2024
ANNUAL SCIENCE RESEARCH SYMPOSIUM

ASRS

PROCEEDINGS

**Proceedings of 2nd Annual
Research Symposium**
15th October 2024

Preface

It is with great pleasure and enthusiasm that we present the proceedings of the Annual Science Research Symposium 2024 (ASRS'24) to all contributors, participants, and attendees. This collection reflects the innovative spirit and dedication of our scientific community, and we hope it serves as a source of inspiration, sparking new ideas and fostering meaningful dialogue.

Organized by the Faculty of Science at NSBM Green University, ASRS'24 is a celebration of the pioneering research efforts of our young researchers. More than just a venue for presenting academic findings, this symposium is a catalyst for driving scientific progress, building valuable skills, and cultivating a dynamic, forward-thinking research environment.

As we commemorate this event, we wish to extend our deepest gratitude to Prof. E. A. Weerasinghe, Vice-Chancellor of NSBM Green University, whose inspiring leadership has been crucial in making this symposium a success. We are equally thankful for the guidance and support of Deputy Vice-Chancellor Prof. Chaminda Rathnayaka, and Prof. Baratha Dodankotuwa, Head of Academic Development and Quality Assurance, whose efforts were instrumental in shaping this event. We also extend a sincere thanks to the participants, faculty, mentors, and the entire NSBM Green University community for their contributions. Last but certainly not least, a special thank you goes to Dr. Nuwanthi Katuwavila, Dean of the Faculty of Science, who has been our guiding light throughout this journey.

Within these proceedings, you will encounter an impressive range of research projects that contribute to the mission of advancing knowledge and improving lives. We hope that this collection educates and inspires you, offering fresh perspectives and sparking collaborations that will drive future scientific breakthroughs.

We encourage you to explore these pages with curiosity and an open mind. Let this be a starting point for new discoveries, partnerships, and innovations that will shape the future of science and health.

The Conference Organizing Committee,
ASRS'24

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Message from The Dean, Faculty of Science

Dr. Nuwanthi Katuwavila
Senior Lecturer /Dean Faculty of Science,
NSBM Green University

I am happy to welcome you to the inaugural Annual Science Research Symposium at the Faculty of Science, NSBM Green University. It is with great pride and enthusiasm that we gather here today to present the very first effort of our students in the field of scientific research. The symposium represents a significant milestone in our commitment to fostering a culture of innovation, inquiry, and discovery within our academic community.

In today's rapidly evolving world, scientific research plays a pivotal role in addressing the complex challenges and opportunities that confront us. Whether it be in the realms of biology, chemistry, medicine, physics, environmental science, or any other field, our researchers are at the forefront of exploring novel solutions and generating insights that have the potential to transform our society for the better. This symposium serves as a platform for our researchers to not only share their findings but also to engage in meaningful discussions, exchange ideas, and forge collaborations.

I would like to extend my heartfelt gratitude to all the participants, both presenters and attendees, for your dedication and passion for science. Your contributions are essential to the success of this event, and I encourage you to make the most of this opportunity to connect with your peers and discover the cutting-edge research happening within our community.

I also wish to express my sincere appreciation to the organizing committee, faculty advisors, and staff members who have worked tirelessly to make this symposium a reality. Your unwavering commitment to nurturing the interest of knowledge is truly

As we embark on this exciting journey of discovery together, I am confident that the First Annual Science Research Symposium will

inspire us all to reach new heights in our scientific endeavors. I look forward to the stimulating discussions, breakthrough insights, and collaborative endeavors that will undoubtedly emerge from this event. I congratulate all of the presenters and wish you all the best in your future research endeavours.

Message from The Head of the Department of Life Sciences

Dr. Miruna Rabindrakumar,
Head/ Senior lecturer Department of Life Sciences,
Faculty of Science,
NSBM Green University

It is with great pride that I welcome you to the 2nd Annual Science Research Symposium of our Department of Life Sciences. This symposium is a celebration of the dedication and academic growth of our undergraduate students as they advance through their research journey.

Our students begin this journey in their second year, where they engage in a thorough literature review. This critical foundation equips them with the theoretical understanding necessary to refine and finalize their research proposals by the third year. They then transition into conducting hands-on research in their fourth year, bringing their ideas to life.

Our students begin this journey in their second year, where they engage in a thorough literature review. This critical foundation equips them with the theoretical understanding necessary to refine and finalize their research proposals by the third year. They then transition into conducting hands-on research in their fourth year, bringing their ideas to life.

I thank the Chairperson of the 2nd Annual Science Research Symposium 2024, and all academic, administration and support staff who have supported our students in their academic endeavors and made this event a success.

Message from The Conference Chair

Dr. Udeshika Yapa Bandara
Conference Chair
2nd Annual Research Symposium
Faculty of Science, NSBM Green University

It is with great pride and pleasure that I welcome you all to the 2nd Annual Research Symposium of the Faculty of Science, NSBM Green University. This event celebrates the culmination of months of hard work, dedication, and collaboration by our undergraduate students, faculty, and staff.

First and foremost, I would like to extend my heartfelt thanks to our undergraduate students, who are the stars of this symposium. I also wish to express my deepest gratitude to the supervisors and faculty members, whose unwavering guidance, mentorship, and support have been instrumental in shaping the success of our students.

Special thanks must also go to the Dean of the Faculty of Science and the Head of the Department of Life Sciences for their continued support and encouragement, which have been critical in ensuring the smooth execution of this symposium and the overall success of our research programme.

Finally, I would like to acknowledge the invaluable contribution of the Young Scientists Circle, whose dedicated efforts and teamwork have played a pivotal role in organizing this symposium. Your enthusiasm and tireless work behind the scenes have helped bring this event to life, and for that, we are deeply grateful. May this symposium serve as a platform for inspiration, collaboration, and the celebration of scientific discovery. Thank you, and I wish all our presenters the very best !

