BOOK OF ABSTRACTS

International Conference and Startup Summit

on

FUNCTIONAL BIOMATERIALS AND SYNTHETIC BIOLOGY

(FBSB-2023)

31st and 1st August 2023

Revolutionizing Healthcare

Editors

Dr. K. Gopal Shankar, L. Karthick, Dr. R. Selvakumar

Jointly Organised & Supported by

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Functional Biomaterials and Synthetic Biology

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PSG INSTITUTE OF ADVANCED STUDIES

PSGIAS, one among the many educational institutions nurtured by PSG & Sons' Charities Trust, was established in the year 2005-06. The Nanotech Research Facility of PSG IAS was inaugurated by Dr. A. P. J. Abdul Kalam, Former President of India in 2009. The institute is affiliated to Anna University, Chennai and Bharathiar University, Coimbatore as a research centre for carrying out research leading to M.Phil and PhD in the field of Nano-Science and Technology, Nanobiotechnology, Biotechnology, Physics, Chemistry and Advanced Manufacturing. The main motto of the Institute is to inculcate the spirit of enquiry among learners. The Institute currently undertakes several sponsored projects from various agencies like DST, SERB, ICMR, DBT, DRDO, ONGC, etc. To date, PSGIAS has received more than 25 crores of financial support from various funding agencies in the research areas of flexible electronics, tissue engineering, plasmonic materials, innovative textiles, water treatment, nanostructured thin films, electrochemical sensors and storage batteries.

PSG SCIENCE & TECHNOLOGY ENTREPRENEURIAL PARK (PSG-STEP)

PSG-STEP was established in 1998 with support from Department of Science & Technology, Government of India, IDBI and ICICI to promote technology based enterprise in the areas of Software, Electronic Products, Hi-Tech Mechanical Products, Eco friendly Textile Products, Bio-Technology and Nano Technology using the core strengths of PSG College of Technology. PSG-STEP is one among an exclusive club of incubators with exclusive incubation facilities and funding mechanisms for startups in multiple technology domains with the support of NSTEDB, DST, BIRAC and MeitY, Government of India. PSG-STEP is the secretariat for the "Asia Pacific Incubation Network" (APIN) an initiative supported by InfoDev, World Bank & DST, Government of India to promote the incubation network in the region. PSG-STEP has been awarded the "Best STEP" in the country by Ministry of Science & Technology, Government of India, New Delhi.

SOCIETY OF CHEMICAL AND SYNTHETIC BIOLOGY (SCSB)

Society of Chemical and Synthetic biology is a non-profit organization. Established in 2019, it is one of the fastest growing synthetic and chemical biology societies in India. The society aims to introduce synthetic biology to Indian researchers and also provide access to synthetic biology and chemical biology resources, connect young researchers from all over the world to industry and academia, organize conferences and workshops besides imparting information about research, training, education, employment and current events and news from synthetic biology and chemical biology fields. Society has chapters in several reputed universities all over India. Recently the society signed

MoU with Synthetic Biology Australasia (SBA), Australia. Signing of MoU with University of Wolverhampton, UK and Sigma Aldrich Chemicals Pvt Ltd is in process.

ABOUT THE CONFERENCE

The international conference and startup summit on "Functional Biomaterials and Synthetic Biology" (FBSB-2023) aims at an innovatory approach of uniting academicians, industrialists, young researchers and budding entrepreneurs to share knowledge and new ideas through interactive discussions and technical sessions. Especially the startup summit focuses on connecting best breed of entrepreneurs, bio-innovators, venture capitalists, business model, policy-makers, academicians, support groups and business practitioners to share their insights, success and innovation. FBSB-2023 is jointly organized by PSGIAS, PSG Science & Technology Entrepreneurial Park (PSG-STEP) and Society of Chemical and Synthetic Biology (SCSB) and is supported by PSG Center for Academic Research and Excellence (PSG CARE). The program includes plenary and invited lectures, poster and oral sessions, industry exhibits, technology innovations display and networking opportunities for entrepreneurship development along with academic knowledge sharing.

Focused thematic areas are

- Bioinspired and Biomimetic materials
- Biomaterials in Drug Delivery Systems
- Bioceramics and composite materials
- Cell & Tissue Science Engineering
- 3D bioprinting of organs
- Stem cell therapeutics
- Biomedical devices (Diagnostics & Therapeutics)
- Biomolecules: Computation, Design & Evolution
- Synthetic biology and Metabolic Engineering
- Primary and Secondary metabolites
- Protein engineering including computational methods to aid the design of genetic systems
- Bioinformatics applied to gene discovery, chemoinformatics, and pathway construction

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Message from the
Managing Trustee

Biomaterials and synthetic biology are the leading research frontiers that are aimed to achieve improved living and health standards for man kind. Advancements in these area of research have lead to development of products for disease management, diagnostics, vaccines, therapeutics, tissue engineering, lab on chip etc. In this context, I am happy to know that Department of Biotechnology, PSG Institute of Advanced Studies are carrying out research to find appropriate funtional biomaterials for various biomedical and tissue engineering applications.

I am also happy to know that they are organising International Conference and Startup Summit on "Functional Biomaterials and Synthetic Biology" (FBSB-2023) during 31st August and 1st September 2023 followed by Post-conference workshop on CRISPR Technologies during 2nd September 2023 along with PSG STEP, PSG CARE and Society of Chemical and Synthetic biology (SCSB). I am sure that this conference and workshop will lead to mutual exchange of knowledge and experiences, networking and pave way for innovation and entrepreneurship in biomaterials and synthetic biology

I wish the program and organizers a grand success.

