ANVESHANA 2024

Nurturing Tomorrow's Researchers

PRAYOGA™

Research to Transform Learning

RESEARCH PROJECT PORTFOLIO

2024

Prayoga Institute of Education Research, Survey No. 133, Ravugodlu, Bolare Post, off Kanakapura road, Bengaluru – 560 116 | www.prayoga.org.in

ANVESHANA RESEARCH PROJECT

Wellness (ANV - PR - 013)

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Enhancing Bilirubin Oxidase Productivity in White Rot Fungus via UV Mutation and Immobilization Techniques: Exploring the Purification and Characterization Strategies

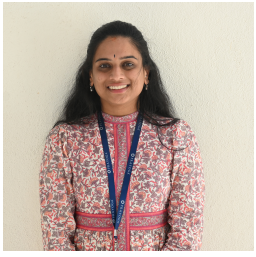
Bilirubin oxidase is a versatile enzyme with applications in bio-electrochemical devices (diagnostic) and bioremediation. It has been primarily used in the determination of bilirubin in serum and thereby in the diagnosis of jaundice. The current processes for the production of bilirubin oxidase have low yields and limited stability. This project aims to enhance the production of bilirubin oxidase from white rot fungus species through UV mutation induction. Additionally, the impact of immobilisation on production efficiency will be explored. The purified enzymes will be characterised for their potential applications in biotechnology. This project will contribute to the understanding of UV mutation induction for improved enzyme production that can have diverse biotechnological applications.

Mentors

Dr. Venkata Krishna B, Senior Researcher, Dept. of Biology, Prayoga

Mrs. Jayatha BC, Research Associate, Dept. of Biology, Prayoga

Dr. Venkata Krishna, an accomplished biotechnologist, holds a doctorate from Visvesvaraya Technological University (VTU) and is an ICAR-NET qualified professional with 12 years of teaching and research experience. His areas of research includes the applications of enzymes, enzyme inhibitors, primary & secondary metabolites, and nanomaterials in the realms of food, health, biotech, and the environment.



Mrs. Jayatha BC holds a Master's degree in Botany from Mount Carmel College, Bengaluru. Her research interests span fields such as Pharmacognosy, Phycology, Ethnobotany, Mycology and Taxonomy. At Prayoga, she is a research associate involved in domain and education research - with particular interest on the Dunning-Kruger effect.

ANVESHANA RESEARCH PROJECT

Wellness (ANV - PR - 014)

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Calcium in Living Color: Investigating the Effects of Anacardic Acids on Intracellular Calcium Levels

Calcium ions are highly versatile intracellular signals that regulate different cellular processes. They are critical to cellular function. This project allows students to observe real-time changes in intracellular calcium levels, understand the role of calcium in cellular signalling, and investigate the effects of different substances on cellular function including anacardic acids (phenolic lipids present in the shell of the cashew nut). The influence of anacardic acids on intracellular calcium levels in living cells is investigated using a fluorescent calcium indicator.

Mentors:

Dr. K. Sandeep Prabhu, Head, Dept. of Veterinary and Biomedical Sciences, Penn State College of Agricultural Science
Ms. Shruthi Chakravarthy, Research Associate, Dept. of Biology, Prayoga
Dr. KS Nagabhushana, Research Director, Prayoga
Dr. Venkata Krishna B, Senior Researcher, Prayoga

Dr. K. Sandeep Prabhu has a PhD in Biochemistry from VMSRF-University, Mysore. He has done his Post-Doctoral Studies at the Center for Molecular Toxicology, Penn State University. At present, he is Department Head and Professor of Immunology and Molecular Toxicology at Penn State University. His areas of research expertise include : redox biology, macrophage biology, Immunotherapies in leukemia, and endogenous bioactive lipid mediators, amongst others.

Dr. K.S. Nagabhushana has research experience in the fields of Natural Products Chemistry, Organic Synthesis, Organometallic Chemistry, Biotechnology, Nanomaterials, Food Chemistry and Catalysis. An interdisciplinary researcher, he is currently working on projects that have an underpinning . As a researcher, he has authored numerous international publications and an inventor in Indian and US patents.

Dr. Venkata Krishna, an accomplished biotechnologist, holds a doctorate from Visvesvaraya Technological University (VTU) and is an ICAR-NET qualified professional with 12 years of teaching and research experience. His areas of research includes the applications of enzymes, enzyme inhibitors, primary & secondary metabolites, and nanomaterials in the realms of food, health, biotech, and the environment.