Organizing committee

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Dr. Nuwanthi Katuwawila
Dr. Miruna Rabindrakumar

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Dr. Udeshika Yapa Bandara

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Dr. Udeshika Yapa Bandara

Programme of the symposium

Time	Event
09.30 am - 09.40 am	Welcoming the Guests and Lightening of the oil lamp.
09.40 am - 09.50 am	Welcome Speech by Conference Chair
09.50 am - 10.00 am	Speech – Head, Department of Life Sciences
10.00 am - 10.20 am	Keynote Speech
10.20 am - 10.30 am	Distribution of token of appreciation – keynote speaker
10.30 am - 10.45 am	Speech by Prof. Baratha Dodankotuwa
10.45 am – 11.15 am	Refreshments with Poster Observations
11.15 am - 3.00 pm	Student oral presentations (10 min presentation and 2 min Q&A)
3.00 pm - 3.30 pm	Vote of Thanks

Profile of the Keynote Speaker

Dr. Laksiri Weerasinghe
Senior Lecturer, Department of Chemistry,
University of Sri Jayewardenepura
B.Sc. (Honors) (Colombo), Ph.D.
(Washington State University, USA)

Dr. Laksiri Weerasinghe is an accomplished academic and researcher with a distinguished career in organic chemistry and nanotechnology. He obtained his B.Sc. (Hons) from the University of Colombo, Sri Lanka, in 2004 and pursued his Ph.D. in Organic Chemistry at Washington State University, USA, graduating in 2013. His postdoctoral research took him to the University of Montreal, Canada, in 2013-2014, and later back to Washington State University in 2014-2015. His academic journey began with a B.Sc. (Hons) in Chemistry from the University of Colombo, Sri Lanka, in 2004, where he laid the foundation for his career in organic chemistry.

Dr. Weerasinghe has contributed significantly to both academia and industry. He worked as a Senior Research Scientist at the Sri Lanka Institute of Nanotechnology (SLINTEC) from 2015 to 2020, where his work involved bridging the gap between organic synthesis and nanotechnology, especially focusing on drug discovery and drug delivery. Dr. Weerasinghe's research interests lie at the intersection of organic chemistry and nanotechnology, with a particular focus on addressing modern challenges in drug discovery and delivery. He is also deeply interested in the synthesis of small molecules and antimicrobial peptides, aiming to unlock their potential as therapeutic agents and explore their broader applications in plant science.

Dr. Weerasinghe currently holds the position of Senior Lecturer II at the University of Sri Jayewardenepura, a role he has held since 2020. Prior to this, he contributed to both academia and industry through various appointments. From 2017 to 2019, he was an Adjunct Senior Lecturer II at SLINTEC Academy, and he also served as a Visiting Lecturer at the University of Kelaniya during the same period. Between 2015 and 2020, Dr. Weerasinghe worked as a Senior Research Scientist at the Sri Lanka Institute of Nanotechnology (SLINTEC), where he made significant contributions to drug discovery and nanotechnology research.

Nano-enabled Organic Chemistry for Sustainability in Medicine and Agriculture

Dr. Laksiri Weerasinghe

Department of Chemistry, Faculty of Applied Sciences, University of Sri Jayewardenepura

The goals of sustainability and environmentally conscious science underlie the precepts of modern chemistry, and organic chemistry is no different in that regard. Currently, the field of organic chemistry is moving toward functional oriented synthetic targets with a high emphasis on reproducibility and scalability.

Small peptides (5-20 AA) found in all living organisms possess antimicrobial, anticancer, antidiabetic properties that are yet to be harnessed. Current research has shown the potency of these small peptides where some of them are already in clinical trials. Due to the availability of peptides in limited quantities in natural sources and the practical difficulties in isolating them from complex biological mixtures, chemical synthesis is so far the most viable option to gain access to reasonable quantities of these molecules. Solid phase peptide synthesis (SPPS) is a technique that has been developed to make desired peptides in high yield.

Currently peptides have gain significant interest as an alternative bioorganic molecule in various application in medicine, agriculture and materials sciences. Despite the promising advantages of using peptides, the internalization of these potent molecules in sufficient quantities into a cell is one of the greatest barriers on developing them as an efficient therapeutics. Nanotechnology has established a new paradigm in biology with the potential of enhancing the stability of important biomolecules such as peptides and nucleotides. The existing stability issues of peptide could be resolved using this enabling strategy.

Despite promising therapeutic applications, the alarming concerns of environmental protection with unsustainable food production also create the unique space for alternative precious methods such as using safe biocompatible molecular strategies to ensure the proper plant growth and development. In this regard, we are also evaluating potential of peptide applications in plant science and agriculture. The emerging research trends at the interface of organic synthesis and nanotechnology in order to solve some of the critical issues in conventional medicine and agriculture will play a major role in developing a sustainable world.

ABSTRACTS

Unraveling Hypothetical Etiologies of Chronic Kidney Disease of Unknown Etiology

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Chronic Kidney Disease of unknown etiology (CKDu) is defined as a slow-progressing, irreversible disease that is asymptomatic until the late stages. Perhaps most importantly, it is not caused by hypertension, diabetes, or other recognized risk factors that typically cause renal diseases such as CKD. CKDu has been reported across several global regions, including South Asia, Central America, Middle East, Balkan countries, and African regions, particularly within agricultural communities. When it came to Sri Lanka, CKDu was embedded within the farming community in the dry zones of the country and showed disease progress in four steps based on histological and clinical characteristics. CKDu has a high patient rate and mortality rate in Sri Lanka, yet its exact causes remain unidentified. There are several main hypotheses including exposure to agrochemicals such as pesticides (pyrethroids), herbicides (glyphosate) and fertilizers (phosphate-based fertilizers). The use of polluted agricultural water containing heavy metals (lead, cadmium, and arsenic) and trace elements (aluminum, fluoride) is also another potential factor. Additionally, contaminated food, along with alcohol consumption, smoking, heat stress, and dehydration are hypothesized to have a weak correlation with CKDu. However, geographical and population differences further complicate its etiology. Recognizing these factors is essential for developing effective prevention strategies to reduce the burden of CKDu. This study offers a broad overview of CKDu's hypothetical etiology, emphasizing the need for further research to clarify its underlying mechanisms.

Keywords - CKDu, agrochemicals, heavy metals, water contamination, renal damage, trace elements

β-Cryptoxanthin: "From Citrus to Cancer Therapy" - A Revolutionizing Natural Compound Therapeutically Targeting Hallmarks of Lung Cancer

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Despite advancements in biomedical science, lung cancer continues to pose a significant global burden due to its high mortality and morbidity rates. The limitations of emerging treatments highlight the need for innovative therapeutic strategies to combat lung cancer. β-Cryptoxanthin, an oxygenated carotenoid primarily found in citrus fruits, also functions as a provitamin A. β-Cryptoxanthin's structural advantages and biochemical properties enhance its anticancer effects through multiple mechanisms, including antioxidant, anti-inflammatory, and antiproliferative activities, as well as modulation of key cellular signaling pathways. Through these mechanisms, β-cryptoxanthin therapeutically targets the hallmarks of lung cancer, including sustaining proliferative signaling, evading growth suppressors, resisting apoptosis, enabling replicative immortality, inducing angiogenesis, activating invasion and metastasis, and deregulating cellular energetics and metabolism, as well as promoting immune resistance. β-Cryptoxanthin restores altered signaling pathways, including MAPK/ERK, SIRT1, NF-κB, RARβ, and α7-nAChR, thereby inhibiting the progression of lung cancer. β-Cryptoxanthin's therapeutic potential includes downregulating angiogenic factors like vascular endothelial growth factors and matrix metalloproteinases, promoting apoptosis through caspase-3 and -7 activation, and inhibiting uncontrolled angiogenesis. It also inhibits lipid peroxidation and glycolysis to restore deregulated metabolism. The literature highlights its anticancer action and mechanistic insights, positioning β-cryptoxanthin as a novel therapeutic approach against lung cancer.