L. Gopalakrishnan
Managing Trustee
PSG Institutions

Message from the

Director Emeritus,
PSG Institute of Advanced Studies

Functional biomaterials and Synthetic biology is an interdisciplinary field that combines principles from biology, engineering, and other scientific disciplines to design, construct, and manipulate biological systems enhancing specific functions for enabling new possibilities in healthcare. With the latest advancements in technology and scientific understanding, we are on the brink of transformative breakthroughs that will revolutionize biotechnology.

The FBSB-2023 conference is a platform for intellectual exchange, collaboration, and innovation. It brings me immense pleasure to witness the convergence of brilliant minds from around the world in the realms of biomaterials and synthetic biology. I take this opportunity to appreciate the efforts put forth by the of PSGIAS Team working on development of novel functional biomaterials for tissue engineering applications.

I am also glad to know that the International Conference and Startup Summit on Functional Biomaterials and Synthetic Biology (FBSB-2023) and Post-conference workshop on CRISPR Technologies is supported by PSG Science and Entrepreneurial Park (PSG-STEP), PSG Center for Academic Research and Excellence (PSG CARE) and Science and Engineering Research Board (SERB).I am sure this conference and workshop will facilitate exchange of ideas, experiences and knowledge.

I wish the conference a grand success.

P. Radhakrishnan
Director Emeritus
PSG Institute of Advanced Studies

Message from the

Principal,

PSG College of Technology

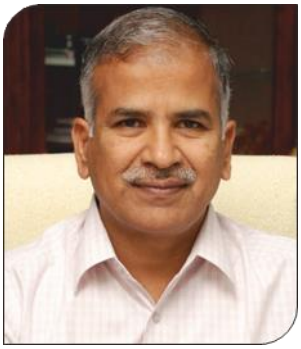
It is indeed very inspiring to know that PSG Institute of Advanced Studies, is organizing this important International Conference and Startup Summit on Functional Biomaterials and Synthetic Biology (FBSB-2023) during 31st Aug & 1st Sept 2023 and Post-Conference workshop on CRISPR Technologies during 2nd Sept 2023 along with Society of Chemical and Synthetic biology (SCSB) & PSG – STEP of PSG College of Technology. This event will cover diverse topics like, Cells and Tissue Science Engineering, Bioinspired and Biomimetic materials, Synthetic biology and Metabolic Engineering. I am sure that this conference will create a sense of interconnectedness among academicians, industrialists, young researchers and budding entrepreneurs.

I wish the international conference all success.

K. Prakasan
Principal
PSG College of Technology, India.

Message from the

Director,
PSG Center for Academic Research and Excellence



I am happy to state that PSGCARE is jointly organizing this International Conference and Startup Summit on "Functional Biomaterials and Synthetic Biology" (FBSB-2023) during 31st Aug & 1st Sept 2023 and a Post-conference workshop on CRISPR Technologies during 2nd Sept 2023 along with Society of Chemical and Synthetic biology (SCSB) and PSG- STEP.

I am sure that this conference will enlighten the participants about the advancements in functional biomaterials and synthetic biology especially the startup summit will focus on connecting best breed of entrepreneurs, bio-innovators, ventures, capitalists, business model, policy-makers, academicians, support groups and business practitioners to share their insights, success and innovation. I appreciate the efforts put forth by the organizing committee to discuss such an important area through this conference.

I wish them all success

R. Rudramoorthy
Director
PSG Center for Academic Research and Excellence, INDIA

Message from the

President,

Society of Chemical and Synthetic biology, India (SCSB)

On behalf of Society of Chemical and Synthetic biology (SCSB), I wish to submit my heartfelt appreciation to PSG Institutions for conducting this two days International Conference and Startup Summit on Functional Biomaterials and Synthetic Biology (FBSB-2023) during 31st Aug & 1st Sept 2023 and for providing SCSB opportunity to be a part of this conference and to organize a Post-conference workshop on CRISPR Technologies during 2nd Sept 2023. As the President of the Society of Chemical and Synthetic biology, I have great pleasure in extending a very warm welcome to the eminent resource persons and participants from all over the India and abroad. SCSB works on the interface of Chemistry and Biology to address the problems of a molecular biologist and has been keen in connecting young synthetic biology aspirants with other peer researchers and industry partners all over the world through annual workshops and conferences.

I am happy to be part of this FBSB-2023 conference.

L. Karthik
President
Society of Chemical and Synthetic biology, India

Message from the

Deputy Director,
PSG Institute of Advanced Studies

With immense pleasure, I am happy to inform you that we are organizing this International Conference and Startup Summit on Functional Biomaterials and Synthetic Biology (FBSB-2023) during 31st Aug & 1st Sept 2023 and Post-conference workshop on CRISPR Technologies during 2nd Sept 2023 jointly with our sister institutes under PSG Sons and Charities. This conference envisages an innovatory approach of uniting academicians, industrialists, young researchers and budding entrepreneurs to share knowledge and new ideas through interactive discussions and technical sessions. I appreciate the efforts put forth by our team in bringing together the leading researchers and entrepreneurs at national and international level to dicuss the significance of functional biomaterials through this conference. I am sure that the young researchers and students will get inspired and gains valuable information through the lead lecture delivered at this conference.