Ms. Shruthi Chakravarthy, currently a Research Associate at Prayoga, with a Masters in Biotechnology from Monash University, Melbourne. In her current position at Prayoga, she is focussed on biochemical techniques, protein chemistry and characterization, and therapeutic research.

ANVESHANA RESEARCH PROJECT

Wellness (ANV - PR - 015)

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Investigating and Raising Awareness of Chemical Hazards in Everyday Life

This project aims to identify chemical hazards in an identified set of everyday items. Students will be actively involved at every stage of this project from sample collection at different locations to sample preparation techniques and the use of advanced instruments such as spectrophotometers, chromatographs, or mass spectrometers. By testing for various compounds the possibility of a health risk can be identified. The project, therefore, is also an educational initiative to create a body of knowledge that empowers the community to promote a healthier and safer living environment. Ultimately, this endeavour aspires to enhance public awareness and contribute valuable insights for proactive measures in minimizing potential health risks associated with common household items.

Mentors:
Dr. S Athavan Alias Anand, Senior Researcher, Dept. of Chemistry, Prayoga
Co-Principal Investigators: Ms. Asha C H, Research Associate, Dept. of Chemistry, Prayoga

Dr S. Athavan Alias Anand is a Senior Researcher, Department of Chemistry Prayoga. He completed his PhD in Chemistry from Annamalai University, Tamil Nadu, and postdoctoral research from the Indian Institute of Science (IISc), Bangalore. His research was focussed on synthesising potent drug candidates as anticancer and antituberculosis agents. At Prayoga, his areas of interest in education research include the impact of student-centred learning environments such as inquiry-based learning (IBL) and flipped classroom methods on chemistry learning.

Asha C.H. is a Research Associate, Chemistry at Prayoga. She holds a Master's degree in General Chemistry, and has completed a project on the synthesis of a novel nicotinonitrile-triphenylamine derivative for organic electrochromic applications during this period. Her academic interests span organic chemistry, spectroscopy, and coordination compounds, all of which offer immense scope for further research.

ANVESHANA RESEARCH PROJECT

Green Chemistry (ANV - PR - 016)

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Green Synthesis and Characterization of Bioconjugated Metal Nanoparticles and their applications in Biomedical Sciences

A few metal or metal oxide nanoparticles exhibit excellent antimicrobial and anticancer properties. However, the effects of mixed metal-metal oxide nanoparticles on these properties are relatively unexplored. Several organic molecules or biomolecules also show antimicrobial and anticancer properties. This research aims to explore the relatively untapped potential of these nanoparticles conjugated with organic or biomolecules in the field of biomedical sciences. During this research, nanoparticles are to be synthesised using unused and used tea leaves, followed by qualitative and quantitative analysis and characterization of the unconjugated and conjugated nanoparticles. Observations of antimicrobial activities will be made. Implications to the field of biomedical sciences will be explored.

Mentors:
Dr. Subhadip Senapati, Senior Researcher, Dept. of Chemistry, Prayoga
Mr. Parikshit Kumar, Research Associate, Dept. of Physics, Prayoga

Dr. Subhadip Senapati received his doctoral degree in 2015 from Arizona State University, studying the structures and functions of a wide range of biological samples using atomic force microscopy (AFM). Upon completion of his PhD, he moved to Case Western Reserve University to pursue postdoctoral research where he investigated the structural, functional, and mechanical features of the G protein-coupled receptor protein rhodopsin, utilising different AFM applications. At present, he is working as a Senior Researcher at Prayoga.

Parikshit Kumar completed his M. Tech in Green Energy Technology from Pondicherry University and is currently a research associate at Prayoga. His project title '3D printed mesh matrix decorated with photocatalyst for wastewater treatment' was designed towards the implementation of 3Rs in nanotechnology. He has presented this project at the AIP international conference ICRAIT 4.0 in 2022 which has been published. At Prayoga, Parikshit's research interests include nanotechnology, catalysis, solid state synthesis, analytical techniques, green chemistry, and crystal structure analysis.