Keywords - β-cryptoxanthin, Lung cancer, Hallmarks, Anticancer, DNA damage, antioxidant.

The Nutritional Composition and Weight Reduction Potential of Flaxseeds: Exploring Bioactive Components and Mechanistic Pathways

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Since 1990, the prevalence of obesity has more than doubled, creating significant global health concerns, and highlighting the urgent need for effective strategies to manage and reduce it. In response to this growing epidemic, the present study examines the potential benefits of flaxseed consumption in managing obesity. The nutritional composition of flaxseeds, particularly their bioactive components, and the underlying mechanisms by which they may contribute to weight reduction are explored. Flaxseeds have essential fatty acids, lignans, and dietary fibers, which play critical roles in managing obesity. Essential fatty acids are known to reduce visceral fat, regulate fat metabolism, enhance adipogenesis, and decrease inflammation. Lignans improve adiponectin and leptin signaling, promoting fatty acid oxidation, regulating energy balance, and suppressing hunger. Additionally, dietary fibers contribute to better digestion, help control caloric intake and improve gut health by fostering a healthy microbiome. Given these effects, flaxseed appears as a promising functional food for obesity management, offering health benefits beyond its basic nutritional value. While flaxseed shows significant promise, the precise mechanisms by which it affects fat metabolism remain unclear. This study highlights the need for further research to fully understand flaxseed's role in obesity treatment, stressing the importance of filling existing knowledge gaps. Ongoing studies are essential to unlocking the full potential of flaxseed as part of an effective strategy to combat the obesity epidemic.

Keywords - Flaxseed, obesity, bioactive components, lignans, dietary fibers, inflammation

Loop-Mediated Isothermal Amplification (LAMP) Technology: A New Frontier in Affordable Diagnostics for Parasitic Infections

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Parasitic infections remain a significant public health challenge globally, with low-income regions suffering disproportionately due to factors such as overcrowding, inadequate vector control, and financial constraints. Malaria, the deadliest parasitic disease, highlights this issue, particularly in Africa, which accounted for 94% of cases and 95% of malaria-related deaths in 2022. Effective diagnosis is crucial for preventing the progression of parasitic diseases to life-threatening stages, but limited access to advanced diagnostic technologies in low-income areas hinders timely detection. Techniques like polymerase chain reaction (PCR), while effective, are often unsuitable in resource-limited settings due to their cost and operational complexity. Loop-mediated isothermal amplification (LAMP) offers a promising alternative for detecting specific DNA sequences with its high sensitivity, specificity, and ease of use. Its affordability and ability to function under constant temperature conditions also reduce reliance on expensive machinery, making it well-suited as a diagnostic tool in low-income countries. This study critically examines the potential of LAMP as an alternative to commonly used diagnostic approaches, highlighting its advantages. Additionally, the potential of developing LAMP as a point-of-care (POC) diagnostic technique is examined. Finally, we explore recent innovations in LAMP technology, such as multiplex LAMP, reverse transcription LAMP, microfluidic LAMP, digital LAMP, and single nucleotide polymorphism LAMP, which further enhance its diagnostic potential. The importance of affordable and precise diagnostic methods is emphasized, especially for regions heavily impacted by parasitic diseases. LAMP emerges as a valuable tool in alleviating disease burden by offering enhanced diagnostic solutions.

Keywords – LAMP, POC, PCR, Sensitivity, Specificity

Physical Activity and its Impact on Brain Physiology

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According to the World Health Organization (WHO), approximately 970 million people are globally affected by mental disorders. Alzheimer's disease and Parkinson's disease have shown an alarming increase in prevalence over the past few years. The number of people living with dementia, including Alzheimer's, is anticipated to reach 82 million by 2030 and 152 million by 2050. Similarly, Parkinson's disease currently affects over 10 million people globally, with its incidence expected to double by 2040. Effective treatment for these mental illnesses has not been discovered yet. However, research has demonstrated that regular physical activity can significantly slow down the progression of neurodegenerative diseases like Alzheimer's and Parkinson's. This study aims to explore the positive impact of physical activity on Alzheimer's and Parkinson's disease, focusing on the physiological changes it induces in the brain. Physical activity results in the activation of the hormonal pathways of dopamine, serotonin, adrenaline and endorphins and the protein BDNF (brain-derived neurotrophic factors), which interrelates it to the therapeutic benefits of Alzheimer's and Parkinson's disease. The main organ interacting with these mechanisms is the hippocampus, a brain region crucial for memory. Dysregulation of these hormonal systems due to sedentary lifestyles results in a high risk of suffering from mental illnesses such as dementia, Alzheimer's disease and Parkinson's disease. Understanding the relationship between physical activity, hippocampal function, hormonal signaling, and mental health outcomes is essential for developing interventions and public health strategies to promote overall well-being.

Keywords - Physical activity, hippocampus, Alzheimer's disease, Parkinson's disease.

Identification and Analysis of Potential Biomarkers for Chronic Kidney Disease of Unknown Etiology

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Chronic kidney disease of unknown etiology (CKDu) is a multifactorial chronic condition that presents a significant global health burden, particularly in agricultural communities within low and middle-income countries. The elusive nature of its etiology hinders accurate diagnosis and effective management. Early detection of CKDu is crucial for mitigating its impact. Biomarkers offer a promising avenue for achieving this goal. This study explores a range of commonly used biomarkers for CKDu, including urinary kidney injury molecule-1, creatinine, serum cystatin C, inflammatory cytokines, heavy metals, neutrophil gelatinase-associated lipocalin, albumin, natriuretic peptides, insulin-like growth factor binding protein 1, fibronectin 1, glutamate cysteine ligase catalytic subunit, glutathione-S-transferase mu 1, alpha 1 microglobulin, and retinol-binding protein 4. These biomarkers demonstrate potential in reflecting kidney damage and disease progression. The primary diagnostic methods for identifying these biomarkers involve blood and urine analysis. However, challenges such as variability in biomarker levels due to diverse influencing factors and limited sensitivity for early-stage detection remain unaddressed. Overcoming these challenges through the development of validated CKDu-specific biomarkers and advanced diagnostic techniques are essential for improving early diagnosis, patient outcomes, and global management of CKDu. Omics approaches, including genomics, proteomics, transcriptomics, and metabolomics, provide promising avenues for identifying novel biomarkers in the early stages of CKDu. These cutting-edge techniques can provide a more comprehensive understanding of the molecular mechanisms underlying the disease, leading to the discovery of more sensitive and specific biomarkers.