I wish this conference a grand success

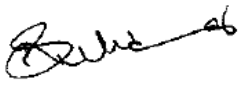
J.Kanchana
Deputy Director
PSG Institute of Advanced Studies

Message from the

Executive Director, PSG-STEP

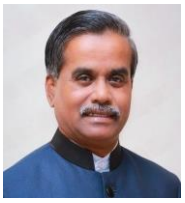
It gives us immense pleasure to be a part of this International Conference and Startup Summit on Functional Biomaterials and Synthetic Biology (FBSB-2023) during 31st Aug & 1st Sept 2023 and a Post-conference workshop on CRISPR Technologies during 2nd Sept 2023 alongwith the Team from PSGIAS, and Society of Chemical and Synthetic biology (SCSB). PSG-STEP plays a critical role in creating an enabling eco-system to promote innovation and entrepreneurship to address the social and industrial problems. The conference focuses on various areas of the upcoming field - functional biomaterials and synthetic biology. We look forward to the conversion of current research into commercially viable applications. We assure you the necessary support–technical, financial, infrastructure and other facilities for the successful development to the application. This conference is an opportunity for the young researchers, innovators, startups and investors to get to interact with various experts in the field of Biotechnology and Nanotechnology around the world to build their innovative idea into a successful product.

We wish all the participants a great success in all their endeavors.



K. Suresh Kumar
Executive Director
PSG-Science & Technology Entrepreneurial Park (PSG-STEP), INDIA

List of Speakers



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Dr. V. Naveen Kumar
Immugenix Biosciences Pvt Ltd,
Chennai

Dr. Subha Kalyaanamoorthy
University of Waterloo,
Canada

Dr. B. Deepak Thimiri Govinda Raj
CSIR,
South Africa

PLENARY LECTURE

PL-1: Use of Native Biomimicry & Synthetic Biology in Functional Biomolecule Design With Diverse Applications

Murali Panchapagesa Muthuswamy
Managing Director, Jananom Private Limited, Coimbatore
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ABSTRACT

Tropical environment in Indian sub-continent has bestowed our region with rich biodiversity and sustainable biomaterials to solve human requirements. If we harness this effectively using principles of biomimicry and leverage synthetic biology to obtain the scale for commercial requirements, India could gain an immense lead in the global biomaterials arena. This could also form a shining example of Make in India for the world theme. The present talk will focus on a case study and discussion to demonstrate the scientific approach towards this.

INVITED LECTURES

IL-1: 3D/4D Printed-Biomaterials for Personalized and Deployable Medical Devices

Kaushik Chatterjee
Professor, IISc, Bangalore
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ABSTRACT

The recent emergence of additive manufacturing/ 3D printing offers novel routes to fabricate implants and tissue scaffolds of complex architecture, which are personalized to meet the patient's needs. In this talk, I will highlight our efforts to incorporate 3D printing to process biomaterials for several biomedical applications. The first part of the talk will highlight the limitations of the as-fabricated parts of titanium parts and the innovative post-fabrication techniques developed in our group. The consequent enhancement in the biomechanical and biological performances will be showcased. Results of an ongoing clinical trial will be presented. The second part of the talk will showcase innovations in 3D printed biodegradable polymers. We have developed a novel surface engineering technique to augment the bioactivity of polylactide scaffolds post-printing. Digital light processing (DLP)-based 3D bioprinting was used to prepare cell-laden hydrogels from photopolymerizable silk fibroin and kappa-carrageenan. These 3D bioprinted gels can also used for tissue regeneration and for preparing tissue-mimetic disease models. We have been using 3D printing to study breast and lung cancers in 3D. In a more recent effort, we are preparing 3D printed polymers that undergo shape change when stimulated to yield 4D printed scaffolds and have explored for repair of peripheral nerves. Taken together, this talk will highlight the innovations in 3D printing and associated technology for clinical translation.

IL-2: Building Biomaterials through Synthetic Biology

Valappil Sisila, Mohan Indhu [a,b], Janani Radhakrishnan [a,b], Niraikulam Ayyadurai [a,b, *]
[a]*Department of Biochemistry and Biotechnology, CSIR - Central Leather Research Institute (CLRI), Chennai, Tamil Nadu – 600020, India*
[b]*Academy of Scientific and Innovative Research (AcSIR), Ghaziabad -201 002 India*
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ABSTRACT

Genetic code expansion enables directed incorporation of noncoded amino acids (NCAAs) and unnatural amino acids (UNAAs) to the active core that confers dedicated structure and function to engineered protein. Many protein biomaterials are tandem repeats that intrinsically include NCAAs generated through post-translational

modifications to execute assigned functions. Conventional geneticengineering approaches using prokaryotic systems has limited ability to biosynthesize functionally active biomaterials with NCAAs/UNAAs. Codon suppression and reassignment introduces NCAAs/UNAAs globally, redesigning engineered proteins to mimic natural matrix-cell interactions for tissue engineering. Expanding the genetic code enables the engineering of biomaterials with catechols, growth factor mimics that facilitate cell-matrix interactions, thereby expressing tissue-specific genes and proteins. Overall, this method of protein engineering shows promise for achieving tissue-informed, tissue-compliant tunable biomaterials.

IL-3: Biological and Environmental Degradation of Graphene Family Materials

Rajendra Kurapati*, Swetha K
School of Chemistry, Indian Institute of Science Education and Research Thiruvananthapuram. India
**Email ID: rkurapati@iisertvm.ac.in*

ABSTRACT

Understanding the biotransformation of nanomaterials is still at the preliminary stage, which is essential to know the fate of the nanomaterials in the organism. Poor knowledge of the biodegradability of inorganic nanomaterials (Au, Ag, etc.) affected the clinical translation of their potential biomedical products. Thus, safety assessment is indispensable for any emerging new technologies or materials to interrogate the potential environmental and health risks. More recently, the graphene family, including other 2D materials, has displayed immense potential for biomedical applications because of their high hydrophilicity and biocompatibility. Once the 2D materials are released into the environment they will be exposed to different types of organisms. However, the biodegradability of 2D materials has been poorly studied, including the effect of chemical functionalization and serum protein corona formation in blood contact with 2D materials. Herein, the biodegradability of 2D materials will be discussed; in particular, the biodegradability of graphene, graphene oxide, h-BN, MoS 2 and black phosphorus sheets will be addressed by the action of human immune cells like neutrophils as well as artificial enzymes. We also developed the “degradation-by-design” concept - how chemical functionalization enhances the

biodegradability and safety of 2D materials. Further, the biodegradation of carbon nano-onions (CNOs) is also studied using the myeloperoxidase isolated from the neutrophils. The results demonstrated that the CNOs could also be degraded by the neutrophils present in human blood. The results recapitulate that degradation of 2D materials and other carbon nanomaterials is possible in humans and could be important to design the biomedical application of 2D materials.

