqutously expressed covalently-closed single-stranded RNAs without 5' end or 3' poly(A) tails. Furthermore, circRNAs have been shown to act as gene regulator by associating with microRNAs and RNA-binding protein (RBPs). A few circRNAs have also been reported to translate into polypeptides through cap-independent translation mechanisms. Moreover, only a fraction of circRNAs have been functionally characterized, while more than a million circRNAs are known to be expressed in different cells and tissues of humans. Several research have established the association of circRNA expression with different physiological and pathological conditions. Our group is interested in characterizing the novel circRNAs and their role in pancreatic β-cell physiology.

Collaborators:

- Dr. Mona Batish, Univ Delaware, USA
- Dr. Pragnya Das, Cooper University Hospital, USA
- Dr. Piyush Khandelia, BITS Pilani, Hyderabad
- Dr. Rupesh Dash, ILS, Bhubaneswar

SRFs:

- Arundhati Das
- Debojyoti Das
- Suman Singh

JRFs:

- Tanvi Sinha
- Susovan Sadukhan

Research Associate:

- Dr. Sharmishtha Shyamal

Laboratory Technician:

- Pranita Kumari Rout

Research Activities:

Identification of protein-coding circRNA splice variants in HeLa cells

The backsplice junction (BSJ) sequence is the unique feature of circRNA for their identification and quantification. The full-length mature sequence of circRNA is derived by combining the exonic sequences between the BSJ sites. Interestingly, a few studies have shown that multi-exonic circRNAs exist in different exon/intron combinations with the same BSJ due to alternative splicing and are termed circRNA splice variants. CircRNAs regulate gene expression by regulating the activity of miRNA/RBP or translating into proteins. Since the function of circRNAs, specifically the protein translated from circRNAs, depend on the full-length sequence of the circRNAs, we sought to identify potential protein-coding circRNA splice variants in HeLa cells. De novo analysis of HeLa cell RNA-seq data identified thousands of circRNA splice variants. The splice variants were validated by circRNA-rolling circle amplification (circRNA-RCA) followed by Sanger sequencing. Interestingly, several validated circRNAs were predicted to code for proteins by the riboCIRC database. Furthermore, analysis of polyribosome fractionations and the open reading frames on the circRNA splice variants suggested the potential for translating circRNAs into different protein products. Finally, bioinformatics analysis revealed the altered structure and functions of proteins translated from circRNA splice variants. Together, our study identified novel proteins derived from circRNA splice variants and their protein isoforms which may regulate various physiological processes.

PanCircBase: An online resource for the exploration of circular RNAs in pancreatic islets

Circular RNAs (circRNAs) are newly discovered members of the non-coding RNA family, which show a characteristic closed-loop structure and function as critical regulators of gene expression in healthy and diseased conditions. Over the years, an unprecedented rise in diabetes cases has been seen globally, a disorder where mild to severe insulin dysfunction causes overall morbidity and death. Recent studies have emphasized the significance of circRNAs in insulin biosynthesis and secretion from β-cells of pancreatic islets. However, the knowledge of all circRNAs expressed in pancreatic β-cells or islets is not readily available in any database. In the present study, we analyzed more than ten RNA sequencing datasets of the pancreatic β-cell and islet to catalog all circRNAs expressed in pancreatic islets and utilized the information to construct, PanCircBase

(https://www.pancircbase.net/), a database that provides: detailed annotation of pancreatic islet circRNAs, helps designing divergent primers for circRNA PCR, designs siRNAs for circRNA silencing, predicts miRNAs associated with circRNAs, and potential translation product of circRNAs (Figure 1). In summary, PanCircBase is a comprehensive database for exploring circRNA expression and its possible function in pancreatic β-cells. PanCircBase can serve as a starting point for studying pancreatic circRNAs and understanding the impact of circRNAs on pancreatic β-cell functions and related pathophysiology, including diabetes.

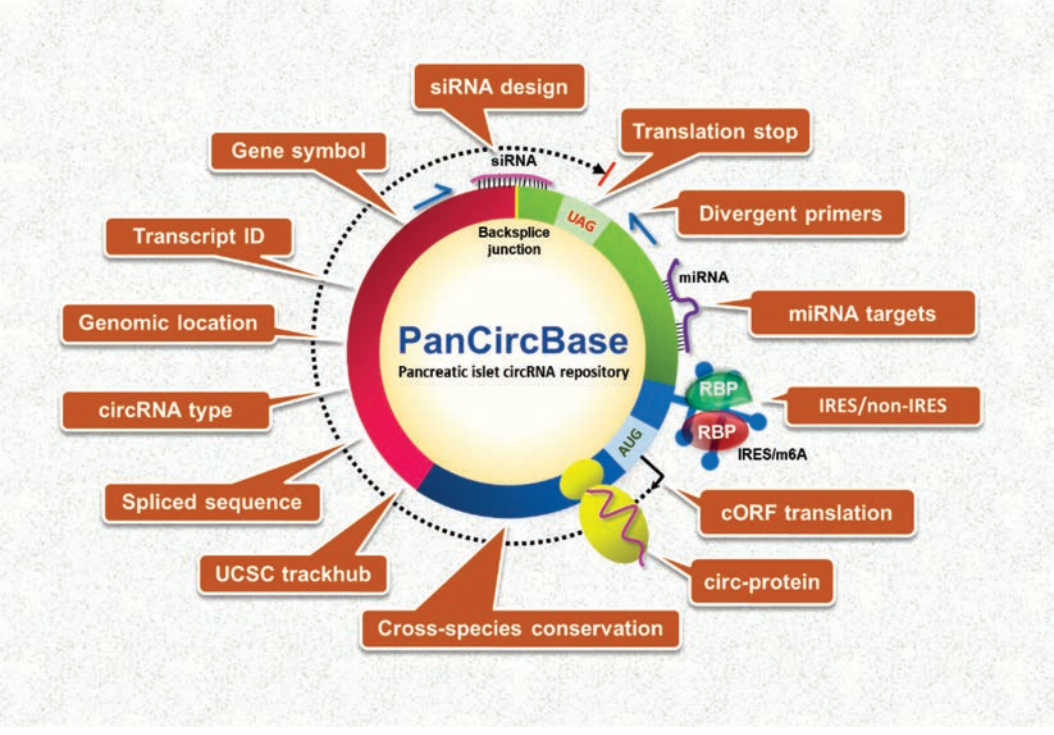


Figure 1: Schematic representation of the database PanCircBase for exploring the functions of circular RNAs in pancreatic islets.

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
3	0	1	1	4	1	1

Clinical Proteomics

Dr. Amol Ratnakar Suryawanshi
Scientist-E

Focus of the Lab:

Biology / Disease based proteome mapping study is essential to understand the biological process and variation due to infection/disease. The functional diversity of proteins depends on various factors such as expressional changes, subcellular localization, post-translational modifications, and interactions, etc. and studying these factors are important to understand cellular physiology and the molecular mechanisms involved in disease pathogenesis. Based on this, presently our laboratory is involved with many multidisciplinary studies with a major research focus on disease proteome mapping, PTM mapping, biomarker discovery and decipher the role of important protein/s in disease pathogenesis using advanced quantitative proteomics approaches in various diseases such as cancer, viral diseases particularly Rabies, COVID-19, Chikungunya, and Dengue.

Collaborators:

- Dr. Rajesh Pharande, MVC, Mumbai
- Dr. Srikanth Rapole, NCCS, Pune
- Dr. Anita Mahadevan, NIMHANS, Bangalore
- Dr. Indibor Singh, RIMS, Imphal
- Dr. Tathagata Choudhuri, Visva Bharti, Shantiniketan
- Dr. Gulam Hussain Syed, ILS, Bhubaneswar
- Dr. Soma Chattopadhyay, ILS, Bhubaneswar
- Dr. Rajeeb Kumar Swain, ILS, Bhubaneswar
- Dr. Jyotirmayee Turuk, ICMR-RMRC, Bhubaneswar

SRF:

- Suchismita Behera

JRFs:

- Nishi Pragnya Naik
- Arpita Kullu
- Subhasmita Das
- Rutuja Pradip Sawant

Laboratory Technicians:

- R. Rajendra Reddy
- Sridhar Behera

Research Activities:

Identification and characterization of differentially expressed proteins in rabies virus infection

Rabies is a neglected tropical zoonotic disease, caused by rabies virus (RABV). According to WHO, it occurs in more than 150 countries and territories including 50,000 human deaths worldwide every year with 60% cases being reported in India. Despite the existence of control measures, dog-transmitted human rabies accounts for >95% reported cases due to unavailability of sensitive diagnostic methods, inadequate understanding of disease progression, and absence of therapeutics. In addition, host factors and their role in RABV infection are poorly understood. In this study, we aimed to identify and characterize the differentially expressed proteins (DEPs) involved in rabies virus infection using advanced quantitative proteomic approaches. Earlier, two MS approaches iTRAQ - 4plex combined with LC-MALDI MS approach and iTRAQ - 8plex combined with HRMS approach were performed using rabies infected and non-infected dog brain tissue samples and a total 19 and 40 altered brain proteins were identified in these approaches respectively. In total, 40 DEPs, including 26 down-regulated and 14 up-regulated proteins, were significantly expressed in furious rabies virus infected samples compared to controls. Functional annotation of these DEPs were performed using various proteoinformatics tools such as Gene Ontology (GO) annotation and Ingenuity Pathway Analysis (IPA), which showed that calcium signaling and calcium transport, efficient neuronal function, and metabolic pathway associated proteins were mostly altered during this infection. Furthermore, neurological disease and psychological disorders that are the typical symptoms of rabies virus infection were identified among the top diseases and disorders.

Interestingly out of these forty DEPs, thirty-eight proteins were either novel or reported for the first time in rabies virus infection. In total, 34 proteins, including 10 down-regulated proteins related to calcium signaling and calcium transport pathways were successfully validated using qRT-PCR, and three proteins, namely CACNA1E, CACNA2D1, and ATP2B1 were validated using western blotting, thereby suggesting that these pathways may play an important role in rabies infection. In addition, presence of human homologs of these DEPs with ≥85% sequence identity suggests that these proteins may play similar roles during rabies virus infection in humans as

well (figure 1). This study provides the map of altered brain proteins and some insights into the molecular pathophysiology associated with furious rabies virus infection in canine and human both. However, their role in viral disease pathogenesis / infection is under investigation.

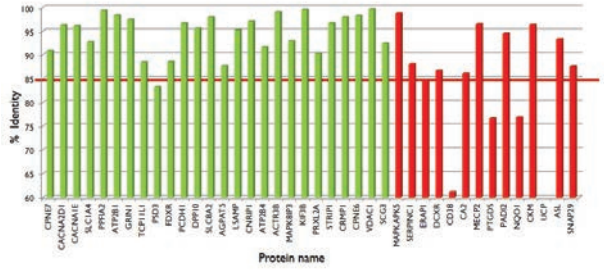


Figure 1: Identification of human homologs by homology search and their percent sequence identity with human homologue for 40 DEPs including 26 down-regulated and 14 up-regulated proteins.

Differential proteomics approach led to identify and characterize signature protein/s involved in Nasopharyngeal Carcinoma (NPC)

Nasopharyngeal carcinoma (NPC) is head and neck cancer and it is rarely occurs worldwide. It is also rare in India, however it is more prevalent in the north-eastern states of India. Lack of specific symptoms and unavailability of robust markers are the major constraint for early diagnosis of NPC. Understanding of molecular pathogenesis of NPC is also unclear. This emphasizes the need, which has to be addressed. In this study, we aim to identify and validate the altered proteins from plasma/tissue samples of NPC cases and Controls from the north-eastern states of India using various quantitative proteomics approaches. Earlier, two different proteomics approaches were used and identified altered proteins. In 2D approach, fifteen altered proteins were identified and nine proteins were identified in iTRAQ approach combined with nLC-MALDI MS/MS. Some of these altered proteins are novel and first time reported in NPC cases. Some of altered proteins were successfully validated with western blotting. Our analysis reported that three proteins were consistent across all the approaches. Further, bioinformatics analysis showed that most of these proteins play an important role in molecular and cellular functions such as cell death and survival, cellular assembly and organization, cellular compromise, cellular response to therapeutics and post-translational modification. Few proteins namely SERPINA3, VDB, and RBP4 were found to be important in NPC and the functional role of these proteins in NPC are currently being deciphered.

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
5	0	3	1	5	0	1

Structural Biology

Focus of the Lab:
Progress in the field of structural biology, and biochemical and biophysical techniques have contributed substantially toward our understanding of important biomolecular machineries. Our group aims to understand the structure and function of chromatin-associated proteins, as well as caseinolytic chaperones using a multi-pronged approach. Some of these proteins have been characterized in detail, while work on others is underway. We also work on several projects where we study the structural features of proteins in collaboration with other groups.

Research Activities:

Characterization of the *Arabidopsis thaliana* chromatin remodeller DEK3 for its interaction with histones and DNA

Arabidopsis thaliana DEK3 is a member of the evolutionarily conserved DEK domain-containing chromatin architectural proteins and forms a critical factor that regulates transcriptional programming, flowering and abiotic stress tolerance response. AtDEK3 contains an uncharacterized N-terminal domain, a middle SAF domain, and a C-terminal DEK domain.

AtDEK3 was studied for its interaction with histone H3/H4 and DNA. The protein interacts with histone H3/H4 tetramer through its hitherto uncharacterized N-terminal domain and the C-terminal DEK domain in a 1:1 stoichiometry, but not with H2A/H2B dimer. The otherwise unstructured N-terminal domain of AtDEK3 undergoes a conformational change upon interaction with H3/H4 and adopts an alpha-helical conformation.

In addition, the in-solution envelope structures of the AtDEK3 domains and their complex with H3/H4 have also been generated. The SAF domain and the DEK domain associate with double-stranded DNA and four-way junction DNA. As DEK3 possesses a histone-interacting domain at both the N and the C-termini and a DNA-binding domain in the middle and at the C-terminus, the protein might play a complex role as a chromatin remodeller.

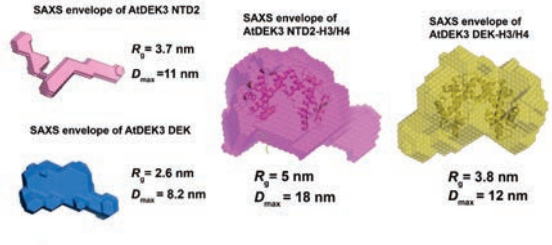


Figure 1: SAXS envelope structures of AtDEK3 domains and their H3/H4 complexes

Dr. Dileep Vasudevan
Scientist-E (On-Lien)

Collaborators:
- Dr. Narottam Acharya, ILS Bhubaneswar
- Dr. Soma Chattopadhyay, ILS Bhubaneswar
- Prof. Kim Lewis, Northeastern University, USA
- Prof. Sheng Luan, U C, Berkeley, USA
- Prof. Klaas van Wijk, Cornell University, USA
- Prof. Claudia Jonak, AIT, Austria

SRFs:
- Ruchir Chandrakant Bobde
- Ketul Saharan
- Surajit Gandhi
- Archana Samal

JRFs:
- Bimal Jana
- Sonali Ghosal

Research Associates:
- Dr. Aritreyee Datta
- Dr. Shaikh Nausad Hossain
- Dr. Chinmayee Mohapatra
- Dr. Dharma Rao Tompa

Laboratory Technicians:
- Manoj Kumar Barik
- Vicky Kumar
- Purushottam Patnaik

Structural basis of mycobacterial inhibition by the natural peptide Lassomycin

Increased antibiotic resistance is threatening a future where existing antibiotics can no longer cure mycobacterial infections. Furthermore, the emergence of multidrug-resistant, totally drug-resistant, and extensively drug-resistant tuberculosis has increased the urgency of discovering new therapeutic leads with unique modes of action. In this regard, some actinomycetes-derived peptides have shown potent and specific activity against *Mycobacterium tuberculosis*. The specificity owes to the fact that these peptides target the

ClpC1 ATPase, an essential enzyme in mycobacteria. and inhibit/activate the proteolytic activity of the ClpC1/P1/P2 complex that participates in protein homeostasis.

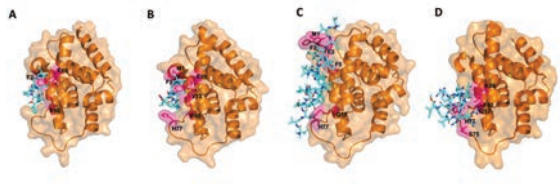


Figure 2: MtClpC1 NTD structures in complex with the natural peptides (A) Cyclomarin A, (B) Rufomycin I, (C) Ecumicin and (D) Lassomycin

We have obtained the high-resolution crystal structure of the N-terminal domain of ClpC1 (ClpC1 NTD) in complex with Lassomycin showing the specific binding mode of Lassomycin and its precise role in mycobacterial inhibition. In addition, the work also compares the Lassomycin complex structure with the previously known structures of ClpC1 NTD with other natural peptides such as Cyclomarin A, Rufomycin I and Ecumicin. Our studies show that the binding of Lassomycin to the non-essential ClpC1 homologs such as ClpC2 and ClpC3 could protect mycobacteria from getting killed by the ClpC1-targeted action of Lassomycin.

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
3	0	2	1 (Submitted)	9	1	2

Therapeutic Biomaterials

Dr Mamoni Dash
Scientist-C

Focus of the Lab:

Polymers are used in diverse biotechnological applications. Our group is involved in the development and characterization of novel polymers, which includes techniques like polymer chemistry, polymer synthesis, and/or polymer modification and characterization. A part of our team is developing biomaterials that can act as architectural support for cell proliferation, differentiation, and regeneration, thus mimicking the extracellular matrix (ECM) during bone formation in critical size defects. We are also using different strategies to utilize polymers as drug delivery systems for targeting to a particular tissue. The team is also involved in developing cationic polymers for nucleic acid delivery.

Collaborators:

- Dr Amaresh Panda, DBT-ILS, Bhubaneswar
- Dr Manju Unnikrishnana, CSIR-IMMT, Bhubaneswar
- Dr Sonu Gandhi, DBT-NIAB, Hyderabad
- Dr Debabrata Biswas, DBT-ILS, Bhubaneswar
- Dr Anna Maria Piras, University of Pisa, Italy

SRFs:

- Pratyush K Das
- Debyashreeta Barik
- Sasmita Samal
- Pratigyan Dash
- Kananbala Patra

JRF:

- Gyanendra Prasad Panda

Laboratory Technician:

- Kapilas Das

Research Activities:

Drug delivery to Osteosarcoma

Osteosarcoma (OS) is a type of bone cancer that involves uncontrolled growth and proliferation of normal bone-forming cells. It is a rare soft tissue malignant tumor with high lung metastasis and mortality rates. Pre-operative chemotherapy or radiation therapy, surgical resection of the lesion and post-operative chemotherapy are still the main treatments for osteosarcoma. In this perspective, the cell derived natural nano-vesicles known as exosomes are extensively studied due to some of their very unique characteristics as cargo carrier. These are known to play a key role in maintaining the bone homeostasis thereby helping in new bone formation. Also, recent studies have shown that targeted therapy for OS based on the nanoparticle mediated drug delivery is one of the preferred methods of OS treatment. Poly-lactic-glycolic acid (PLGA) nanoparticles mediated drug delivery has been studied for their sustained release profile for which these are being exploited in targeting OS. Zoledronate is the most potent anti-osteoporotic drug known to inhibit the uncontrolled proliferation of osteoclasts. We have tried to re-purpose the drug to analyze its anti-cancerous properties. A total of 4 N-BPs (Amino bisphosphonates) were screened for their potent cytotoxicity against K7M2 (mouse osteosarcoma cell line) and MC3T3E1 (healthy counterpart). The most potent BP observed is zoledronate. It was observed that zoledronate as a nanoformulation has a higher uptake of nanoparticles (95%) in K7M2 whereas in MC3T3E1 the percent population internalizing NPs was 45%.

Native zoledronate was treated to the human OS cell line, Saos-2 cells and we found it to be lethal even at a lower concentration such as 10uM both at 72h and 96h. However, at the same concentration and time point, PLGA encapsulated zoledronate are showing higher ratio of live cells to dead cells. This indicated the sustained release efficiency of PLGA nanoparticles. the zoledronate has a sustained release of 15% after 96 hours from the nanoparticle. Such a sustained release provides rescuing effect on the normal pre-osteobalst cells with IC50 of 100.3 micromolar. We also observed that the PLGA-NPs are stable within the cells till 24 hr after which they start getting degraded by lysosomes. These PLGA nanoparticles are being coated with cell membrane of the osteosarcoma cells for active targeting to the osteosarcoma sites. Different techniques are being used to coat these nanoparticles and the effect of coating on parameters like internalization, toxicity, drug release etc. are being investigated in details.

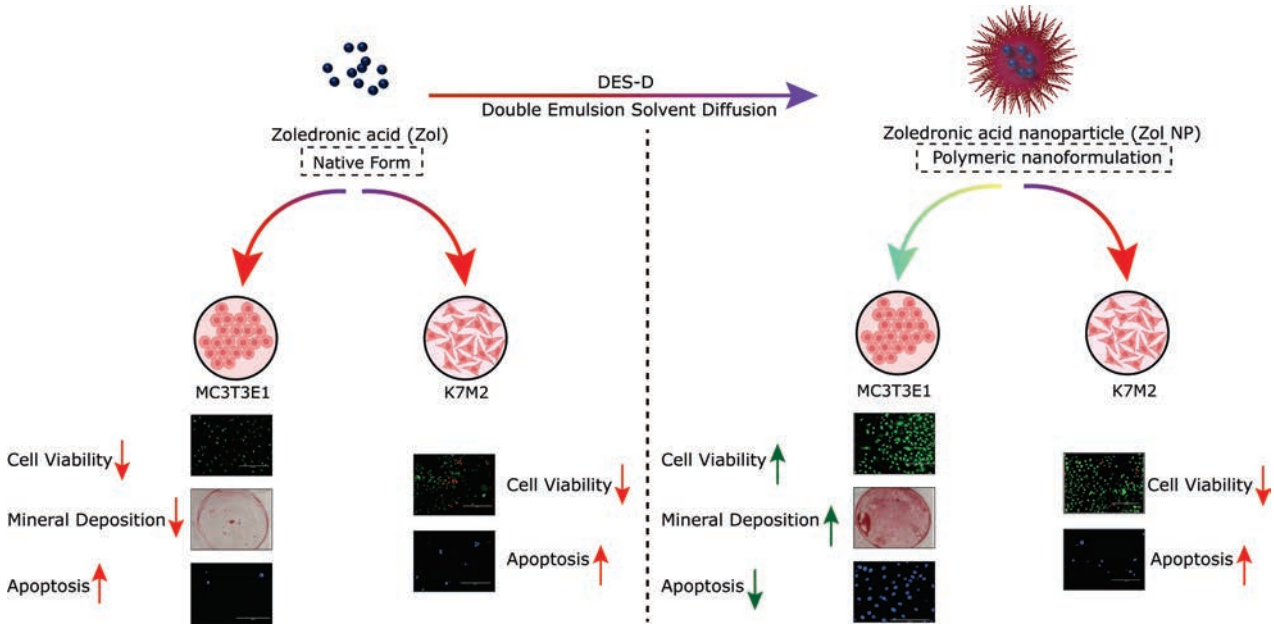


Figure 1. Zoledronic acid in its native form is cytotoxicity to both normal healthy pre-osteoblast cells and osteosarcoma cells. Native zoledronic acid hampers viability, mineralization and differentiation. Upon nanoencapsulation in a polymeric matrix, the drug is released in a slow and sustained manner thus overcoming the existing drawbacks of administering native zoledronic acid. The results indicate that zoledronic acid nanoformulation can be used to passively target osteosarcoma with minimum side effects to healthy bone cells.

Achievements in 2022-2023						
Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
1	2	2	0	6	1	2

Human/Medical Genetics

Dr. P. V. Ramchander
Scientist-F

Focus of the Lab:

Our lab primarily addresses the clinical enigmas prevalent in our population by extensively studying the genetic-epigenetic aspects of the diseases. Diseases having a complex background often involve interplay of genetic, epigenetic and environmental factors. This interplay varies with the varied ethnicity of the population and may result in differential intensity of the clinical condition. We explore the gene/genetic variants which hold a pivotal role in disease pathogenesis. Presently, the lab is working on rare pediatric diseases and major hearing impairments (otosclerosis, congenital hearing loss and otitis media). The novel/associated variants are then characterized using cell lines or in zebra fish. Our observations and results help design/develop measures to mitigate the risks in population by molecular diagnosis, treatment, and genetic counseling.

Collaborators:

- Dr. Rajeeb Kumar Swain, ILS, Bhubaneswar.
- Dr. Swarupa Panda, Dr. Roma Rattan, Dr. Chinmay Sunder Ray, Dr. Khirod Chandra Panda, Dr. Jyotish Chandra Choudhury, SCB Medical College Cuttack.
- Dr. Joseph John, Dr. Amit Kumar Satapathy, AIIMS, Bhubaneswar
- Dr. Ashim Desai, Dr. ABR Desai ENT Clinic and Research Center, Mumbai.
- Dr. Saber Masmoudi, Centre de Biotechnology de Sfax (CBS), Tunisia.
- Dr. Richard J Salvi, The State University of New York at Buffalo, USA.

SRFs:

- Neha Singh
- K. Abhishek
- Ruchika Raghuvanshi

JRFs:

- Rituparna Sahoo
- Ipsita Rakshit

Senior Project Associate:

- Dr. Chandra Bhan Singh

Laboratory Technician:

- Ranjan Kumar Barik

Research Activities:

Deciphering role of m6A reducing RUNX2 expression and otosclerosis susceptibility

Otosclerosis (OTSC) is a condition of abnormal bone growth in the stapes footplate of the middle ear that impedes mobility and limits the transmission of sound to the inner ear. In the current research we explored the novel N6-methyladenosine (m6A) marks, functionally impact the transcriptional cascades that downregulate RUNX2 expression and affect bone mineralization in otosclerotic stapes leading to the progression of OTSC. Here, we found reduced expression of m6A, its internal cotranscriptional modifications METTL3, METTL14, and ALKBH5 could reduce the translation efficiency of RUNX2 subsequently decreasing the osteoblastogenesis in otosclerotic stapes (Fig. 1 A & C). Further, the study revealed the downregulation of osteogenic activity using other osteogenic markers like OCN, Alizarin Red S, and H&E staining (Fig. 1 C & D). Collectively, our results demonstarted that targeting the m6A regulator, METTL3, and other epigenetic marks, regulating the expression of RUNX2 in otosclerotic stapes supports these novel marks and plays a potential therapeutic target in OTSC diagnosis and therapeutics.

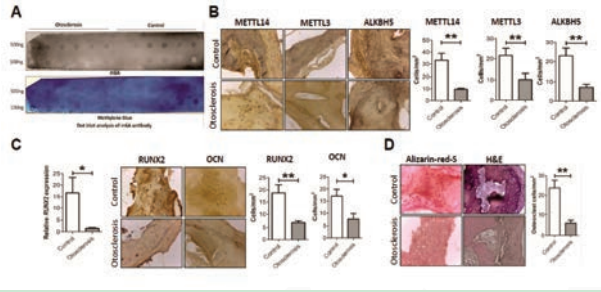


Figure 1: Differentiation m6A RNA Modification (A) The expression of m6A was detected in otosclerotic and control stapes using dot blot. (B) The levels of methyltransferases METTL3, METTL14, and ALKBH5 in otosclerotic and control samples were measured by immunohistochemistry. (C) The expression of RUNX2 and OCN were analyzed in otosclerotic and control stapes using immunohistochemistry. (D) Quantification of osteogenic activities were measured by alizarin and H&E staining. **P<0.001 *P<0.05 by Student's t test. Error bars represent SD of the mean.

Identification of putative methylation study targets for otitis media associated genes

Otitis media (OM), the multifactorial middle ear disorder is known for affecting at least 80% of children during their childhood. This complex disease is also responsible for

the deprived overall development of children due to the disabling hearing loss it causes. Apart from the genetic association studies in humans, the data for co-study of its accessory factors like the epigenetic contributors are very scarce and scattered in the field of OM. We tried to assimilate useful information required to get important insights into the genetics/epigenetics of OM and possible implications for various populations by creating a single point knowledge access platform called GeMemiOM (https://www.gememiom.org). GeMemiOM encompasses the otitis media associated gene details, CpG island (CGI) and transcription factor (TF) binding status determining short nucleotide variations (SNVs), protein-protein interaction, co-expression, genetic interactions, pathway analysis and miRNA targets. The above data are categorically archived and the images/tables can be visualized/ downloaded by the users. This comprehensive database would facilitate the decisiveness of clinicians/researchers for candidate gene or methylation studies, hence encouraging OM research in various populations.

Whole exome sequencing revealed novel variants in Indian families with congenital hearing loss

Hereditary hearing loss is genetically heterogeneous condition. In our previous candidate gene study, we found predominant GJB2 variants in non-syndromic hearing loss (NSHL) patients. In the present study, the GJB2-negative NSHL families with whole exome sequencing revealed novel compound heterozygote variants in MYO7A gene in a family 1 (Fig. 2) and detected a reported pathogenic splice site variation in MARVELD2 gene in family 2 segregating with the hearing loss in an autosomal recessive inheritance pattern. These variants were absent in 140 unrelated NSHL cases and 150

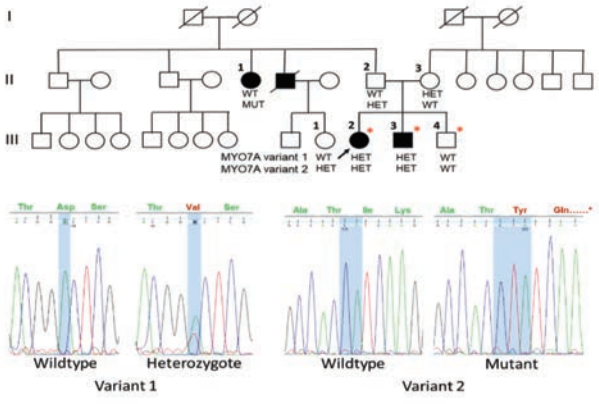


Figure 2: Pedigree showing the inheritance of MYO7A novel compound heterozygote variants segregating with non-syndromic hearing loss.

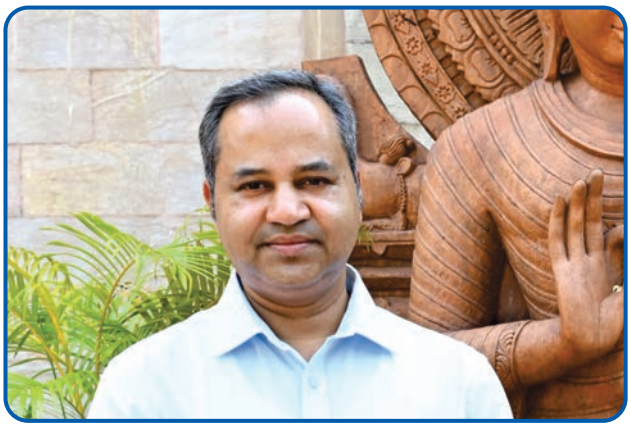
controls screened by PCR-RFLP and Sanger sequencing indicating their rare nature in this population. Both MYO7A variants fall in the first FERM3 domain of myosin VIIa protein and are predicted to be disease-causing. This study expanded the spectrum of deafness variations in Indian population. In parallel, spatiotemporal studies of PDE1C (novel NSHL gene) in zebrafish showed its expression in otic vesicles of wild type zebrafish embryos conferring its implication in maintenance of inner ear function. Knock down studies of pde1c in zebrafish and NGS analysis in more NSHL families are underway.