Keywords – Chronic kidney disease of unknown etiology, potential biomarkers, diagnostic techniques, omics, S*ri Lanka*

Navigating the Obesity – Breast Cancer Nexus

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Breast cancer (BC) represents the uncontrolled proliferation of breast cells which can either be invasive or non-invasive. The most prevalent cause of cancer-related fatalities in women worldwide is BC, including in Sri Lanka. Ageing, genetic mutation, family history, hormone replacement therapy, alcohol consumption, and obesity have been identified as the key risk factors for the formation of breast cancer. Obesity is defined as a body mass index (BMI) above 30 and is associated with BC through four primary mechanisms: leptin and leptin receptor expression, alterations in sex hormone levels, the effects of adipokines, and insulin and insulin growth factor-1 signaling. The complicated relationship between obesity and BC affects tumour characteristics and clinical outcomes. Obese women often present larger (≥ 1.7 cm), poorly differentiated tumours and have worse overall survival. However, no discernible correlation exists between molecular subtypes and BMI. In premenopausal obese individuals, estrogen and progesterone receptor-positive malignancies are the most common molecular subtype of breast cancer, while aggressive types, such as inflammatory and triple-negative cancers, are also frequently observed. Studies indicate that post-menopausal obese women have an elevated risk of breast cancer. Mammography, a common screening tool can yield false positive results due to increased breast tissue thickness in obese women. The heterogeneity of study populations, variations in defining or measuring obesity, and confounding factors concerning treatment variations and comorbidities have hindered the development of a generalized consensus on the relationship between obesity and BC. As a result, additional studies and comprehensive reviews are essential to validate the connection between obesity and BC development, treatment outcomes, and disease progression.

Keywords – Breast cancer, obesity, postmenopausal, premenopausal

Dietary Influence and Gut Microbiota in Gastritis Progression

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Gastritis, an inflammatory condition on the stomach's mucosal lining, affects nearly half of the global population and can be either communicable (primarily due to *Helicobacter pylori* infection) or non-communicable. This literature review aims to explore the relationship between gut microbiota and gastritis, and the role of dietary components in its development and progression. Research information was gathered from academic databases such as Google Scholar, PubMed, and Scopus. The analysis shows that certain dietary components, such as high salt, spicy foods, coffee, processed foods, and alcohol, can negatively impact gastritis by influencing various biochemical pathways. These include increasing gastric acid secretion, promoting reactive oxygen species (ROS) production, causing osmotic imbalances, and activating inflammatory pathways. These factors facilitate the adhesion and colonization of *H. pylori* while reducing beneficial gut microbiota, thereby worsening gastritis. Conversely, dietary components such as probiotic-rich foods, garlic, and polyphenol-containing foods such as turmeric, green tea, berries, and aloe vera have protective effects. They exert antimicrobial and anti-inflammatory actions, reduce *H. pylori* levels, and enhance beneficial gut microbiota, thereby alleviating gastritis. The findings suggest that managing dietary habits can significantly influence the prevention and treatment of gastritis by modulating gut microbiota and associated biochemical pathways. Further research is needed to fully understand these interactions and optimize dietary recommendations for gastritis management.

Key words – Gastritis, Gut microbiota, Helicobacter pylori, Dietary components, Biochemical pathways

Efficacy of Medicinal Plants as Potent PPAR Gamma Agonists Against Diabetes Mellitus

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Type 2 diabetes mellitus (T2DM) is a significant global threat. Numerous studies have focused on discovering agonists that target different mechanisms to treat T2DM, which is primarily characterized by insulin resistance. Among these, peroxisome proliferator-activated receptor gamma (PPAR-γ), a ligand-activated nuclear receptor, has become a target of interest to ameliorate insulin resistance and improve T2DM outcomes. Clinically approved antidiabetic drugs, like thiazolidinediones (TZDs), act as synthetic PPAR-γ ligands but are associated with adverse side effects, including fluid retention, weight gain, heart hypertrophy, bone fractures, and hepatotoxicity. As a result, the development of potent PPAR-γ ligands derived from natural plants has emerged as a major objective of current drug discovery due to their effectiveness, availability, reduced toxicity, and broad range of action. This study is intended to summarize promising medicinal plants such as *Glycyrrhiza glabra*, *Fragrans Myristica Houtt, Punica granatum, Citrus junos Tanaka, Scoparia dulcis, Piper chaba* and their active compounds which can interact with the receptor protein. The findings emphasize the potential of these ligands as PPAR-γ agonists, crucial for regulating glucose levels, and point to their promise for future diabetes treatments. This study offers strong evidence for the use of natural compounds in pharmaceutical drug development.

Keywords – Type 2 diabetes mellitus, peroxisome proliferator-activated receptor gamma, thiazolidinediones, agonists, glucose homeostasis.

Unraveling Drug Resistance in *Mycobacterium leprae*

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Leprosy is a chronic infectious disease affecting the skin, eyes, peripheral nerves, and upper respiratory tract. *Mycobacterium leprae* is the major causative agent of leprosy, while *Mycobacterium lepromatosis* is the second agent. The disease can be severe, ranging from tuberculoid to lepromatous leprosy. Hypopigmented patches, muscle weakness, numbness, and painless ulcers on the soles and feet are some of the clinical symptoms related to leprosy. Clinical diagnosis is the major diagnostic method used for leprosy in Sri Lanka. Around 2000–2500 new leprosy cases are reported annually in Sri Lanka. Approximately 10% of these cases occur in children. Leprosy can be cured with multidrug therapy (MDT), which was introduced by the World Health Organization in the 1980s. It consists of dapsone, rifampicin, and clofazimine. *M. leprae* exhibits drug resistance through several mechanisms, including genetic mutations, target modifications, phenotypic resistance, and the activity of efflux pumps. Understanding genetic mutations and phenotypic changes in *M. leprae* is crucial for developing effective treatments. Early detection prevents the spread of resistant *M. leprae* and improves treatment outcomes. MDT is essential to prevent the emergence of resistance.

Keywords – Leprosy, elimination, Sri Lanka, multidrug therapy, drug resistance.