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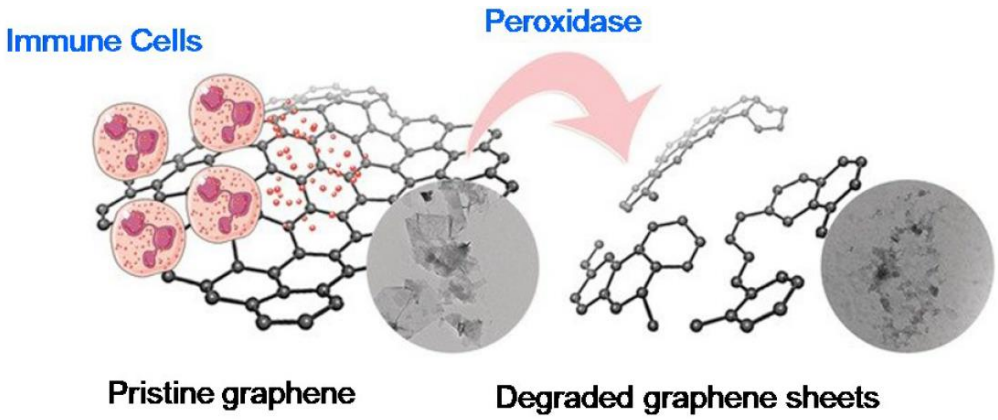

IL-4: ASSESSMENT OF ANTIVIRAL AND ANTIMICROBIAL NATURAL PRODUCTS AS POTENTIALLY THERAPEUTIC AGENTS

Pattanathu Rahman[a,b]

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ABSTRACT

Biochemicals from herbs used in traditional medicine might have a role to play in helping fight Covid-19 variants. Despite significant advancements in the administration of vaccines across the globe, concerns have grown over the capacity of new variants to escape natural and/or vaccine-induced immunity. There is a need for various treatment options for Covid-19 to slow infection rates and ease symptoms, and medicinal plants might prove to be a way forward. We found five phytocompounds could bind to the spike protein of SARS-CoV-2 and prevent the virus from entering cells and causing infection, potentially offering new avenues to prevent and treat the disease (Smith et al., 2020; Vellingiri et al., 2020; Kar et al., 2022). These findings generated a scope forfuture in vitro studies with the selected phytocompounds along with microbial biosurfactants (Figure 1) to validate their antimicrobial therapeutic potential with the collaboration of Liverpool School of Tropical Medicine. β-amyrin, curcumin, cymaroside, friedelin, quercetin, rhamnolipid, 3-β-taraxerol, moxifloxacin was tested for their antimicrobial activity on clinically important pathogens such as Pseudomonas aeruginosa, Methicillin-Resistant Staphylococcus aureus (MRSA) and Candida auris. The results revealed that no compound inhibited P. aeruginosa except for curcumin, which reduced cell viability by ~70%. Similarly, no compound inhibited MRSA, although quercetin reduced viability by ~40%. Moxifloxacin (MOX) was used as a positive control for susceptibility testing.