Achievements in 2022-2023

Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
1	0	2	1	2	1	1

Vascular Biology

Dr. Rajeeb Kumar Swain
Scientist-E



Focus of the Lab:

The focus of our laboratory is to study organ development during embryogenesis. We study the developmental processes through zebrafish embryos to understand how normal physiological processes are coordinated in adults. This in turn helps us to better understand the human disease biology where the normal cellular and molecular process are mis-regulated. In particular, we are investigating the molecular mechanisms underlying kidney development and function using zebrafish as a model. We are also interested to create zebrafish models of human kidney diseases.

I have taken initiative to establish zebrafish as a model for cancer and infectious diseases. Several groups at ILS and other institutes have been using these models to understand mechanisms of cancer metastasis, chemoresistance, radiation modifiers, *M. tuberculosis, S. aureus* and chikungunya infection.

Collaborators:

- Dr. Manjusha Dixit, NISER, Bhubaneswar
- Dr. Pramoda K. Sahoo, CIFA, Bhubaneswar
- Dr. Hirak Kumar Barman, CIFA, Bhubaneswar
- Dr. P. K. Umasankar, RGCB, Thiruvanathapuram
- Dr. Syed K. Hasan, ACTREC, Mumbai
- Dr. Soma Chattopadhyay, DBT-ILS, Bhubaneswar
- Dr. Sandip K. Mishra, DBT-ILS, Bhubaneswar
- Dr. Rupesh Dash, DBT-ILS, Bhubaneswar
- Dr. Shantibhusan Senapati, DBT-ILS, Bhubaneswar
- Dr. P. V. Ramchander, DBT-ILS, Bhubaneswar
- Dr. Sanjeeb Sahoo, DBT-ILS, Bhubaneswar

SRFs:

- Usharani Nayak
- Manaswini Rout
- Sanjeev Anand
- Deepak Singh
- Kiran Avula

JRFs:

- Kalyani Sahoo
- Susovan Sadhukhan

Laboratory Technicians:

- Suryashikha Mohanty
- Laxmipriya Patnaik
- Satya Ranjan Behera

Research Activities:

Kidney development, function and disease models

Zebrafish embryos have two functional nephrons that are physiologically similar to mammalian nephrons. There is also significant conservation among the signaling pathways and transcription factors that regulate zebrafish and mammalian kidney development. Model organisms that faithfully recapitulate human diseases play important roles in understanding the disease process and provide valuable ground to find their cure. Zebrafish is an excellent model to study the development, pathophysiology and molecular aspects of human kidney diseases. We have been studying the molecular mechanisms that regulate nephron segmentation, cilia formation, and maintenance of cellular architecture and regulation of gene expression using zebrafish as a model.

Cilia and flagella associated protein 300 (cfap300) was identified in a mRNA in situ hybridization screen carried out in our lab as a gene that is expressed in zebrafish developing pronephros along with other organs. We have carried out TALEN mediated knock-out of this gene. These mutants do not show any morphological abnormality. However, the development of corpuscles of Stannius (CS), an endocrine organ involved in regulation of calcium homeostasis does not happen properly. We show that the number of CS cells is reduced in cfap300$^{-/-}$ embryos. These cells also do not extrude from the distal early tubule cells. Further investigation suggests that the inability of these cells to extrude may be due to increase in cadherin expression.

Functional characterization of mutations associated with pediatric rare genetic disorders

Our laboratory is a collaborator on DBT funded “Mission program on pediatric rare genetic disorders”. One of the aims of this project is to use zebrafish as a model to functionally validate and characterize the genes implicated in pediatric rare genetic disorders. We have proposed to validate genes implicated in Refsum disease, ARPKD and pcdh12 that is implicated in cerebral ataxia, dystonia, retinopathy and dysmorphism. The

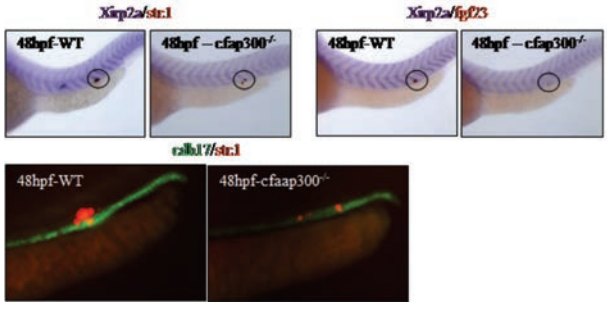
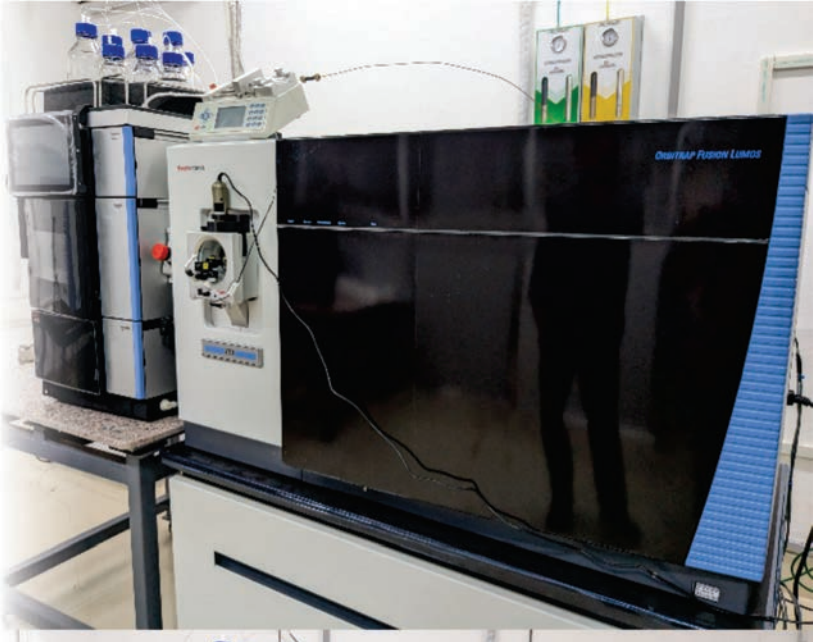


Figure : cfap300-/- have reduced number of CS cells as seen by expression of stc1 or fgf23 (upper panel), xirp2a marks the somite. Fluorescent in situ hybridization shows that the CS cells extrude from the tubule in the wild type embryos whereas the extrusion is impaired in cfap300-/- embryos (lower panel). Cdh17 marks the nephron and stc1 marks the CS cells.

characterization of zebrafish pcdh12 will be carried out in collaboration with Dr Ashwin Dalal. Other genes implicated in pediatric rare genetic disorders as suggested by other laboratories who are part of this mission program will also be taken up in future. To this end, we have designed, synthesized and validated the gRNA against pcdh12 and pkhd1 genes. Two gRNA targeting the exon-1 and exon-3 of pcdh12 were injected into the zebrafish embryos that will result in deletion of exon-1 to exon-3. These F0 embryos are being grown to adulthood. Similarly, two gRNA targeting Exon-3 and 13 targeting zebrafish pkhd1 has been designed, synthesized and validated. The F0 embryos are being grown to adulthood. Two gRNA against phyh/pahx (exon - 1 and 8) implicated in Refsum disease have been synthesized and are being validated by microinjection followed by genotyping of the embryos.

Achievements in 2022-2023

Publications	Patents Filed	Extramural Grants	PhDs Awarded	Invited Speaker	Conference/ Workshop Organized	Awards to PI/Lab
4	0	2	0	5	1	1



INFRASTRUCTURE AND FACILITIES AT DBT-ILS

Infrastructure and Facilities at DBT-ILS

ILS-Bioincubator

Experimental Animal Facility

Advance Mass Spectrometry Facility

Bioinformatics Facility

Biophysical Characterization Facility

Biorepository

Biosafety Level 3 Facility

Animal Biosafety Level 3 Facility

FACS Facility

Imaging Facility

Immunogenicity Assay Platform

Next Generation Sequencing Facility

Transmission Electron Microscopy Facility

Central Instrumentation Facility

Bioincubator

Dr. Nivedita Jena
COO, Bioincubator, ILS

Contact Details
Ph. No. : +91 674 2304320
Email : nivedita@ils.res.in
Webpage : http://bioincubator.ils.res.in

Brief about the facility

DBT-ILS, Bhubaneswar has taken a major step forward in promoting entrepreneurship in the biotechnology sector by establishing a biotech incubator. The incubator is focused on domains such as bioinformatics, biopharmaceuticals, bioprocessing, industrial biotechnology, MedTech, food and wellness, indigenous biotech products, agriculture, and allied area.

DBT-ILS Bioincubator aims to nurture early-stage inventions and develop them into technologies and products. Our mission is to nurture promising new ideas to help them form emerging biotech companies and support them throughout all phases of their company growth. DBT ILS Bioincubator has supported 32 startups since its inception. Currently, 23 are incubated, and 9 startups have graduated. The startups we nurtured have gained traction, and many government financing programs have recognized and supported them. The impact created so far are; that 4 products have been launched, 17 provisional patents have been filed, 4 patents have been granted, 11 trademarks have been registered, and 30 prototypes have been made. The DBT ILS startups have generated 157 employments, and 17 of its startups are led by women entrepreneurs. In addition, the incubator has routinely organized technical training programs to create a pool of skilled human resources, and more than 2100 people have benefited.

Sector

DBT ILS Bioincubator would scout for startups that could be aligned with the strength of the institutes as well as encourage faculties and schools towards translational products and entrepreneurship. We would host acceleration, hackathons, ideations, and on board startups on the below-listed domains.

- Antiviral therapeutics, Devices, and diagnosis
- Precision medicine - Cancer and Metabolic diseases
- Biomanufacturing - Indigenous biotech products, Natural products, Nutraceuticals, and phytochemicals
- Climate Resilient Agriculture
- Technologies that could amplify the livelihood generations

Details of the facility along with achievements in this year

- Total uses of facility: 32 start-ups
- Number of Startups on boarded in the year: 11
- Workshops and Training Conducted : 47
- External Funding Raised by Startups at the Center
- Employment Generated : 157
- Revenue generated if any : 13,56,011 Lakh
- Data resulted in publication/patent if any

- **Awards**:
  - Performance award by MSME department, Start-up Odisha at Make in Odisha Conclave - 5 Lakh
  - Got Recognized for received startup India seed fund by the State government

Facilities provided to start-ups

Dedicated laboratory space for wet lab experiments, with necessary equipment and facility, including a well-established cell culture facility and a central facility will all advanced equipment and infrastructure. Facilities includes BSL III, proteomics, bioinformatics, animal house, next generation sequencing, green house, and zebrafish and tissue culture facilities.

Depending on the requirements and relevance, the ILS bio incubator will have flexibility and operational facilitation for promoting innovation. Incubator ensures that the growing under it get all the benefited from it which includes financial, mentorship and infrastructural support throughout incubation. It also promises technical assistance from the trained professional in their areas of expertise

Impact of the DBT - ILS Bioincubator

- **No. of products/technologies commercialized :** 50
- **No. of Jobs created : 157**
- **No. of events conducted:** 67
- **No. of IPs filed/generated :** 17 (4 granted)

Startups	Investment by Angel/VC	Startup Grants	Women Led Startups
32	100.12 Cr	5.08 Cr	17

Patents	Trademark Registered	Jobs Created
17	11	157

Startup Portfolio

The DBT ILS Bioincubator portfolio includes some of the most promising ventures. These entrepreneurs are building innovative solutions that impact the future by impacting society.

Startup Portfolio

Agri and Allied	Aromasymphonies	COWBIT	NETRAUM AYURVEDA	
Biopharma		BIOMOLICS		UBC
Device and Diagnosis	SICHERN	DESSINR	OREASE ORAL CARE SOLUTIONS	chainworks.io
Food and wellness	DAVIK	ODISHA BEVERAGES	Bio Tatwa Balancing Elements of Life	SCYLENE WELLNESS
Industrial Biotechnology	MicrobioTx		RnaBio WE ACCELERATE RESEARCH	CretBio
Bio services		GENOMIKI	PROANTEK	

Graduated Start-ups

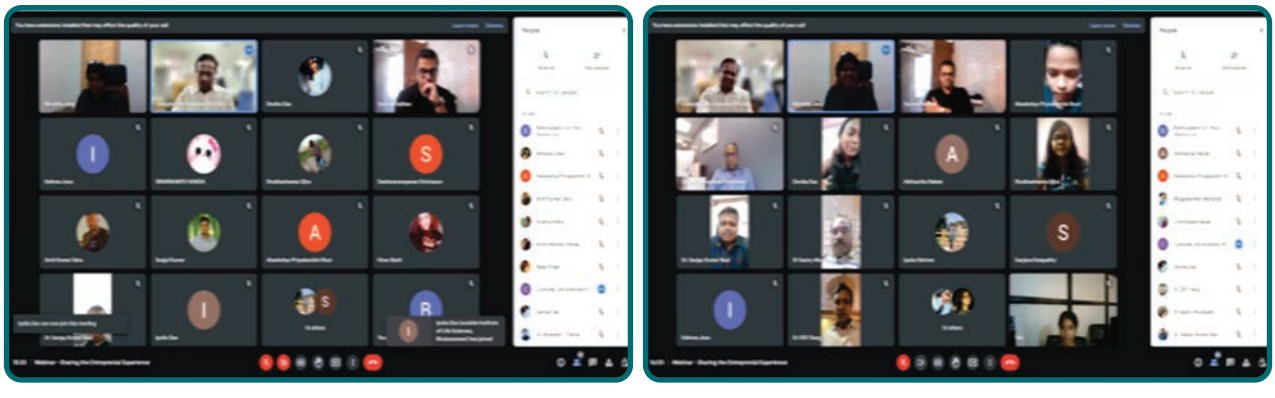
AUM	Inofinity	ThinkGenix Regenerating Bio Molecules	STERADIAN
MOLVETLAB PVT.LTD.	VIVFY	insectika transform bio-waste into Next Generation Protein	IDREAM TECH

Events/Workshops at DBT - ILS Bioincubator

Numerous training sessions for faculty and students as well as workshops for new businesses are being carried out all year long. For students and faculty, the event includes a design workshop series, entrepreneurial boot camps, and motivational speaking series. The ILS bioincubator has scheduled many mentoring sessions, Odisha Biotech startup summit, startup meet-up programmes, and other activities for our incubates.

List of Events	Date	No. of Participants
April 2022		
Mass- hands-on training	5th April	26
Entrepreneurship Boot Camp	6th April	40
WEBINAR-Insight into entrepreneurship in Biotechnology	27th April	28
May 2022		
HPLC Training	13th May	16
Startup Career Fair	14th May	115
BOOT CAMP - Fundamentals of Life Science Entrepreneurship-MITS	19th May	36
BOOT CAMP - Essentials of Life Science Entrepreneurship-MITS	20th May	36
City camp- Venture Center	30th May	80
June 2022		
i-connect , product launch	1st June	55
Summer internship - Molecular Biology techniques	16th June - 13th July	7
Biotechnology internship in association with Scylene technologies	1st to 28th June	17
July 2022		
Biotechnology Ignition grant session with Venture center	12th July, 2022	55
Workshop& boot camp on Bio entrepreneurship- Centurion University	14th July, 2022	50
Brain storming and consultation	18th July, 2022	45
Big session with Ccamp	19th July, 2022	43
August 2022		
workshop on Nucleic acid Isolation with Rna Biotech	6th august, 2022	16
Awareness and Registration Camp Opportunities for Women -Led Enterprises in the Agri-Food- Livestock Sector: Unlocking the potential of women entrepreneurs with ISAP	23rd August, 2022	35
Awareness and Registration Camp Opportunities for Women -Led Enterprises in the Agri-Food- Livestock Sector : Unlocking the potential of women entrepreneurs	24th August, 2022	40
Awareness and Registration Camp Opportunities for Women -Led Enterprises in the Agri-Food- Livestock Sector : Unlocking the potential of women entrepreneurs with ISAP	25th August, 2022	43
September 2022		
Internship on Microbial and Molecular Biology Techniques	7th Sep -21st Sep	15
Workshop Bacterial culture and Plasmid DNA isolation in collaboration with Rna Biotech	24th Sep	17
Odisha Biotech Startup Summit	28th and 29th Sep	95
October 2022		
Workshop on PCR;in collaboration with Rna Biotech	15th Oct 2022	7
Boot camp - Nuts and bolts of Life Science entrepreneurship Salepur Autonomous college	27th Oct,2022	64
Protein Purification and Crystallography workshop	20th and 21st Oct 2022	30

November 2022		
Internship Program	31stOct-30 Nov	14
Startup Clinic for incubated startups	1st Nov	31
RT-PCR WITH Rna Biotech	5th Nov	7
Visit of Department of Science and Technology, Govt of Odisha Officials	7th Nov	25
Bioinformatics workshop	10-14 Nov	13
Boot camp- e yuva fellows GIET	29th Nov	14
Make in Odisha Conclave	30th Nov to 3rd Dec, 2022	
December 2022		
Visit of Dr. Subhra R. Chakrabarti, Director (Operations) -BIRAC	9th December 2022	
Visit of BIRAC Officials-10-12-2022-Manish Diwan, Subhra Ranjan Chakrabarti, Deepanwita Chattopadhyay, and Taranjeet Kaur	10th December 2022	
Boot Camp-Ramadevi University	12th December 2022	45
Visit To Incubation Centre - Medinapore college	14th December 2022	32
January 2023		
Boot Camp on Bioentrepreneurship for Life Science graduates North eastern hill university and Kharoshotra College	20th Jan 2023	30
Entrepreneurial Talk	28th Jan 2023	36
February 2023		
ILS Innovation Showcase	2nd Feb 2023	25
Boot camp NIIS	27th Feb 2023	25
Science day	28th Feb 2023	300
March 2023		
Women's day	6th March, 2023	250
Odisha Biotech Founders meet	15th March, 2023	52



Webinar-sharing entrepreneur Journey

DST Govt of Odisha official interacting with our Startups

Experimental Animal Facility

Dr. Sarita Jena
Scientist-E

Contact Details
Phone No.: 91-674 2304233 / 2300137
Ext: 243
Email : saritajena@ils.res.in
Webpage : https://ils.res.in/animal_house/index.html

Brief about the facility

The experimental animal facility of the institute has been registered (No. 76/GO/ReRcBi/S/99/CPCSEA) for "Research for education purpose, research for commercial purpose and in-house breeding of small animals" under the Committee for the purpose of Control and Supervision of Experiments on Animals (CPCSEA), Ministry of Fisheries, Animal Husbandry and Dairying, Deptt. Of Animal Husbandry and Dairying, Government of India and has registered and approved the Institutional Animal Ethics Committee (IAEC) with nine members.

The Experimental Animal Facility of the Institute is a central facility which procures, imports, breeds and maintains the laboratory animals to meet the requirements of the scientific groups of the Institute. In 2022-23, the institute established the Animal Biosafety Level-3 (ABSL3) facility to perform experiments with laboratory animals infected with indigenous or exotic microbial agents with the potential for aerosol transmission and agents causing serious or potentially lethal diseases of humans. In addition to animal experimentation, experimental animal facility and ABSL3 caters to the requirements of private and government institutions in collaborative or fee-for-services mode. For this purpose, the facility registration has been amended for "Research for commercial purpose on small animals (rat, mouse and hamster)".

Details of the facility along with achievements in this year

- Three IAEC meetings were organized in 2022-23. In these meetings, 37 new projects were approved by the IAEC. The total number of animals used for experiments by the principal investigators /researchers in 2022-23 was 3867.
- The facility works as per the guidelines of CPCSEA and guidance of IAEC to ensure humane animal care and treatment and supplies genetically pure and healthy animals. It provides husbandry, veterinary care and research technical support to facilitate animal experimentation.
- At present, the animals are maintained with barrier facility and provision of Individually Ventilated Caging (IVC) system of rearing for mice, rats and hamsters. The animals are provided sterilized feed, corncob bedding, and enrichment materials, and are maintained hygienically in a noise-free environment in the temperature range of 20-22 ºC and humidity of 40-60% as per CCSEA guidelines. A 12:12 light and dark cycle is maintained for proper health and breeding. Health is monitored regularly, along with required therapeutic and prophylactic measures.
- In 2022-23, the facility produced 9130 animals of different strains and species. In addition, 243 nude mice and 12 NOD-SCID mice were procured for different IAEC -approved research protocols. The animal house maintained and bred the following species and strains of animals in 2022-23.

Table: Strains of animals available in Institute of Life Sciences

Sl. No.	Species	Strain	Source of Procurement
1	Mouse	BALB/C	NII, New Delhi, Imgenex, Bhubaneswar
2	Mouse	C57BL/6	NII, New Delhi, Imgenex, Bhubaneswar
3	Mouse	C3H/OUJ	NII, New Delhi
4	Mouse	C3H/HEJ	NII, New Delhi
5	Mouse	FVB.LYZM CRE	NII, New Delhi
6	Mouse	CBA/CAJ	NII, New Delhi
7	Mouse	Tg(K18-hACE2)2Prlmn	Jackson Laboratory, USA, NCBS, Bengaluru
8	Mouse	B6.DMD	Jackson Laboratory, USA
9	Mouse	FVB/J	NII, New Delhi

10	Mouse	FVB-AT-ATX	Alexander Fleming Biomedical Sciences Research Centre, Greece
11	Mouse	B6-GFP	NII, New Delhi
12	Mouse	B6.129 floxed Myh9	CNRS, France
13	Mouse	C57BL/6 NTac-C1qbp	CNRS, France
14	Mouse	NUDE	Hylasco Bio-Technology Pvt. Ltd, Hyderabad
15	Mouse	NOD-SCID	ACTREC, Navi Mumbai, Hylasco Bio-Technology Pvt. Ltd, Hyderabad
16	Mouse	B6/RKO	New York University, USA
17	Mouse	B6/ENPP2	Alexander Fleming Biomedical Sciences Research Centre, Greece
18	Mouse	B6/SJL	NII, New Delhi
19	Mouse	IRGM-/-	Duke University, USA
20	Mouse	B6.LYZ2	Jackson Laboratory, USA
21	Mouse	B6.ITGAX	Jackson Laboratory, USA
22	Mouse	B6.LCK	Jackson Laboratory, USA
23	Mouse	B6.CD19	Jackson Laboratory, USA
24	Mouse	B6.PAX7	Jackson Laboratory, USA
25	Mouse	B6.LPA1	Alexander Fleming Biomedical Sciences Research Centre, Greece
26	Mouse	B6.MIF KO	Ohio State University, USA
27	Mouse	OT-I/Rag	University de Lausanne, Switzerland
28	Mouse	OT-II CD45.1	University de Lausanne, Switzerland
29	Mouse	FLT3L	University de Lausanne, Switzerland
30	Mouse	NcoR1xCD11C Cre	University de Lausanne, Switzerland
31	Mouse	C57BL/6.STING1 KO	Jackson Laboratory, USA
32	Mouse	Nrf2 KO	Jackson Laboratory, USA
33	Mouse	Mavs KO	Jackson Laboratory, USA
34	Mouse	B6(C9)IFNAR1	Jackson Laboratory, USA
35	Mouse	B6.Cg.Tg.(CAG -Cre/ESR1)Samc/J)	Jackson Laboratory, USA
36	Mouse	B6.129S4-Krastm4Tyj/J	Jackson Laboratory, USA
37	Mouse	B6.129P2-Trp53tm1Brn/J	Jackson Laboratory, USA
38	Mouse	B6.FVB-Tg(Pdx1-cre)6Tuv/J	Jackson Laboratory, USA
39	Mouse	DZIP3_FLOX/+	Cyagen Biosciences Inc. China
40	Mouse	B6 db/db	NISER, Bhubaneswar
41	Rat	Copenhagen	NII, New Delhi
42	Hamster	Syrian Golden Hamster	NCLAS, NIN, Hyderabad

Advance Mass Spectrometry Facility (Central Proteomics Facility)

Brief about the facility

DBT- Institute of Life Sciences (ILS), Bhubaneswar has recently established, the "Advance Mass Spectrometry Platform" at ILS with support of the DBT SAHAJ-Infrastructure Programme grant. The Advance Mass Spectrometry Platform includes two major mass spectrometers. One is Thermo Scientific make Orbitrap Fusion Lumos Mass Spectrometer which is basically Orbitrap based High-Resolution Mass Spectrometer (HRMS) suitable for various discovery proteomics applications such as Global & Quantitative Proteomics, Metabolomics, Post-translational modifications (PTMs) identification, etc. Another one is Thermo Scientific make TSQ Quantis plus Triple Quadrupole Mass Spectrometer, which is LC-MS/MS with Triple Quadrupole technology suitable for targeted proteomics applications and validation of peptides and small molecules. Overall, this platform is helpful to cover all major multi-omics applications.

The major aim to establish the Advance Mass Spectrometry platform at ILS is to support the ongoing research activities of ILS and neighbouring institutes as well as capacity building in terms of workshops and hands-on training for the faculties and research personnel working in other institutions in Odisha. The internal and external users make extensive use of the facility. In this year, data from the facility has contributed substantially towards publications in reputed journals.

List of the instruments/equipment available in the facility

Sl. No.	Name of the instrument/equipment	Technical Specifications and applications
1.	**High Resolution Mass spectrometer (HRMS) Thermo Scientific Orbitrap Fusion Lumos Mass spectrometer** 	The thermo scientific Orbitrap mass spectrometry is the industry leading high performance mass spectrometer with enhance sensitivity. It combines the best of Quadrupole, Orbitrap, and Linear ion trap. It enables life scientist working with the most challenging samples of low abounding, High complexity, Difficulty to analyse chemical structure. This can perform a wide variety of analysis from depth discovery experiments to characterizing of complex PTMs. It is mainly used for discovery proteomics application.
2.	**Liquid Chromatography Tandem Mass Spectrometer (LC-MS/MS) Thermo Scientific TSQ QUANTIS PLUS Mass spectrometer** 	Thermo Scientic TSQ Quantis Plus Triple Quadrupole Mass Spectrometer combines three Quadrupole analyser, which provides the sensitivity and robustness to meet the most demanding analytical challenges. This instrument can confidently quantify compounds at extremely low concentrations in the most challenging matrices. It is used for targeted proteomics application.

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Services: Mass spectrometers in this facility are available for internal and external users on chargeable basis depending on type of requirement. The instrument user charges and booking details are available ILS website. Facility manager may be contacted for any query or more details if required.

Bioinformatics Facility

Brief about the facility

The ILS has a vibrant bioinformatics facility to support cutting-edge life science research. It has both the hardware and software to support high-end bioinformatics research. ILS, currently, has two computing clusters for use by all the scientists for bioinformatics, computational biology, machine learning, and image analysis, etc. The HPC facility also has relevant software for modern cutting-edge research in areas such as drug discovery, high throughput sequencing data analysis, machine learning, and high-end molecular simulations.

List of the instruments/equipment available in the facility

Sl. No.	Name of the instrument/ equipment	Make and model	Technical Specifications and applications
1.	High-performance computing facility	A.Dell B. HP	A total of about 450 processor cores and two NVIDIA Tesla P100 GPU nodes (16 GB).
2.	Commercial and open-access software	EMacs, Octave, Scilab, MPI, OpenMP, Gnuplot, NAMD, VMD, GROMACS, Schrodinger, Autodock, Burrows-Wheeler Aligner (BWA), Bowtie2, CIRCexplorer2, STAR aligner, Deeptools2, Picard Tools, Samtools, BEDTools, BCFtools, Sambamba, GATK, Varscan, MuTect, snpEff, snpSift, Ensemble VEP, VCF-kit, Meerkat, CNVnator, SOAPdenovo2, SGA assembler, Allpaths-LG, BayesTyper, ADMIXTURE, AMBER, etc.	Drug discovery, high throughput sequencing data analysis, machine learning, and high-end molecular simulations.

Details of the facility along with achievements in this year

The ILS bioinformatics facilities provide access to high-end computing to address questions related to the field of cancer biology, virology, plant biology, etc. The facility is easily accessible to ILS scientists and scholars. It has been used a lot during the COVID-19 pandemic for sequencing data analysis and drug discovery etc. The BIC has been at the core of various collaborative research efforts culminating in many high-quality publications, and patents, shaping the research at ILS and neighbouring areas. These facilities are also being utilized for storing the research data of ILS as well as data from other departments such as finance and accounting, stores and purchase, etc. We have done various workshops related to bioinformatics where many people have been trained every year.

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Biophysical Characterization Facility

Brief about the facility

The Biophysical Characterization Facility was established with funding support from DBT through the RRSFP project "Bioactive Bhubaneswar Biophysical Characterization Facility" (currently SAHAJ scheme; Ref: BT/INF/22/SP33046/2019). The crystallization robot allows rapid crystallization setups, with minimal protein and crystallization screen conditions. The Rigaku XRD machine provides clean X-ray Diffraction data with strong signal and less of noise. The crystallization robot, along with the X-ray Diffractometer allows the steps from protein crystallization to structure solution to be carried out rapidly in-house. Analytical Ultra-Centrifugation (AUC) experiment is one of the best to obtain the binding stoichiometry of different biomolecular complexes, to understand the oligomeric status of proteins and to find out the precise molecular mass of protein/complex samples. The in-house Optima AUC machine is being used for all these kind of experiments with the help of sedimentation velocity property of the molecules of interest. The internal and external users make extensive use of the facility. In this year, data from the facility has contributed substantially towards publications in reputed journals such as JoVE, Plant Cell and BBA-GRM. We have had external users both from academia and industry for this facility.

List of the instruments/equipment available in the facility

Sl. No.	Name of the instrument/equipment		Technical Specifications and applications
1.	Protein Single Crystal X-Ray Diffractometer (XRD) Rigaku-Synergy Custom System with RA-Micro 7HF X-Ray Generator and HyPix6000 Direct Photon Counting Detector		Used for X-ray diffraction studies of protein crystals in order to determine the atomic resolution three-dimensional structure of proteins.
2.	Robotic Protein Crystallization System SPT LabTech-Mosquito XTal 3		Used for high-throughput crystallization setups of protein samples; calibrated for 96-well 2-drop crystallization plates.
3.	Analytical Ultra-Centrifuge Beckman-Coulter Optima AUC		The facility enables users to perform analysis of three to seven samples simultaneously. The machine is used to obtain the binding stoichiometry in different biomolecular complexes, oligomeric status of proteins, and to analyse precise molecular mass of protein/complex samples.

Training programme/workshop conducted for skill development

A two-day workshop on Recombinant Protein Purification and Protein Crystallography was carried out for college faculty with funding support from SERB (SSR scheme; 20th to 21st October 2022). The workshop covered aspects of protein crystallization and XRD experiments.

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Biorepository

In the backdrop of the COVId-19 pandemic, ILS had proposed to establish a biorepository to collect, process, store and disseminate well characterized clinical specimens and accompanying deidentified health information to qualified researchers for use in a wide range of biomedical studies. These studies may include characterizing the basic pathophysiology of the disease, its clinical outcomes as well as the development of diagnostic kits, therapeutics and vaccines. We had also proposed to isolate and adapt SARS-CoV-2 belonging to different clades that can be quickly amplified in cell culture systems. These viruses can be used for testing drug candidates in vitro and animal challenge models as well as vaccine candidates.