Trends in Forensic Microbiology and the Future Directions in Sri Lanka

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Forensic science is known to be a broad field in which scientific methods are used as solutions to resolve criminal cases and legal concerns. As for the subdivision of forensic science, forensic microbiology has been extensively utilized for the evaluation of the cause and manner of death, individual recognition, crime scene detection, and postmortem interval estimation. Globally, there is an emphasis on creating novel techniques for microbial identification to tackle challenging forensic problems. Therefore, current research is broadening the applications of forensic microbiology. Since the beginning of the pre-20th century, forensic microbiology has evolved from simple culture techniques to culture-independent techniques and ultimately to advanced methods such as machine learning algorithms and artificial intelligence (AI). These techniques can be used to find microbial evidence in different criminal investigations. Currently, in Sri Lanka, DNA analysis, fingerprint analysis, ballistics, toxicology, and digital forensics are mostly used. However, the use of forensic microbiology is very scarce and is in the primary stages in local investigations. The use of microorganisms in the field of forensics can be further strengthened through the development of deep learning techniques and AI. However, further actions should be taken to minimize their limitations, and more consideration should be given regarding the implementation of these advanced techniques in Sri Lanka.

Keywords - Forensic microbiology, artificial intelligence, forensic science, Sri Lanka

Datura metel Phytochemistry & its Antidiabetic Potential

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Diabetes mellitus (DM) is a common disorder in the metabolism of macronutrients. Diabetes and associated complications are currently treated with synthetic pharmaceuticals; however, considering these drugs' negative effects and high cost, there is a trend towards alternative herbal remedies. Many medicinal plants have been traditionally used to relieve diabetes over the years. One such plant with several pharmacological properties, including antidiabetic potential, is *Datura metel*. Most medicinal plants, including *Datura metel* contain bioactive compounds known as phytochemicals. They are also known as the plant's secondary metabolites, which are responsible for the pharmacological activity with neurological, cytotoxic, insecticidal, analgesic, antibacterial, antidiabetic, anti-inflammatory, and antioxidant properties. *Datura metel* leaves, seeds, and roots are particularly rich in these phytochemicals, mainly alkaloids, polyphenols, terpenes. Hyoscine (scopolamine), atropine, and hyoscyamine are the main alkaloids found in *Datura metel*. These phytochemicals must be extracted, and advantageous compounds must be isolated to get maximum therapeutic effects, without any adverse toxicity. Polar solvents like methanol were proven to be more effective in extracting secondary metabolites, due to their ability to make secondary interactions with polar sites of phytochemical compounds. *Datura metel* seed and leaf extracts have been shown to possess hypoglycemic activity without adverse effects in in vivo studies. These extracts lower post-prandial blood glucose levels, by inhibiting α-amylase, and α-glycosidase enzymes. However, consuming higher doses can cause toxicity, therefore further studies must be done to confirm the optimal dosage.

Keywords - Diabetes mellitus, Datura metel, hypoglycemic activity, phytochemicals, alkaloids

Nature's Defense: An Overview of Plant-Based Mosquito Repellents

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Diseases transmitted by mosquitoes are widely prevalent worldwide, intensifying the need for proper repellents. Concerns regarding the toxicity and other adverse impacts of artificial chemical repellents such as DEET have put natural replacements into action. This study aims to evaluate the efficacy of plant-derived mosquito repellents from Sri Lanka, with a focus on active ingredients, mechanisms of action, safety, and market potential. The findings exemplify the effectiveness of these natural remedies and validate their efficacy as organic alternatives to chemical-based products. Natural products are generally considered to be safer than synthetic chemicals, but the efficacy and toxicity of these natural products need to be tested further to ensure consumer safety. Furthermore, the feasibility of using plant derivatives as insect repellents faces several challenges that remain in the experimental stage. Natural repellents from plants such as citronella, neem, lemon eucalyptus, and wild turmeric present a viable alternative to synthetic counterparts and deserve further exploration. Compounds such as citronellal, citronellol, geraniol, limonene, citral, azadirachtin, terpinene-4-ol, and eucalyptol, present in these plants, exhibit high mosquito repellency. The findings highlight the need for more investigation into natural alternatives, particularly regarding their effects on human health and ecosystem balance.

Keywords - Citronella, mosquito-borne diseases, natural repellents, neem, Sri Lanka

Bio-Inspired Packaging: A Review of *Lactobacillus*-Derived Nanoparticles for Egg Preservation

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Eggs are highly vulnerable to microbial contamination, and conventional preservation methods often fail to provide sufficient protection, increasing the risk of foodborne illnesses. This underscores the need for innovative packaging solutions that improve microbial safety and shelf life. The synthesis of nanoparticles using *Lactobacillus* bacteria presents a bio-inspired, environmentally friendly, and sustainable approach. *Lactobacillus* species exhibit metabolic diversity, non-pathogenic nature, and strain-specific biosynthetic abilities. These characteristics allow them to synthesize nanoparticles with desirable properties like size variation, biocompatibility, biodegradability, and antimicrobial activity. This study examines the potential of *Lactobacillus*-derived nanoparticles in egg packaging, focusing on improving barrier properties and extending the shelf life of eggs. Research has demonstrated the effectiveness of nanoparticles in reducing bacterial contamination. Nanocomposite film coatings and colloidal silver nanoparticle sprays have effectively provided antibacterial activity against *Salmonella enteritidis*, *Staphylococcus aureus*, *Bacillus cereus*, and *Escherichia coli*. Colloidal sprays, with smaller pores and uniform particle dispersion, have proven more effective in preventing microbial growth. Additionally, biologically synthesized silver nanoparticle/acidocin complexes used as immersion solutions for disinfecting eggshells have shown significant antibacterial effects against *S. aureus* and *B. cereus*. The findings highlight the potential of *Lactobacillus*-derived nanoparticles to enhance food safety, extend egg shelf life, and reduce environmental impact, offering a safer and more sustainable alternative for food packaging.

Keywords - antimicrobial nanoparticles, bio-inspired packaging, egg preservation, food safety, Lactobacillus-derived nanoparticles

Exploring the Therapeutic Potential of *Costus Speciosus* in Managing Type 2 Diabetes: An Investigation into Its Phytochemical Composition and Anti-Diabetic Properties.

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According to epidemiological research, diabetes mellitus (DM) and related metabolic and endocrine problems are expected to become widespread worldwide. Type 2 diabetes mellitus (T2DM) is primarily characterised by insulin resistance and impaired insulin secretion. While conventional treatments such as dietary modifications, physical exercise, hypoglycemic drugs, and lipid-lowering therapies provide therapeutic benefits, they often come with undesirable side effects. This has led to increasing interest in natural products as alternative sources for developing novel anti-T2DM agents. Emerging research highlights *Costus speciosus* as a promising medicinal plant with potent anti-diabetic properties. This study delves into the limitations of current treatments and the therapeutic potential of *Costus speciosus*, focusing on its key phytochemical compounds, particularly steroidal saponins (e.g., diosgenin) and terpenes (e.g., costunolide and eremanthin), which contribute to its efficacy. These compounds exert their antidiabetic effects through multiple mechanisms, mainly inhibition of α-amylase activity and enhancement of glucose transport across cell membranes. *Costus speciosus* demonstrates significant potential as a natural treatment for T2DM, encouraging further research into the molecular mechanisms of active compounds and their specific roles in mediating antidiabetic effects.