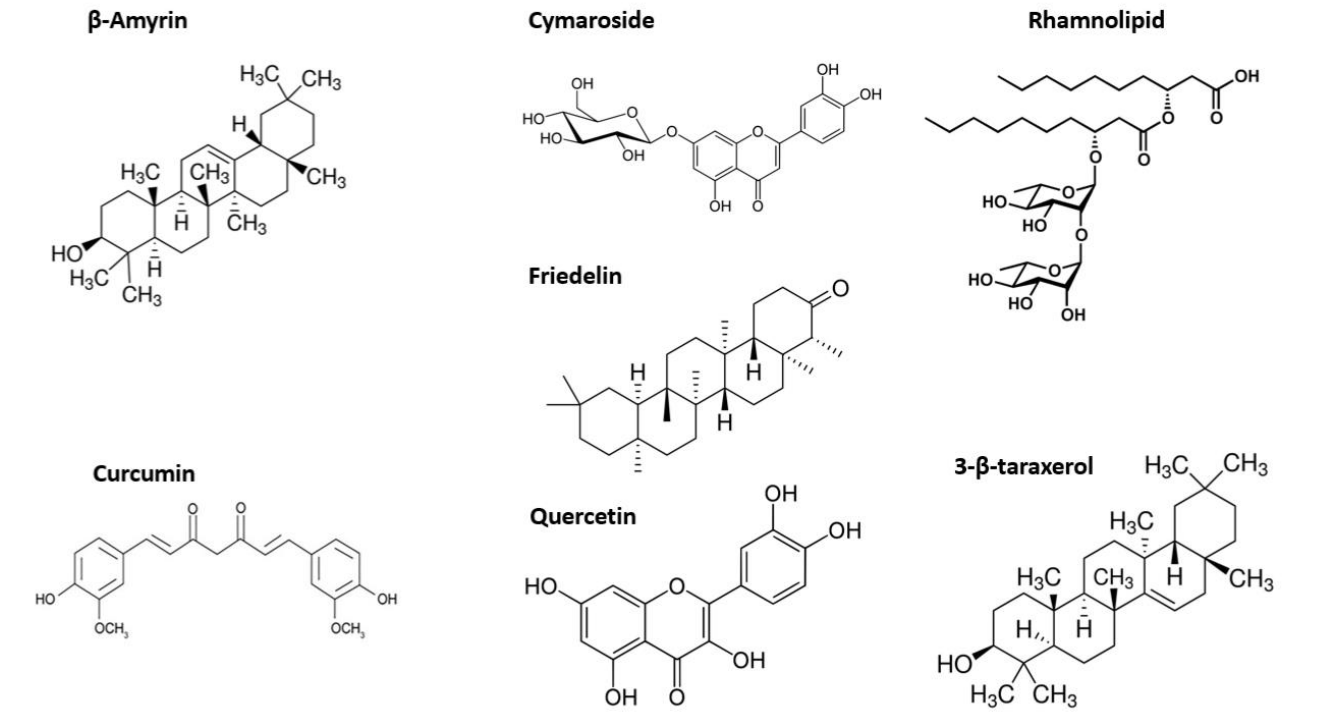

Figure 1. Structures of β-amyrin, curcumin, cymaroside, friedelin, quercetin, rhamnolipid, 3-β-taraxerol

IL-5: Advancements in Biofabrication and Bridging the Gap between Clinics and Research Labs

Piyush Padmanabhan
CEO and Co-Founder of Next Big Innovation Labs, Bangalore
Email ID: piyush@nextbiginnovationlabs.com

ABSTRACT

The leaps and bounds taken in the domain of bioprinting have been nothing short of extraordinary. The progress of research conducted in the domain is diverse and have great clinical implications. In this talk, Piyush Padmanabhan will be delving into some of the advancements made in the field of biofabrication by Next Big Innovation Labs® and by various research labs in the world. The talk will also encompass the steps we would have to take in order to translate the applications of biomaterials and biofabrication tools from the research laboratories to the surgery room.

IL-6: Harnessing the CRISPR CAS Systems for Programmable Editing of Human Gut Microbiome

V. Naveen Kumar
ImmuGenix Biosciences Pvt Ltd, Chennai-600011, Tamil Nadu, India
Email ID: naveenkumar.nsd1527@gmail.com

ABSTRACT

The modern CRISPR Cas tool in bacterial system is as an adaptive immune response for the abolition of extracellular genome or to resist the phage infection. CRISPR Cas systems have the ability to memorize, adapt and lyse the nucleic acid sequences that have been previously or newly encountered. Biomimicry approach translated the CRISPR Cas system principles to develop a key technology for genome editing and regulation in a wide range of organisms and cell types. Healthy humans live in a symbiotic relationship with trillions of microorganisms (Microbiome) that inhabit the exposed surfaces of our bodies and play an essential role in the maturation of the host-immune response, production of metabolites, brain–gut axis and many more. This close relationship makes our microbiome an interesting target for therapies with the goal to induce desired responses, immunological, metabolic or even neurological in nature. CRISPR-Cas systems can be used to modify the genome of gut microorganisms and bacteriophages. CRISPR-Cas systems can also be delivered to bacterial population and programmed to specifically eliminate members of the microbiome for the benefit of human health. The engineered CRISPR-Cas systems can be used to control gene expression and modulate the production of metabolites and proteins. These therapies can be additive therapies supplementing the host microbiota with individual strains or consortiums of bacterial species, subtractive therapies aiming to eliminate disease-causing members of the microbiome, and modulatory therapies aiming to modulate the composition or activity of the endogenous microbiome. Together these tools provide exciting opportunities to investigate the complex interplay between members of the microbiome and our bodies, and present new avenues for the development of drugs that target the microbiome.

IL-7: Functional Tissue Regeneration Using Nano-engineered Injectable Hydrogels

Janani Radhakrishnan
DBT – National Institute of Animal Biotechnology (NIAB), Hyderabad, India
Email ID: janani@niab.org.in

ABSTRACT

The major goal of tissue engineering and regenerative medicine is to restore the structural, morphological and functional features of diseased / injured tissues. Injectable in situ forming hydrogels are promising modalities that enable nanoparticles and cells / stem cells delivery, minimally invasive and fills irregular defects. Injectable biphasic semi-interpenetrating polymer networks (SIPN) hydrogel were impregnated with chondroitin sulfate (ChS) loaded zein nanoparticles (NPs) for functional cartilage restoration. The ChS impregnated microporous hydrogel demonstrated chondrocyte-matrix interaction with cell–cell clustering, spheroidal morphology, long-term proliferation, higher fold expression of cartilage-specific genes and matrix proteins as hyaline cartilage characteristics. The hydrogel was nano-engineered with ChS-NPs and nanohydroxyapatite (nHA) (~30-90 nm) in chondral and subchondral hydrogel zones of anisotropic osteochondral-mimetic gradient scaffold. In rabbit osteochondral defect model, complete closure of defect was observed by radiology and microcomputed tomography (mCT) in gradient hydrogels (8 weeks) with collagen and glycosaminoglycan deposition in neo-matrix, presence of hyaline cartilage-characteristic matrix, chondrocytes, osteoblasts, confined mineralization in subchondral bone and lateral host-tissue integration.