ANVESHANA RESEARCH PROJECT

Earth Sciences (ANV - PR - 017)

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On Lake Sedimentology and Hydrogeology using Geophysical Electrical Resistivity Technique to Identify Potential Sites for Groundwater Recharge - South Bangalore, Karnataka

Lakes are natural depressions that form a basin for the collection of rainwater in its catchment. They are vital sources of both clean surface water and groundwater replenishment - both of heightened significance in the context of climate change. It is essential to revive the ecological and hydrological value of lakes, diminished as a consequence of the expansion of piped/potable water supply. The major challenge in this endeavour is measuring the two key parameters 1) sediment stratigraphy at the bottom of a lake and 2) its hydrogeology to gauge the impermeability of lake sediment to groundwater recharge. This project will use the electrical resistivity technique in a non-destructive geophysical method to identify the shallow subsurface stratigraphy of lake sediments.

Mentors:
Dr. Ajit Singh, Senior Researcher, Dept. of Earth Sciences, Prayoga
Dr. Biraj Borgohain, Senior Researcher, Dept. Earth Science, Prayoga
Dr. Omprakash S S, Researcher, Department of Physics, Prayoga

Dr. Ajit Singh was awarded a PhD in Earth Sciences from Indian Institute of Technology (IIT) Kanpur, followed by postdoctoral fellow at Imperial College of London, UK and the Indian Institute of Technology (IIT) Gandhinagar. He has 16 years of experience in River Science, Earth Surface Processes, Hydrology, Geoarchaeology and Climate & Tectonic Controls. He also served as water domain expert in the Jal Jeevan Mission. GoI. He has authored 16 peer reviewed articles; 2 book chapters and 20 seminars/conferences. At Prayoga, his present focus is on river rejuvenation, groundwater management and rainwater harvesting.

Dr. Omprakash was awarded a PhD in nanotechnology from Mangalore University. His expertise involves fabrication and characterization of thin films for development of transistors, solar cells and sensors, with many publications to his name. He was a Junior Research Fellow (JRF) at RV College of Engineering, Bangalore and lectured at various colleges teaching physics and electronics. He is an expert in designing custom fabrication units, primarily developing custom designed instruments such as spin-spray pyrolysis unit and gas sensing unit. He was able to develop thin film transistors (TFT) on rigid and flexible substrates.

Dr. Biraj Borgohain has a PhD in Earth Science from Indian Institute of Technology (IIT) Bombay. Following a postdoctoral stint at his alma mater, he was Assistant Professor at SDS Uttarakhand University. His research interests include thermochronology, geomorphology, sedimentology, and statistical and numerical modelling. At Prayoga, his research focus is on climate-tectonic processes, and mineral-microbe interactions that impact the habitability and sustainability of life. He is also involved in science education research for school students as a means to popularise geoscience and prepare them for careers in Earth Sciences.

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ANVESHANA RESEARCH PROJECT

Earth Sciences (ANV - PR - 018)

Mineral-Microbe Interactions: Exploring through Milk Fermentation Experiments

Mineral-Microbe Interactions (MMI) has been a key factor for sustaining life on our planet. The science of MMI is an invaluable tool and promising application in increasing crop productivity, biorestoration and bioremediation technologies. Through this project, students will indulge in studying MMI through milk fermentation experiments. Milk contains diverse microbiomes and curdles under specific conditions. Can minerals help create conditions to ferment milk? Is the resultant curd (fermented milk) consumable? The project aims to find the answer to these questions. Towards this, an interaction between minerals from different rocks and microbes of milk will be studied to understand the role of minerals in the milk fermentation.

Mentors:

Dr. Biraj Borgohain, Senior Researcher, Dept. Earth Science, Prayoga
Dr. Venkata Krishna B, Senior Researcher, Dept. of Biology, Prayoga,
Dr. Ajit Singh, Senior Researcher, Dept. of Earth Sciences, Prayoga.

Dr. Biraj Borgohain has a PhD in Earth Science from Indian Institute of Technology (IIT) Bombay. Following a postdoctoral stint at his alma mater, he was Assistant Professor at SDS Uttarakhand University. His research interests include thermochronology, geomorphology, sedimentology, and statistical and numerical modelling. At Prayoga, his research focus is on climate-tectonic processes, and mineral-microbe interactions that impact the habitability and sustainability of life. He is also involved in science education research for school students as a means to popularise geoscience and prepare them for careers in Earth Sciences.