Number of samples collected:
312 Individual COVID-19 patient samples, 60 non-infected controls, 35 convalescent cases

Nature/type of sample collected:
Serum, Plasma, PBMC, Urine, Stool, Nasopharyngeal swab, Oropharyngeal swab

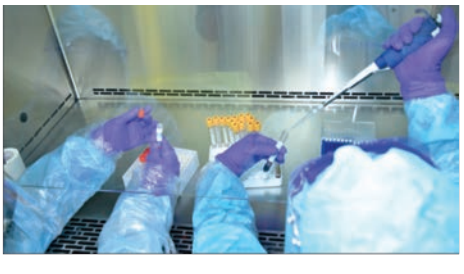
Samples shared with academia:
250 (Serum), 250 (Plasma), 250 (Oropharyngeal swab), 20 (PBMC), 200 (Stool) samples from unique patients have been used.

Samples shared with industry:
150 (Oropharyngeal swab), 20 (serum), Drug screening using virus culture (5 companies).

Achievements :
09 publications
22 viral cultures established

List of the instruments/equipment available in the facility

Liquid Nitrogen container, -80 and Biosafety cabinet



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Biosafety Level 3 Facility

Brief about the facility

The BSL3 laboratory at ILS-Bhubaneswar is a modular facility containing the Virus-culture and Bacterial Culture labs. The facility was commissioned in Mar 2020 and was extensively utilized for COVID-19 testing, isolation and culture of SARS-CoV2 circulating variants, COVID-19 related research activities. The ILS-BSL3 facility has all the required infrastructure for mammalian cell culture based research activity with Risk Group 3 bacterial and/or viral human pathogens. The facility is also being used at DBT-ILS to provide antiviral testing service in fee-for service mode for candidate agents against SARS-CoV2 and COVID-19, which has attracter multiple private and government clients. It is also open for external users who want to avail the facility. The internal and external users make extensive use of the facility. In this year, data from the facility has contributed substantially towards publications in reputed journals.

List of the instruments/equipment available in the facility

Sl. No.	Name of the instrument/equipment	Technical Specifications and applications
1.	CO2 Incubator (Eppendorf)	Mammalian cell culture
2.	High-Speed Tabletop Centrifuge (Thermo Scientific)	Cell culture and sample processing
3.	Class II Type B2 Biosafety Cabinets (Biosafe Pvt Ltd)	Mammalian cell culture and infectious work
4.	Orbital shaker incubator (Thermo Scientific)	Bacterial Culture
5.	Ultra-deep freezer (-80C) (Thermo Scientific)	Storage of biohazardous biological samples
6.	TANBead Maelstrom 4800	High throughput RNA isolation
7.	Nextractor® NX-48S (Genolution)	High throughput RNA isolation

Highlights of this year

Total number of users : Internal: 7 faculty & External: Biovalidation services provided to 19 external clients
Publication : More than 10 high quality publications were published by the research groups that use the facility

Training programme / workshop conducted for skill development

Training and refresher program was conducted for interested ILS students, staff, and technicians in Basic Laboratory Biosafety practices and standard operating protocols in Biosafety level 3 laboratory.

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Details For Instrument/facility Booking : Through ILS Service E-portal

Animal Biosafety Level 3 (ABSL3) Facility

Brief about the facility

The establishment of ABSL-3 animal challenge platform for testing of potential antiviral and vaccine candidates against SARSCoV2 was initiated on 19/01/2021 at DBT-ILS, Bhubaneswar with DBT-BIRAC funding. The new ILS-ABSL3 facility has the state of instrumentation facility run and monitored by experienced scientists and staff. The facility provides service for antiviral and vaccine candidate evaluation against SARS-CoV2 infection in Syrian hamster and/or K18-ACE2 transgenic mice on a fee-for-service mode. The internal and external users make extensive use of the facility. In this year, data from the facility has contributed substantially towards publications in reputed journals.

List of the instruments/equipment available in the facility

Sl. No.	Name of the instrument/ equipment	Make and model	Technical Specifications and applications
1.	Quantum GX2 microCT Imaging System	PerkinElmer	Used for antiviral animal studies in the ABSL3 facility

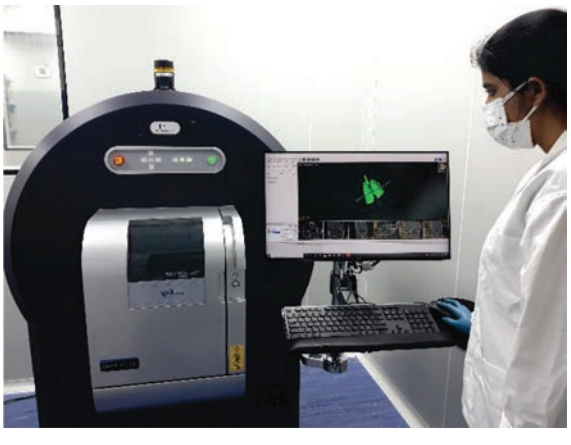
Highlights of this year

In the past the facility has attracted multiple private and government clients and services have been provided in fee-for service mode. Currently the facility is getting utilised for Mycobacterium tuberculosis and SARS CoV2 related studies.

- Total number of users: Internal: 7 studies & External : 2 studies performed
- One publication and one patent filed

Training programme/workshop conducted for skill development

- Two staffs got trained to handle the microCT Imaging System and analyse the data
- Orientation program was conducted for interested ILS students and technicians to work at ABSL3 facility



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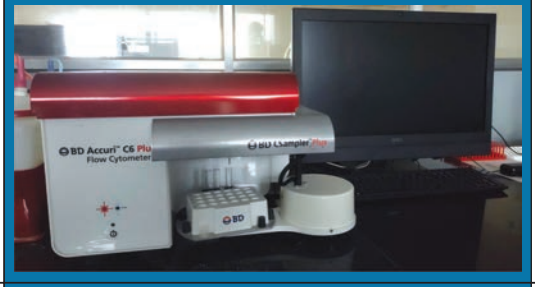
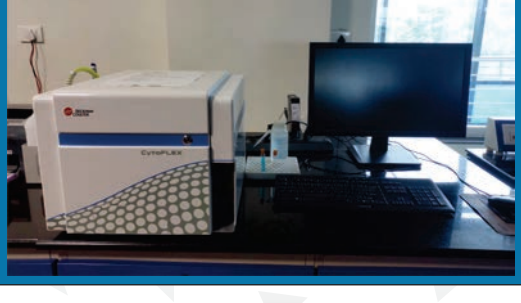
FACS Facility

List of the instruments/equipment available in the facility

Sl. No.	Name of the instrument/equipment	Technical Specifications and applications
1.	FACS CALIBUR-BD Bio-Sciences 	This system is compact and easy to use. Its dual-layer design provides the flexibility and sensitivity needed for multicolor analysis on this system. Two lasers air-cooled argon Blue laser and a Red diode laser are spatially separated for high sensitivity, minimal need for compensation, and flexibility in Fluorochrome selection. It can detect 3 numbers of blue fluorochromes and one red fluorochrome.
2.	ACCURI C6 PLUS-BD Bio-Sciences 	It is a portable lightweight table top easy-to-use automated flow cytometer. It has a non-pressurized, peristaltic pump system, which drives the fluidics to consume a very less amount of sheath fluid. It supports 96 and 48-well plates with 24 tube racks for continuous sample loading. It is also equipped with blue and red lasers and 4 fluorescence detection filters.
3.	LSR Fortessa-BD Bio-Sciences 	This instrument delivers the optimal sensitivity and resolution required for multicolor applications. This also allowed the user to fully customized the fluorescence filter configuration to deliver flexibility and power for advanced research. This multicolor cell analyzer is equipped to detect up to 16 colors simultaneously with the support of 4 lasers. Its fluidics system features fixed gel coupled cuvette flow cell technology to improve the detection signals.
4.	LSR Fortessa (SORP)-BD Bio-Sciences 	This analyzer is the same as LSR Fortessa and upgraded with a Yellow-Green (561 nm) Laser and can detect up to 20 fluorescence colors simultaneously.
5.	Cytoflex S-Beckman Coulter 	It is a photodiode-based multi-color flow cytometer. It is equipped with 4 lasers with a minimum of 13 emission parameters. It has a large dynamic display range up to the 7th log position to resolve dim and bright populations in the same sample. In this machine, cells can be acquired and saved by number, time, and volume options. It is also equipped with a syringe and peristaltic pump-based fluid disc system to consume very less amount of sheath fluid.

6.	Moflo Astrios-Beckman Coulter 	It is a powerful sorting capability with a high-speed 6-way jet-in-air proficiency sorter. It has 5 lasers with 5 pinhole configuration system. Cells can be analyzed by 5 exciting lasers with 20 different Fluorochrome emission filters. It has a broad range of sorting options like 1 – 6-way tubes and 6-1536 well plates. Built-in Baker Steril guard cabinet ensures biosafety is maintained at all times to eliminate cross-contamination.
7.	FACS Melody-BD Bio-Sciences 	It is easy to use tabletop automated cell sorter. It is enriched with FACS chorus software which guides throughout the entire cell sorting process using advanced automation technology. It has 2-way sorting capacity gel couple cuvette technology for generating optimum signal resolution. This Instrument can analyze a minimum of 10 parameters with 3 Laser systems.
8.	Image Stream X-Amnis 	It is the powerful combination of quantitative image analysis and flow cytometry in a single platform that creates exceptional new experimental capabilities. Imaging flow cytometers can bring more power and insight into research. Amnis applications use high-throughput imaging of events such as internalization, shape change, and cell-cell interactions to obtain novel quantitative data to elucidate cell signaling, chemotaxis, the immunological synapse, and more.
9.	Helios-Fluidgm 	It is a time-of-flight mass cytometer with heavy metal labeling technology instrument. It empowers researchers to interrogate more than 60 markers simultaneously on millions of single cells. The high purity and choice of heavy metal ion tags rather than Fluorochrome provide minimal background noise from signal overlap or endogenous cellular components.

Highlights of this year

- ILS FACS facility is well-equipped with high-end analyzers and sorters for any kind of cells.
- The facility is equipped to handle sorting for infectious materials.
- The facility is maintained by facility manager (Mr. P. Nath), who is working with this facility over a decade.
- The facility is used by both internal and external users on charge basis.
  - o Total uses of facility
    - Internal – 427 students, 20 faculties
    - External – 20 students, 5 Institutes
  - o Revenue generated if any – 5, 51,250/- (Five lakhs fifty-one thousand two hundred and fifty only)

The internal and external users make extensive use of the facility. In this year, data from the facility has contributed substantially towards publications in reputed journals.

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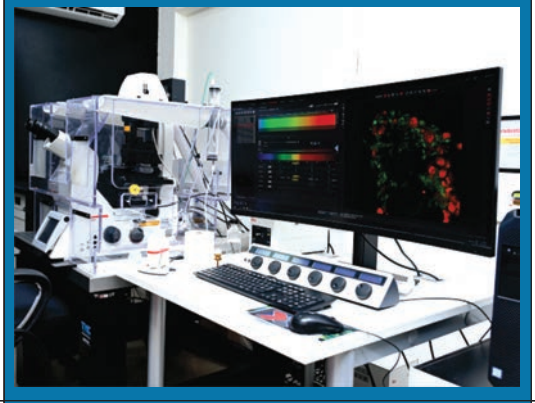
Imaging Facility

List of the instruments/equipment available in the facility

Sl. No.	Name of the instrument/equipment	Technical Specifications and applications
1.	**STED Confocal (Leica Sp8 Inverted Microscope with STED Module)** 	STED Dual imaging for 488 and 633 Excitation Dye, 4 colour Imaging of Fluorescent Dye haveing 405, 488, 555, 633 excitation, 3 Hyd GaAsP Detector and 2 PMT detector, High Speed Resonant Scanner, Motorized Galvo Stage, FRET, FRAP, Lightening Imaging,Otical Slicing, 3D Construction, Live Cell imaging, Lambada Scan, Colocalization Analysis, Quantification etc Objective-10X APO dry (NA-0.4), 20X APO dry (NA-0.75), 40X APO dry (NA-0.85), 63X APO oil immersion (NA-1.4), 100X APO oil immersion(NA-1.47) (STED obj) **Resolution** Around-50nm in STED imaging and 350nm in Basic Confocal Imaging
2.	**Stellaris 5 (Leica Inverted Microscope)** 	4 colour Imaging of Fluorescent Dye haveing 405,488,555,633 nm excitation , 2 Slicon Based Hyd Detector,one PMT detector, General Scanner, Motorized Stage, FRET, FRAP, Lightening Imaging, Otical Slicing, 3D Construction, Colocalization Analysis, Quantification etc Objective-40X dry (NA-0.85), 63X oil immersion (NA-1.4), 100X oil immersion(NA-1.4) **Resolution** Around- 350nm in Confocal Imaging
3.	**Up Right Fluorescent Microscope Zeiss Axio Imager with Apotome Module** 	4 Channel Imaging namely DAPI, FITC, hodamine, Cy5 Band Pass Filter, Motorized Z sectioning and Motorized Stage, 3D, 2.5D Reconstruction Tile Stiching, Colour Camera-Axiocam 305 (5 megapixel), Monochrome Camera –Axiocam 503 (38frames /Sec), M Objective-5X Ec Neu Fluoro dry obj (NA-0.17), 10X Apo dry (NA-0.45), 20X Plan dry (NA-0.8),4 0X Oil EC Plan Neu Fluoro (NA-1.3), 63X Plan Apo oil immersion (NA-1.4)
4.	**Zeiss Live Cell Imager Cell Discoverer 7** 	7 LED 385, 420, 470, 511, 567, 590, 620 nm and Quadrant Band Pass Filter and Tri Band Pass Filter, In built CO2 and temperature module, 3 Objective- 5X Plan Apochromat (NA-0.35), 20X Autocorection Collar Paln Apochromat (NA-0.95), 50X Plan Apochromat, Auto Correction Collar, Auto water Immersion (NA-1.2), Magnifier Changer -0.5X, 1X, 2X , Platform for 35/60mm Dish, 6 Well Palte, 96 Well Plate, Long Slide, Carrier Tile Scan, Time Laps, Z sectioning, Multicannel Imaging, 3D Construction, Colocalisation Analysis, Kollabari 2 Module for Definite Focus. Haveing Axiocam 506 mono and Axiocam 702 nm Camera.

5.	High Content Imaging Thermofischer Cx7 LZR 	High Content Screening is the Automated microscopy with Quality driven Image Analysis, Around 20 Bioaplication Analysis , 7 Excitation Laser (405,450,488,561,594,647,785 nm) Carrier Patform-96 well Plate,6 Well Plate , On Stage Incubator for Live Cell Imaging with Kinemetics Analysis Obj-2X,PLAPO NA(0.08) Obj-4X,UPLFN NA(0.13) Obj-10X,UPLFN NA(0.3) Obj-20X,semi Apo FL NA(0.45) Obj-20X,semi Apo FL NA(0.75) Obj-40X,semi Apo FL NA(0.6) Oribitor Robot For Loading Plate and with Bar Code Reader

Details of the facility along with achievements in this year

In Last Financial Year There are 639 User Uses our Facility out of Which 628 Internal user and 11 External User and An amount Rs 1,95,570 is generated (Internal Rs 1,82,570 and External Rs13,000).
The internal and external users make extensive use of the facility. In this year, data from the facility has contributed substantially towards publications in reputed journals such as Nature Communications, JVI, The EMBO Journal.

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Immunogenicity Assay Platform

Brief about the facility

Immunogenicity platform at ILS was established with the support of DBT-BIRAC COVID Suraksha Mission. We have established state of the art full spectra multicolor flow cytometer ie., Cytek Aurora with 5 lasers and Meso Scale Discovery SQ120mm platform. These two instruments have the capability to analyse the humoral and cell mediated immunity to assess the vaccine efficacy in the clinical trial samples or the samples from animal trials. We have recently performed a longitudinal two year analysis of CAVAXIN vaccination on humoral and T-cell responses. Our analysis depicted that Omicron variant could be the best candidate for vaccine generation as the antibody titres after Omicron infection were stable for longer time than the WT SARS-CoV-2 variant. The NABL accreditation for the facility is under process. Moreover, we have organized two hands on workshops to train the stakeholders including clinicians, faculty members, Postdocs, PhD and masters students. The internal and external users make extensive use of the facility. In this year, data from the facility has contributed substantially towards publications in reputed journals.

List of the instruments/equipment available in the facility

Sl. No.	Name of the instrument/equipment	Technical Specifications and applications
1.	Cytek Aurora Flow Cytometer (Cytek N7-00003) 	• Cytek Aurora is equipped with up to five lasers, 64 detection channels for fluorescence, and three channels for scatter (blue laser FSC, blue laser SSC, and violet laser SSC). • The system is intended to be used for analyzing cells in the fields of immunology, biochemistry, biology, oncology, hematology, virology and pathology research. • Hands-on training program using full spectra multicolor flow cytometry, organized twice by ILS, Bhubaneswar in 2023.
2.	Meso QuickPlex (MSD SQ 120 MM) 	• MSD is based on MULTI-ARRAY technology, a proprietary combination of patterned arrays and electrochemiluminescence detection that results in exceptional sensitivity, speed, dynamic range, and convenience. • Use for detection of multiple biomarkers/ analytes simultaneously in a single well.

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Next Generation Sequencing Facility

Brief about the facility

Next Generation Sequencing facility at ILS is a fee-for-service facility which can be used by inside and outside ILS users for performing any NGS experiment like RNAseq, ChIPseq, Whole Genome Sequencing, Exome sequencing and targeted sequencing. The users can discuss the experimental plan with the scientist incharge and the facility manager and then quotation for the service is provided to them for the services. The user can opt for whether only the sequencing is required by NGS platform or data analysis also need to be performed. The facility has already provided a number of services and large number of service requests are coming for NGS services. The facility has been used to perform NGS for SARS-CoV-2 lineage identification during COVID pandemic through INSACOG project. The internal and external users make extensive use of the facility. In this year, data from the facility has contributed substantially towards publications in reputed journals.

List of the instruments/equipment available in the facility

Sl. No.	Name of the instrument/equipment	Technical Specifications and applications
1.	Tape Station Agilent Technologies & 4200 	The Agilent 4200 Tape Station is used to identify the DNA fragmentation quality for performing NGS experiments. The system offers walk-away operation with fully automated sample loading, run and analysis. In this machine 16 samples can be analysed at a time.
2.	NextSeq550, Illumina 	The NextSeq 550 instrument is used for low to medium throughput NGS analysis like transcriptome, ChIP-seq and targeted sequencing. The maximum output of the machine is 120Gb in a single run.
3.	NOVASeq6000, Illumina 	The NOVASeq6000 instrument is recently installed at ILS and this system can be used to analyse whole genomes and exomes of bigger species like humans. It generates up to 6 Tb data and 20 billion reads in dual S4 flow cell mode with streamlined workflows. Using this system 56 human whole genomes can be sequenced in 48 hours.

Training programme/workshop conducted for skill development

- We have trained 23 batches of students from different colleges and Institutes through the Outreach Centre of the Institute and a number of workshops.
  (1) Regional Medical Research Centre (RMRC), Bhubaneswar (2)Indian Institute of Science Education And Research (IISER), Berhampur (3) Orissa University of Agriculture & Technology (OUAT), Bhubaneswar (4) National Institute of Technology (NIT), Rourkela (5) Fakir Mohan University, Balasore (6) Ravenshaw University, Cuttack (7) Utkal University, Bhubaneswar (8) Siksha 'O' Anusandhan (SOA), Bhubaneswar (9) Nandankanan Zoological Park, Odisha (10) L V Prasad Eye Hospital, Bhubaneswar
- NGS services provided to several academic institutes including CDRI, NISER, AIIMS, OUAT, KIIT.

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Transmission Electron Microscopy Facility

Brief about the facility

The JEM-2100plus is a multipurpose analytical electron microscope used for different range of micro structure evaluation. This model has up to 200 kV Acc. voltage and LaB6 filament provides high energy electron beam which offers detailed information about the size, shape, morphology of samples and helps in biological/medical, material science studies. The facility has an excellent ultra-microtome Leica UC7 which provides wide range of sectioning options for ultra-structural studies. In this financial year 2022-23 the facility is used by 34+ internal users from 13 different ILS labs and external users from 11 different institutions. The total revenue generated by the facility is Rs.263950.. The internal and external users make extensive use of the facility. In this year, data from the facility has contributed substantially towards publications in reputed journals.

List of the instruments/equipment available in the facility

Sl. No.	Name of the instrument/equipment	Technical Specifications and applications
1.	**Transmission Electron Microscope (JEOL-JEM 2100 Plus)** 	**Voltage:** 80-200kV, **Resolution:** Point-0.27nm & Lattice 0.14 nm, **Magnification:** 1200x to 1000000x, **Camera:** Gatan's high speed CMOS RIO9 camera (3Kx3K), with Tomography
2.	**Ultra-microtome (Leica-EM Uc7)** 	Advance touch screen control unit, **Cutting Speed:** 0.05-100 mm/s, **Section Thickness:** 50-15000 nm

Training programme/workshop conducted for skill development

In Aug 2022 a skill development seminar was conducted by the facility for students on TEM sample preparation. During this time students from more than 15+ school/collages also visited the facility.

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Services: Details for instrument/facility booking is available on ILS service e-portal

Central Instrumentation Facility

Real Time PCR
- Applied Biosystem QuantStudio6 Pro
- AppliedBiosystem QuantStudio6 Flex
- Applied Biosystem QuantStudio5
- Applied Biosystem QuantStudio3 (4 Nos)
- Bio-Rad QX 200 Droplet Digital PCR
- Applied Biosystem StepOne
- Roche Light Cycler QPCR

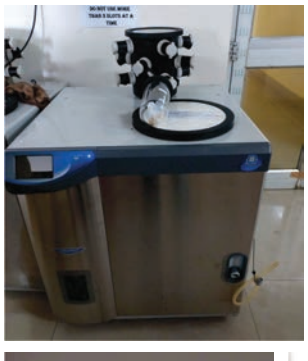
Chemi/Gel DOC
- Bio-Rad Chemi DOC MP Imaging System (2 Nos)
- Bio-Rad Gel DOC XR+ (2 Nos)

Ultra Centrifuge
- Beckman Coulter Optima XPN-100 (2 Nos)
- Beckman Coulter Table Top Optima MAX-XP

Centrifuge
- Kubota 7000 High Speed Centrifuge (2 Nos)
- Beckman Coulter Avanti J-E

Other Major Instruments
- Agilent Sea Horse XFp Analyser
- REMI CIS 24 Plus Shaker Incubator
- SONICS Vibro-Cell Sonicator (2 Nos)
- LABCONCO Freeze Drier (2 Nos)
- STANSTED SPCH-10 Pressure Cell Homogeniser
- NEW BRUNSWICK SCIENTIFIC Innova 43 Incubator Shaker (2 Nos)
- Typhoon Biomolecular Imager
- JEOL Scanning Electron Microscope
- Jasco Circular Dichroism Spectrometer
- Malvern Isothermal Titration Calorimeter







ASBMB PUBLICATIONS
Journal of Virology
AMERICAN SOCIETY FOR MICROBIOLOGY
Published Monthly by the American Society for Microbiology
JVI
JUNE 2023, VOLUME 97, NUMBER 6
Taylor & Francis
JOURNAL OF BIOLOGICAL CHEMISTRY
THE EMBO JOURNAL
Volume 42 Issue 14 | 17 July 2023
Cell fate probabilities during retinal development
EMBOpress
Cellular and Molecular Life Sciences
SUGAR BEET SINK-SOURCE REVERSION
www.plantcell.org

RESEARCH PUBLICATIONS AND AWARDS

Research Publications and Awards

Publications

Research Article

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Book Chapters

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2. Sherpa, T., Kumari, K., Jha, D. K., Tripathy, M. K., & Dey, N. CRISPR/Cas based genome editing and its possible implication in bamboo research. Genetics, Genomics and Breeding of Bamboos. 2023 doi: https://doi.org/10.1201/9781003287605

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Patents

Sl. No.	Name of the Scientist	Patents Filed
1.	Dr. V. A. Nagaraj	• A pharmaceutical composition to combat artemisinin resistance in malaria. (Indian Patent Application No. 202231018911). • A pharmaceutical composition to combat artemisinin resistance in malaria. (PCT Application No. PCT/IN2023/050301).
2.	Dr. Mamoni Dash	• A Thermoresponsive Hydrogel And A Method Of Preparation Thereof, (Indian Patent Application Number- 202331020916).
3.	Dr. Narottam Acharya	• A live attenuated vaccine against candida albicans and a method thereof (Indian Patent Application No.: 202231043203).
4.	Dr. Soma Chattopadhyay	• An Antiviral therapeutic herbal composition for treatment of SARS-CoV-2 and method for preparation thereof. (Indian Patent Application No.: 202131057294) dated 27/12/2022. • Cocrystal of telmisartan and ascorbic acid, composition comprising same and method of use. (Indian Patent Application No. 202331016591) dated 13.03.2023

Awards and Honors, Memberships/Fellowships

- **Dr. Santosh Chauhan** has been elected as a Fellow of Indian Academy of Sciences (IASc) 2023
- **Dr. Soma Chattopadhyay** has been elected as a Fellow of the National Academy of Sciences, India (NASI), 2022
- **Dr. Amaresh Panda** was listed among the top 2% of scientists of the world for the year 2021 in the list published by Stanford University, USA.
- **Dr. Sanjeeb K Sahoo** was listed among the top 2% Scientists across the world in 2022, published by Stanford University, USA.
- **Dr. Namisha Sharma** received the Young Scientist Award (2021-22) of National Academy of Agricultural Sciences, New Delhi
- **Dr. Namisha Sharma** received the Young Scientist Platinum Jubilee Award (2021-22) of The National Academy of Sciences, New Delhi

Other Awards to Scientists

Dr. Amaresh Panda

- Non-Executive Director of RNA Biotech Private Limited.

Dr. Namisha Sharma

- Prof. Har Swarup Memorial Lecture (2022), Indian National Science Academy (INSA), New Delhi.
- Prof. S.K. Sopory Young Scientist Award (2023), Indian Society of plant Physiology, New Delhi.
- Inspire Faculty Award (2021) of Dept. of Science & Technology, Govt. of India

Dr. Rupesh Dash

- SERB-STAR award 2020-2023

Dr. Sandip K Mishra

- Appreciation letter from the office of Honorable Governor of Odisha.
- Science Achiever from Odisha given by Odisha Bigyan Academy.
- Awarded with UAE INDO B J Kennedy distinguished research excellence award by IMRF Institute of Higher Education and Research, DUBAI Chapter.
- Proud Indian Iconic Research Leader of the Year by REd TALKS, Ratna Prasad Multidisciplinary Research and Educational Society.
- Pink October Excellence for Innovation on Breast Cancer by KRIAA foundation.

Society Memberships

Dr. Amaresh Panda

- Full Member of RNA Society, USA

Dr. Dileep Vasudevan

- Executive Council Membership of the Indian Crystallographic Association (ICA)

Dr. Namisha Sharma

- Elected as a member of INYAS (2023) Indian National Science Academy (INSA), New Delhi.

Dr. Seema Pradhan

- Member of the Society for Ethnopharmacology (SFE-India) in September 2022.

Dr. Soma Chattopadhyay

- Member of American Society of Microbiology (ASM)

Journal Editors

Dr. Amaresh Panda

- Guest Associate Editor of the journal International Journal of Molecular Sciences.
- Associate editor of the journal PeerJ.
- Associate editor of the journal Frontiers in Genetics.