Keywords: Type 2 diabetes mellitus, Costus speciosus, secondary metabolites, mechanisms of action, α-amylase inhibition.

Study of Asthma Prevalence Associated with Indoor Urban Environmental Factors

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Asthma is a chronic lower respiratory disease characterized by bronchial hyperresponsiveness and bronchoconstriction. It affects people of all ages, including neonates, and can have either an early or late onset globally. As the most prevalent chronic respiratory disease in 2015, asthma affected 358 million people worldwide, and the global burden is projected to rise to 400 million by 2025, primarily due to urbanization. Frequent exposure to indoor allergens, such as cockroach, mouse, and dust mite allergens, pet dander, and Aspergillus spores, along with indoor air pollutants like volatile organic compounds (VOCs)—mainly benzene, acetaldehyde, formaldehyde, and toluene—particulate matter (PM), and carbon monoxide from building materials, chemical products, and combustion sources, is significantly linked to asthma exacerbations. If not addressed, these factors can lead to increased morbidity in individuals with asthma. Examining the contributions to disease progression both in Sri Lanka and globally, controlling habits and lifestyle factors—such as smoking, the use of strong perfumes, frequent household cleaning, access to better combustion sources, and the use of eco-friendly chemical products and medications—has been identified as influential in managing asthma progression and improving the quality of life for individuals with asthma. Among the various strategies to reduce indoor pollutants and allergens, frequent dusting and cleaning, ensuring proper ventilation, and minimizing the use of chemical products with high VOC content are the most effective and achievable methods to enhance air quality and promote recovery in individuals with asthma.

Keywords – Asthma, prevalence, indoor, urban, environmental factors

Decoction, Boiling, and Solvent Extraction for Extraction of Antiproliferative Compounds from Natural Plants

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Cancer is the second leading cause of mortality worldwide, responsible for over nine million deaths annually. To effectively treat cancer patients, it is crucial to identify compounds with antiproliferative properties. The growing interest in natural compounds, particularly from plants, has led to the exploration of their anticancer properties due to evidence of fewer side effects compared to synthetic drugs. Various extraction methods, from traditional to modern, are used to isolate these compounds from natural plants. This study discusses the extraction of compounds from plant materials for cancer treatment, highlighting various methodologies, including boiling, decoction, and solvent extraction. It emphasizes the application of these methods both globally and in Sri Lanka. Boiling and decoction are used in traditional practices due to their simplicity and eco-friendliness. Solvent extraction is a versatile and widely used method for obtaining a broad range of compounds using different solvents. The effectiveness of each extraction method in obtaining bioactive compounds with antiproliferative potential is highlighted. The findings demonstrate the importance of selecting appropriate extraction methods to maximize the bioavailability of antiproliferative compounds. Enhancing bioavailability helps in the development of effective cancer treatments. Collaborations between scientists, pharmacologists, and traditional medicinal practitioners can facilitate the formation of clinically useful drugs from these plant-derived compounds. Optimizing these extraction techniques is crucial for maximizing bioavailability and enhancing eco-friendliness, ensuring their effective use in cancer treatments.

Keywords - Antiproliferative compounds, natural plants, decoction, boiling, solvent extraction

Asthma Prevalence with Outdoor Urban Environmental Factors

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Urbanization is a major outcome of the industrial revolution. Due to urbanization, environmental conditions and lifestyles of humans have changed. It directly impacts public health, particularly the prevalence of non-communicable diseases like asthma. Asthma is a multi-factorial respiratory disease associated with genetic factors, environmental factors, socioeconomic factors, lifestyle factors, climate and weather. Among them, outdoor urban environmental factors have a significant effect on global asthma prevalence. Higher levels of air pollution are typically found in urban environments, primarily due to increasing emissions from vehicles, industrial processes, and construction. Ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter (PM) are the most prevalent air pollutants in both indoor and outdoor environments. There are various trends of asthma prevalence that can be identified when comparing global and local disease conditions. As a result of issues like environmental triggers, healthcare accessibility, and air pollution, the prevalence of asthma can vary between urban and rural areas. Asthma rates are generally higher in urban areas due to increased allergens and air pollution. In contrast, rural regions face asthma triggers from pesticide use, agricultural dust, and pollen. However, these factors can vary depending on the specific area and its environmental conditions. Different types of prevention strategies have been identified to avoid or minimize these risk factors.

Keywords – Urbanization, asthma, outdoor, air pollution, prevalence

Nano-fortification of Food

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Nano-fortification refers to enhancing food products with essential nutrients using nanotechnology. This enables the delivery of nutrients in a more efficient and targeted manner, potentially improving their absorption and bioavailability in the body. It presents a novel approach to address nutritional deficiencies and promote overall health. Various nanomaterials such as nanoparticles, nano-emulsions, nano-capsules and nanoliposomes are utilized to fortify food. Nanomaterials can incorporate nutraceuticals such as vitamins, and bioactive compounds, thereby improving their stability, bioavailability and functionality in the body. It provides an opportunity to develop novel products which are beneficial for health. Nanomaterials possess diverse characteristics, including small size and high surface area-to-volume ratio with uniform dispersion, enabling consistent and efficient interactions between the nutrients and the food matrix. Additionally, nanomaterials possess enhanced stability and solubility, facilitating the targeted delivery of nutrients. Moreover, nanomaterials allow customization of nutrient delivery systems, allowing for the development of personalized nutrition interventions tailored to individual needs. Therefore, these characteristics highlight the versatility and effectiveness of nanomaterials in enhancing the nutritional quality and functional properties of food products. According to current research it is evident that nano-fortified food allows increased absorption of various nutrients to produce energy. Ongoing research in this field aims to develop innovative functional food products as well as to ensure the safety, efficacy, and widespread adoption of nano-fortified foods, which would contribute to the enhancement of global health and well-being.

Keywords - Nano-fortification, nanotechnology, nanomaterials, nutrients, nanoparticles

Diversity and Adaptive Mechanisms of Oil-Degrading Bacteria in Varied Environments: A Comprehensive Review.