The injectable hydrogel was engineered to co-deliver mesenchymal stem cells (MSC) with 5-Azacytidine (5-Aza) loaded zein NPs for attenuating adverse cardiac remodeling after myocardial infarction (MI). The co-delivery of 5-Aza in hydrogel supported in vitro MSC proliferation, migration, angiogenesis and significantly increased expression of cardiac specific genes. In rat MI model, functional cardiac parameters such as cardiac output and ejection fraction was improved by co-delivering 5-Aza with MSCs. Histology showed reduced fibrosis, attenuated infarct expansion and cardiac tissue restoration and angiogenesis. Thus, injectable hydrogel systems facilitates spatial delivery of nano-carriers, co-deliver cells / stem cells to achieve functional tissue regeneration.

IL-8: Cellular Conversations at the Edge: Eph/Ephrin and Tissue Mechanics

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ABSTRACT

The establishment of sharp borders between tissue interfaces is crucial for the proper organization of organs, and in certain tissues, it underlies the formation of signalling centres that regulate the growth and patterning of adjacent tissues. The segmentation of the vertebrate hindbrain serves as a paradigmatic example of this. The hindbrain is regionalized into rhombomeres with varying identities and at the interfaces of these rhombomeres, boundary cells function as signalling centres that control the generation of new neurons. Differential mechanical tension and chemical signals have been proposed as the primary mechanisms responsible for establishing and maintaining tissue boundaries.

Eph and Ephrin transmembrane proteins play a pivotal role in mediating bidirectional cell-to-cell communication. They are known to initiate heterotypic signalling at segment borders, which is essential for enhancing border sharpening and promoting the development of boundary cells. However, the precise mechanism through which Eph/Ephrin regulate the formation of boundary cells remains elusive.

By utilizing CRISPR/Cas9 genome editing to target Eph genes, our study demonstrates that Eph/Ephrin-dependent cell-to-cell interactions at rhombomere interfaces induce mechanical changes within the neural tissue, which trigger the tissue-specific gene expression programmes required to establish tissue boundaries.

IL-9 Driving Innovations in Biofabrication and Tissue engineering with CELLINK.

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ABSTRACT

Three-dimensional (3D) printing, also referred to as additive manufacturing, is driving major innovations in the area of engineering, medicine, manufacturing, and art. Advances in this technology have enabled the fabrication of functional tissue

substitutes using biocompatible materials, cells, and supporting components. 3D bioprinting technology promises to bridge the gap between laboratory-cultured tissue constructs and native tissues and organs. Cellink's state-of-the-art extrusion and light-based bioprinters help unlock greater insights by building more complex and physiologically relevant tissue models, enabling advances in critical research areas including personalized medicine, drug discovery, regenerative medicine, and cosmetics to name a few. From printing artificial corneas for curing corneal blindness to developing wound-healing patches for delivering antibiotics, Cellink's technology impacts the future of healthcare in significant amounts. By combining the field of material science, biomechanics, sensing, and cells, our advanced bioprinters have helped in developing biohybrid soft robotics and biosensors. 4D bioprinting, an advance of 3D bioprinting technology, utilizing the dimension of time and shape on printed structure, is the most recent medical technology made possible with Cellink's technology, transforming the artificial organs and prosthetic industry. In this presentation, I will bring forward the applications of 3D bioprinting technology with recent successes and future translations in various domains.

Keywords: Hazardous wastes handling, disposal, legislative requirement, Hazardous substances management, handling of specialized/ specific wastes.

IL-10: Biomaterials & biocompatibility: an overview

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ABSTRACT

The history of biomaterials spans over 5000 years, revealing a fascinating evolution of materials designed to interact with biological systems. This conference presentation delves into the historical trajectory of biomaterials, tracing their development from ancient times to the present day. It explores the various definitions of biocompatibility that have emerged over the years, highlighting the challenges that arise due to the incomplete understanding of a crucial concept: most biocompatible material initially

causes an adverse reaction. The presentation will then move to the meaning and limitations of the definitions of bio-inert, bio-tolerated, biocompatible and bioactive, clarifying that for any material the biocompatibility is only regulated by the outermost few atomic layers, the only ones that physically touch the biological environment. Finally, a few examples of technological and medical interest will be presented and discussed: titanium and tantalum cellular solids, poly-methyl-methacrylate bone cements, polycaprolactone bioresorbable scaffolds and silicon nitride

IL- 11: Development of Rapid Detection of Salmonella Using CRISPR/Cas12A Method

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ABSTRACT

Salmonella severely threatens global human health and causes financial burden. The ability to sensitively detect Salmonella in food samples is highly valuable but remains a challenge. Herein, a sensitive detection method for Salmonella was developed by Our team using CRISPR/Cas12a system. The optimal concentration ratio of Cas12a enzyme, CRISPR RNA (crRNA) and FQ-probe was optimized. We are in the process of the development of chip based technique.

IL-12: 3D (Bio) Printing: The Art of Engineering Tissues

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ABSTRACT

3D Printing and bioprinting are pioneering technologies that enable fabrication of biomimetic, multiscale, multi-cellular tissues with highly complex tissue microenvironment, intricate cytoarchitecture, structure-function hierarchy, and tissue-specific compositional and mechanical heterogeneity. Given the huge demand for organ transplantation, coupled with limited organ donors, these technologies could solve the crisis of organ shortage by fabrication of fully-functional whole organs. This talk will briefly introduce the need for these technologies in the field of tissue engineering and its potential applications. Some of the key projects from our lab,

namely development of new ecofriendly bioinks for bioprinting of soft tissues, biomimetic bone implant design based on architected meta-materials for better biomimicry and mitigation of stress-shielding, and bioprinting of vascularized human skin tissue will be dealt with.