Dr. Anshuman Dixit

- Became Associate editor for Molecular Diversity journal
- Appointed an Editorial board member for the journal Scientific reports

Received by the Students/ Project Staffs

- **Sourav Ghosh** from Dr. Arun Nagaraj's lab became the top eight finalists of TNQ Inspiring Science Award, and received a medal, citation and Apple laptop.
- **Ketul Saharan**, from Dr. Dileep Vasudevan's lab received EMBO Scientific Exchange Grant (SEG) for three months training in NTU, Singapore (September to December 2022).
- **Pratyush Kumar Das**, from Dr. Mamoni Dash's lab

received American Chemical Society (ACS) Best Poster Award at 27th Indian Society of Chemists and Biologists International Conference (ISCBC-2022) on Research and Innovation in Chemical, Pharmaceutical and Biological Sciences Birla Institute of Technology, Mesra, Ranchi, 16-19th Nov, 2022

- **Pratigyan Dash** from Dr. Mamoni Dash's lab received American Chemical Society (ACS) Best Oral Presentation Award, 27th Indian Society of Chemists and Biologists International Conference (ISCBC-2022) on Research and Innovation in Chemical, Pharmaceutical and Biological Sciences, Birla Institute of Technology, Mesra, Ranchi, 16-19th Nov, 2022
- **Pratigyan Dash** from Dr. Mamoni Dash's lab presented and bagged the best Oral presentation Award on "A Symposium into the key trends in Biomaterials research" hosted by Therapeutic Biomaterials and Polymer Chemistry Team of Institute of Life Sciences, Bhubaneswar, 27-28th Sep, 2022
- **Swagata Bose** from Dr. Narottam Acharya's lab bagged best poster award in "12th conference on yeast biology: Fundamentals to Application of yeast and fungi" conducted by IISER, Mohali, during 10-13th Mar, 2023.
- **Jeky Chanwala** from Dr. Nrisingha Dey's lab got the best poster award at "Current Trends and Future Prospects Of Plant Biology" organized by the Department of Plant Sciences, University of Hyderabad during 23rd-25th Feb, 2023.
- **Sandhya Suranjika**, from Dr. Nrisingha Dey's lab bagged the best poster award at the "International Conference on Agriculture & Rural Development (Agri Vision-2023)", at Centurion University, Bhubaneswar, during 27-29th Jan, 2023.
- **Sandhya Suranjika**, from Dr. Nrisingha Dey's lab got the Young Researcher Travel award during the International Bioresource Conclave and Ethnopharmacology Congress which was held in Imphal, India, during 24-26th Feb, 2023.
- **Soumya Shree Nayak**, from Dr. Nrisingha Dey's lab got the Young Researcher Travel award during the International Bioresource Conclave and Ethnopharmacology Congress which was held in Imphal, India, during 24-26th Feb, 2023
- **Priyanka Mohapatra** from Dr. SK Sahoo's lab bagged the Best poster Award at 22nd International Society of Ethnopharmacology along with 10th International Congress of Society of Ethnopharmacology Conference (ISE SFEC 2023) organized at Imphal, Manipur, India, during 24-26th Feb, 2023.
- **Priyanka Mohapatra** from Dr. SK Sahoo's lab bagged Best poster Award at Symposium on Insights into the key trends in Biomaterials Research, organized by DBT-Institute of Life Sciences, Bhubaneswar, Odisha during 27-28th Sep, 2022
- **Bibhudev Barik** from Dr. Soumen Chakraborty's lab bagged the best poster award at the 42nd annual conference of the Indian Association for Cancer Research-2023 at ACTREC, Navi Mumbai.
- **Kaushik Sen** from Dr. Sunil Raghav's lab received 2nd prize in poster presentation at SIRCON-2022 conference held at NCCS Pune during 24-25th Sep, 2022
- **Kiran Avula** from Dr. Gulam H Syed's lab received the Best Oral Presentation Award at the International Conferece on Virology, Infection Diseases, and COVID19. Oct 2022, Safa Park, Dubai, UAE
- **Usharani Nayak** from Dr. Rajeeb Swain's lab received Prof. U. N. Singh poster presentation award for best poster presentation at "4th Indian Zebrafish Investigators Meeting – IZIM 2022" organized by IISER and ARI, Pune during 21st-23rd Sep, 2022

Extramural Research Grants

Sl. No.	Name of the Scientist	Name of Project	Grant Agency	PI/Co-PI	Duration
1.	Dr. Amaresh Panda	Analysis of the impact of mRNA-mRNA/circRNA interactions in pancreatic β-cell physiology	Wellcome Trust/DBT India Alliance	PI	2019-2024
2.	Dr. Amaresh Panda	Exploring the protein-coding functions of circular RNAs in skeletal muscle cell differentiation	DST-SERB	PI	2023-2026
3.	Dr. Amol Suryawanshi	Epidemiology of Cervical, Endometrial and Ovarian cancers and their association with viral pathogens and tumour markers: A case-control study in Odisha	ICMR	Co-PI	2021-2024
4.	Dr. Amol Suryawanshi	Proteomics study to explore the signature molecules associated with severe pathogenesis of SARS-CoV-2 infection	ICMR	PI	2022-2025
5.	Dr. Arun Nagaraj	Evalution of safety in afficacy of curcumin [(Biocurcumax capsule) as an + (Sulfadoxine Pyrimethamine) tablet] for treatment of uncomplicated P. falciparum malaria. Phase-IIa Double-blind Clinical Trial	DBT	Co-PI	2021-2024
6.	Dr. Dileep Vasudevan	Unraveling the function of plant FKBP nucleoplasmins through structural studies	DST-SERB	PI	2019-2022
7.	Dr. Dileep Vasudevan	Bioactive Bhubaneswar Biophysical Characterization Facility	DBT	PI	2019-2023
8.	Dr. Gulam Hussain Syed	Anti-viral screening platforms for viral diseases: with special reference to COVID-19	DBT	Co-PI	2021-2025
9.	Dr. Gulam Hussain Syed	Characterizing the significance of mitochondria-centric signaling events in Japanese Encephalitis Virus lifecycle and neurodegeneration	DST-SERB	PI	2020-2023
10.	Dr. Mamoni Dash	Bioactive Protein Scaffolds with Gradient Structures for Bone Tissue Engineering	Ramalingaswami Fellowship	PI	Completed in December 2022
11.	Dr. Mamoni Dash	Exosome encapsulated protein hydrogels targeting Osteoclast activity in Osteoporosis	DBT	PI	2020-2023
12.	Dr. Mamoni Dash	A polymer based solution to pest control	DBT-BIRAC	PI	2022-2023
13.	Dr. Namisha Sharma	Long non-coding RNAs in tomato and their role in epigenetic regulation of gene expression upon virus infection	DST-INSPIRE Faculty Fellowship	PI	2022-2027
14.	Dr. Narottam Acharya	Fidelity and processivity of variants of human DNA polymerase delta (Polδ): Implications in DNA double-strand break repair and carcinogenesis	DBT	PI	2021-2024

15.	Dr. Narottam Acharya	Evaluation of pathogenic potential of various DNA polymerase knock out strains of Candida albicans: Implications in development of live attenuated anti-fungal vaccine	DBT	PI	2021-2024
16.	Dr. Narottam Acharya	DNA-Protein Cross link repair in Candida albicans	DST-SERB	PI	2022-2025
17.	Dr. P. V. Ramchander	Mission Program on Pediatric Rare Genetic Disorders	DBT	PI	2022-2027
18.	Dr. P. V. Ramchander	Understanding the genetic basis of hearing loss using zebrafish model	DST-SERB	PI	2022-2025
19.	Dr. Rupesh Dash	Global profiling of circular RNAs and their novel functions in rewiring cisplatin resistance of OSCC	ICMR	PI	2023-2026
20.	Dr. Rupesh Dash	Exploring the potential role of Never in mitosis gene A (NIMA)-related kinase 9 in rewiring docetaxel resistance in oral squamous cell carcinomas	DST-SERB	PI	2023-2026
21.	Dr. Rupesh Dash	Rewiring to reverse Chemoresistance in Oral Squamous Cell Carcinomas through Single Cell Transcriptomics	DST-SERB	PI	2020-2023
22.	Dr. Sandip K Mishra	DZNepA as a therapeutic drug candidate for breast cancer treatment	DBT	PI	2022-2025
23.	Dr. Sandip K Mishra	A study of anti-cancerous activity of anti-microbial peptide Tachyplesin-I and other potential compound present in Indian horse shoe crab in breast cancer	Govt. of Odisha	PI	3 years
24.	Dr. Sanjeeb Sahoo	Nanoherbicide: A controlled release formulation to improve rice production	DST	PI	2022-2025
25.	Dr. Sanjeeb Sahoo	Assessment and Evaluation of Therapeutic Potential of Natural Compounds of selected Marine Bioresources	DBT	PI	2021-2024
26.	Dr. Santosh Chauhan	Determine whether IRGM is a novel therapeutic target for inducing broad-spectrum antiviral immunity	DST-SERB	PI	2020-2023
27.	Dr. Santosh Chauhan	Understanding the enigma of interconnection between inflammatory bowel disease (IBD) and neurodegeneration utilizing genetically predisposed IBD mice model	DHR/ICMR	PI	2021-2024
28.	Dr. Soma Chattopadhyay	Anti-viral screening platform for viral diseases: with special reference to COVID-19	DBT	PI	2021-2024
29.	Dr. Soma Chattopadhyay	Development of an Infectious Clone for an Indian Strain of Chikungunya Virus (VAJRA Faculty Scheme)	DST-SERB	PI	2021-2023

30.	Dr. Soma Chattopadhyay	Advanced Mass Spectrometry platform at ILS Bhubaneswar	DBT-SAHAJ	PI	2021-2025
31.	Dr. Soma Chattopadhyay	Translational Research Consortia (TRC) for Chikungunya virus in India	BIRAC	Co-PI	2019-2023
32.	Dr. Soumen Chakraborty	Genome-wide identification of the transcriptional ..... EVI1 transplanted mice model	DST-SERB	PI	2020-2023
33.	Dr. Soumen Chakraborty	Comprehensive transcriptomic and functional analysis of Chronic Myeloid Leukemia-Blast Crisis (CML-BC) with respect to CML-chronic phase (C.P.) using paired samples of CML	DBT	PI	2022-2025
34.	Dr. Sunil K. Raghav	The Indian SARS-CoV-2 Genomics Consortium (INSACOG)	DBT	PI	2021-2024
35.	Dr. Sunil K. Raghav	ZBT10: a potential trigger for dendritic cell immune responses	DST- SERB	PI	2020-2023
36.	Dr. Sunil K. Raghav	GenomeIndia: Cataloguing the genomic variation in India	DBT	PI	2020-2023
37.	Dr. Sunil K. Raghav	Establish state of the art clinical-immunogenicity assay platform to facilitate COVID-19 vaccine development	BIRAC	PI	2022-2023
38.	Dr. T. K. Beuria	Screening and identification of efflux pump inhibitors to combat antibacterial resistance in multi drug resistant S. aureus	DST- SERB	PI	2022-2025
39.	Dr. Shantibhusan Senapati	Technological Innovation for development of functional food from ethnic fermented foods of the Indian Himalayas	DBT	PI	2023-2026
40.	Dr. Rajeeb K. Swain	Mission program on pediatric rare genetic disorders	DBT	PI	2022-2027
41.	Dr. Rajeeb K. Swain	Establishment of Biotech – KISAN hub at DBT-ILS	DBT	PI	2023-2026

Ph. D. Degree Awarded

Sl. No.	Name of the Scientist	PI Name	Thesis Title
1.	Aniruddha Das	Dr. Amaresh Panda	Identification and characterization of circular RNA splice variants
2.	Suchismita Behera	Dr. Amol R Suryawanshi	Identification and characterization of differentially expressed proteins in rabies virus infection: Implication in understanding pathogenesis.
3.	Ruchir C. Bobde	Dr. Dileep Vasudevan	Structural and functional characterization of plant histone deacetylases.
4.	Bharati Singh	Dr. Gulam H Syed	Mitochondrial homeostasis and quality control in Dengue infection
5.	Shraddheya Kumar Patel	Dr. Narottam Acharya	Deciphering the role of Pol 32, the non-essential subunit of DNA polymerase delta in Candida albicans pathogenesis
6.	Premlata Kumari	Dr. Narottam Acharya	DNA-protein crosslink repair in pathogenic yeast C. albicans
7.	Lini Sethi	Dr. Nrisingha Dey	Characterization of recombinant promoter for efficient gene expression in plants
8.	Kirtal Hansdah	Dr. P. V. Ramchander	Identification and Characterization of Genetic and Molecular Contributors to Nonsyndromic Otosclerosis
9.	Pallavi Mohapatra	Dr. Rupesh Dash	Identification of CMTM6 as a novel regulator of cisplatin resistance in Oral Squamous Cell Carcinomas
10.	Priya Singh	Dr. Sanjeeb K Sahoo	Piperlongumine-based nanomedicine: a multimodal approach for targeting breast cancer stem cells (CSCs) in Triple Negative Breast Cancer
11.	Saikat De	Dr. Soma Chattopadhyay	Development of MBZM-N-IBT as anti-Chikungunya virus molecule
12.	Gyan P. Mishra	Dr. Sunil K Raghav	A multi-omics approach to understand the host response upon pathogen infection
13.	Atimukta Jha	Dr. Sunil K Raghav	Role of Nuclear Receptors and Coregulators in dendritic cells
14.	Sana Fatma	Dr. Rajeeb K Swain	Role of uncharacterized proteins in the development and function of zebrafish kidney.
15.	Lipika Das	Dr. Subrata K Das	Composition and functional characterization of microbiome collected from aquatic animals

SCIENCE OUTREACH

Science Outreach

Insights into the Key Trends in Biomaterials Research

Recent scientific developments and inventions are mostly targeted toward improved human health. The field of biomaterials makes use of bio-engineered products which have the ability to interact with biological systems and can be used for medical and diagnostic purposes. The field of biomaterial research is growing exponentially and holds lots of opportunities for scientific pursuits. These opportunities have drawn the interest of several scientific minds from various disciplines in the field to work towards the betterment of human health.

The aim of the event was to create awareness among students and researchers about the potential this particular field of biomaterial research holds. The symposium was purposefully designed to amalgamate some noted researchers in the field who can share their perspectives and inspire others. The symposium was also aimed at providing ideas on recent trends in the field and enhancing the existing knowledge pool. The symposium was also organized with the aim to facilitate healthy discussion, exchange of scientific ideas, and collaborative research between peers and the participants.

Major Outcome

- The participants found the field of Biomaterial Research to be of deep interest.
- The peers from various disciplines shared their research experiences and knowledge with the participants.
- Several challenges in the field of human health were addressed and the role of biomaterials for the same was successfully highlighted.
- The poster and oral presentation sessions provided a suitable platform for healthy competition among the presenters and brought about an extensive discussion on various topics.
- The participants were able to have a one-to-one discussion with the guest speakers and were able to get suitable feedback and suggestions for their queries.

SCIENTIST(S) IN-CHARGE/ORGANISING COMMITTEE OF THE EVENT:
Dr. Mamoni Dash, Dr. Rupesh Dash, Dr. Sanjeeb Kumar Sahoo
DURATION: 27th-28th September, 2022 at the Institute of Life Sciences, Bhubaneswar
NUMBER OF PARTICIPANTS: 90

Odisha Biotech Startup Summit

Odisha Biotech Startup Summit is the flagship biotech startup conference featuring thought-provoking keynote sessions, panel sessions, personal interactions with thought leaders, and networking opportunities. Interest in the biotech industry has grown exponentially since the Covid19 pandemic, presenting new opportunities for investors. This year's Biotech Summit bought together industry, startups, experts, scientists, executives, and investors from across the nation to discuss the latest developments shaping the biotechnology industry, focusing on eastern Odisha. The summit will also connect participants with emerging biotech companies at the expo. Odisha Biotech Startup Summit is a one and half-day event that will cover the trends of innovation and opportunities in the Biotech sector across the sectors of Agriculture, Health care, Food Processing, Industrial Biotech, and Biopharma for startups. It will also cover the essentials for entrepreneurship for startups. It is the first-ever Odisha Biotech Startup Summit 2022 in the state.

Domains/Sector: Agriculture, value-added products, Industrial Biotechnology, Waste management companies, Medtech device and diagnosis, BioIT, BioPharma, Ayurveda products, Nutraceutical, Chemical, food, and wellness products, drug discovery, Manufacturing etc.

Connectors: Start-ups, Experts, Scientists, Executives, Industries, and Investors Supporters: BIRAC, Startup Odisha

SCIENTIST(S) IN-CHARGE/ORGANISING COMMITTEE OF THE EVENT:
Dr. Nivedita Jena
DURATION: 28th-29th September, 2022 at the Institute of Life Sciences, Bhubaneswar
NUMBER OF PARTICIPANTS: 95, **EMINENT SPEAKERS:** 28, **STARTUP STALLS:** 30

National Conclave on Ethnopharmacology Translational Perspective towards Modern Medicine

The main objectives of the conclave were to focus to revitalize traditional medicine and address some of the crucial and contemporary issues on Ethnopharmacology and medicinal plant research for their promotion and development with particular reference to the tribal-dominated districts of Odisha. This conclave aims to explore the traditional knowledge for the development of therapeutics from natural resources with the integration of modern science and technology. The conclave will act as a platform for dialogue between the practitioners of ethnomedicine and various stakeholders, viz. community, academia, tribal healers, anthropologists, researchers from the field of medicine, pharmacy, Ayush, industry representatives, and NGOs working on community health. Participants of the conclave will be provided the opportunity for dissemination of knowledge for the promotion and development of Ethnopharmacology and medicinal plants research.

Major Outcome

- The two-day conclave theme Ethnopharmacology – Translational Perspective towards Modern Medicine was the first programme organized under the auspices of the Society for Ethnopharmacology, Bhubaneswar Local Chapter, after it was formed in September 2022.
- It was one of its own kind of event with some unique features viz., (a) Inter-institutional collaboration: where three research institutes (ILS, IBSD, and RMRC-ICMR) of national importance, one university (Utkal University) and one organization from the development sector (MAMTA) collaborated to organize the conclave.
- The conclave is very much Inter-disciplinary in nature, people from very different academic and research backgrounds came together to explore newer area of research, especially in the state of Odisha which is well-known for its rich biodiversity and diverse tribal communities with rich tradition of indigenous knowledge systems, especially in the areas of ethno-medicinal practices.
- Blending of field science with advance lab science – this conclave brought together people having expertise and experience in field based science such as anthropology, sociology, high throughput life science, and pharmaceutical sciences. This was a unique experiment of its kind, especially in the context of Odisha.
- A special session was devoted for interaction with tribal and ethnic healers and medicine-men who have been practicing ethnomedicine for at least 20 years. The healers were also felicitated by the organizers of the conclave in recognition of their contribution to the indigenous knowledge system and serving their community.

SCIENTIST(S) IN-CHARGE/ORGANISING COMMITTEE OF THE EVENT: Dr Sanjeeb K Sahoo (Organizing Secretary)
DURATION: 17th-18th November, 2022 at the Institute of Life Sciences, Bhubaneswar
NUMBER OF PARTICIPANTS: 200

Workshops Organized at DBT-ILS

A Two-day Workshop on 'Recombinant Protein Purification and Protein Crystallography

Date organized: 20th-21st Oct 2022
Organized by: Dr. Dileep Vasudevan

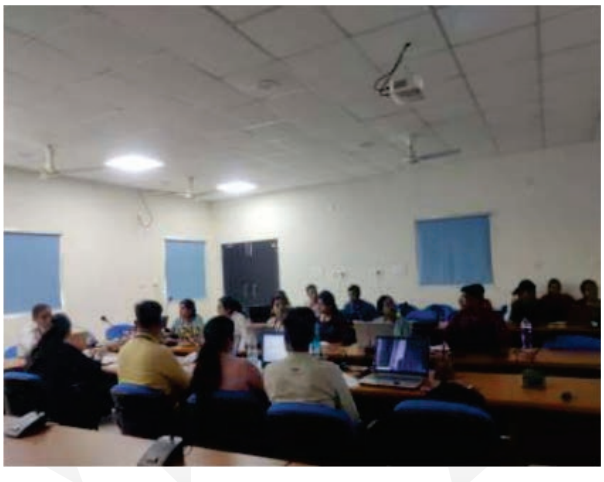
Institute of Life Sciences, Bhubaneswar, successfully organized a two-day workshop on 'Recombinant Protein Purification and Protein Crystallography' for college faculty on the 20th and 21st of October 2022. The workshop was organized by ILS scientist Dr. Dileep Vasudevan and his group members, along with colleagues Dr. Narottam Acharya, Dr. Tushar Kant Beuria, and Dr. Nivedita Jena, with funding support from SERB. The then ILS Director Prof. Pulok K. Mukherjee inaugurated the workshop and addressed the participants, where he emphasized the need to conduct such workshops for college faculty and students. A total of 30 faculty of colleges from different parts of Odisha participated in this interactive workshop. The workshop covered theoretical and practical aspects of common chromatographic techniques employed for recombinant protein purification, as well as the advanced technique of protein crystallography. ILS former Director Dr. B. Ravindran addressed the concluding session and distributed the participation certificates. The workshop was funded by the Scientific Social Responsibility (SSR) support to Dr. Vasudevan through his ongoing SERB project and with additional support from ILS.

6th National workshop on Drug Design and Discovery-2022

Date organized: 10-14th Nov 2022
Organized by: Dr. Anshuman Dixit

The workshop was aimed at inculcating clear understanding of the fundamentals of drug discovery in participants. Advanced concepts and cutting-edge research problems were also discussed. A total of 20 participants which included Masters & Ph.D. students and faculties from various universities attended the workshop. Leading experts from India and abroad covered different topics related to drug design and discovery e.g. machine learning, structure and based ligand based design, virtual screening, protein structure modeling, and molecular dynamics. The experts also conducted training sessions where the participants were trained through case studies and an opportunity to learn with subject experts so as to develop an in-depth understanding of modern drug discovery research. The workshop concluded with vote of thanks by the convener Dr. Anshuman Dixit to all the resource persons for their help in making this workshop a success.




Distinguished Public Lecture by Prof. Harold Varmus Nobel Laureate

DBT-ILS organized a public lecture on the 13th of February wherein esteemed Nobel Laureate Prof. Harold E Varmus spoke on the topic " A Half-century of Cancer Research". The event was presided over by Director-in-charge, Dr Pulok Kumar Mukherjee and Prof. Partha P Majumdar, National Science Chair, Government of India. The event was attended by scientific fraternity from DBT-ILS and many other neighboring institutes and research organization. Clinicians as well as students from across Bhubaneswar also attended the talks. Adequate arrangements were made for hosting the lecture of Prof Varmus for benefiting society at large.

Prof Varmus's scientific work was focused principally on the mechanisms by which retroviruses replicate, cause cancers in animals, and produce cancer-like changes in cultured cells. Prof Varmus's work included the identification of a cellular gene that gave rise to the v-src oncogene of Rous Sarcoma Virus. This discovery triggered the identification of many other cellular proto-oncogenes—progenitors of viral oncogenes and targets for mutations that drive human cancers. During his public lecture at DBT-ILS he shed light on his research accomplishments. He emphasized on following one's curiosity and the eagerness to fearlessly find the unknown. He advised scientists to carry out research in collaboration with universities and academic institutions so that research results are translated for the benefit of the human kind.

While interacting with scientists and students at DBT- ILS, Prof Varmus complemented the ongoing research focus of DBT-ILS in the area of cancer research, disease biology and plant and environmental biotechnology. DBT-ILS has world class infrastructure and the scientists at ILS are pursuing some very relevant scientific questions especially in the field of cancer research. Prof. Varmus also emphasized that research scholars are the strength of any institute and complemented the research temperament at DBT-ILS. The students also actively interacted with Prof. Harold on various issues pertaining to research and scientific values.




Talks Delivered by Invited Experts at DBT-ILS

April, 2022 - March, 2023			
Date	**Title of the Talk**	**Speaker's Name**	**Affiliation of the Speaker**
21-03-2023	Annulate Lamellae: Exploring an underexplored cell organelle	Prof. Jomon Joseph	NCCS, Pune
06-03-2023	Identification of Antimalaria drugs targeting P. falciparum glutamic acid rich protein	Dr. Deepak K. Raj	University of South Florida
24-02-2023	Harnessing the immunoporotic potential of Bregs under inflammatory bone loss in post menopausal osteoporosis: bench to bedside	Dr. Rupesh K. Srivastava	AIIMS, New Delhi
13-01-2023	A half century of Cancer Research	Prof. Harold Varmus	Weill Cornell Medical College, New York
09-12-2023	Importance of PPP initiatives for making Atmanirbhar Bharat and BIRAC initiatives	Dr. Shubhra R. Chakrabarti	Director Operations, BIRAC
23-11-2022	Research on patient-derived tumor samples: my education during past two decades	Dr. Murali Dharan Bashyam	CDFD, Hyderabad
10-11-2022	Host Cell Responses to Zika Virus Infection	Prof. Asit K. Pattnaik	University of Nebraska, USA
03-11-2022	Reverse genetics of RNA viruses	Prof. Asit K. Pattnaik	University of Nebraska, USA
02-11-2022	RNA viruses: Genome organization and Replication strategy	Prof. Asit K. Pattnaik	University of Nebraska, USA
05-08-2022	Biological tissue processing for transmission electron microscopy	Prof. Tapas Chandra Nag	AIIMS, New Delhi

Other Events Organized at DBT-ILS

Date	Events
21.06.2022	International Yoga Day
3–4.08.2022	Scientific Advisory Committee (SAC) 2022
29.09.2022	Hindi Pakhwada
02.09.2022	Swatch Sagar Surakshit Sagar, Bateswar Beach, Ganjam
28.02.2023	National Science Day
06.03.2023	International Womens Day

National Events participated by DBT-ILS Team

Date	Event	Participants
4-7.11.2022	National Conference on Akash Tattva, "Akash for Life" Uttaranchal University Campus, Dehradun	Dr Rajeeb Swain, Dr Debabrata Biswas
21-24.01.2023	India International Science Festival MANIT, Bhopal	Dr Rajeeb Swain, Dr Nivedita Jena, Dr Namisha Sharma, Dr Seema Pradhan

Invited Talks/Keynote Lectures by ILS Scientists

Dr. Amaresh Panda

- Served as the Chief Guest and delivered an invited talk entitled "Functional noncoding RNAs in muscle" in the Annual Seminar event of Rajadhani College, Bhubaneswar on 20th Jan 2023.
- Delivered an invited talk entitled "RNA quantification using ddPCR: Progress and challenges" at the 15th India ddPCR Symposium 2022, held at Taj Yaswantpur, Bangalore on 7th Dec 2022.
- Delivered an invited talk entitled “Role of RNA circles in muscle regeneration” in the Workshop on Droplet Digital™ PCR at Institute of Life Sciences, Bhubaneswar on 2nd Jun, 2022.
- Delivered an invited talk entitled "Role of RNA circles in muscle regeneration” at Department of Biotechnology, Utkal University, Bhubaneswar on 28th May 2022.

Dr. Amol R Suryawanshi

- Delivered an invited talk entitled "Quantitative Proteomics for the understanding of viral disease biology" in ICAR winter school on “Advances in Proteomics and Animal Disease Diagnostics (APMADD)” held at the College of Veterinary & Animal Sciences (COVAS), Udgir, Maharashtra, during 9-29th Dec, 2022.
- Delivered an invited talk entitled "Clinical proteomics for biomarker discovery" in Pre-conference CME session on “Recent Diagnostics in Biomarker identification” held at AIIMS, Bhubaneswar on 3rd Dec, 2022.
- Delivered an invited talk entitled "Delineation of altered brain proteins associated with rabies virus infection by quantitative proteomics" in 14th Annual Meeting of the Proteomics Society of India and International Conference on Proteins & Proteomics (PSI-ICPP 2022) at the CSIR-Indian Institute of Chemical Biology (IICB), Kolkata, India, during 3rd-5th Nov, 2022.
- Delivered an invited talk entitled "Proteomics for understanding Disease biology" in DST-STUTI-ICT training program on “Modern Analytical Techniques for the Characterization of Pharmaceuticals”, organized by “School of Pharmaceutical Sciences, Siksha 'O' Anusandhan Deemed to be University, Bhubaneswar during 31st Oct to 7th Nov, 2022.
- Delivered an invited talk entitled "Proteomics for understanding Disease biology" in a workshop on "Recent advancement on Drug Development for GI disorders" held at Central Ayurveda Research Institute, Bhubaneswar on 27th Sep, 2022.

Dr. Arun Nagaraj

- Delivered a talk in Odisha Biotech Startup Summit 2022 on “Malaria: Challenges Ahead in Diagnosis and Treatment” 28th-29th Sep, 2022.

Dr. Debabrata Biswas

- Participated in the National Conference on Akash Tattva, "Akash for Life".
- Participated in the National Conclave on Ethnopharmacology - Translational Perspective towards Modern Medicine.
- Participated in the 18th Regional Science Congress 2022, Institutional Visit by Navodaya Vidyalaya Samiti.

Dr. Dileep Vasudevan

- Delivered invited lecture in the Five-Day Workshop on Biochemical and Biophysical Characterization of Proteins organized by NIT, Rourkela, during 19th-23rd Oct, 2022.
- Delivered lectures in the Two-Day Workshop on Recombinant Protein Purification and Protein Crystallography held at ILS Bhubaneswar, during 20th-21st Oct, 2022.
- Delivered invited lectures in the Multidisciplinary Refresher Course in Biological Science for faculty by Pandit Ravishankar Shukla University, Raipur, during 14th-26th Nov, 2022.
- Delivered invited talk at the 49th National Seminar on Crystallography held at the University of Jammu, Jammu & Kashmir, during 28-30th Nov, 2022.

- Delivered invited talk at the CEMBIOS Symposium held at NISER, Bhubaneswar, 13-14th Feb, 2023.
- Delivered invited lecture in the Faculty Refresher course in Biotechnology, Utkal University, Bhubaneswar, 15th Feb, 2023.
- Delivered invited lead talk at the GNR Centenary Symposium for Structural Biology held at the Cochin University of Science and Technology (CUSAT), Cochin, 21st-22nd Feb, 2023.
- Delivered invited talk at the Kerala University of Fisheries & Ocean Studies (KUFOS), Cochin, 23rd, Feb, 2023.
- Delivered invited talk at the DBT - Rajiv Gandhi Centre for Biotechnology (DBT-RGCB), Thiruvananthapuram, 24th Feb, 2023.

Dr. Gulam H Syed

- Invited as an expert on the panel discussion on topic "Leveraging Opportunities in Translational & Clinical Research" in the Apollo Clinical Research Conclave 2nd-3rd Dec, 2022.
- Delivered invited talk in the International Conference on Virus Evolution, Infection and Disease Control (ICVEIDC) held at the University of Hyderabad, from 15-17th Dec, 2022.

Dr. Mamoni Dash

- Delivered invited talk at SERB sponsored Accelerate Vigyan Workshop titled: "AI-APMED: Artificial Intelligence (AI) Aided Personalized Medicine and Drug Delivery" at NIT Rourkela, 4-5th Jan, 2023.
- Delivered invited talk on Mucins: A biomimetic template for bone regeneration, for the MAHE Young Scientist Award 2022 at the BIOREMEDI 2022 organized by IIT Guwahati, during 16-19th Dec, 2022.
- Delivered invited talk on Matrix elasticity of in-vitro osteoporotic models at the CompFlu 2022 organized by IIT Kharagpur, 20th-21st Dec 2022.
- Delivered invited talk on Mucins as potential models for understanding bone regeneration at the EMBO lecture course, Microphysiological systems: Advances and applications in human relevant research, 4-6th Nov 2022.
- Delivered invited talk on Polymers as engineered biomimetic matrices for bone regeneration at the NASI Jharkhand chapter organized by CSIR-NM, on 20th January 2023.

Dr. Namisha Sharma

- Invited at University of Hyderabad, Telangana, as Panellist in "Millet Awareness Program" where 800 school students where made aware about the benefits of millets for the human health, on 23rd Dec, 2022.
- Invited at University of Hyderabad, Telangana, as an invited speaker in "CTFPPB-2023" and delivered an oral presentation highlighting the main findings of my study, during 23rd-25th Feb, 2023.

Dr. Narottam Acharya

- Delivered invited talk in "12th conference on yeast biology: Fundamentals to Application of yeast and fungi" conducted by IISER, Mohali during Mar 10-13th, 2023.
- Delivered a talk on "DNA polymerases of Candida albicans: Role in fungal pathogenesis and implication in whole cell vaccine development" on 11th Mar, 2023.

Dr. P. V. Ramchander

- Presented the ongoing work on 'Pediatric Rare Genetic Disorders' in the meeting conducted by CDFD, Hyderabad on 8th Mar, 2023.

Dr. Rupesh Dash

- Delivered invited talk for 47th Annual Conference of the Indian Society of Human Genetics at Andhra University, Vishakhapatnam was held during 23rd-25th Jan, 2023.

Dr. Sandip K Mishra

- Keynote speaker organized by College of Pharmaceuticals sciences, Puri.
- Keynote speaker organized by Pattamundai College.

- Keynote speaker organized by Proteomics society at Utkal University.
- Invited spokesperson at the National seminar on cancer Biology, DBT-ILS.Dr.

Dr. Sanjeeb Sahoo

- Delivered invited talk on “Nanomedicine in human health care” on "Trends in Biotechnology and its Contemporary Relevance organized by UGC-Human Resource Development Centre, Utkal University as Refresher Course in Biotechnology, during 10th-23rd Feb 2023.
- Delivered invited talk on “Ethnopharmacology and anticancer drug discovery: A journey with Nano-formulations” National Conclave on Ethnopharmacology on 22nd Indo-US International conference global advances & challenges in Pharmacology and Pharmaceutical Sciences organized by College of Pharmaceutical Sciences, Puri, Odisha, India during 23rd-24th Dec, 2022.
- Delivered invited talk on “Ethnopharmacology and anticancer drug discovery: A journey with Nano-formulations” National Conclave on Ethnopharmacology – Translational Perspective Towards Modern Medicine organized by Institute of Life Sciences, Bhubaneswar, India during 26-27th Nov, 2022
- Delivered invited talk on “Phytochemical based Nanomedicine: a panacea for cancer treatment” in the Insights into the Key Trends in Biomaterials Research organized by Institute of Life Sciences, Bhubaneswar, India during 26-27th Sep, 2022
- Delivered invited talk on “Phytochemical based Nanomedicine: a panacea for cancer treatment” in the 9th Convention Society for Ethnopharmacology, National Seminar on Translational research on Indian Medicinal Plants organized by School of Natural Product Studies, Jadavpur University, Kolkata, India during 23rd-24th Sep, 2022
- Delivered invited talk on “Phytochemical based Nanomedicine targeting Breast Cancer” in the SERB sponsored workshop on "Computer Aided Drug Designing" organised by the Department of Biotechnology at Motilal Nehru National Institute of Technology Allahabad, Prayagraj, India during 10-11th Sep, 2022

Dr. Seema Pradhan

- Delivered invited talk on the Topic “Millets: Miracle food for future” at KISS-DU, Bhubaneswar on 19th Dec, 2022

Dr. Soma Chattopadhyay

- Delivered invited talk entitled “Development of anti-viral molecule” in the workshop on “Recent advancement on Drug development for GI disorders” organized by Ayurveda Research Institute, Bharatpur, Bhubaneswar” on 27th Sep, 2022.
- Delivered a lecture entitled “Development of anti-viral molecule: Implication in translation” in the conference on “Odisha Biotech Start-up Summit”, which was organized by Institute of Life Sciences” during 28-29th Sep, 2022.
- Delivered talk on "Development of anti-virals from Plants" in National conclave on Ethnopharmacology-Translational Perspective Towards Modern Medicine, Institute of Life Sciences, Bhubaneswar
- Delivered invited talk on "Overview of Chikungunya virus study at Institute of Life Sciences" at Manipal Institute of Virology, in Manipal, on 19th Jan, 2023.
- Delivered a lecture entitled “Development of Anti-viral against the Chikungunya Virus” on 14th Feb, 2023 in the Refresher Course in the Biotechnology Department which was organised by The UGC-Human Resource Development Centre (HRDC) of Utkal University during 10th-23rd Feb, 2023.