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Oil, derived from organic materials, can have detrimental effects on ecological balance when accumulated excessively. Oil spills pose significant environmental threats, impacting ecosystems and public health. Interestingly, microorganisms can effectively clean up oil spills through chemical breakdown. This study analyzes various cleanup methods, emphasizing bioremediation as an eco-friendly and cost-effective technique for restoring oil-contaminated environments. Environmental factors can influence bacterial activity differently across various ecosystems. Oil-degrading bacteria exhibit distinct structural and genetic adaptations, including metabolic pathways such as aerobic and anaerobic processes. Enzymes also play a crucial role in oil degradation, with genetic adaptations varying based on environmental conditions. The methodology includes isolating and culturing bacteria, followed by experimental techniques like biodegradation pot experiments, metagenomic analysis, and bioaugmentation to assess bacterial biodegradability. For optimization, a central composite design is employed. The research focuses on genetically engineered microorganisms to enhance bioremediation efficiency. Additionally, next-generation sequencing is utilized to determine the functional capacity of the microbial community. Surfactant utilization serves as an adaptive mechanism that can improve oil spill recovery. Moreover, the synthetic aperture radar (SAR) imagery technique offers a novel solution for real-time detection of oil spills. The study underscores the ecological importance of bacteria in degrading hydrocarbons and restoring contaminated environments through various adaptive mechanisms.

Keywords - Bacteria, oil-degrading, oil spills, genetic adaptations, bioremediation

Diversity and Ecological Significance of Vermicomposting Bacteria

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Vermicomposting, a bioconversion process employing earthworms to decompose organic matter, has gained significantattention due to its eco-friendly waste management and soil-enriching properties. The microbial communities inhabiting the vermicompost matrices are central to the success of vermicomposting, which play pivotal roles in organic matter degradation, nutrient mineralization, and overall ecosystem functioning. Vermicomposting has demonstrated significantly higher bacterial diversity compared to aerobic composting. A diligent investigation into various vermicompost samples has unveiled a diverse array of bacteria including Firmicutes, Acidobacteria, *Bacillus, Azotobacter*, and more, presenting remarkable metabolic versatility and adaptive strategies to thrive in this specialized environment. Identification techniques scaling from traditional culture-based procedures to exceptional molecular approaches such as pyrosequencing have characterized these bacterial communities, revealing a wealth of previously unrecognized taxa and functional potentials. Moreover, copious literature has highlighted the ecological significance of vermicomposting bacteria in nutrient cycling, soil quality improvement, plant harvest promotion, and medicine. Furthermore, the practical implications of bacteria in vermicomposting, bioremediation, agricultural practices, and waste management underscore their immense potential in diverse applied domains. This study underscores the techniques for isolating and identifying different vermicomposting bacteria and the significance of understanding the composition and functions of vermicomposting bacteria for mobilizing their beneficial applications in agriculture and medicine.

Keywords – Applications, bacteria, earthworms, vermicomposting, waste

Bovine Alpha-Casein: Genetic Effects on Health-Related Peptides

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Bovine alpha-casein, a key milk protein, is recognized for its health benefits due to the presence of bioactive peptides. It exists in two primary forms, αS1 and αS2, encoded by the CSN1S1 and CSN1S2 genes, respectively. Genetic variations, particularly the A and B variants, significantly affect the structure, digestion, and function of alpha-casein. α-Casomorphin, a bioactive peptide derived mainly from the A and B variants of αS1 casein, exhibits opioid-like properties and has shown potential in inhibiting breast cancer cell growth. This makes it a promising compound for cancer-related therapeutic strategies. Another important peptide is casokinins, produced from both αS1 and αS2 caseins, which act as angiotensin I-converting enzyme (ACE) inhibitors. This function is critical for cardiovascular health, particularly in managing blood pressure and preventing hypertension. Further, alpha-casein displays antimicrobial properties. The peptide isracidin, derived from the B variant of αS1 casein, has been shown to exhibit strong antibacterial activity against Lactobacilli, offering potential benefits in preventing infections. However, alpha-casein is also associated with allergenic reactions in sensitive individuals, though the molecular mechanisms behind this are not yet fully understood. Despite these known benefits, there is still a need for further molecular research to explore how different genetic variants of alpha-casein influence its bioactive properties and their overall impact on human health. Understanding these mechanisms can help optimize the use of alpha-casein in therapeutic applications.

Keywords – Bovine milk, casein protein, α-casmorphin, opoid agonist, casokinins

Genetic Polymorphism of Beta Casein in Bovine Milk and its Health Benefits

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Genetic polymorphism in beta-casein, a major milk protein, has been shown to influence various health outcomes in consumers of bovine milk. This study examines the genetic variants of beta-casein found in different bovine populations and explores their associated health benefits. Beta-casein is one of the casein proteins, consisting of A1 and A2 genetic variants. The primary difference between these two genetic variants is the mutation of a single amino acid at position 67 in the peptide chain. The A1 and A2 variants of beta-casein have been studied, with the A2 variant showing health advantages. Gastrointestinal digestion of genetic variants releases bioactive peptides called beta-casomorphins with antioxidant, antimicrobial and antihypertensive activities. Beta-casomorphins are produced by the proteolysis of beta-casein ranging from 4-11 amino acids, with the first three remaining identical, beginning at position 60 of the 209-casein amino acid sequence. Compared to the A2 variant, the A1 variant is more likely to experience enzymatic cleavage during digestion, producing the peptide beta-casomorphin-7 (BCM-7), a known μ-opioid receptor agonist consisting of 7 amino acids. Beta-casomorphin-7 promotes the binding and activation of μ-opioid receptors of various organ systems, such as the digestive tract, and central nervous system. Therefore, the A1 variant has been associated with health risks, including type I diabetes, as well as cardiovascular and digestive disorders. Consumers interested in the health benefits of A2 beta-casein may consider selecting dairy products that produce this variant. Continued research is essential to understand the effects of A1 and A2 variants, along with their derived peptides, on human health.

Keywords – beta-casein, A1 variant, A2 variant, beta-casomorphin-7.

Investigation of Induction Techniques to Accelerate Agarwood Resin Production

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Agarwood, a highly prized aromatic resin, is primarily produced by trees in the *Thymelaeaceae* family, particularly the *Aquilaria* species. It finds widespread use in the production of medicine, fragrances, and incense. Most *Aquilaria* species are distributed across Asia. *Gyrinops Walla* commonly known as Walla Patta is native to Sri Lanka. While healthy *Aquilaria* trees do not naturally produce resin, they form as a defense mechanism in response to injuries, infections, or physical damage. The primary constituents of high-quality agarwood are sesquiterpenoids and 2-(2-phenethyl) chromones (PECs). The mevalonic acid and methylerythritol phosphate pathways contribute significantly to the production of sesquiterpenoids. Although the PEC formation pathway remains unclear, studies suggest the involvement of type III polyketide synthases. Natural agarwood formation is a time-consuming process, often taking decades to produce high-quality resin. To meet the increasing market demand, researchers have explored artificial induction methods. These methods include biological inoculation, chemical induction, and physical induction. Fungal species such as *Aspergillus* sp., *Lasiodiplodia* sp., *Diplodia* sp., *Fusarium bulbiferum*, and *Penicillium* sp., have been used in biological inoculation. Chemical induction methods have utilized sulfuric acid, acetic acid, and alcohol, while physical induction methods have involved physical wounding, bark removal, and holing. This study provides a comprehensive overview of agarwood formation, its distribution, and the effectiveness of various artificial induction techniques. Future research should focus on identifying the most efficient method for producing high-quality agarwood in a short timeframe.