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Dr. Ajit Singh was awarded a PhD in Earth Sciences from Indian Institute of Technology (IIT) Kanpur, followed by postdoctoral fellow at Imperial College of London, UK and the Indian Institute of Technology (IIT) Gandhinagar. He has 16 years of experience in River Science, Earth Surface Processes, Hydrology, Geoarchaeology and Climate & Tectonic Controls. He also served as water domain expert in the Jal Jeevan Mission. GoI. He has authored 16 peer reviewed articles; 2 book chapters and 20 seminars/conferences. At Prayoga, his present focus is on river rejuvenation, groundwater management and rainwater harvesting.

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ANVESHANA RESEARCH PROJECT

Advanced and Functional Materials (ANV - PR - 019)

Fabrication of Metal Oxide Thin Films for Advanced Electronic Devices

The fabrication of metal oxide thin films for advanced electronic devices involves a meticulous process aimed at producing high-quality, functional coatings vital for cutting-edge technologies. The aim of the project is to synthesise and fabricate thin films of metal oxides. The properties of these films are to be fine tuned based on their distinct electrical, optical, and structural attributes. By adjusting parameters and employing post-treatment techniques, the methodology aims to refine film quality, uniformity, and substrate adhesion to elevate performance to fabricate the device . This research aims to contribute to the evolution of electronic device technology by delineating a systematic approach to fabricate metal oxide thin films tailored for diverse applications in the realm of advanced electronics.

Mentors:
Dr Omprakash S S, Researcher, Department of Physics, Prayoga
Adarsh V N, Research Associate, Department of Physics, Prayoga

Dr. Omprakash was awarded a PhD in nanotechnology from Mangalore University. His expertise involves fabrication and characterization of thin films for development of transistors, solar cells and sensors, with many publications to his name. He was a Junior Research Fellow (JRF) at RV College of Engineering, Bangalore and lectured at various colleges teaching physics and electronics. He is an expert in designing custom fabrication units, primarily developing custom designed instruments such as spin-spray pyrolysis unit and gas sensing unit. He was able to develop thin film transistors (TFT) on rigid and flexible substrates.

Adarsh V. N.. has completed his Master's degree in Electronics from Bangalore University. His work on the project 'Design and development of high energy density and high power density nanocomposite based supercapacitors for energy storage applications' was part of Student Project Proposal (SPP) 45th series by Karnataka State Council for Science and Technology and Indian Institute of Science, Bangalore. At Prayoga, his research explorations include synthesis of nanomaterials , working with sustainable materials for Electronic applications such as TFTs and Memristors.

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ANVESHANA RESEARCH PROJECT

Advanced and Functional Materials (ANV - PR - 20)

Engineering Cerium Oxide Nanoparticles with Tunable Physicochemical Properties

The structures and surface characteristics of the nanomaterials have a major influence on their physicochemical properties. The project aims to synthesise and design nanomaterials with precise morphologies, with potential for use in a wide variety of applications. Here, a simple and effective wet chemical method for the controlled synthesis of a range of diverse morphologies of cerium oxide nanostructures is presented. The hydrophobicity of the synthesised cerium oxide nanostructures will be evaluated by contact angle measurements. An exploration of intrinsic physicochemical properties when synthesising nanomaterials ultimately enhances their performance.

Mentors:
Dr. Ramya Prabhu B, Researcher, Dept. of Chemistry, Prayoga
Ms. Swetha, Research associate, Dept. of Chemistry, Prayoga

Dr. Ramya Prabhu completed her doctoral research at the Centre for Nano and Soft Matter Sciences (CeNS), Bengaluru, GoI. She obtained a DST INSPIRE fellowship for her Ph.D. work at CeNS. During her Ph.D, she supervised numerous visiting students from various academic levels and contributed to scientific publications. She received various awards throughout her doctoral studies, notably the Best Oral Presentation Award at 3rd Indian Materials Conclave (IndMac) organised by IIT, Madras. Dr. Ramya has developed a keen interest in science education, educational research, and adolescent psychology.

Shwetha Nataraj is a research associate at Prayoga, with a strong interest in sustainability and using science to address environmental challenges and develop sustainable technologies. She completed her Master's degree in Nanoscience and Nanotechnology from the University of Madras where she worked on nano-catalyst development for water splitting. She also worked on a project on the synthesis of doped mesoporous silica to drive selective hydrogenation. This experience sparked her interest in catalysis, and she aspires to further explore this field.