Dr. Soumen Chakraborty

- Delivered invited talk on Chronic Myeloid Leukemia: Past, Present and the Future. Refresher Course in Bio-Technology, Utkal University, on 20th Feb, 2023

Dr. Sunil K. Raghav

- Delivered invited talk on “Targeting immunometabolism: A promising gateway to fine-tine immune cell function” at ACBICON Odisha meeting at AIIMS on 25th Mar, 2023.
- Delivered invited talk on “Targeting metabolism to fine-tune immune responses” at Immunocon-2022 in PGI Chandigarh during 23rd-26th Oct, 2022.

- Delivered invited talk on “Synthetic metabolic inhibitors perturbs cellular metabolism and thereby fine-tune immune responses” at Society of Ethnopharmacology conclave held at Jadavpur University Kolkata during 21st-23rd Sep, 2022.
- Delivered invited talk on “Comparative epigenomics identified preferential control of TLR9 versus TLR3 responses by NCoR1 in conventional dendritic cells” at SBC-2022 meeting held at Biswa Bangla Convention Centre, Kolkata during 8th-11th Dec, 2022.

Dr. Anshuman Dixit

- Delivered invited talk on "Repurposing drugs for COVID-19 therapeutics: A computational Approach" at National Workshop on Drug Design and Discovery at ILS, Bhubaneswar during 10-14th Nov, 2022
- Delivered invited talk on "Development of targeted therapies against Oral squamous cell carcinoma" at JSS College of Pharmacy, Mysore, on 13th Dec, 2022.
- Delivered invited talk on "Bioinformatics in drug discovery" on 20th Feb. 2023 at Refresher Course in Bio-Technology at Utkal University, Bhubaneswar.
- Delivered invited talk on "Development of molecularly targeted therapies for oral squamous cell carcinoma", at a seminar on drug discovery organized by Parul University, Vadodara on 30th Mar, 2023.

Dr. Rajeeb K. Swain

- Delivered invited talk at “4th Indian Zebrafish Investigators Meeting – IZIM 2022” organized by IISER and ARI, Pune during 21st-23rd Sep, 2022.
- Resource person at workshop on “Zebrafish in Biomedical Research” organized by ARI and IISER, Pune during 20-24th Mar, 2023.
- Resource person at Faculty development training program of Biju Patnaik University of Technology (BPUT), Nodal Centre: College of Pharmaceutical Sciences (CPS), Mahuda on 28th Aug, 2022.
- Resource person at 5th Faculty Induction Program at The UGC-Human Resource Development Centre, DDU Gorakhpur University, Gorakhpur on 6th Sep, 2022.
- Chief Speaker at Annual Seminar of Department of Zoology, S.C.S. (autonomous) College, Puri on 28th Mar, 2023.

Dr. Subrata K Das

- Delivered a plenary talk on “Exploration of Bioresources and Translational Research” in the International Conference on Technological Innovations in Animal Science Research and Social Transformation organized by the Department of Zoology, Utkal University and Zoological Society of Orissa, Bhubaneswar during 24-26th Feb, 2023.

Conference/Symposium/Workshops attended and Oral /Poster Presentation by Students

1. **A Khuntia**, presented poster at 10th International Congress of Society of Ethnopharmacology Conference (ISE SFEC 2023) organized from 24th - 26th February 2023 at Imphal, Manipur, India.
2. **A Mohapatra**, presented poster at Symposium on Insights into the key trends in Biomaterials Research, organized from 27th - 28th September 2022 by DBT-Institute of Life Sciences, Bhubaneswar, Odisha
3. **A. Das**, Presented a talk entitled "Role of Subcellular Localization of Circular RNAs in Muscle Cell Differentiation" in 11th RNA group meeting, at NCCS, Pune, from 1st - 3rd December, 2022.
4. **A. Samal**, participated in the CEMBIOS Symposium held at NISER, Bhubaneswar, 13th-14th February, 2023.
5. **A. Samal**, presented poster at the 48th National Seminar on Crystallography held at University of Jammu, Jammu & Kashmir, 28th-30th November, 2022.
6. **B Barik**, 42nd Annual Conference of the Indian Association of Cancer Research. 12th-16th January 2023.
7. **D K Jha**, presented a poster entitled "Genome-wide screening and Functional analysis of GRAS gene family under abiotic stress and phytohormone treatments in Pearl millet" organized by the Department of Plant Sciences, University of Hyderabad during 23th-25th February 2023.
8. **D. Barik**, attended a conference at 16th Complex Fluid Symposium (CompFlu-2022 held at IIT Kharagpur, Research Park, Kolkata between 19th to 21st December 2022.
9. **D. Barik**, attended a symposium on Next-generation organoids, By Prof Matthias Lutolf, Ecole Polytechnique, Federale de Lausanne; Hosted By Gordana Vunjak-Novakonic at Columbia University on 16th February 2022.
10. **D. Barik**, presented a poster entitled "Matrix stiffness of mineralized methacrylate-hydrogels and their influence on stem cell behavior" at Bio-Remedi organized by IIT Guwahati, India from 15th -18th December 2022.
11. **D. Barik**, presented a poster entitled "Microporous chitosan and mucin montmorillonite nanocomposite hydrogel for tissue engineering" at Microphysiological systems: Advances and applications in human-relevant research, EMBO Lecture at Hyderabad from 31st October- 04th November 2022
12. **D. Das**, presented poster entitled "Glucose-regulated circular RNA Rabep1 regulates Pten expression through miR-335-3p in pancreatic beta-cells" in 11th RNA group meeting, at NCCS, Pune, from 1st -3rd December, 2022.
13. **D. R. Tompa**, participated in the CEMBIOS Symposium held at NISER, Bhubaneswar, 13th-14th February 2023.
14. **G P. Panda**, attended 16th Complex Fluids Symposium 2022 (COMPFLU-2022) organised by Indian society of Rheology and IIT Kharagpur, from 19th-21st December 2022.
15. **G P. Panda**, presented paper at 16th Complex Fluids Symposium 2022 (COMPFLU-2022) organised by Indian society of Rheology and IIT Kharagpur, from 19th-21st December 2022.
16. **J Chanwala**, presented a poster entitled "Multifacet role of WRKYs and its cross talk under abiotic stresses in Pearl Millet" organized by the Department of Plant Sciences, University of Hyderabad during 23th-25th February 2023.
17. **K Kumari**, presented a poster entitled "Efficient synthetic promoter for promoting plant-based research" organized by the Department of Plant Sciences, University of Hyderabad during 23th-25th February 2023.
18. **K Sen**, gave an oral presentation "Nuclear Receptor Co-repressor NCoR1 governs immune tolerance in conventional dendritic cells by fine-tuning glycolysis and fatty acid oxidation" and presented a poster at SIRCON-2022 conference held at NCCS Pune from 24th-25th September 2022.
19. **K Sen**, poster presentation "Nuclear Receptor Co-repressor NCoR1 governs immune tolerance in conventional dendritic cells by fine-tuning glycolysis and fatty acid oxidation" at 49th Annual Conference of Indian Immunology Society (Immunocon) – 2022, organized at PGIMER, Chandigarh
20. **K. Patra**, attended seminar on Scientific Research-Technology and Innovation: Practical Outcome at CSIR-Institute of Mineral and Material Technology, Bhubaneswar on 16th March 2023.
21. **K. Patra**, participated in Complex Fluids Symposium (CompFlu 2022) at Indian Institute of Technology, Kharagpur from 19th - 21st December 2022.
22. **K. Patra**, presented poster on "Identifying the most potent bisphosphonate towards reducing osteoclastic activity

and developing in vivo models for osteoporosis" at symposium on insights into the key trends in biomaterials research, organized by DBT-ILS, Bhubaneswar from 27th -28 th October 2022.

23. **K. Patra**, presented work (oral) at International Conference for Biomateials, Regenerative medicine and Devices (BioRemedi 2022), organized by Indian Institute of Technology, Guwahati under the research area of "Materials for Delivery of Bioactives" from 15th -18th December 2022.

24. **K. Saharan**, participated in the CEMBIOS Symposium held at NISER, Bhubaneswar, 13th-14th February, 2023.

25. **N. Singh** and **A. Chatterjee**, participated in International Bioresource Conclave and Ethnopharmacology Congress held at IBSD, Imphal, Manipur, and made oral and poster presentations. February 2023.

26. **P. K. Das**, presented a poster at the DBT (Govt. of India) sponsored 27th Indian Society of Chemists and Biologists International Conference (ISCBC-2022) on Research and Innovation in Chemical, Pharmaceutical and Biological Sciences organized by Birla Institute of Technology, Mesra, Ranchi, from 16th -19th November 2022.

27. **P K. Das**, presented a poster at the National Symposium on Insights into the Key Trends in Biomaterials Research organized by the Institute of Life Sciences, Bhubaneswar, from 27th -28th September 2022.

28. **P. Mohapatra**, presented poster at 10th International Congress of Society of Ethnopharmacology Conference (ISE SFEC 2023) organized from 24th - 26th February 2023 at Imphal, Manipur, India.

29. **P. Sa**, presented poster at 10th International Congress of Society of Ethnopharmacology Conference (ISE SFEC 2023) organized from 24th - 26th February 2023 at Imphal, Manipur, India.

30. **P. Dash**, presented Oral presentation and bagged the best Oral presentation Award on "A Symposium into the key trends in Biomaterials research" hosted by Therapeutic Biomaterials and Polymer Chemistry Team of Institute of Life Sciences, Bhubaneswar, 27th -28th September 2022

31. **P. Dash**, presented Oral presentation and bagged the best Oral presentation Award on the 27th-ISCB international conference (ISCBC-2022) -research and Innovation in chemical, pharmaceutical, and biological sciences jointly organized by: Indian Society of Chemists and Biologists (ISCB) and Department of Chemistry, Birla Institute of Technology, Mesra, Ranchi

32. **R. C. Bobde**, gave oral presentation at the 48th National Seminar on Crystallography held at University of Jammu, Jammu & Kashmir, 28th-30th November, 2022.

33. **R. C. Bobde**, participated in the CEMBIOS Symposium held at NISER, Bhubaneswar, 13th-14th February 2023.

34. **R. C. Bobde**, participated in the EMBO Practical Course on Cryo-Electron Microscopy and 3D Image Processing (CEM3DIP) of Macromolecular Assemblies and Cellular Tomography held at IISER, Pune, 4th-16th December 2022.

35. **Ruchika**, participated in 33rd International workshop on "Bioinformatics, Genomics, Transcriptomics, Microbiome, and NGS data analysis", organized by Nextgenhelper, New Delhi from 13th-26th March 2023.

36. **S Chanda**, 42nd Annual Conference of the Indian Association of Cancer Research. 12th-16th January 2023.

37. **S Chatterjee**, delivered talk on "DNA damage response signaling is essential for efficient Chikungunya virus replication" in the IUBMB Focused Meeting on Biochemistry & Molecular Biology of RNA Viruses in THSTI, Faridabad from 15th - 18th November 2022.

38. **S De**, presented poster on "Development of a novel small molecule (MBZM-N-IBT) to restrict Chikungunya virus infection by diminishing nsP2 protease activity in vitro, in vivo and ex vivo" in the IUBMB Focused Meeting on Biochemistry & Molecular Biology of RNA Viruses, in THSTI, Faridabad from 15th - 18th November 2022.

39. **S K. Shaw**, Presented Poster at 24th INDO-US Flowcytometry Workshop organized by TETC at IIT Gandhinagar, from 1st - 4th February 2023.

40. **S Lama**, 42nd Annual Conference of the Indian Association of Cancer Research. 12th-16th January 2023.

41. **S Mohanty**, 41st IACR Annual Conference (IACR-2022) Organised by Amity University Uttar Pradesh, NOIDA, India held during 2nd - 5th March 2022

42. **S Podder**, presented poster at Immunocon 2022,the 49th Annual Conference Of Indian Immunology Society from 23rd - 26th November 2022 held at PGIMER,Chandigarh

43. **S. Podder**, presented poster at SBC 2022, the 91ST SBC-2022 meeting from 8th-11th December, 2022 at Biswa Bangla Convention Centre, Kolkata.

44. **S. R. Sahu, Dr. A Dutta, S Bose** & **B G Utkalaja**, attended and presented poster in "12th conference on yeast biology: Fundamentals to Application of yeast and fungi" conducted by IISER, Mohali from March 10th- 13th, 2023.

45. **S. S. Nayak**, presented a poster entitled "Generating Genomic resources for an invasive halophytes Phragmites karka", from January 6th-9th, 2023 at NABI, Mohali, India.

46. **S. S. Nayak**, presented a poster entitled "Generating Genomic resources for an invasive halophytes Phragmites karka", from January 27th-29th, 2023 at Centurion University, Bhubaneswar.

47. **S. Suranjika**, presented a poster entitled "Transcriptomics of Vigna aconitifolia for developing a gene expression atlas", from January 27th-29th, 2023 at Centurion University, Bhubaneswar.

48. **S. Suranjika**, presented a poster entitled "Transcriptomics of Vigna aconitifolia for developing a gene expression atlas" at the International Conference for Ethnopharmacology from February 24th-26th, 2023

49. **S. Suranjika**, presented an oral presentation entitled "Transcriptomics of Vigna aconitifolia for developing a gene expression atlas" at the International Conference on Pulses, organized by the Indian Society of Pulses Research and Development, from February 10th-12th, 2023 at New Delhi

50. **S. Gandhi**, participated in the CEMBIOS Symposium held at NISER, Bhubaneswar, 13th-14th February 2023.

51. **S. Gandhi**, presented poster at the 48th National Seminar on Crystallography held at University of Jammu, Jammu & Kashmir, 28th-30th November 2022.

52. **S. N. Hossain**, participated in the CEMBIOS Symposium held at NISER, Bhubaneswar, 13th-14th February 2023.

53. **S. N. Hossain**, presented poster at the 48th National Seminar on Crystallography held at University of Jammu, Jammu & Kashmir, 28th-30th November 2022.

54. **S. Singh**, presented a poster entitled "Global mapping of circular RNA-mRNA interactome by CLiPPR-Seq" in 11th RNA group meeting, at NCCS, Pune, from 1st – 3rd December 2022.

55. **T. Sherpa**, presented a poster entitled "Characterization of sub-genomic transcript promoter from Horseradish Latent Virus (HRLV) and its utilization in plant translational research", from January 27th-29th, 2023 at Centurion University, Bhubaneswar.

56. **U. Nayak,** presented a poster at "4th Indian Zebrafish Investigators Meeting – IZIM 2022" organized by IISER and ARI, Pune from 21st -23rd September 2022.

Project Trainees and Interns

1. **Abinash Kumar Jena** (MSc dissertation student): Cloning, expression and purification of Cyclophilin 95 from Arabidopsis thaliana (Dr. D. Vasudevan)
2. **Aishani Pattnaik**: Role of wild type and mutant p53 and their interaction with GPCRs in Breast Cancer (Dr. S. K. Mishra)
3. **Ajmeera Usharani** (Winter trainee): Basics of protein chromatography (Dr. D. Vasudevan)
4. **Akansha Priyadarshini Karna**: Cloning of NSP2 truncation of CHIKV (Dr. S. Chattopadhyay)
5. **Asmita Rout**: Isolation and molecular cloning of PgWRKYs promoter of Pearl Millet (Dr. N. Dey)
6. **Bandana Mishra**: Maintenance of Plasmodium falciparum cultures and generation of knockouts by SLI method (Dr. A. Nagaraj)
7. **Bijyalaxmi Sethi**: Learning basic techniques for synthesis and characterization of polymer hydrogels. (Dr. M. Dash)
8. **Charchika Satpathy**: To generate stable basp1 knockdown on ossc cell lines using shrna knockdown technology (Dr. R. Dash)
9. **Debashis Ray**: Standardization of validation assay for conforming the expression of altered proteins NQO1 and SLC1A4 in rabies virus infection. (Dr. A. Suryawanshi)
10. **Devika P. Nair**: Comparative expression analysis of dynein arm assembly factors in cfap300 mutants (Dr. R. Swain)
11. **Dibyasha Samantaray**: Role of Endoplasmic reticulum exit sites in Hepatitis C virus lifecycle (Dr. G. H. Syed)
12. **Ishita Mohanty**: Role of mTOR in Breast Cancer progression (Dr. S. K. Mishra)
13. **Komal Pati**: Isolation of RNA from cells and tissues using in-house RNA Isolation Reagent (Dr. A. Panda)
14. **Konagalla Suma**: Down-regulation of CPNE6 in Rabies Virus Infected Humans: A Quantitative Analysis (Dr. A. Suryawanshi)
15. **Madusmita Sethy**: Cloning and expression of cytochrome b5 from Plasmodium (Dr. A. Nagaraj)
16. **Mahaksh Verma**: Physicochemical characterization of Vinyl based polymers (Dr. M. Dash)
17. **Manisha Verma** (Winter trainee): Molecular biology basics for structural characterization of protein targets (Dr. D. Vasudevan)
18. **Meena Kumari Das**: Proteoinformatics analysis of human serum/plasma proteins altered during SARS-Cov-2 infection (Dr. A. Suryawanshi)
19. **Mohammed Anas**: Screening For The Prevalence Of Dengue Virus In Tribal Pockets Of Odisha, India (Dr. G. H. Syed)
20. **Mugdha Barik**: To screen for circular RNAs to derive their correlation with cisplatin resistance in cancer cell lines (Dr. R. Dash)
21. **Neha Gantayat** (Summer trainee): Cloning and expression of recombinant proteins for structural studies (Dr. D. Vasudevan)
22. **Nishant Parida**: Cloning of NSP4 truncation of CHIKV (Dr. S. Chattopadhyay)
23. **Pooja B** : Alginate Tyramine conjugated hydrogels for drug delivery (Dr. M. Dash)
24. **Prabir Mallick**: Interaction of GPCR signaling with p53 in the Breast Cancer Modulation (Dr. S. K. Mishra)
25. **Prakash Mohapatra**: Identification of phytochemicals of Ashtavarga with anti-cancer properties using Network Pharmacology and Bioinformatics Approaches (Dr. A. Dixit)
26. **Pratiksha Bhengra**: Screenings of FDA approved natural compounds against the flaviviruses (Dr. G. H. Syed)
27. **Pratyush Kumar Samal**: Molecular cloning and transient GUS analysis of PgNAC100 promoter (Dr. N. Dey)
28. **Sabitri Patel**: Learning Molecular Biology technique like RT-PCR and Cloning (Dr. S. Chattopadhyay)
29. **Sambit Baliarsingh**: Standardization of validation assay for confirming the expression of altered proteins

SERPINC-1 and CKM in rabies virus infection (Dr. A. Suryawanshi)

30. **Samikshya Swagatika Sahoo**: Molecular Cloning and Overexpression of Efflux Pump Master Regulator MgrA (Dr. T.K Beuria)
31. **Santanu Paul**: Role of GPCR in Breast Cancer progression (Dr. S. K. Mishra)
32. **Shivani Bohidar**: Protein structure prediction (Dr. A. Dixit)
33. **Shree Tripathy**: G protein coupled receptor mediated signaling in Estrogen receptor positive/ negative Breast Cancer Cells (Dr. S. K. Mishra)
34. **Shreya Pandey**: Deciphering the role of GPCR in Breast Cancer (Dr. S. K. Mishra)
35. **Shreya Ray**: Molecular docking and its applications. (Dr. A. Dixit)
36. **Shweta Mishra**: Role of HIFalpha in Breast Cancer (Dr. S. K. Mishra)
37. **Sonali Mohapatra**: Isolation and characterization of exosomes from osteosarcoma cell lines and it's downstream quantification (Dr. M. Dash)
38. **Sonu Sucharita**: Integrating Network Pharmacology approach to reveal the anti-neoplastic effects of Morus alba in human Head and Neck cancer (Dr. A. Dixit)
39. **Spandan Patra**: Learning Molecular Biology and cell cultures technique (Dr. S. Chattopadhyay)
40. **Srusty Sriya Pradhan**: Learning techniques in proteomics research (Dr. A. Suryawanshi)
41. **Stithipragyan Kar**: Role of p53 and GPCR in Breast Cancer Regulation (Dr. S. K. Mishra)
42. **Subhashree Sahu and Ms. Suchita Sarangi**: Completed 2 months of training on common lab practices (Dr. N Dey)
43. **Sudipta Mahapatra** (Summer trainee): Cloning, expression and chromatographic purification of a nucleoplasmin protein from Danio rerio (Dr. D. Vasudevan)
44. **Tannistha Hota**: Comparative expression analysis of different cadherins and dynein arm assembly factor genes in cfap300 mutants (Dr. R Swain).
45. **Vinit Gupta**. Multivariate Statistical Analysis to Identify Genetic Polymorphism Associated with Diabetes and Its Major Complications in an Ethnic Group of India (Dr. S. Raghav)
46. **Vishal Natu**: Application of polymer based pesticides formation in rice plants and study its biodegradation profile (Dr. M. Dash)

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16 Mr. Suvendu Ojha, SRF
17 Mr. Jugal Kishor Sahu, SRF
18 Ms. Sasmita Samal, SRF
19 Ms. Deepti Parida, SRF
20 Mr. Abinash Behera, SRF
21 Ms. Sameekshya Satapathy, SRF
22 Mr. Bineet Kumar Mohanta, SRF
23 Mr. Rakesh Mohapatra, JRF
24 Ms. Khushboo Parveen, JRF
25 Ms. Bidisha Sahoo, JRF

CSIR - SRA

1 Dr. Shaikh Nausad Hossain (CSIR-SRA)

UGC Fellows

1 Mr. Debojyoti Das, SRF
2 Ms. Manisha Sethi, SRF
3 Ms. Bhabasha Gyandeep Utkalaja, SRF
4 Ms. Arundhati Das, SRF
5 Mr. Sibasish Mohanty, SRF
6 Mr. Hiren G. Dodia, SRF
7 Ms. Pratigyan Dash, SRF
8 Ms. Rina Yadav, SRF
9 Mr. Ketul Saharan, SRF
10 Ms. Pinkilata Pradhan, SRF
11 Ms. Amrita Ray, SRF
12 Mr. Rahul Das, SRF
13 Mr. Surajit Gandhi, SRF
14 Ms. Sneha Dutta, SRF
15 Ms. Archana Samal, SRF
16 Ms. Shamima Azma Ansari, SRF
17 Mr. Subhasish Prusty, SRF
18 Mr. Sayantan Chanda, SRF
19 Mr. Rajib Kundu, SRF
20 Ms. Sonali Sahoo, SRF
21 Mr. Deepak Kumar Jha, SRF
22 Mr. SK Sahidur Rahaman, JRF
23 Mr. Devashish Barik, JRF
24 Mr. Susovan Sadhukhan, JRF
25 Ms. Salona Kar, JRF
26 Mr. Rakesh Padhan, JRF
27 Ms. G. Kumari, JRF
28 Ms. Arpita Kullu, JRF
29 Ms. Nishi Pragnya Naik, JRF
30 Mr. Pritish Samal, JRF

31 Ms. Kalyani Sahoo, JRF
32 Ms. Monalisa Ghosh, JRF
33 Ms. Samiksha Behera, JRF
34 Ms. Samanwita Das, JRF
35 Ms. Subhasmita Das, JRF
36 Ms. Sonali Ghosal, JRF
37 Mr. Bimal Jana, JRF
38 Ms. Jyotirmayee Sahoo

Research Staffs - Projects

1 Dr. Archana Tripathy, Quality Control Consultant
2 Dr. Chinmayee Mohapatra (DST WOS-A)
3 Dr. Shamim Akhtar Sufi, RA-I
4 Dr. Sweta Thakur, RA-I
5 Dr. P. Sanjai Kumar, RA-I
6 Dr. Simran Sinsinwar, RA-I
7 Dr. Koustav Chatterjee, RA-I
8 Dr. Ipsita Mohanty, RA-I
9 Dr. Shasank Sekhar Swain, RA-I
10 Dr. Dharma Rao Tompa, RA-I
11 Ms. Maria Adhikary, RA-I
12 Dr. Shradha Mawatwal, RA-I
13 Dr. Sharmistha Shyamal, RA
14 Dr. Abinash Dutta, RA
15 Dr. Amruta Mohapatra, RA
16 Dr. Madhuri Dutta, RA
17 Mr. Viplov Kumar Biswas, SRF
18 Ms. Ankita Datey, SRF
19 Ms. Atimukta Jha, SRF
20 Mr. Gyan Prakash Mishra, SRF
21 Ms. Archana Mahapatra, SRF
22 Ms. Kananbala Patra, SRF
23 Ms. Swagata Bose, SRF
24 Mr. Subhashish Samantaray, SRF
25 Ms. Aditi Chatterjee, JRF
26 Ms. Madhusmita Sethy, JRF
27 Ms. Diya Chattopadhyay, JRF
28 Ms. Sushree Ankita Mohapatra, JRF
29 Ms. Rituparna Pal, JRF
30 Ms. Subhadarshini Parida, JRF
31 Ms. Preeti Barla, JRF
32 Ms. Sheetal Dash, JRF
33 Ms. Rituparna Sahoo, JRF
34 Ms. Rutuja Sawant, JRF
35 Mr. Rohit Mishra, JRF
36 Ms. Bidisha Chjakraboty, JRF
37 Mr. Somanath Baral, JRF
38 Mr. Sharad Singh, Research Assistant
39 Mr. Sweta Smita Pani, Research Assistant
40 Dr. Chandra Bhan Singh, Senior Project Associate
41 Mr. Avula Kiran, Senior Project Associate
42 Mr. Soumendu Mahapatra, PA-II
43 Ms. Soumya Shree Nayak, PA-II
44 Ms. Sandhya Suranjika, PA-II
45 Mr. Pratyush Kumar Das, PA-II
46 Ms. Arunita Patra, PA-II
47 Ms. Adyasha Panda, PA-II
48 Mr. Gyanendra Panda, PA-I
49 Ms. Supriya Suman Keshry, PA-I
50 Mr. Ramyasingh Bal, PA-I
51 Mr. Shakti Prasad Mishra, PA-I
52 Ms. Ipsita Rakshit, PA-I
53 Ms. Anjali Girish, PA
54 Ms. Rojalin Priyadarshini, PA
55 Mr. Sudhakar Panda, PA
56 Ms. Ipsita Acharya, Data Web Developer
57 Mr. Udvas Ghorai, Technical Assistant
58 Mr. Rajshree Rajmohan Jena, Technical Assistant
59 Ms. Monalisa Das, Technical Professional
60 Ms. Suravi Mohanty, Technician
61 Mr. Sudarshana Jena, Field Lab. Attendant
62 Mr. Dushmanta Parida, Technician
63 Ms. Rasmita Das, Technician
64 Mr. Sourya Prakash Nayak, Technician
65 Mr. Kartik Jana, Technician
66 Mr. Mrutyunjaya Padhy, Technician
67 Mr. Sridhar Behera, Technician-III
68 Mr. Tejeswar Dass, DEO
69 Mr. Rakesh Chandra Samantaray, Field Data Collecter

DBT-ILS Legal & Estate Affairs

The Legal & Estate Affairs Division (L&EA) looks after all legal matters under various Acts, including RTI. This division is also entrusted with works related to estate Affairs, Housekeeping & welfare, Building engineering & construction security & surveillance, and vigilance & discipline. The performance of the L & EA division of ILS during 2022-23 is summarized as:

1. 10 Online & 21 offline applications along with 3 appeals seeking information under RTI Act were received during 2022-23 and the information sought was provided to all the applicants within the prescribed time limit. The replies were all self-contained and were also disposed of within the stipulated time frame.
2. Vigilance awareness week was observed in the institute. Seminars and competitions were conducted among the staff and students of the institute.
3. Swatch Bharat Abhiyan conducted on 2nd October 2022 at ILS, Bhubaneswar. In line with the government guidelines and Swatchhta Shapath was administrated as part of national cleanness campaign.
4. Other programs in line with the Government of India's directions namely Anti-terrorism Day and Martyr's Day were observed in the institute.

AUDITOR'S REPORT & AUDITED ACCOUNTS 2022-23

जीव विज्ञान संस्थान

INSTITUTE OF LIFE SCIENCES

(An Autonomous Institute of the Department of Biotechnology, Government of India)

Bhubaneswar

APDP & CO.
CHARTERED ACCOUNTANTS

Plot No. 804, Road No.1
Mahavir Nagar, Jharpara,
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Independent Auditors' Report

To the Governing Body of

Institute of Life Sciences, Bhubaneswar

Report on the Financial Statements

We have audited the accompanying financial statements of **Institute of Life Sciences** ("the Institute"), which comprise the Balance Sheet as at 31st March, 2023, the Statement of Income & Expenditure and the Receipt and Payment Account for the year then ended, and a summary of the significant accounting policies and other explanatory information (herein after referred to as "Financial Statements").

In our opinion and to the best of our information and according to the explanations given to us, the accompanying financial statements for the year ended 31st March, 2023 are prepared in all material respects in accordance with the Chartered Accountants Act, 1949, and give a true and fair view in conformity with the accounting principles generally accepted in India of the state of affairs of the Institute as at 31st March, 2023 and its deficit for the year ended on that date.

Basis of Opinion

We conducted our audit in accordance with accounting principles generally accepted in India, including the Accounting standard issued by ICAI. Our responsibilities under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are independent of the Society in accordance with the code of Ethics issued by ICAI and we have fulfilled our other ethical responsibilities in accordance with the Code of Ethics. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis of our opinion.

Emphasis of Matter
We draw our attention to the following:

ADVANCES

We observed that Following advance with different Organization and vendor are still unadjusted and brought forward in the books of account since long. So in our opinion necessary steps to be taken by the Institute to adjust the below mentioned advance and to Capitalize the Capital- WIP immediately for the fair representation of Fixed Asset value in the books of accounts.

Name of the Organization	Amount in Rs.
Adv. To CPWD	11,32,92,985
Capital-WIP- not Capitalized- construction activities by CPWD	7,35,73,719
Adv. to World Courier India Pvt. Ltd.	87,311

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Management's Responsibility for the Financial Statements.

The Management is responsible for the preparation of these Financial Statements in Accordance with The Chartered Accountants Act, 1949 that give a true and fair view of the state of affairs, financial performance of the society in accordance with the Accounting principles generally accepted in India, including the Accounting Standards issued by the Institute of Chartered Accountants of India. This responsibility also includes maintenance of adequate accounting records for safeguarding of the assets of the society and for preventing and detecting frauds and other irregularities; selection and application of appropriate accounting policies; making judgments and estimates that are reasonable and prudent; and design, implementation and maintenance of adequate internal financial controls that were operating effectively for ensuring the accuracy and completeness of the Accounting records, relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the management is responsible for assessing the Institute's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the management either intends to liquidate the Institute or to cease operations, or has no realistic alternative but to do so.