Keywords – Aquilaria, Thymelaeaceae, polyketide synthases, agarwood

Study of Anticancer Effects of *Spatholobus Spp.* for Drug Discovery Against Breast Cancer

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Breast cancer is one of the most common malignancies and a leading cause of cancer-related morbidity and mortality among women worldwide. Despite advancements in conventional therapies, the development of more effective and less toxic therapeutic options remains essential. The application of medicinal plants in cancer treatments has gained attention due to their bioactive compounds with potential anticancer properties. This study is focused on Spatholobus species, a genus rich in bioactive compounds such as flavonoids and alkaloids which can specifically target estrogen receptors (ER), thereby making them as promising candidates for ER+ breast cancer treatment. Studies were performed on in vivo, in vitro, and in-silico approaches with a special emphasis on in-silico methods such as molecular docking and structure-based virtual screening. These techniques have been employed to investigate the binding affinities of Spatholobus compounds to ER and pro-apoptotic proteins such as caspase-3. In addition, the pharmacological mechanisms including the inhibition of MAPK and PI3K/AKT pathways are also discussed. These findings suggests that Spatholobus species, particularly Spatholobus suberectus, have significant potential as sources of novel ER-targeted therapies with fewer side effects compared to conventional treatments. However, further in vivo and clinical studies are required to validate their therapeutic efficacy and safety.

Keywords: Breast cancer, estrogen receptor mechanism, In-silico methods, Spatholobus parviflorus, Spatholobus suberectus.

Genomic Insights into Leprosy

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Leprosy is a neglected chronic infectious disease caused by *Mycobacterium leprae* and *Mycobacterium lepromatosis*, and despite global efforts to control its spread, it continues to pose a significant health challenge in high-endemic areas. Control strategies prioritize early diagnosis and treatment, but these are often undermined by social stigma, limited diagnostic tools, and gaps in healthcare infrastructure. The *Mycobacterium* transmission is complex, with multibacillary cases playing a key role in ongoing transmission. *M. leprae*, a slow-growing, microaerophilic bacterium, primarily infects Schwann cells in peripheral nerves and macrophages in the skin. A newer species, *M. lepromatosis*, identified in 2008, has been detected in patients from Mexico, Singapore, Canada, and Colombia. Both bacteria cause similar clinical manifestations in humans, as both are closely linked to leprosy. In recent years, molecular epidemiology has emerged as a valuable tool in leprosy research. This field has helped track how the disease spreads, identify reservoirs of infection, and better understand the genetic variation within the bacterial populations that cause leprosy. It has also played a role in detecting drug resistance and refining strategies for disease control. Research into the genetic makeup of *M. leprae* and *M. lepromatosis*, especially the role of pseudogenes, offers promising insights into the biology and transmission of leprosy. These advances in molecular epidemiology could contribute significantly to improving global control measures and future treatments for leprosy.

Keywords – Leprosy, molecular epidemiology, genetic variation, pseudogenes, disease transmission

In Silico Analysis of Genes Involved in Withanolide Biosynthetic Pathway

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Withanolides are a group of naturally occurring steroidal lactones with significant pharmaceutical applications, including anti-inflammatory, anti-cancer properties. Understanding the biosynthetic pathways of withanolide synthesis is crucial for harnessing their therapeutic potential. Withanolide biosynthetic pathway involves two primary pathways which are the mevalonate pathway (MVA) and the methylerythritol phosphate pathway (MEP). In this study, we focus on the *in-silico* approaches that had been used to identify genes related to withanolides biosynthesis pathway. *Ab initio*, homology-based, and functional annotation methods were discerned under this category. Cytochrome P450 (CYP450) genes were identified using the Ab initio method, while glycosyltransferases (GT) and methyltransferases (MT) were detected through homology. Additionally, WRKY and MYB transcription factors were discovered through functional annotation. This study identified several CYP450, GT, and MT genes involved in withanolide biosynthesis, with 315, 195, and 363 unigenes from the CYP450, GT, and MT families, respectively. Additionally, 3D structural predictions were made for the CYP71D and CYP76 gene families from cytochrome P450, along with UGT73C and UGT74B from glycosyltransferases. Additionally, several preserved domains, such as the heme binding, GT-B fold, and S-adenosylmethionine binding domains, clarify the functional roles of gene families in withanolide biosynthesis. In silico methods offer insights into withanolide biosynthesis, but their reliability needs validation through in vitro analysis and gene silencing. This enhances credibility and supports further research, ultimately paving the way for the biotechnological use of withanolides.

Keywords - Withanolide, Ab initio, homology-based, annotation, in silico

Epidemiological Trends and Clinical Patterns of Eczema and Psoriasis

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Eczema and psoriasis are prevalent dermatological conditions with diverse clinical presentations and significant epidemiological impacts worldwide. This study explores their epidemiology, pathogenesis, and clinical patterns, emphasizing the need for improved diagnostic strategies. Psoriasis affects 2-3% of the global population, whereas eczema, particularly atopic dermatitis, is more common in children, affecting up to 20%, while it affects about 3% of adults. Psoriasis typically presents with various phenotypes, including plaque, guttate, inverse, pustular, and erythrodermic forms. These phenotypes differ in distribution, severity, and response to treatments. Eczema manifests in different forms such as atopic dermatitis, contact dermatitis, and nummular eczema, each characterized by dry, itchy, and inflamed skin. Both conditions present a wide range of symptoms and co-morbidities. Key risk factors include genetic predisposition, environmental triggers, lifestyle factors, and immune dysregulation. Genetics plays a critical role in both diseases. In psoriasis, over 60 susceptibility loci have been identified. PSROS1 is the major genetic determinant of psoriasis. Eczema is closely linked to mutations in the FLG gene, which weaken the skin's barrier function. Treatment options for both conditions vary from topical therapies to systemic medications. Eczema and psoriasis are prevalent conditions with substantial clinical and genetic variability. Improved understanding of their epidemiology and genetic mechanisms enhances diagnostic accuracy and treatment strategies. Future research should focus on refining personalized treatment approaches and overcoming disparities in healthcare access.

Keywords – Eczema, psoriasis, epidemiology, clinical patterns

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