IL- 13: Industrial Biotechnology & Commercialization

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ABSTRACT

There are numerous challenges to commercialising biotechnology discoveries. Obtaining regulatory approval, cost, and technology are among the major barriers to commercialization. This includes not only drug approval, but also the manufacturing process. The costs of developing a products and obtaining regulatory approval for its release are enormous. Many of the start-up biotechnology companies fail or necessarily become consumed by the large pharmaceutical houses because their fail to factor the risk of not achieving approval, or at least gaining approval in a timely fashion, into their business plan. Further, they do not take an integrated approach to product and process development. For the most part emphasis has been on drug discovery. Process development has been neglected. In fact, the knowledge base for development, design, and validation exists only with the large pharmaceutical companies. Therefore, the opportunities for a start-up biotechnology company to become a full-scale drug producer are extremely rare. A deeper appreciation of these problems is needed by R&D of start-up biotech companies if they are to be successful.

IL- 14: Contactless magnetically responsive injectable hydrogel as versatile platform in regenerative medicine

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ABSTRACT

In some pathological conditions such as neuromusculoskeletal injuries or tumor removal surgery, the loss of tissue results in the radical disruption of the native tissue architecture with severe and permanent deficits and disabilities. Several well-oriented scaffolds, able to reproduce the crucial tissue microarchitecture and to sustain regenerative process, have been produced by various techniques (e.g. bioprinting, electospinning, freeze-drying), but very few have shown translational applications also due to the invasive surgery necessary to be implanted. Injectable hydrogels can be transplanted via minimally invasive injection, but usually without displaying any aligned structure.We recently developed an injectable hydrogel, with anisotropic architecture to better mimic the morphology of the native muscle by applying a static magnetic field (SMF), based on gellan gum (GG), a biocompatible and biodegradable polysaccharide, hyaluronic acid (HA) and magnetic collagen fibers (MagFib) for skeletal muscle regeneration. Moreover, hydrogels can be used for the encapsulation of both drugs and cells, overcoming the limitations of conventional drug delivery, and cell therapies.Gellan Gum hydrosol (1%), a biocompatible and biodegradable polysaccharide, was added of sodium citrate (0.1%) and hyaluronic acid (HA, 0-0.6%) can be injected at 37°C. The gelation occurs in the presence of cations (e.g. PBS, cell culture media, biological fluids) in few minutes. MagFib are prepared by mixing the 1mg/mL magnetic nanoparticles to collagen type I at pH 7.4 in different ratios, then they are added to the hydrosol. Mechanical properties were investigated. An extensive 3D in vitro cell culture was performed to study cell behavior and immunomodulation. Potential toxicity was evaluated also in vivo. Preliminary evaluation of release of drugs and extra cellular vesicles derived from mesenchymal stem cells was also evaluated.The results showed that the hydrogel could be easily extruded by a 30G needle. MagFib embedded into the hydrogels were easily aligned by a short (<10 min) application of an external static magnetic field (400mT, distance of ≈4cm). Hydrogels

exhibited good biocompatibility without affecting cell viability and morphology. Even in vivo, the hydrogel was easily injected and aligned, and no local or systemic immune reaction was detected.In conclusion, the versatility of the proposed system can be expected to find application to several different minimally invasive or endoscopic surgical interventions on different body parts that might benefit from the injection of bioactive materials, such as muscles, tendons, nerves, cartilage, ligaments, spinal cord.

IL- 15: TWIST DNA VARIANT LIBRARY – WRITING THE FUTURE PROTEIN ENGINEERING

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ABSTRACT

DNA variant libraries are essential to modern protein and metabolic engineering research. Modern, high-throughput DNA synthesis technologies have lowered the cost and improved the throughput of library synthesis, making them more accessible to both academic and biotech scientists. The utility of combinatorial libraries for discovering desired protein variants, however, depends on library quality and complexity.

Twist Bioscience's portfolio of high-quality DNA variant library formats enable exploration of a diverse range of variants. With years of molecular biology expertise and dedication to what we create, we ensure that you uncover more of what you want, and only what you want. To create custom built libraries that suit your requirements, we use Twist's proprietary silicon-based DNA synthesis platform for massively paralleled oligonucleotide synthesis to print each variant base-by-base. This enables precise synthesis of desired variants at user-defined ratios without unwanted motifs that could impact downstream processes. Using this technology, we build diverse, high-quality libraries that are just what you need to streamline your screening process, identify hits faster, and achieve higher success rates. All of the NGS-verified quality control is done in-house, ensuring that both the input and output are high-quality and clean, and that all desired variants are present.

IL-16: Intelligent and Sustainable Biomaterials and Scaffolding Technologies for Tissues Engineering and Regenerative Medicine

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ABSTRACT

Failure of the tissues or organs as a result of trauma or illness is a serious health issue that affects many people worldwide. The problem is made worse by the large discrepancy between the number of donor transplants available and those waiting for a transplant. Tissue engineering and regenerative medicine are concepts that try to create human tissue substitutes using cells, biochemical signals, and biomaterials, giving the field fresh hope. In this regard, our team at SCTIMST Trivandrum has been working on various R&D projects employing a range of intelligent and sustainable biomaterials and manufacturing techniques. The development of thermoresponsive polymers for epithelial cell sheet engineering, the biofabrication of alginate-gelatin-based 3D bioprinted skin tissue constructs, the fabrication of electrospun nanofibrous scaffolds for co-culture applications, and the preparation of optically transparent films made of silk fibroin for corneal tissue engineering applications are some of the topics that will be covered in this presentation.

Acknowledgments

The PI sincerely acknowledges all students, staff and collaborators for their immense contribution to the work presented here. Also, PI acknowledges SERB, DST and SCTIMST for funding the work through various schemes.