The management is responsible for overseeing the Institute's financial reporting process.

Auditors' Responsibility

Our objective are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and not to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with SAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with SAs, we exercise professional judgment and Maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, Whether due to fraud or error design and perform audit procedures responsive to those Risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, Intentional omissions, misrepresentations, or the override of internal control.

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- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Institute's internal control.

- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the management.

- Conclude on the appropriateness of the management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Societies ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Society to cease to continue as a going concern.

- Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

We communicate with the management regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

We also provide the management with a statement that we have complied with relevant ethical requirements regarding independence, and to communicate with them all relationship and other matters that may reasonably be thought to bear on our independence and where applicable related safeguards.

Opinion

In our opinion and to the best of our information and according to the explanations given to us, the aforesaid financial statements read together with notes to Accounts thereon subject to our comments given in annexure give the information required by the Act in the manner so required and give a true and fair view in conformity with the accounting principles generally accepted in India:

a) in the case of the Balance Sheet, of the state of affairs of the Society as at 31st March, 2023.

(b) in the case of the Income & Expenditure Account, of the excess of expenditure over Income of the society for the year ended on that date and,

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Other matters

Additional details as enclosed in Annexure -A

Report on Other Legal and Regulatory Requirements

1. We report that:

(a) We have sought and obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purposes of our audit.
(b) In our opinion, proper books of account as required by law have been kept by the Institute so far as it appears from our examination of those books.
(c) The Balance Sheet, the Statement of Income and Expenditure, and the Receipt & Payment Statement dealt with by this Report are in agreement with the books of account.
(d) In our opinion, the Balance Sheet, the Statement of Income and Expenditure, and the Receipt & Payment Statement comply with the Accounting Standards.

M/S APDP & CO
Chartered Accountants
FRN- 324002E

Date: 28th Jul 2023
Place: Bhubaneswar

CA P. Swain, FCA
Partner
M.No. 058193
UDIN- 23058193BGXJXT3736

APDP & CO. BBSR CHARTERED ACCOUNTANTS

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Annexure-A

Auditor's report on other matters

1. **Whether books are being maintained in Tally ERP on regular basis and financial statements are prepared from the books of accounts maintained in Tally only.**

- Yes, Tally ERP has been implemented and financial statements are prepared based on the data updated in Tally ERP on daily basis.

2. **Whether the ILS is regular in depositing statutory dues i.e. provident fund, TDS, GST and any other statutory dues to the appropriate authorities and if not, the extent of the arrears of outstanding statutory dues on the balance sheet date.**

- All the statutory dues have been paid to the appropriate authority and required returns also have been filed in due time.

3. **Whether institute is maintaining Fixed Assets Register and assets purchased during the period are properly recorded in register.**

- Yes, Institute is maintaining Fixed Assets Register and assets purchased during the period are properly recorded in computerized software.

4. **Whether Closing Inventory have been valuated at the end the financial year and necessary accounting entries have been passed in the books of accounts.**

- Yes, Closing inventory have been valuated and appropriate accounting impact has been given in the books of accounts.

5. **Whether all the revenue grants received as per the entitlement of the institute are duly accounted for in the books of accounts. Also whether Capital Grant is recognized only on receipt basis.**

- Yes. All revenue grants as per the entitlement of the institute are duly accounted for in the books of accounts and Capital Grant is recognized only on receipt basis.

For M/S APDP & CO
Chartered Accountants
FRN- 324002E

Date: 28th Jul 2023
Place: Bhubaneswar

APDP & CO BBSR CHARTERED ACCOUNTANTS

CA P. Swain, FCA
Partner
M.No. 058193
UDIN- 23058193BGXJXT3736

INSTITUTE OF LIFE SCIENCES
NALCO SQUARE, BHUBANESWAR

BALANCE SHEET AS AT 31ST MARCH 2023

CAPITAL FUND AND LIABILITIES	Schedule	Current Year 2022-23	Previous Year 2021-22
CAPITAL FUND	1	2,09,75,99,085	2,16,60,63,159
RESERVES AND SURPLUS	2	31,62,034	36,77,502
EARMARKED/ ENDOWMENT FUNDS	3		
SECURED LOANS AND BORROWINGS	4		
UNSECURED LOANS AND BORROWINGS	5		
DEFERRED CREDIT LIABILITIES	6		
CURRENT LIABILITIES AND PROVISIONS	7	6,03,98,890	7,36,74,331
TOTAL		**2,16,11,60,009**	**2,24,34,14,992**
ASSETS			
FIXED ASSETS	8	1,59,31,09,389	1,51,11,52,907
CAPITAL WORK-IN PROGRESS	8	7,35,73,719	7,35,73,719
INVESTMENTS-FROM EARMARKED/ENDOWMENT FUNDS	9		
INVESTMENTS-OTHERS	10		
CLOSING INVENTORY	11	43,24,337	41,88,326
CURRENT ASSETS, LOANS & ADVANCES			
(i) CASH AND BANK BALANCES	12	34,35,55,002	46,39,32,998
(ii) DEPOSITS & ADVANCES	12	14,65,97,562	19,05,67,042
MISCELLANEOUS EXPENDITURE (to the extent not written off or adjusted)			
TOTAL		**2,16,11,60,009**	**2,24,34,14,992**
SIGNIFICANT ACCOUNTING POLICIES	25		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	26		

Place: Bhubaneswar
Date:28.07.2023

As per our attached report of even date

For and on behalf of Institute of Life Sciences

For and on behalf of
M/S APDP & CO
Chartered Accountants
FRN- 324002E

Dr. R. K. Behera
Finance & Accounts Officer

Dr. Debasis Dash
Director

CA P. Swain, FCA
Partner
M.No. 058193
UDIN 23058193BGXJXT3736

वित्त और लेखा अधिकारी / Finance & Accounts Officer
जीव विज्ञान संस्थान/ Institute of Life Sciences
भुवनेश्वर / Bhubaneswar– 751023

निदेशक / Director
जीव विज्ञान संस्थान/ Institute of Life Sciences
भुवनेश्वर / Bhubaneswar– 751023

APDP & CO BBSR CHARTERED ACCOUNTANTS

INSTITUTE OF LIFE SCIENCES
NALCO SQUARE, BHUBANESWAR

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2023

	Schedule	Current Year 2022-23	Previous Year 2021-22
INCOME			
Income from Services	12		
Grants (Recurring)	13	47,13,45,413	65,85,73,634
Fees	14	10,50,000	10,04,800
Income from Investments	15		
Funds transferred to Funds)			
Income from Royalty, Publication etc.	16	-	9,15,552
Interest	17	1,39,58,631	1,01,24,739
Other Income	18	2,53,44,852	2,73,74,536
TOTAL (A)		**51,16,98,896**	**69,79,93,261**
EXPENDITURE			
Establishment Expenses	20	11,66,66,952	12,51,64,083
Other Administrative Expenses etc.	21	18,53,16,671	19,26,55,386
Expenditure on Grants, Subsidies etc.	22	18,09,06,503	31,29,03,447
(Increase)/decrease in Inventories	11	(1,36,011)	(41,88,326)
Interest	23		
Refund of Unspent Grant & Interest	24	1,17,18,012	1,61,81,696
Loss on Foreign Exchange			
Depreciation for theyear-end-corresponding to **Schedule-8)**		**23,40,59,731**	**20,45,48,304**
TOTAL (B)		**72,85,31,858**	**84,72,64,590**
Balance being excess of Expenditure Over Income(A-B)		(21,68,32,962)	(14,92,71,328)
Provision made for Gratuity & Leave Salary		3,00,00,000	
BALANCE BEING SURPLUS/(DEFICIT) CARRIED TO CAPITAL FUND		**(24,68,32,962)**	**(14,92,71,328)**
SIGNIFICANT ACCOUNTING POLICIES	25		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	26		

Place: Bhubaneswar
Date:28.07.2023

As per our attached report of even date

For and on behalf of
M/S APDP & CO
Chartered Accountants
FRN- 324002E

For and on behalf of Institute of Life Sciences

Dr. R. K. Behera
Finance & Accounts Officer

Dr. Debasis Dash
Director

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निदेशक / Director
जीव विज्ञान संस्थान/ Institute of Life Sciences
भुवनेश्वर / Bhubaneswar- 751023

APDP & CO BBSR CHARTERED ACCOUNTANTS

INSTITUTE OF LIFE SCIENCES,
NALCO SQUARE, BHUBANESWAR

RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 2023

Receipts	Current Year 2022-23	Previous Year 2021-22	Payments	Current Year 2022-23	Previous Year 2021-22
I. Opening Balance			**I. Expenses**		
a) Cash in hand			a) Establishment Expenses	11,66,66,952	12,41,89,307
b) Bank Balances					
i) In current accounts	9,445	7,465	b) Administrative Expenses	18,46,70,515	18,48,32,610
ii) In deposit accounts	4,48,01,638	4,57,41,616			
iii) Savings accounts	41,91,21,915	26,20,76,968	II. Payments made against funds for various	14,34,10,003	19,16,61,371
			a) out of Fellowship grants	1,56,50,436	1,59,04,075
			b) Reimbursement received for Covid test	2,16,27,281	4,64,83,681
II. Grants Received			III. Investments and deposits made		
a) From Government of India			a) Out of Earmarked/Endowment funds		
Non-Recurring	16,83,68,889	40,94,73,909	b) Out of Own Funds (Investments-Others)		
Recurring	44,97,18,132	59,91,56,773			
b) From State Government			IV. Expenditure on Fixed Assets & CWIP		
Non-Recurring	1,00,00,000	-	a) Purchase of Fixed Assets	26,86,34,368	23,47,41,923
Recurring	-	90,043	b) Expenditure on Capital Work-in-progress		
c)Other Re-imbursement & Contribution	2,16,27,281	5,81,96,333	V. Refund of surplus money/Loans		
d) Grant from DBT for Other agencies	-	-	a) To the Government of India	3,13,15,165	1,61,47,374
e) Recurring	-	11,30,485	b) To the State Government		
			c) To other providers of funds	-	13,488
III. Income on Investments from					
a)Earmarked/Endow. Funds			VI. Finance Charges (Interest)		
b)Own Funds (oth. Investment)					
			VII. Other Payments (Specify)		
IV. Interest Received			a) Current Liabilities & Provisions	2,71,10,084	87,55,705
a) On Bank deposits	1,39,58,631	1,07,99,767	b) Current Assets, Loans & Advances	56,65,361	11,26,16,850
b) Loans. Advances etc.					
			d) Grant -DBT distributed for other agencies	-	5,23,79,523
V. Other Income	2,14,58,727	2,64,11,799			
VI. Amount Borrowed			a) Cash in hand		-
VII. Any other receipts (give details)			b) Bank Balances		
a) Current Liabilities & Provisions	80,38,639	1,10,95,549	i) In current accounts	5,020	9,445
b) Current Assets, Loans & Advances	12,01,869	2,74,78,201	ii) In deposit accounts	7,44,75,175	4,48,01,638
			iii) Savings accounts	26,90,74,807	41,91,21,915
Total	**1,15,83,05,166**	**1,45,16,58,907**	**Total**	**1,15,83,05,166**	**1,45,16,58,907**

Place: Bhubaneswar
Date: 28.07.2023

Dr. R. K. Behera
Finance & Accounts Officer

Dr. Debasis Dash
Director

वित्त और लेखा अधिकारी / Finance & Accounts Officer
जीव विज्ञान संस्थान/ Institute of Life Sciences
भुवनेश्वर / Bhubaneswar– 751023

निर्देशक / Director
जीव विज्ञान संस्थान/ Institute of Life Sciences
भुवनेश्वर / Bhubaneswar– 751023

As per our attached report of even date

For and on behalf of
M/S APDP & CO
Chartered Accountants
FRN- 324002E

CA P. Swain, FCA
Partner
M.No. 058193
DIN 23058193BGXJXT3736

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INSTITUTE OF LIFE SCIENCES
NALCO SQUARE, BHUBANESWAR
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2023
SCHEDULE 1- CAPITAL FUND

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
Balance as at the beginning of the year	2,16,60,63,159	2,09,75,99,085	1,90,98,63,590	2,16,60,63,159
Reserve & Surplus			-	
Add: Contributions towards Capital Fund			-	
DBT Core Grant	12,35,36,601		21,38,19,909	
ILS-DBT-NER-PJ-NERBPMC-A K PARIDA	5,00,000		5,00,000	
ILS-DBT-PJ-Marine Bioresource-BNP-AParida			26,50,000	
ILS-GOVT ODISHA-S&T-INCUBATION CENTRE	1,00,00,000		-	
ILS-DBT-PJ-Anti-Fungal Vaccine-NAcharya	4,10,050		5,00,000	
ILS-BIRAC-PJ-Animal Model-SARS-CoV2-SSenapati	66,27,000		-	
ILS-DBT-PJ-CARCINOGENESIS-NACHARYA			6,00,000	
ILS-DBT-PJ-DZIP3-S CHAUHAN			9,10,000	
ILS-DBT-PJ-Spectrometry Platform-Soma	1,08,95,238		8,80,00,000	
ILS-SERB-PJ-PROTEIN CROSSLINK- N ACHARYA			5,00,000	
ILS-DBT-PJ-JUTE STEM - S MAJUMDER			10,00,000	
ILS-DBT-PJ-WESTERN HIMALAYAN- A PARIDA			24,94,000	
ILS-DBT-PJ-BIOTECH-KISAN HUB- A PARIDA			10,00,000	
ILS-BIRAC-PJ-COVID-19 VACCINE DEVELOPMENT- SKR	2,50,00,000		4,00,00,000	
ILS-BIRAC-PJ-Animal Model-SARS-CoV2-SSenapati			3,65,00,000	
Grant For DBT-PJ ANTI-Viral Screening Platform-SOMA			2,10,00,000	
ILS-ICMR-PJ-Pathogenesis-SAR COV2-ARS	14,00,000			
Unspent Interest & Grant			(40,03,012)	
Trf. from the Income and Expenditure Acct	(24,68,32,962)		(14,92,71,328)	
BALANCE AT THE YEAR-END		2,09,75,99,085		2,16,60,63,159

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2023
SCHEDULE 2- RESERVES AND SURPLUS

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
1. Capital Reserve:				
As per last Account				
Addition during the year				
Less: Deductions during the year				
2. Revaluation Reserve				
As per last Account				
Addition during the year				
Less: Deductions during the year				
3. Special Reserve				
As per last Account				
Addition during the year				
Less: Deductions during the year				
4. General Reserve		31,62,034		36,77,502
As per last Account	36,77,502		28,56,580	
Addition during the year			8,20,922	
Less: Deductions during the year	5,15,468		-	
TOTAL		31,62,034		36,77,502

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2023
SCHEDULE 7- CURRENT LIABILITIES AND PROVISIONS

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
A. CURRENT LIABILITIES		33,81,793		2,19,58,800
1 Sundry Creditors:				
a) For Goods & Consumables & Others	2,181		96,83,332	
b) For Equipment & Furniture etc	20,55,500		1,10,02,111	
2 Security Deposit from Suppliers/Contractors	13,24,112		12,73,357	
3 Other Current Liabilities		5,70,17,097		5,17,15,531
Gratuity & EL & HPL of DVSingh in FD	-		1,47,355	
Leave salary & EPF Poayable DV Singh CUSB	-		5,08,354	
Provision for Retirement Benefit	5,35,15,910		2,85,62,677	
Prov. for Leave Salary Encashment				
Fund From CA18013 UBI, SB 643 Uco	6,39,225		6,39,225	
Hostel Caution Money From Scholar	8,10,000		7,30,000	
Payable to Bharatkosh	-		20,834	
EPF Payable	-		7,680	
Refundable to Govt.	-		1,95,97,153	
NPS payable	-		-	
GST payable	2,16,713		4,22,562	
TDS on GST Payable	8,43,790		3,06,675	
TDS-IT-Non Salary Payable	4,93,458		2,15,016	
Liability of different Project	4,93,000		5,58,000	
TOTAL		6,03,98,890		7,36,74,331

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APDP & CO BBSR CHARTERED ACCOUNTANTS

INSTITUTE OF LIFE SCIENCES,
NALCO SQUARE, BHUBANESWAR
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2023
SCHEDULE 8- FIXED ASSETS

(Amount in Rs)

Sl.No.	DESCRIPTION	Rate of Depreciation	GROSS BLOCK				DEPRECIATION				NET BLOCK	
			Cost/valuation As on 01.04.2022	Additions	Deduction	Cost/ valuation as on 31.03.2023	Opening Balance as on 01.04.2022	For the Year	Deletion	Closing Balance as on 31.03.2023	As on 31.03.2023	As on 31.03.2022
1	Furniture & Fixtures	10%	8,39,76,560	2,25,24,646		10,65,01,206	4,43,04,634	52,02,925		4,95,07,559	5,69,93,647	3,96,71,926
2	Plant & Machinery	15%	9,41,39,373	-		9,41,39,373	6,43,59,569	44,66,971		6,88,26,540	2,53,12,833	2,97,79,804
3	Vehicle	15%	88,20,018	-		88,20,018	38,33,325	7,48,004		45,81,329	42,38,689	49,86,693
4	Books	40%	3,72,02,249	15,272		3,72,17,521	3,71,76,234	14,509		3,71,90,743	26,779	26,016
5	Electronic Material	15%	14,436	-		14,436	14,249	28		14,277	160	188
6	Scientific Equipment	15%	1,72,66,77,507	28,64,00,160		2,01,30,77,666	86,95,35,863	15,97,59,732		1,02,92,95,595	98,37,82,071	85,71,41,643
7	Security Post	10%	14,500	-		14,500	12,704	180		12,884	1,616	1,796
8	Software	40%	56,31,646	2,01,600		58,33,246	55,75,082	1,03,265		56,78,347	1,54,899	56,564
9	Building	10%	75,16,70,319	-		75,16,70,319	30,11,91,424	4,50,47,890		34,62,39,314	40,54,31,005	45,04,78,895
10	EPABX	15%	46,782	-		46,782	46,360	63		46,423	359	422
11	Computer	40%	5,06,11,834	53,33,624		5,59,45,458	3,62,12,644	70,13,947		4,32,26,591	1,27,18,867	1,43,99,190
12	Scientific Equipment (FIST FUND)	15%	14,27,529	-		14,27,529	13,92,849	5,202		13,98,051	29,478	34,680
13	Scientific Equipment (SRC)	15%	11,23,221	-		11,23,221	10,95,963	4,089		11,00,052	23,169	27,258
14	DISC Room	10%	95,100	-		95,100	82,575	1,253		83,828	11,272	12,525
15	Office Equiment	15%	4,71,99,211	15,40,912		4,87,40,123	2,96,05,989	28,28,579		3,24,34,568	1,63,05,556	1,75,93,223
16	Land	0%	83,11,150	-		83,11,150	-	-		-	83,11,150	83,11,150
17	Electrical Installation	10%	15,09,44,989	-		15,09,44,989	6,23,14,054	88,63,094		7,11,77,148	7,97,67,841	8,86,30,935
	TOTAL OF CURRENT YEAR		2,96,79,06,426	31,60,16,214	-	3,28,39,22,639	1,45,67,53,519	23,40,59,731	-	1,69,08,13,250	1,59,31,09,389	1,51,11,52,907
	PREVIOUS YEAR		2,61,05,14,507	38,32,80,740	2,58,88,821	2,96,79,06,426	1,27,48,79,944	20,45,48,304	2,26,74,729	1,45,67,53,519	1,51,11,52,907	1,33,56,34,563
	CAPITAL WORK-IN PROGRESS				-						7,35,73,719	7,35,73,719

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APDP & CO. BBSR CHARTERED ACCOUNTANTS

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2023

SCHEDULE 11- CLOSING INVENTORY

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
Closing Inventories				
Chemical & Consumables- Core		29,08,416		18,27,107
Opening Balance	18,27,107			
Purchased During the period	7,11,29,491			
Utilised During The Period	7,00,48,182			
Closing balance	29,08,416		18,27,107	
Chemical & Consumables- Projects		12,60,048		
Opening Balance	22,26,854			
Purchased During the period	7,19,50,806			
Utilised During The Period	7,29,17,612			22,26,854
Closing balance	12,60,048		22,26,854	
Other Inventory- Core		1,55,873		
Opening Balance	1,34,365			
Purchased During the period	13,48,517			
Utilised During The Period	13,27,009		-	1,34,365
Closing balance	1,55,873		1,34,365	
TOTAL		43,24,337		41,88,326

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2023

SCHEDULE 12- CURRENT ASSETS, LOANS, ADVANCES ETC.

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
A. CURRENT ASSETS:				
1 Cash balances in hand				
DBT Core Grant				
2 Bank Balances:	-		-	
a) With Scheduled Banks:	-		-	
In current accounts	-	-	-	-
Savings accounts	-	26,90,79,827	-	41,91,31,360
DBT Core Grant	-		-	
Union Bank of India, CSPUR (SB 6285)	6,99,11,327		14,97,84,897	
AXIS BANK LTD SB 915010028405272	1,44,15,444		5,36,330	
Indian Overseas Bank SB A/c 015901000022319	3,33,035		3,14,375	
Union Bank of India-(Retirement Benefits)(17393)	12,659		5,33,569	
Fastag Wallet 19000008671924 Axis Bank	5,020		9,445	
ILS-DBT-PJ-LIA-SIGID	-		-	
Union Bank of India (SB 17015)	35,328		34,351	
ILS PROJECT CONSUMABLE	-		-	
Union Bank of India (SB 17189)	6,09,058		5,92,229	
ILS-Wellcome Trust DBT-Dengue-GHSyed	-		-	
Union Bank of India (SB 17357)	1,241		-	
ILS-BIRAC-PJ-IMRS-V A NAGARAJ	-		-	
Union Bank of India (SB 17394)	45,960		44,690	
ILS-Welcome Trust DBT-IRGM-Mediated-SChauhan	-		-	
Union Bank of India (SB 17395)	-		4,322	
ILS-DBT-CEIB-Malaria-V A Nagaraj & BR	-		-	
Union Bank of India (SB 17419)	-		17,122	
ILS-DBT-PJ-MBZM-N-IBT-Soma	-		-	
Union Bank of India (SB 17826)	6,712		6,526	
NASI-Enhancing Productivity-Aparida	-		-	
Union Bank of India SB 18078	36,037		8,79,790	
Identification-Genetic And Epigenetic-PVR	-		-	
Union Bank of India SB 18035	-		7	
IBSD-PJ-Bioresources Management-Aparida	-		-	
Union Bank of India SB 17334	20,629		20,059	
ILS-SERB-PJ-Hepatitis C-Gsyed	-		-	
Union Bank of India SB 17953	-		3,97,927	
INSTITUTE OF LIFE SCIESNCES-FCRA	-		-	
Union Bank of India-SB 17067	3,66,861		2,01,661	
State Bank Of India-40102381550	3,745		4,56,249	
ILS-Conference, Symposium & Seminar	-		-	
Union Bank of India SB 17942	3,65,965		3,51,441	
ILS-DBT-NER-BPMC-BHIMKOL-NDEY	-		-	
Union Bank of India SB 18198	-		3,10,957	
ICICI Bank A/c 722101000170	3,04,915			
ILS-DBT-PJ-FtsEx-TKBeuria	-		-	
Union Bank of India SB 18133	-		6,368	
ILS-S&T-GoO-PJ-Anticancerous-SKM	-		-	
Union Bank of India SB 18107	1,00,582		97,803	
ILS-SERB-PJ-AMINO ACID-A NAGARAJ	-		-	
Union Bank of India SB 18259	-		1,742	
ILS-DBT-PJ-DIVERSITY OF SLE-B RAVINDRAN	-		-	
Union Bank of India SB 18297	1,458		12,423	
ICICI Bank 722101000170	2,71,005			
ILS-DST-WOS-PJ-MESOPOROUS-FAHIMA	-		-	
Union Bank of India SB 18443	-		58,525	
ILS-DST-PJ-NANOPARTICLES-SSENAPATI	-		-	
Union Bank of India SB 18499	114		16,724	

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APDP & CO. BBSR CHARTERED ACCOUNTANTS

Particulars	Current Year - 2022-23	Previous Year - 2021-22
ILS-DST-WOS-PJ-TRIM FAMILY-AHSAN	-	-
Union Bank of India SB 18500	-	30,902
ILS-DBT-ICMR-PJ-Onset Sepsis-DVS	-	-
Union Bank of India SB 18232	-	1,952
ILS-DBT-PJ-Network-Minor Pulses-AParida	-	-
Union Bank of India SB 18326	3,41,248	1,61,45,028
ICICI Bank A/c 722101000170	42,56,037	
ILS-DBT-PJ-ECONOMIC EMPOWERMENT-RSWAIN	-	-
Union Bank of India SB 18523	14,061	13,672
ILS-SERB-PJ-SWI-SNF-PPRASAD	-	-
Union Bank of India -SB 18571	-	3,57,109
ILS-DBT-PJ-Role of Subcellular-APanda	-	-
Union Bank of India SB 18522	-	1,89,110
ILS-BIRAC-PJ-TRC-CHIKUNGUNYA-SOMA	-	-
Union Bank of India SB 18606	18,52,140	26,67,329
ILS-DBT-PJ-Tribal health-Odisna-AParida(Flagship)	-	-
Union Bank of India SB 18603	51,382	1,99,819
ICICI A/c 722101000170	1,10,71,078	
ILS-AG&FE-IIMT-PJ-NABARANGPUR-RSWAIN	-	-
Union Bank of India SB 18669	1,88,333	1,83,087
ILS-ICMR-PJ-KINOME SCREENING-RDASH	-	-
Union Bank of India SB 18632	-	12,83,537
ILS-DBT-PJ-SPENE-MALARIA PARASITE-ANAGARAJ	-	-
Union Bank of India SB 18687	-	204
ICICI A/c 722101000170	1,39,222	
ILS-D3T-Wellcome Trust-PJ-Pancreatic-ACPanda	-	-
Union Bank of India SB 18706	17,87,446	4,52,232
ILS-DBT-PJ-BHUBANESWAR-BCF-DVASUDEVAN	-	-
Union Bank of India SB 18729	2,61,078	55,49,718
ICICI A/c 722101000170	54,56,811	
ILS-SERB-PJ-FKBP-DVASUDEVAN	-	-
Union Bank of India SB 18725	-	3,00,413
ILS-DBT-PJ-GENOMEINDIA-SKR	-	-
Union Bank of India SB 18753	1,07,759	74,023
ICICI A/c 722101000170	31,96,485	
ILS-SERB-PJ-Ecotropic VI-SChakraborty	-	-
Union Bank of India SB 18761	2,16,464	55,775
ILS-DBT-PJ-NBACD-IRGM-S CHAUHAN	-	-
Union Bank of India SB 18771	111	6,780
ICICI A/c 722101000170	4,827	
ILS-DBT-NER-PJ-NERBPMC-A K PARIDA	-	-
Union Bank of India SB 18781	3,63,291	2,33,75,946
ICICI A/c 722101000170	2,40,02,275	
ILS-DBT-PJ-AYUSH NETWORK-COV2-VIRUS-APARIDA	-	-
Union Bank of India SB 18839	38,145	36,957
ILS-DBT-PJ-BIOREPOSITORY FOR COVID19-APARIDA	-	-
Union Bank of India SB 18863	1,30,170	26,50,061
ICICI A/c 722101000170	4,94,057	
ILS-BIRAC-BIONEST-PJ	-	-
Union Bank of India SB 18888	49,52,058	1,55,10,557
ILS-DBT-PJ-Marine Bioresource-BNP-AParida	-	-
Union Bank of India SB 18948	1,41,280	66,46,545
ICICI A/c 722101000170	21,45,023	
ILS-SERB-PJ-ZBTB10-SKR	-	-
Union Bank of India SB 18800	15,58,943	3,71,650
ILS-SERB-ORAL SQUAMOUS-RDASH	-	-
Union Bank of India SB 18905	25,523	11,70,256
ILS-DBT-PJ-ATAD2-SSENAPATI	-	-
Union Bank of India SB 18775	32	18,743
ICICI Bank A/c 722101000170	1,92,773	
ILS-SERB-PJ-Antiviral Immunity-SChauhan	-	-
Union Bank of India SB 18904	2,36,550	53,232
ILS-SERB-PJ-JEV LIFE CYCLE-GSYED	-	-
Union Bank of India SB 18916	4,54,986	51,903
ILS-DBT-PJ-CURCUMIN-MALARIA-ANAGARAJ	-	-
Union Bank of India SB 18819	13,673	7,88,559
ICICI Bank A/c 722101000170	26,228	
ILS-GOVT ODISHA-S&T-INCUBATION CENTRE	-	-
Union Bank of India SB 18799	1,03,89,573	2,58,111
ILS-DBR-PJ-FLAVIVIRAL-PREETHY	-	-
Union Bank of India SB 18812	3,51,484	3,41,750
ILS-DST-PJ-Anti-Fungal Vaccine-NAcharya	-	-
Union Bank of India SB 18914	12,687	6,72,900
ICICI Bank A/c 722101000170	4,06,561	
ILS-DBT-PJ-CARCINOGENESIS-NACHARYA	-	-
Union Bank of India SB 18949	8,304	10,94,283
ICICI Bank A/c 722101000170	17,897	

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APDP & CO. BBSR CHARTERED ACCOUNTANTS

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
ILS-ICMR-PJ-STOMACH CANCER-A DIXIT	-		-	
Union Bank of India SB 18951	48,279		3,46,383	
ILS-DST-WOS-A-PJ-Oral Cancer-VMohanty	-		-	
Union Bank of India SB 18941	50,275		48,880	
ILS-DBT-Council S&T Odisha-Skill Vigyan	-		-	
Union Bank of India SB 18950	4,53,334		5,07,077	
ILS-DBT-PJ-PROTEIN HYDROGELS-MAMONI DASH	-		-	
Union Bank of India SB 18840	17,737		9,56,034	
ICICI Bank A/c 722101000170	8,39,544			
ILS-BIRAC-PJ-Animal Model-SARS-CoV2-SSenapati	-		-	
SBI, Rail Vihar Br. SB39948600730	11,73,738		1,04,499	
ILS-DBT-PJ-INSACOG-A PARIDA	-			
Union Bank of India SB 18957	11,22,892		67,10,085	
ILS-DBT-PJ-SCALING UP COVID-19 TESTING	-			
Union Bank of India SB 18969	2,53,450		3,24,622	
ILS-DBT-PJ-SPECTROMETRY PLATFORM-SOMA	-			
Union Bank of India SB 18997	6,75,019		8,94,60,844	
ICICI Bank A/c 722101000170	4,84,192			
ILS-SERB-PJ-EFFLUXPUMP-TKB	-			
Union Bank of India SB 19099	75,471		21,32,264	
ILS-DBT-PJ-HOMEOBOX A10- S CHAUHAN	-			
Union Bank of India SB 19090	6,152		9,57,998	
ICICI Bank A/c 722101000170	1,23,363			
ILS-SERB-PJ-PROTEIN CROSSLINK- N ACHARYA	-			
Union Bank of India SB 19102	7,16,253		24,07,200	
ILS-DBT-PJ-JUTE STEM - S MAJUMDER	-			
Union Bank of India SB 19103	11,70,302		28,15,760	
ILS-BIRAC-PJ-PROTEIN D-SAR-COV-2-SSenapati	-			
Union Bank of India SB 19106	14,437		1,03,132	
ILS-ICMR-PJ-IBD MICE- S CHAUHAN	-			
Union Bank of India SB 19126	17,06,341		23,77,072	
ILS-DBT-PJ-WESTERN HIMALAYAN- A PARIDA	-			
Union Bank of India SB 19115	1,62,739		1,09,12,800	
ICICI Bank A/c 722101000170	46,14,640			
ILS-DBT-PJ-BIOTECH-KISAN HUB- A PARIDA	-			
Union Bank of India SB 19116	1,31,113		78,00,000	
ICICI Bank A/c 722101000170	39,10,240			
ILS-SERB-PJ-HEARING LOSS- PVR	-			
Union Bank of India SB 19125	6,63,919		17,35,410	
ILS-ICMR-PJ-EPIGENETIC DRUGS-COV2- P PRASAD	-			
Union Bank of India SB 19134	3,52,293		48,29,629	
ILS-BIRAC-PJ-COVID-19 VACCINE DEVELOPMENT- SKR	-			
Union Bank of India SB 19104	3,35,46,047		4,82,60,000	
ILS-DBT-PJ-ANTI-VIRAL-SCREENING PLATFORM-SOMA				
ICICI Bank A/c 722101000170	2,27,84,896			
SBI, Rail Vihar-SB 40930333761	2,65,083			
ILS-BIRAC-PJ-PEST CONTROL-MDASH				
Union Bank of India SB 19138	5,51,950			
ILS-SERB-PJ-DICOT PLANTS-NDEY				
Union Bank of India SB 19149	6,04,436			
ILS-DBT-PJ-Traditional Healthcare-SKR				
Union Bank of India SB 19148	33,599			
ICICI Bank A/c 722101000170	17,09,280			
ILS-DST-PJ-NANOHERBICIDE-SKSAHOO				
Union Bank of India SB 19169	135			
ILS-DST-WOS-MDR-XDR-C MOHAPATRA				
Union Bank of India SB 19153	1,17,227			
ILS Startup India Seed Fund Trust & Retention Acccou				
Union Bank of India SB 19123	1,28,37,684			
ILS-ICMR-PJ-Pathogenesis-SAR COV2-ARS				
Union Bank of India SB 19178	48,23,574			
ILS-DBT-PJ-DZNepA Cancer-SKM				
ICICI Bank A/c 722101000170	31,58,865			
ILS-DBT-PJ-CML-CHRONIC-SCHAKRABORTY				
ICICI Bank A/c 722101000170	35,80,000			
ILS-DBT-PJ-Pediatic-Disorder-PVR/Rswain				
ICICI Bank A/c 722101000170	21,44,857			
ILS-DBT-PJ-HSP70-Golden Hamsters-BR				
ICICI Bank A/c 722101000170	1,88,650			
ILS-ICMR-PJ-Resistance of OSCC-RDash				
Union Bank of India SB 19440	16,12,444			
ILS-DBT-PJ-DZIP3-S CHAUHAN	-			
ICICI Bank A/c 722101000170	5,85,696			
Union Bank of India SB 19143	9,789			
Fixed Deposit with Banks	7,44,75,175	7,44,75,175	4,46,54,283	4,46,54,283
FD for Gratuity & EL & HPL of Dr. D V Singh	-	-	1,47,355	1,47,355

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भुवनेश्वर / Bhubaneswar– 751023

APDP & CO. * BBSR * CHARTERED ACCOUNTANTS

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
TOTAL (A)		**34,35,55,002**		**46,39,32,998**
B. LOANS, ADVANCES AND OTHER ASSETS				
ADVANCES				
1 Advance to Parties		**13,72,77,622**		**17,62,83,628**
Adv. for Journal	-		26,194	
Adv. to BPCL for Diesel, Petrol & Oil	1,80,634		1,23,478	
Adv. to CPWD for Const. Cam.I-II	10,92,92,985		10,92,92,985	
Adv. for Scientific Equipment	1,78,40,326		5,97,08,031	
Adv. paid to Exe. Engineer, PH	9,22,335		9,22,335	
Adv. to Anand Industrial Gases for LN2	30,000		30,000	
Adv. to G. C. Sen Agency	23,85,268		9,31,883	
Adv. to CPWD for UPS Bionest Prj	40,00,000		40,00,000	
Adv. with Univercell Biosolution	-		3,94,922	
Adv. to Kaback System	-		3,85,580	
Adv. for Consumables/Supplies & Scientific Serv	24,78,795		3,43,515	
Adv. to World Courier India Pvt. Ltd.	87,311		87,311	
Adv. for Repair of Equipment	59,967		37,394	
2 Staff Advance		**14,34,951**	-	**2,82,405**
a) Employees			-	
T. A. Advance	3,54,188		7,405	
LTC Advance	3,57,622		-	
Medical Advance	90,000		-	
Contingency Advance	12,649		45,000	
Adv. for Expenses for meeting etc.	6,20,492		2,30,000	
b) Fellowship Advance		**13,67,573**	-	**12,91,144**
Adv. Fellowship to CSIR Fellows	1,42,017		1,68,588	
Adv. Fellowship to DBT Fellows	35,941		54,941	
Adv. Fellowship to ICMR Fellows	2,30,478		2,30,478	
Adv. Fellowship to DST Inspire Fellows	5,04,423		5,04,423	
Adv. Fellowship to UGC Fellows	7,714		32,714	
Adv. Fellowship from user-fees	4,47,000		3,00,000	
3 Deposits		**57,41,345**	-	**57,41,345**
Security for LPG Gas Connection	1,67,150		1,67,150	
Security for N2/Co2 Gas Cylinder etc.	4,13,536		4,13,536	
Security Deposit with CESCO	45,92,489		45,92,489	
Security Deposit with BCDD-II, CESU	13,492		13,492	
Security Deposit - National Prd Council New Delhi	5,54,678		5,54,678	
4 Other Current Assets		**7,76,071**	-	**69,68,520**
TDS Receivable	58,759		6,48,487	
TCS Receivables	12,647		8,891	
Margin Money in FD for LC	2,06,665		48,21,145	
User Fee/Royalty Receivables			9,31,997	
Reveivable from projects	4,98,000		5,58,000	
TOTAL (B)		**14,65,97,562**		**19,05,67,042**
GRAND TOTAL (A+B)		**49,01,52,563**		**65,45,00,040**

SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31ST MARCH 2023

SCHEDULE 13- GRANT - IN - AID

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
1) Central Government (Recurring Grants)		**43,09,98,600**		**56,96,97,448**
DBT Core Grant	30,00,00,000		29,69,19,103	
DBT-Tata Invo. Fellowship				
ILS-DBT-PU-PTBP2-S Chakraborty			31,54,558	
ILS-DBT-PJ-ATX AXIS-VRAI			7,20,000	
ILS-DBT-PJ-Integrative Genomics-SKR				
ILS-SERB-PJ-Hepatitis C-GSyed			3,82,800	
ILS-DBT-NER-BPMC-BHIMKOL-NDEY			6,73,767	
ILS-DBT-PJ-LIVELIHOODS NEI-APARIDA				
ILS-DBT-PJ-FtsEx-TKBeuria			15,15,000	
ILS-DBT-PJ-DIVERSITY OF SLE-B RAVINDRAN	8,97,672		16,53,731	
ILS-DST-WOS-PJ-MESOPOROUS-FAHIMA			9,00,000	
ILS-DBT-PJ-TELMISARTAN-CHIKUN-SOMA				
ILS-DST-WOS-PJ-TRIM FAMILY-AHSAN				
ILS-DBT-ICMR-PJ-Onset Sepsis-DVS				
ILS-DBT-PJ-Net-Minor Pulses-AParida			6,55,46,890	
ILS-DBT-PJ-ECONOMIC EMPNT-RSWAIN				
ILS-SERB-PJ-OSCILLATION-TKB				
ILS-SERB-PJ-SWI-SNF-PPRASAD			15,00,000	
ILS-DBT-PJ-Role of Subcellular-APanda			11,90,138	
ILS-BIRAC-PJ-TRC-CHIKUNGUNYA-SOMA	45,69,600		49,62,000	
ILS-DBT-PJ-Tribal Health-Odisha-AParida(Flagship)	1,98,48,756		2,48,86,000	
ILS-ICMR-PJ-KINOME SCREENING-RDASH			13,89,362	
ILS-DST-PJ-SPENE-MALARIA PARASITE-ANAGARAJ	6,78,680		7,54,743	
ILS-DBT-Wellcome Trust-PJ-Pancreatic-ACPanda	44,69,756		27,95,479	

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APDP & CO. BBSR CHARTERED ACCOUNTANTS

Particulars		Current Year - 2022-23		Previous Year - 2021-22	
	ILS-DBT-PJ-BHUBANESWAR-BCF-DVASUDEVAN	14,76,988		13,80,000	
	ILS-SERB-PJ-FKBP-DVASUDEVAN	9,00,000		10,00,000	
	ILS-DBT-PJ-GENOMEINDIA-SKR	49,00,000			
	ILS-SERB-PJ-Ecotropic VI-SChakraborty	15,00,000		13,00,000	
	ILS-DBT-PJ-NBACD-IRGM-S CHAUHAN			4,75,124	
	From DST for Entrepreneurship Trainging Progra				
	FromILS-DBT-NER-PJ-NERBPMC-A K PARIDA	2,46,84,895		1,83,39,719	
	ILS-DBT-PJ-AYUSH NETWORK-COV2-VIRUS-APARIDA				
	ILS-DBT-PJ-BIOREPOSITORY FOR COVID19-APARIDA			15,15,572	
	ILS-BIRAC-BIONEST-PJ				
	ILS-DBT-PJ-Marine Bioresource-BNP-AParida			40,39,160	
	ILS-SERB-PJ-ZBTB10-SKR	15,00,000		8,00,000	
	ILS-SERB-PJ-SARS-CoV-2-RDASH			2,00,000	
	ILS-SERB-ORAL SQUAMOUS-RDASH			12,80,000	
	ILS-DBT-PJ-ATAD2-SSENAPATI	2,34,911			
	ILS-SERB-PJ-Antiviral Immunity-SChauhan	20,00,000			
	ILS-SERB-PJ-JEV LIFE CYCLE-GSYED	19,00,000			
	ILS-DBT-PJ-Anti-Fungal Vaccine-NAcharya	20,68,303		11,52,120	
	ILS-DBT-PJ-CARCINOGENESIS-NACHARYA			7,50,000	
	ILS-ICMR-PJ-STOMACH CANCER-A DIXIT	1,55,740			
	ILS-DBT-PJ-PROTEIN HYDROGELS-MAMONI DASH	13,83,141		11,54,752	
	ILS-BIRAC-PJ-Animal Model-SARS-CoV2-SSenapati			59,48,000	
	ILS-DBT-PJ-INSACOG-A PARIDA	70,80,080		5,04,09,740	
	ILS-DBT-PJ-DZIP3-S CHAUHAN	20,52,892		44,30,010	
	ILS-DBT-PJ-SCALING UP COVID-19 TESTING			1,44,00,000	
	ILS-DBT-PJ-Spectrometry Platform-Soma			5,00,000	
	ILS-SERB-PJ-EFFLUXPUMP-TKB			23,15,906	
	ILS-DBT-PJ-HOMEOBOX A10- S CHAUHAN			10,81,520	
	ILS-SERB-PJ-PROTEIN CROSSLINK- N ACHARYA			20,71,800	
	ILS-DBT-PJ-JUTE STEM - S MAJUMDER			21,15,760	
	ILS-BIRAC-PJ-PROTEIN D-SAR-COV-2-SSenapati			3,09,300	
	ILS-ICMR-PJ-IBD MICE- S CHAUHAN	15,44,544		44,94,209	
	ILS-DBT-PJ-WESTERN HIMALAYAN- A PARIDA			84,18,800	
	ILS-DBT-PJ-BIOTECH-KISAN HUB- A PARIDA			68,00,000	
	ILS-SERB-PJ-HEARING LOSS- PVR			17,35,410	
	ILS-ICMR-PJ-EPIGENETIC DRUGS-COV2- P PRASAD			48,29,629	
	ILS-BIRAC-PJ-COVID-19 VACCINE DEVELOPMENT- SKR	83,88,000		82,60,000	
	Grant For SERB-PJ-DICOT Plants-NDEY			16,22,952	
	Grant For DST_WOS-MDR-XDR-CMOHAPATRA			11,98,600	
	Grant For ILS-BIRAC-PJ-PEST CONTROL-MDASH	7,64,205		12,83,340	
	Unidentifies-Fellowship Grant			14,66,068	
	Grant ILS-DBT-PJ-Traditional Healthcare-SKR			27,26,080	
	Grant DST-PJ-NANOHERBICIDE - SKSAHOO	14,04,240		1,50,000	
	Grant-DST-Wos-PJ-TRIM Family-Ahsan			8,00,000	
	ILS-DBT-PJ-ANTI-VIRAL-SCREENING PLATFORM-SOMA	72,78,320			
	ILS Startup India Seed Fund Trust & Retention Acccou	1,26,00,000			
	ILS-ICMR-PJ-Pathogenesis-SAR COV2-ARS	37,16,948			
	ILS-DBT-PJ-DZNepA Cancer-SKM	32,32,000			
	ILS-DBT-PJ-CML-CHRONIC-SCHAKRABORTY	35,80,000			
	ILS-DBT-PJ-Pediatic-Disorder-PVR/Rswain	38,00,800			
	ILS-DBT-PJ-HSP70-Golden Hamsters-BR	7,00,000			
	ILS-ICMR-PJ-Resistance of OSCC-RDash	16,88,129			
	Fellowship Grants		1,78,05,295		2,92,12,198
	Fell. Grant from DST for JRF/SRF DST-Inspire	33,34,736		95,82,105	
	Grant for Ramalingaswami Fellows from DBT	5,99,387		5,00,000	
	Grant Received From IIS for DBT-RA	15,04,188		37,52,940	
	Grant CSIR Conting. SRA Pool			79,966	
	Grant SERB Vajra Adjunct Faculty	13,13,360		18,54,000	
	Grant Received for DBT-JRF From Consortium	40,33,997		73,08,082	
	Fellowship Grant From CSIR	6,17,807		80,000	
	Fellowship Grant From ICMR	27,13,256		19,00,305	
	Grant From SERB for N Post Doc. Fellow			3,82,800	
	Grant From SERB for Teachers Associateship				
	Research Grant DST	7,00,000			
	Grant From DST for Inspire Faculty	29,00,000		37,72,000	
	Travel Grant (Foreign) - SERB	88,564			
2)	**State Government(s)**		2,21,27,281		5,82,86,376
	Start up Odisha - Performance Grant	5,00,000			
	Reimbursement-NHM//DPH Govt of Odisha- Covid-19	2,16,27,281		5,81,96,333	
	ILS-S&T-GoO-PJ-Anticancerous-SKM			90,043	
3)	**Government Agencies**		-		-
	Fund From RMRC Against Reimb. of Covid19 Exp.				
4)	**Institutions/Welfare Bodies**		4,14,237		9,20,894
	ILS-Wellcome Trust DBT-Dengue-GHSyed			9,20,894	
	ILS-Welcome Trust DBT-IRGM-Mediated-SChauhan	4,14,237			
	Proteomic Society				
	Welcome Trust for EMBO Seminar				

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APDP & CO. BBSR CHARTERED ACCOUNTANTS

Particulars	Current Year - 2022-23	Previous Year - 2021-22
5) International Organisations	-	4,56,718
INSTITUTE OF LIFE SCIESNCES-FCRA		4,56,718
6) Others	-	
TOTAL OF GRANTS RECEIPTS	47,13,45,413	65,85,73,634

SCHEDULE 14- FEES

Particulars	Current Year - 2022-23	Previous Year - 2021-22
	10,50,000	10,04,800
1) Fee for Right to Information		
2) Fee collected under Ph.D.Course	10,50,000	10,04,800
TOTAL	10,50,000	10,04,800

SCHEDULE 16- Income from Royalty, Publication etc.

Particulars	Current Year - 2022-23	Previous Year - 2021-22
1) Lumpsum Premium & Royalty Received	-	9,15,552
		9,15,552
TOTAL	-	9,15,552

SCHEDULE 17- INTEREST

Particulars	Current Year - 2022-23	Previous Year - 2021-22
1) On Term Deposits:	-	-
a) With Scheduled Banks/Nationalised Bank		
b) With Non-Scheduled Banks		
c) With Institutions		
d) Others		
2) On Savings Accounts:	1,39,58,631	1,01,24,739
a) With Scheduled Banks/Nationalised Bank	1,39,58,631	1,01,24,739
b) With Non-Scheduled Banks		
c) With Institutions		
d) Others		
3) On Loans:		
a) Employees/Staff		
b) Others		
4) Interest on Debtors and Other Receivables		
TOTAL	1,39,58,631	1,01,24,739

SCHEDULE 18- OTHER INCOME

Particulars	Current Year - 2022-23	Previous Year - 2021-22
	2,53,44,852	2,73,74,536
Sale of Tender Paper		
Misc. Receipts	4,78,933	3,43,037
Rent Collected towards ATM Room	65,624	1,14,842
Guest House Room Rent	4,21,438	1,83,180
Hostel Room Rent	11,07,513	14,01,962
Refund of Top-Up-IRGM	16,586	
Overhead/Sposorship/different Projects/oth Fees	1,56,67,149	1,87,21,996
Receipt on Auction/Disposal of Scrap	3,00,951	1,33,149
Quarter Rent Collected	5,57,100	6,14,591
User Fees Collected From Industries	4,71,780	28,89,000
Contribution received for SWF	9,52,335	12,25,544
Licence Fee	2,58,677	4,29,265
Utilisation of Ret. Provision	50,46,767	13,17,970
TOTAL	2,53,44,852	2,73,74,536

SCHEDULE –20 ESTABLISHMENT EXPENSES

Particulars	Current Year - 2022-23	Previous Year - 2021-22
	11,66,66,952	12,51,64,083
1 Salary	9,80,68,993	9,49,90,100
2 Fellowship	60,44,012	1,81,90,570
3 Bonus		
4 EPF Contribution (Employer's Contribution)	17,27,945	34,27,408
5 EPF-EDLI & Admin. Charges	83,997	1,69,509
6 Medical Reimbursement	21,75,028	28,17,681
7 Gratuity, Retirement & Terminal Benefits	42,91,750	-
8 Tuition fee	11,55,965	11,08,761

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APDP & CO. BBSR CHARTERED ACCOUNTANTS

Particulars	Current Year - 2022-23	Previous Year - 2021-22
9 Leave Encashment on LTC/Retirement	31,19,262	44,60,055
10 New Pension Sch (Employer's Cont.)		
TOTAL	11,66,66,952	12,51,64,083

SCHEDULE 21- OTHER ADMINISTRATIVE EXPENSES ETC.

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
		18,53,16,671		19,26,55,386
Consumables & Supplies	6,82,43,850		6,54,25,046	
Mice & Animal Feed	28,85,641		22,51,924	
POL for Gen-set and Vehicle	21,97,185		18,31,741	
Printing and Stationery	13,48,517		5,47,186	
Sequencing Charges/Scientific Services	15,16,440		10,81,518	
Advetisement Expenses	3,04,629		1,20,114	
Electricity Charges	2,12,81,249		2,89,16,404	
Telephone Charges	1,97,335		1,99,135	
Audit Fee	88,500		88,500	
Water Charges	43,212		82,668	
Advocate Fee	16,150		73,900	
Job Contract/Job Works	3,81,64,973		4,12,04,681	
Housekeeping Expenses	-		2,26,021	
Photocopy Charges	71,311		-	
Postage/Courier Charges	1,14,356		86,093	
Patent Charges	4,83,724		10,60,304	
Reimbursement of Newpaper	73,000		1,63,200	
Reimbursement of telephone bills	2,70,184		3,41,957	
Municipal Tax	22,39,299		22,39,299	
Contractual Staff Expenses	95,83,721		97,71,532	
Remuneration to Admn. Facilitator at DBT	26,44,155		22,21,800	
Bio-Medical Waste Disposal Charges	2,77,322		2,14,969	
Misc Contingency Expenses	14,88,785		25,13,418	
Patent Advocate Fee	1,06,150		2,16,387	
Honorarium to Advisor	-		66,000	
Honorarium to Legal Advisor	3,60,000		3,94,800	
Lease Line Charges	1,35,405		1,80,540	
Printing of Annual Report & Audited Accounts	3,52,462		1,23,209	
Publication Fee & Article Processing Fee	59,31,795		19,88,954	
Medi Claim Policy Premium	9,03,223		9,75,704	
AMC for Sc. Equipment & Other Equip.	9,63,408		6,83,894	
Rem. to Admn. Liasion Professional at NII	3,52,000		5,28,000	
General Repair & Maintenance	59,89,644		46,87,351	
Repair of Equipment etc.	54,88,624		56,40,482	
Vehicle Insurance	1,65,352		1,71,837	
Repair & Maintenance of Vehicle	2,88,410		57,442	
Seminar, Conference & Meeting	52,57,619		20,21,607	
Sitting Fee	4,48,500		5,61,996	
Travelling and Conveyance	18,99,995		5,19,891	
LTC (Leave Travel Concession)	7,55,109		68,105	
Taxi Hiring Charges	2,11,075			
Online/Print Journals	26,194		-	
Expenditure on Retirement Benefit			78,53,190	
Transfer to staff Welfare Funds	9,52,335		12,25,544	
Expenditure for Ph.D. Course	11,95,833		16,79,000	
Loss/Gain- Sale of Asset	-		23,50,042	
TOTAL		18,53,16,671		19,26,55,386

SCHEDULE 22- EXPENDITURE ON GRANTS

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
CSIR Conting. SRA Pool				
Exp. CSIR Conting. SRA Pool	14,857	14,857	61,551	61,551
Exp.Fund of Omix Res. & Diagnos. Lab.		-		-
Consu.-Omix Res. Diagno Lab P Ltd.		-		-
Exp. -Under Tata Innov. Fell.-Dr. NDey		-		83,700
Fellowship	-		25,000	
Contingency	-		58,700	
Exp. from CSIR Fellowship Grant		2,46,902		53,106
Fellowship-CSIR	-		-	
Contingency-CSIR	2,46,902		53,106	
Exp. from DBT Fellowship Grant		55,00,062		59,43,026
Fellowship-DBT	51,60,747		55,48,073	
Contingency-DBT	3,39,315		3,94,953	
Exp. from ICMR Fellowship Grant		25,84,518		7,82,500
Fellowship-ICMR	25,14,268		7,82,500	
Contingency-ICMR	70,250		-	
Exp.from DST-Inspire Fellowship Grant		63,51,813		57,95,291
Fellowship-DST-Inspire	41,04,793		34,81,682	
Contingency-DST-Inspire	1,22,474		1,69,310	

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APDP & CO. BBSR CHARTERED ACCOUNTANTS

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
Fellowship-DST Inspire Faculty	17,67,800		15,16,000	
Research Exp. -DST-Inspire Faculty	3,56,746		6,28,299	
Exp.from Ramalingaswami fel. grant		4,98,373		18,12,147
Dr. Punit Prasad				
Contingency	2,88,101		97,670	
Dr. Mamuni Dash				
Fellowship	-		12,07,936	
Contingency	2,10,272		5,06,541	
Dr. Amaresh Panda-Ramanija Fellow		-		-
Fellowship				
Contingency & Overhead				
Exp. From SERB N Post Doc Fellow		4,54,055		13,43,054
Fellowship	2,79,896		11,08,233	
Contingency	1,74,159		1,84,821	
Overhead	-		50,000	
ILS-DBT-PU-PTBP2-S Chakraborty		-		29,95,759
Recurring				
Contingency			7,944	
Manpower				
Travel				
Consumable A/c			29,87,815	
ILS-Wellcome Trust DBT-Den-GHSyed		-		28,88,786
Top Up Salary				
Fellowship			3,50,000	
Consumable			23,62,246	
Contingency			1,45,640	
Overhead			30,900	
Transfer to pj. consumable A/c				
Travel				
ILS-Welcome Trust DBT-IRGM-SChauhan		6,573		72,03,720
Top Up Salary				
Fellowship			8,11,842	
Consumable	6,300		59,37,148	
Contingency	273		2,20,168	
Overhead			2,20,000	
Travel			14,562	
ILS-DBT-CEIB-Malaria-V A Nagaraj & BR		-		3,37,897
Manpower			1,05,000	
Consumable A/c			2,32,867	
Contingency			30	
ILS-SERB-PJ-Chik-Soma Chattopadhyay		-		7,55,457
Manpower			1,19,867	
Consumable A/c			6,27,377	
Contingency			8,213	
ILS-DBT-PJ-White Spot-DVasudevan		-		50,891
Consumable A/c			50,888	
Manpower & Fellowship				
Overhead				
Contigencies			3	
Travel				
ILS-DST-WOS-PJ-Asiatic Grain-Sagarika		-		1,26,311
Consumable A/c			1,13,486	
Fellowship				
Overhead				
Travel			3,989	
Contigencies			8,836	
ILS-IBSD-PJ-Bioresources Mgt-Aparida		-		35,523
Contigencies			35,523	
ILS-SERB-PJ-Zebrafish-Rswain		-		6
Contigencies			6	
INSTITUTE OF LIFE SCIESNCES-FCRA		2,96,575		4,74,612
Contigencies	6		1,681	
Admin Expenses-EMBO	2,96,569		4,72,931	
ILS-NASI-Enhancing Prodivity-AParida		8,62,173		6,66,658
Contigencies	8,08,388		6,24,021	
Travel	53,785			
Fellowship & Manpower			42,637	
ILS-DST-Ide-Genetic and EpigeneticPVR		7		-
Fellowship & Manpower				
Contigencies	7			
ILS-DBT-NER-BPMC-BHIMKOL-NDEY		11		3,99,809
Consumables			1,07,589	
Fellowship & Manpower			1,79,000	
Contigencies	11		63,220	
Overhead			50,000	

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APDP & CO. BBSR CHARTERED ACCOUNTANTS

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
Exp for Workshop				
Travel				
ILS-DST-Indo-UK-PJ-Freshwater-SKD		-		**4,12,604**
Travel			3,854	
Consumables				
Fellowship & Manpower			4,03,750	
Contigencies			5,000	
ILS-SERB-PJ-RAGE-VRai		-		**17,519**
Travel				
Consumables				
Overhead				
Contigencies			17,519	
ILS-DBT-PJ-LIVELIHOODS NEI-APARIDA		-		**2,98,555**
Travel			8,980	
Consumables			40,355	
Overhead				
Contigencies			1,00,878	
Fellowship & Manpower			1,48,342	
ILS-DBT-PJ-FtsEx-TKBeuria		-		**16,49,035**
Travel				
Consumables			11,71,418	
Overhead			1,00,000	
Contigencies			41,165	
Fellowship & Manpower			3,36,452	
ILS-DBT-PJ-MEF2C-SChakraborty		-		**1,71,737**
Fellowship & Manpower				
Consumables			1,62,210	
Contigencies			9,527	
ILS-SERB-PJ-CAFS-SSenapati		-		**2,15,260**
Consumables			1,70,004	
Overhead				
Contigencies			45,256	
Travel				
ILS-S&T-GoO-PJ-Anticancerous-SKM		-		**95,955**
Consumables			95,937	
Contigencies			18	
ILS-SERB-PJ-AMINO ACID-A NAGARAJ		-		**86,225**
Travel				
Consumables			69,001	
Overhead				
Contigencies			17,224	
ILS-DBT-PJ-DIV.-SLE-B RAVINDRAN		**5,90,687**		**16,08,550**
Travel			19,359	
Consumables	1,717		7,61,838	
Fellowship & Manpower	5,88,967		7,05,723	
Contigencies	3		1,21,630	
ILS-DST-WOS-PJ-MESOOUS-FAHIMA		**50,000**		**7,84,545**
Fellowship & Manpower			6,50,348	
Consumables			1,14,127	
Travel				
Overhead	50,000			
Contigencies			20,070	
ILS-DBT-PJ-TELM-CHIKUNGUNY-SOMA		-		**5,97,128**
Consumables			4,83,402	
Fellowship & Manpower			1,13,667	
Contigencies			59	
ILS-DST-WOS-PJ-TRIM FAMILY-AHSAN		**3,93,090**		**63,800**
Fellowship	3,93,090		63,800	
ILS-DBT-PJ-Network-M-Pulses-AParida		**1,14,19,211**		**5,84,53,528**
Contigencies	3,39,669		1,33,195	
Distribution of Grant to Other agency			5,03,33,345	
Fellowship & Manpower	61,84,069		54,19,689	
Training & Workshop				
Consumables	47,56,104		23,67,299	
Overhead			2,00,000	
Travels	1,39,369			

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APDP & CO. BBSR CHARTERED ACCOUNTANTS

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
DBT-WelcomeTrust-Pancreatic-ACPand		30,02,891		44,07,328
Consumbale	17,43,334		31,46,388	
Contigencies	6,169		472	
Fellowship	8,93,532		10,20,132	
Top-Up Fellowship	15,984		1,78,632	
Travel	21,357			
Overhead	3,22,515		61,704	
ILS-DBT-PJ-ECON-EMPOWERMENT-RSWAIN		-		9,71,930
Contigencies			51,546	
Consumables			5,27,702	
Manpower			3,52,000	
Travel			40,682	
ILS-SERB-PJ-OSCILLATION-TKB		-		1,46,348
Contigencies			50,244	
Consumables			96,104	
Overhead				
Travel				
ILS-SERB-PJ-SWI-SNF-PPRASAD		3,57,026		16,06,703
Contigencies	17		20,224	
Consumables	1,88,724		10,97,479	
Overhead			83,000	
Fellowship	1,38,400		4,06,000	
Travel	29,885			
ILS-DBT-PJ-Role of Subcellular-APanda		28,000		13,19,746
Contigencies			124	
Consumables	28,000		8,78,622	
Fellowship			3,41,000	
Overhead			1,00,000	
ILS-BIRAC-PJ-TRC-CHIKUNGUNYA-SOMA		54,22,459		69,87,854
Contigencies	3,24,022		1,01,597	
Consumables	29,93,373		48,83,052	
Fellowship	17,16,519		15,07,015	
Overhead	3,65,568		4,96,200	
Travel	22,977			
ILS-DBT-PJ-Trib-Health-Odi-AParida(Flagship)		87,77,509		1,96,70,854
Contigencies	81,599		85,617	
Manpower	29,57,000		38,36,154	
Consumables	55,58,613		1,57,49,073	
Overhead				
Travel	1,80,297			
ILS-AGSFE-IIMT-PJ-NABARANGPUR-RSWAIN		-		5,44,532
Contigencies			29,446	
Manpower			3,22,000	
Consumables			96,000	
Overhead				
Travel			72,940	
Training Exp			24,146	
ILS-ICMR-PJ-KINOME SCREENING-RDASH		12,14,717		15,72,706
Contigencies	19,282		2,081	
Manpower	1,34,800		3,41,000	
Consumables	10,60,635		11,36,306	
Overhead			43,319	
Travels			50,000	
ILS-DBT-PJ-SPENE-MAL-PARASITE-ANAGARAJ		5,01,793		7,85,873
Contigencies	73		24,177	
Manpower	3,72,000		4,03,000	
Consumables	1,29,720		3,58,696	
ILS-DBT-PJ-BHUBANESWA-BCF-DVASUDEVAN		10,11,629		10,76,596
Travel	70,287		41,260	
Overhead	1,00,000		1,00,000	
Fellowship	3,64,033		6,54,240	
Contigencies	1,52,333		1,03,734	
Consumables	3,24,976		1,77,362	
ILS-SERB-PJ-FKBP-DVASUDEVAN		11,31,797		7,34,035
Contigencies	35,462		27,204	
Manpower	2,57,226		3,72,000	
Consumables	6,74,692		2,84,831	
Overhead	1,00,000		50,000	

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APDP & CO. CHARTERED ACCOUNTANTS BBSR

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
Travel	4,417			
Scientific Social Responsibility	60,000			
ILS-DBT-PJ-GENOMEINDIA-SKR		**15,44,084**		**8,41,959**
Travel				
Contigencies	6,567		17,868	
Manpower	7,15,100		7,74,562	
Consumables	4,22,417		49,529	
Overhead	4,00,000			
ILS-SERB-PJ-Ecotropic VI-SChakraborty		**13,66,723**		**14,43,668**
Contigencies	37,202		32,168	
Consumables	12,45,066		13,02,821	
Overhead	29,334		1,08,679	
Travel	55,121			
ILS-DBT-PJ-NBACD-IRGM-S CHAUHAN		**118**		**4,95,173**
Contigency	118		6	
Consumable			4,95,167	
Cash Award				
ILS-DBT-NER-PJ-NERBPMC-A K PARIDA		**2,37,03,821**		**1,80,01,968**
Contigency	5,75,778		7,05,050	
Opeartional Exp	90,00,244		68,94,036	
Meeting Exp	10,38,984		6,13,200	
Manpower Exp	1,25,33,039		92,38,881	
Travel Exp	5,55,776		5,50,801	
ILS-DBT-PJ-AYUSH NETWORK-COV2-VIRUS-APARIDA		-		**11,24,242**
Contigency			68	
Consumables			2,89,466	
Fellowship			8,34,708	
ILS-DBT-PJ-BIOREPOSITORY FOR COVID19-APARIDA		**18,61,661**		**18,47,521**
Contigency	3,60,029		50,366	
Consumables	4,54,446		5,61,848	
Fellowship & Manpower	10,47,186		12,35,307	
ILS-BIRAC-BIONEST-PJ		**37,21,368**		**15,85,329**
Operational Cost	2,55,463		46,334	
Manpower	15,69,400		14,85,900	
Training Exp	8,74,189		53,095	
Consumables	10,22,316			
ILS-SERB-PJ-ZBTB10-SKR		**3,20,505**		**22,47,143**
Fellowship	2,39,000		3,72,000	
Overhead			1,00,000	
Contigency	2,031		13,294	
Consumable	79,474		17,61,849	
ILS-SERB-PJ-SARS-CoV-2-RDASH		-		**3,20,982**
Consumables			1,96,941	
Fellowship			1,24,000	
Overhead				
Contigencies			41	
ILS-SERB-ORAL SQUAMOUS-RDASH		**11,65,707**		**12,36,115**
Consumables	9,44,349		9,56,032	
Fellowship	1,39,839		1,80,000	
Overhead			1,00,000	
Contigencies	81,519		83	
ILS-DBT-PJ-ATAD2-SSENAPATI		**57,345**		-
Consumables	44,227			
Contigencies	13,118			
ILS-SERB-PJ-Antiviral Immunity-SChauhan		**18,39,871**		**22,42,830**
Overhead	1,00,000			
Consumable	13,45,988		18,38,927	
Contigencies	21,883		34,903	
Fellowship	3,72,000		3,69,000	
ILS-SERB-PJ-JEV LIFE CYCLE-GSYED		**15,23,442**		**19,93,833**
Consumable	9,27,091		15,19,333	
Contigencies	42,389		38,726	
Fellowship	4,40,706		4,35,774	

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APDP & CO. BBSR CHARTERED ACCOUNTANTS

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
Overhead	1,00,000			
Travel	13,256			
ILS-DBT-PJ-CURCUMIN-MALARIA-ANAGARAJ		**7,15,742**		**10,35,926**
Consumables	4,08,025		3,15,416	
Fellowship	2,72,600		6,54,240	
Travels				
Contigencies	35,117		66,270	
ILS-GOVT ODISHA-S&T-INCUBATION CENTRE		-		**31,609**
Contigencies			31,609	
ILS-DHR-PJ-FLAVIVIRAL-PREETHY		-		**72,832**
Contigencies			6	
Consumables			72,826	
Fellowship				
Overhead				
ILS-DBT-PJ-Anti-Fungal Vaccine-NAcharya		**17,99,221**		**21,43,303**
Contigencies	1,00,000		19,689	
Consumables	9,96,540		15,98,508	
Fellowship	6,54,240		5,25,106	
Travel	48,441			
ILS-DBT-PJ-CARCINOGENESIS-NACHARYA		**4,53,440**		**15,78 835**
Contigencies	58		62	
Consumables	1,71,382		10,54,192	
Manpower	2,82,000		5,24,581	
ILS-ICMR-PJ-STOMACH CANCER-A DIXIT		**4,44,689**		**1,61,432**
Contigencies			6	
Fellowship	4,31,520		1,48,480	
Overhead	13,169		12,946	
ILS-DST-WOS-A-PJ-Oral Cancer-VMohanty		-		**5,12,239**
Fellowship			2.54,800	
Overhead				
Contigency			19,849	
Consumables			2,37,590	
ILS-DBT-Council S&T Odisha-Skill Vigyan		**66,943**		**9,83,456**
Manpower Cost			5,00,000	
Contigencies	6		1,82,997	
Consumables	66,937		1,65,650	
Training Cost			1,34,809	
ILS-DBT-PJ-PROTEIN HYDROGELS-MAMONI DASH		**14,70,961**		**16,54,229**
Fellowship	4,20,000		4,20,000	
Contigencies	25,974		6,161	
Consumables	9,41,737		11,78,068	
Overheads	50,000		50,000	
Travel	33,250			
ILS-BIRAC-PJ-Animal Model-SARS-CoV2-SSenapati		**27,729**		**1,34,05,665**
Consumables	27,729		85,95,175	
Contigencies			15,95,654	
Manpower			32,14.837	
Bank Charges				
SERB Teachers Associa.		-		-
Exp. From SERB Teachers Associa.				
Grant of FICCI for Mr. Fredy Brice		-		-
Exp. From Grant of FICCI for Mr. Fredy Brice				
ILS-DBT-PJ-Marine Bioresource-BNP-AParida		**42,67,335**		**69,65,585**
Contigency	8,730		70,370	
Consumables	23,02,103		56,84,474	
Manpower & Fellowship	15,46,880		10,89,839	
Travel	4,09,622		1 21,302	
ILS-DBT-PJ-INSACOG-A PARIDA		**1,28,70,502**		**4,36,66,978**
Consumables	1,14,87,536		4,22,09,895	
Contigencies	2,13,697		69,962	
Fellowship	7,23,202		10,12,173	
Overhead	1,08,000		3,60,000	
Travel	3,38,017		14,948	
ILS-DBT-PJ-DZIP3-S CHAUHAN		**57,44,261**		**1,52,951**

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APDP & CO. BBSR CHARTERED ACCOUNTANTS

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
Consumables	53,71,924		1,02,951	
Overhead	50,000		50,000	
Fellowship	2,75,562			
Travel	17,103			
Contigency	29,672			
ILS-DBT-PJ-SCALING UP COVID-19 TESTING		77,590		**1,40,94,095**
Consumables	77,590		1,19,34,616	
Contigencies			679	
Fellowship			21,58,800	
ILS-DBT-PJ-Spectrometry Platform-Soma		117		**15,750**
Consumables			6,398	
Contigencies	117		9,352	
ILS-SERB-PJ-EFFLUXPUMP-TKB		20,96,201		**1,83,642**
Overehead			1,68,333	
Contigencies	19,978		15,309	
Consumables	14,21,983			
Fellowship	6,54,240			
ILS-DBT-PJ-HOMEOBOX A10- S CHAUHAN		8,34,635		**1,23,522**
Overehead			1,00,000	
Contigencies	18,576		23,522	
Consumable	4,47,814			
Travel	20,245			
Fellowship	3,48,000			
ILS-SERB-PJ-PROTEIN CROSSLINK- N ACHARYA		12,42,044		**1,64,600**
Overehead			1,64,600	
Consumable	7,51,773			
Fellowship	4,18,871			
Travel	21,709			
Contigencies	49,691			
ILS-DBT-PJ-JUTE STEM - S MAJUMDER		15,80,031		**3,00,000**
Fellowship & manpower	9,47,118		3,00,000	
Consumable	6,22,198			
Contigencies	6,182			
Travel	4,533			
ILS-DBT-PJ-WESTERN HIMALAYAN- A PARIDA		29,24,799		
Fellowship & Manpower	6,07,017			
Contigency	28,018			
Consumable	22,26,582			
Travel	63,182			
ILS-DBT-PJ-BIOTECH-KISAN HUB- A PARIDA				
Contingency	6	15,93,855		
Cost of Implimenting Activity	42,900			
Communication Cell	1,74,000			
Farmer's Training Programme	3,04,154			
Recurring Cost for Tinkering Lab.	9,82,576			
Scientists' Trainging Programme	43,769			
Travel	46,450			
ILS-SERB-PJ-HEARING LOSS- PVR		10,16,484		
Fellowship & Manpower	2,08,000			
Contigency	26,196			
Consumable	6,56,954			
Overhead	1,25,334			
ILS-BIRAC-PJ-PROTEIN D-SAR-COV-2-S SENAPATI		90,725		**2,06,168**
Consumable	4,602		2,06,168	
Contigencies	19,457			
Manpower & Fellowship	66,666			
ILS-ICMR-PJ-IBD MICE- S CHAUHAN		22,59,718		**21,17,137**
Contigencies	184		94	
Overhead			70,865	
Disbursement to other Agency			20,46,178	
Consumables	18,89,534			**15,54,000**
Fellowship	3,70,000			
ILS-ICMR-PJ-EPIGENETIC DRUGS-COV2- P PRASAD		45,52,453		
Fellowship & Manpower	3,65,786			
Contigency	36,513			

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APDP & CO. BBSR CHARTERED ACCOUNTANTS

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
Consumable	40,09,485			
Overhead	1,40,669			
ILS-BIRAC-PJ-COVID-19 VACCINE DEVELOPMENT- SKR		93,82,495		
Fellowship & Manpower	30,22,612			
Contigency	1,05,762			
Consumable	62,36,728			
Travel	17,393			
ILS-DBT-PJ-ANTI-VIRAL-SCREENING PLATFORM-SOMA		54,93,424		
Fellowship & Manpower	20,59,160			
Contigency	2,214			
Consumable	34,32,050			
ILS-BIRAC-PJ-PEST CONTROL-MDASH		13,81,532		
Fellowship & Manpower	6,07,280			
Contigency	7,083			
Consumable	6,66,692			
Exp. for Outsourcing	1,00,477			
ILS-SERB-PJ-DICOT PLANTS-NDEY		10,43,002		
Fellowship & Manpower	1,92,000			
Contigency	34,937			
Consumable	7,12,285			
Overhead	1,01,206			
Travel	2,574			
ILS-DBT-PJ-Traditional Healthcare-SKR		10,16,800		
Consumable	6,00,000			
Fellowship & Manpower	4,16,800			
ILS-DST-PJ-NANOHERBICIDE-SKSAHOO		11,34,419		
Consumable	5,72,634			
Fellowship & Manpower	5,11,785			
Overhead	50,000			
ILS-DST-WOS-MDR-XDR-C MOHAPATRA		10,95,861		
Consumable	2,99,907			
Fellowship & Manpower	6,83,572			
Overhead	88,000			
Contigency	24,382			
ILS-ICMR-PJ-Pathogenesis-SAR COV2-ARS		3,60,874		
Manpower	2,41,226			
Overhead	1,05,348			
Travels	14,300			
ILS-DBT-PJ-DZNepA Cancer-SKM		73,135		
Manpower	69,135			
Contigency	4,000			
ILS-DBT-PJ-Pediatic-Disorder-PVR/Rswain		16,55,943		
Manpower	67,742			
Contigency	1,09,695			
Consumable	14,58,991			
Travels	19,515			
ILS-DBT-PJ-HSP70-Golden Hamsters-BR		5,11,350		
Manpower	1,19,593			
Exp. Outsourcing	2,25,000			
Consumable	1,66,757			
ILS-ICMR-PJ-Resistance of OSCC-RDash		75,685		
Overhead	49,169			
Contigency	65			
Consumable	26,451			
Honoratium to SERB-VAJRA Faculty	11,13,360	14,53,519	15,54,000	
Reseach Exp SERB Vajra Faculty	3,40,159			
Expenditure from Overhead & bank Charges	170	170	10,403	10,403
Exp MK Bhan YFP sel Com		3,50,865		-
Bank Charges				
Covid-19 from RMRC,State Govt & DBT Fund		2,16,27,281		**5,20,71,561**
Exp for Covid-19 Testing & Other	2,16,27,281		5,20,71,561	
ILS-Conference, Symposium & Seminar		2,99,303		2,27,621

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APDP & CO. BBSR CHARTERED ACCOUNTANTS

Particulars	Current Year - 2022-23	Previous Year - 2021-22
Seminar & workshop	2,99,267	2,27,500
Bank Charges	36	121
TOTAL	18,09,06,503	31,29,03,447

SCHEDULE 24 -Refund of Unspent Grant & Interest

Particulars	Current Year - 2022-23		Previous Year - 2021-22	
REFUND OF UNSPENT GRANT & Interest		1,17,18,012		1,61,81,696
Refund of Bal. Grant of DBT Fellows to DBT/IIS	1,21,001		3,27,066	
Refund of Unspent Grant SERB Post Doc	1,08,313			
Ref-Bharatkosh-ILS-DBT-CEIB-MALARIA-VANAGARAJ	17,370			
ILS-DBT-PJ-DZIP3-SChauhan'	23,771			
ILS-DST-PJ-NANOHERBICIDE- S K SAHOO	492			
ILS-DST-PJ-NANOPARTICLES- S SENAPATI	923			
ILS-DBT-Spectrometry Platform-Soma's project	22,57,822			
DBT-PJ-Jute-STEM-S.Majumder	57,721			
ILS-DBT-NER-BPMC-BHIMKOL-NDEY	13,000			
ILS-DBT-Home box a10-Schauhan	11,323			
Ref- Grant-Bharatkosh-ILS-DBT-PJ-FtsEx-TKBeuria	-		12,226	
Refund of Grant-SRA Pool to CSIR	-		2,637	
Refund of Unspent Grant of DST-Inspire	2,663		8,04,812	
ILS-SERB-PJ-RAGE-VRai			14,924	
Refund of Unspent Grant-ILS-Wellcome Trust DBT-Dengue-GHSyed			13,488	
Refund of Unspent Grant-ILS-SERB-PJ-Zebrafish-Rswain			1,21,528	
ILS-DBT-PJ-FtsEx-TKBeuria(BT-PR21546)	6,506		1,611	
ILS-SERB-PJ-CAFS-SSenapati			58,730	
ILS-SERB-PJ-OSCILLATION-TKB			20,002	
ILS-DBT-PJ-BHUBANESWAR-BCF-DVASUDEVAN	20,04,920		31,44,681	
ILS-SERB-PJ-SARS-CoV-2-RDASH			21,713	
ILS-DBT-PJ-Anti-Fungal Vaccine-NAcharya	35,471		4,19,558	
Refund-Seminar, Workshops, Conference/ Meeting			99,562	
Refund of Tata Innov. Fell. Grant			135	
Refund Bharat Kosh -Covid Testing Grant From DBT			27,240	
Ref Bharatkosh- Interest of Ramalinga Swami	829		20,834	
Deposited in BHARATKOSH - White Spot-D.Vasudevan	-		16,383	
Refund Bharta Kosh- ILS-DBT-PJ-Network Minor Pulses	4,15,845		17,60,877	
Refund Grant Int-ILS-DST-Nanoparticles-Ssenapati	16,159		3,060	
Refund Bharta Kosh-ILS-DBT-PJ-ATAD2-Ssenapati	3,922		8,233	
Ref-ILS-DBT-PJ-Carcingenesis-Nachary	35,610			
Ref-Bharatkosh- ILS-DBT-PJ-Marine Biresource-BNP-Aparida	2,34,210			
Refund Bharatkosh ILS-DBT-PJ-INSACOG- A PARIDA	12,546			
ILS-SERB-PJ-Hepatitis C-Gsyed				
ILS-DST-Indo-UK-PJ-Freshwater-SKD	-		6,82,215	
Refund of Grant-DST Fellowship Grant	41,26,287			
Refund of Unspent Fellowship Grant DBT	2,36,692			
ILS-DST-WOS-PJ-Asiatic Grain-Sagarika			11,455	
ILS-DBT-PJ-TELMISARTAN-CHIKUNGUNYA-SOMA	-		1,02,993	
Ref.Bharatkosh ILS-DBT-PJ-PTBP2-Schak.	-		2,03,504	
Ref-Bharatkosh ILS-DST-Genetic And Epi.-PVR	-		264	
Ref-Bharatkosh-ILS-DBT-PJ-MEF2C-Schakraborty	-		2,37,695	
Int Ref-Bharatkosh-tILS-DBT-PJ-LIVE.-APARIDA	-		2,31,254	
Bharat Kosh ILS-DBT-PJ-Role of Subcellular-Apanda	1,65,763		13,272	
Int Ref-Bharatkosh-ILS-DBT-NER-BPMC	4,88,704		5,62,059	
Ref-Bharatkosh-ILS-DBT-PJ-CHIKV-SOMA	-		2,13,485	
Int Ref-Bharatkosh-ILS-DBT-PJ-DIV.OF SLE-B RAVIND	31,405		32,599	
Ref-Bharatkosh-ILS-DBT-PJ-Integrative Genomics-SKR	-		2,11,584	
Ref.Bharatkosh ILS-DST-WOS-PJ-MESOOUS-FAHIMA	9,323		3,442	
Ref-Bharatkosh-ILS-DST-WOS-PJ-TRIM FAMILY-AHSAN	4,38,630		2,302	
Refund of Interest- Core	-		62,93,136	
Refund Bharta Kosh-ILS-DBT-PJ-Biorepository	-		17,147	
Refund ILS-DBT-PJ-CURCUMIN-Malaria-ANAGARAJ	46,595		17,577	
Refund ILS-DBT-Flagship-Dr.A.Parida	1,62,483		3,76,888	
Refund -DBT-PJ-NBACD-IRGMS-Schauhan	1,953		11,646	
Refund -DBT-PJ-PROTEIN HYDROGELS-M.DASH	28,676		8,517	
Ref of Interest- MALARIA Parasite-VANagaraj	2,834		49,362	
ILS-SERB-PJ-AMINO ACID-A NAGARAJ	1,765			
ILS-DBT-ICMR-PJ-Onset Sepsis-DVS	1,980			
ILS-SERB-PJ-SWI-SNF-PPRASAD	9,479			
ILS-ICMR-PJ-KINOME SCREENING-RDASH	84,165			
ILS-DST-PJ-NANOHERBICIDE-SKSAHOO	4,19,821			
ILS-SERB-PJ-FKBP-DVASUDEVAN	81,042			
TOTAL		1,17,18,012		1,61,81,696

वित्त और लेखा अधिकारी / Finance & Accounts Officer
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निर्देशक / Director
जीव विज्ञान संस्थान/ Institute of Life Sciences
भुवनेश्वर / Bhubaneswar- 751023

APDP & CO. BBSR CHARTERED ACCOUNTANTS

INSTITUTE OF LIFE SCIENCES
NALCO SQUARE,
BHUBANESWAR – 751 023

SCHEDULE - 25: SIGNIFICANT ACCOUNTING POLICIES.
FOR THE YEAR ENDED 31st MARCH 2023

1. **ACCOUNTING CONVENTION:**

The financial statements are prepared on the basis of historical cost convention unless otherwise stated and on the basis of the accrual system of Accounting except in the case of Government Grant (see point 5 below)

2. **INVENTORY VALUATION:**

Physical verification of Chemicals/Consumables & other inventories has been conducted at the end of the financial year, i.e., 2022-23, by the management of the Institute. The Institute is maintaining proper records showing full particulars, including quantitative details and the situation of the inventories. Based on the available records and information the total value of the inventory is Rs 43,24,337/- as on 31.03.2023.

3. **INVESTMENT:**

The Institute has not made any investment during the financial year. However, provision for diminution against the value of the investment is not required to be incorporated in the Books of Accounts.

4. **FIXED ASSETS:**

(I) Fixed Assets are stated at cost inclusive of freight, duties and taxes, other incidental and direct expenses incurred in connection with the acquisition of Fixed Assets. Fixed Assets are capitalized with the value of acquisition costs.

(II) Depreciation for the financial year 2022-23 has been provided on W. D. V. method at the rate prevailing to the concerned Fixed Assets as specified in the Income Tax Act, 1961.

In respect of the addition of Fixed Assets during the year, depreciation was considered as per Income Tax Rules. Details of depreciation on Fixed Assets are on the schedule – 8 is an integral part of the financial statement.

वित्त और लेखा अधिकारी / Finance & Accounts Officer
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निर्देशक / Director
जीव विज्ञान संस्थान/ Institute of Life Sciences
भुवनेश्वर / Bhubaneswar– 751023

APDP & CO. BBSR CHARTERED ACCOUNTANTS

5. **TREATMENT OF GRANT:**

(I) Government Grants are accounted for on the basis of receipt of cheques/ transfers

(II) Recurring Grants have been recognized in the Income & Expenditure Account in the year of receipt of a grant in aid, whereas Non-Recurring Grants have been treated as a capital fund.

6. **FOREIGN CURRENCY TRANSACTIONS:**

(i) Transactions denominated in foreign currency are accounted for at the exchange rate prevailing at the date of transaction.

(ii) Current Assets and Current Liabilities are converted at the exchange rate prevailing at the year-end and adjusted to the cost of the fixed assets if the liability relates to the fixed assets and, in other cases, is considered as revenue.

7. **RETIREMENT BENEFITS:**

Provision partially made towards gratuity payable on retirement and leave salary encashment of employee based on valuation of the retirement liability for the period from 01/04/2022 to 31/03/2023.

8. **RE-GROUPING & RE-ARRANGE :**

Previous figures have been re-grouped and re-arranged wherever found necessary inconformity with the current year's presentation of the accounts of the Institute.

As per our reports of even date attached
For and on behalf of
M/S APDP & CO
Chartered Accountants

CA P. Swain, FCA,
Partner
M.No-058193
Date: 28th Jul. 2023
Place: Bhubaneswar.

For and on behalf of
Institute of Life Sciences

Dr. R. K. Behera
Finance & Accounts Officer
वित्त और लेखा अधिकारी / Finance & Accounts Officer
जीव विज्ञान संस्थान/ Institute of Life Sciences
भुवनेश्वर / Bhubaneswar- 751023

Dr. Debasis Dash
Director
निदेशक / Director
जीव विज्ञान संस्थान/ Institute of Life Sciences
भुवनेश्वर / Bhubaneswar- 751023

APDP & CO. BBSR CHARTERED ACCOUNTANTS

INSTITUTE OF LIFE SCIENCES
NALCO SQUARE,
BHUBANESWAR – 751 023

SCHEDULE - 26: NOTES ON ACCOUNTS.

FOR THE YEAR ENDED 31st MARCH 2023

1. **CONTIGENT LIABILITIES:**

   There are no such contingent liabilities as at the end of the financial year for the Institute of Life Sciences.

2. **CAPITAL COMMITMENTS:**

   The estimated value of the capital commitment as at the end of the financial year 2022-23 is Nil.

3. **TAXATION:**

   In view of the tax exemption under section 12AA of IT Act 1961, no provision for Income Tax had been considered necessary.

4. **FOREIGN CURRENCY TRANSACTIONS:**

   (i) Value of imports calculated on C.I.F. basis: ` 1,21,45,539/-

   (ii) Expenditure in Foreign Currency : ` 1,83,77,920/-

5. **INVENTORY:**

   The closing stock of all purchases such as chemicals, glassware, consumables and stationery have been valuated per the guidelines issued by ICAI.

6. **RECEIPT & PAYMENTS ACCOUNTS:**

   The Receipt & Payment Account had been prepared using direct method presenting all receipts and payments during the year under major heads, in the interest of better disclosure.

वित्त और लेखा अधिकारी / Finance & Accounts Officer
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APDP & CO. BBSR CHARTERED ACCOUNTANTS

9. **PROJECT GRANTS:**

All Research Projects are incorporated in the accounts for the year under audit in the consolidated Receipt & Payment Account, Income & Expenditure Account and Balance Sheet.

10. **OTHERS:**

Previous year figures have been regrouped/ rearranged wherever found necessary in conformity with the current year's presentation of financial data.

As per our reports of even date attached

For and on behalf of
M/S APDP & CO.
Chartered Accountants

For and on behalf of
Institute of Life Sciences

CA P. Swain, FCA,
Partner
M.No-058193

Dr. R. K. Behera
Finance & Accounts Officer

Dr. Debasis Dash
Director

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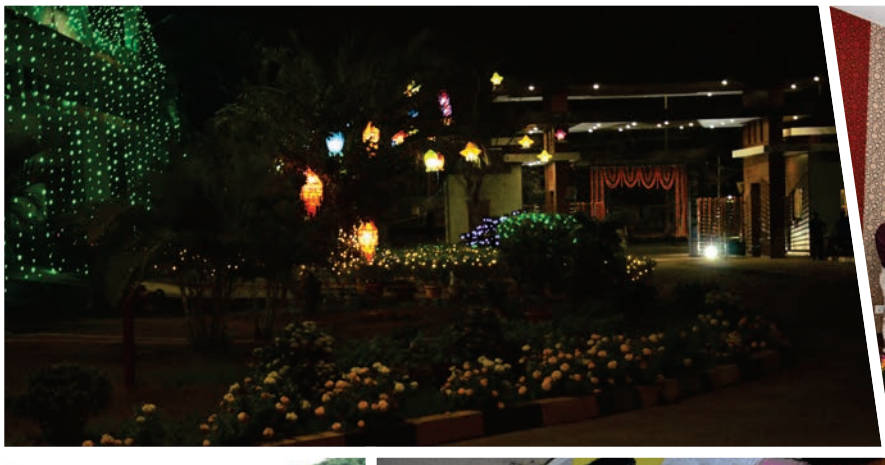
भुवनेश्वर / Bhubaneswar- 751023

Date: 28th Jul 2023
Place: Bhubaneswar.

APDP & CO. BBSR CHARTERED ACCOUNTANTS



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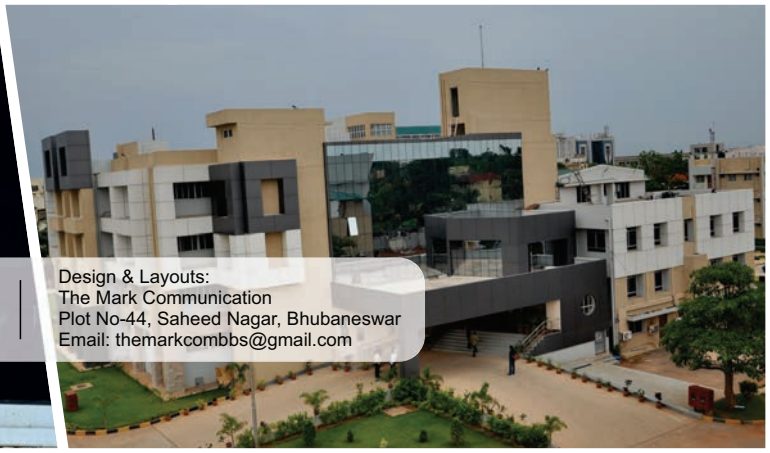

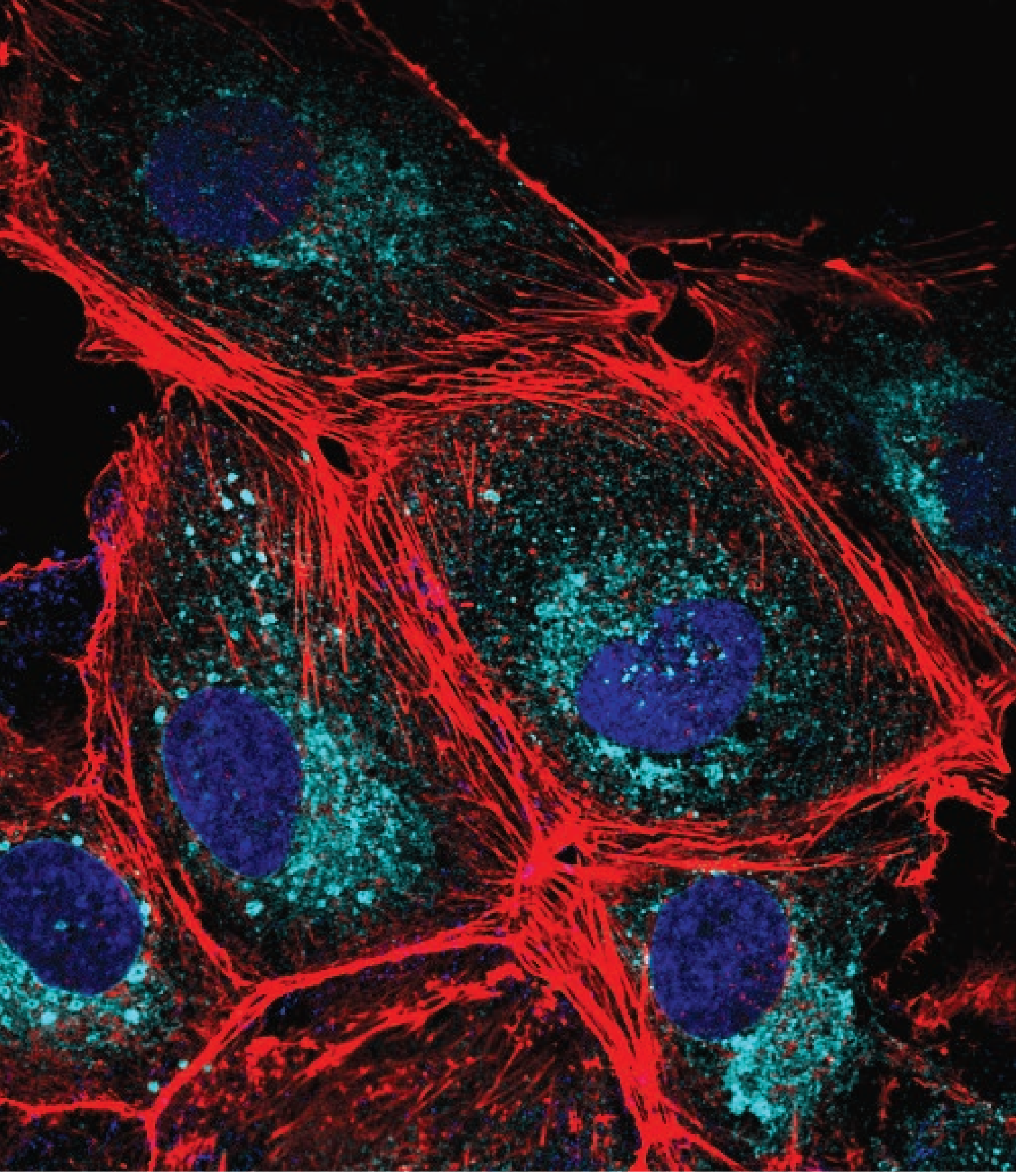

जीव विज्ञान संस्थान

INSTITUTE OF LIFE SCIENCES

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Image Courtesy: -Virus-Host Interactions Lab, DBT-ILS