IL-17: Reprogramming of Escherichia coli for Biotechnological Applications

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ABSTRACT

Synthetic biology is a new emerging field that employs the application of engineering principles to biology. The recent advances in synthetic biology have led to the development of a number of synthetic circuits for wide range of applications in disease diagnostics, disease treatment, and production of biomaterials, biofuels and fine chemicals. It is defined as "design and construction of new biological parts, device and systems or redesign the exiting systems for useful purpose". The ultimate goal of synthetic biology is to program and build engineered biological systems that process information, manipulate chemicals, fabricate materials and structures, produce energy, provide food, and maintain and enhance human health and our environment. A small genetic parts such as promoter, RBS, CDS, terminator, degradation tag can be designed and also assembled together to build a circuits that can be used for production of chemicals, drugs and therapeutics. In this work, we explain about current progress and future perspective on synthetic biology along with genome editing which is currently considered as a ground-breaking technology for genome editing, regulation and also for development of a rapid, specific and sensitive diagnostic tool for detection of infectious and non-infectious diseases.

IL-18: From Proteins to Therapeutics: Computational Biochemistry Driving Discoveries

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ABSTRACT

Proteins play a vital role in various biological processes, making their characterization crucial for understanding their functions and properties. Leveraging the continuous advancement in computational methods and high-performance computing technologies, bioinformatics approaches have emerged as powerful tools in accelerating biomolecular research. The objective of this talk is to highlight our team's

efforts in the field of biocatalysis, protein engineering and drug discovery. Through the utilization of state-of-the-art computational techniques, we have successfully applied computational methods for various applications, such as probing the catalytic mechanisms of PET-hydrolysing enzymes, engineering enhanced variants of carbonic anhydrase, and identifying novel mechanisms and hits to target SARS-CoV2 main protease. The outcomes of our research have provided valuable insights into the workings of important biomolecules, paving the way for the development of novel biocatalysts and small molecule therapeutics. By demonstrating the seamless integration of computational methods with experimental approaches, this talk underscores the potential of computational biochemistry in driving ground-breaking discoveries.

IL- 19: GLOBAL BIO-FOUNDRY ALLIANCE

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ABSTRACT

Background: Global bio-foundry Alliance (GBA) has been established between countries, including the UK, US, Japan, Singapore, China, Australia, Denmark, and Canada through 16 research institutions. Global bio-foundry Alliance plays the key role in the synthetic biology drive towards a new global bioeconomy that is accelerated by advanced technology innovation. Establishment of Biofoundry program in South Africa and in Africa will plan key scientific and the strategic role in promoting synthetic biology and precision medicine program in Africa. This would further enable bioeconomy and industrial development towards SME program. At our CSIR Synthetic Biology and Precision medicine Centre, we are currently establishing biofoundry lab that will implement various synthetic biology and precision medicine projects in South Africa.

Methods: We are currently establishing two research components in the CSIR Synthetic Biology and Precision Medicine Centre Bio-foundry program which includes industrial synthetic biology and functional precision medicine program. We implement Biofoundry biodesign and biological engineering Design-Build-Test-Learn (DBTL) cycle into our industrial synthetic biology and functional precision medicine program. In our

Industrial synthetic biology program, we are working on a) ValitaCHO: Development of superior CHO cell line system for hyper-burst protein expression system using directed evolution and synthetic biology approaches; b) Lactochassis: Designer microbes for industrial synthetic biology platform applications; In our Cancer Precision Medicine program: we are working on drug repurposing based drug sensitivity screening platformfor B-cell malignancies and ovarian cancer treatment for South African patient cohort.

Results: We are currently at the Design phase of the Design-Build-Test-Learn (DBTL) cycle in our industrial synthetic biology and functional precision medicine program. We have so far have progressed in generation of the preliminary data on ValitaCHO cell-line chemstress fingerprinting profiling. We are currently designing the directed evolution approach for generation superior CHO cell line. In the Lactochassis project, we are currently designing the computational biology based genome mapping for Lactochassis. In our precision medicine platform, we are currently progressing in design and build phase of platform where we have currently procured 770 cancer drugs for drug repurposing platform which can be applied for blood and ovarian cancer cohort.

Conclusion: Using Bio-design DBTL cycle, we aim to implement our industrial synthetic biology and cancer precision medicine platform at CSIR Synthetic Biology and Precision Medicine Centre. These platforms will enable establishment of one of the first Biofoundry labs in Africa

ORAL PRESENTATIONS

OP-1: Microfluidic Enabled 3D-Printer for Bio-fabrication

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ABSTRACT

Bio-printing involves depositing materials layer-by-layer loaded with tissue mimicking environment to generate 3D structures. Bioprinter uses bio-ink which is composed of base hydrogel, cells, growth factors and crosslinking agent. The heterogeneity of tissue environments need specialised polymers to mimic the biofabrication of tissues. The use of different polymers and cell types can generate the desired tissue structure. However, challenges like the rapid printing of complex tissues like tumoroids, cartilage, and implant scaffolds with diverse cell types to mimic native tissue functionality. Single- material-based bioprinting can mimic tissue properties, but creating a heterogeneity of the tissue environment is complex. Combining multiple bio-inks with different cell types and hydrogels makes it possible to address challenges associated with reproducing tissue heterogeneity. Microfluidics manipulates and controls small amounts of fluids within microscale channels and chambers. Integration of these two technologies provides highly regulated 3D tissue constructs with multiple cell types, growth factors, and biomaterials. Herein, we develop a re-engineering technology with a 3D printer incorporated with microfluidic-based multi-cell bio fabrication (Micro-Fuse-Bio printer). The micro-Fuse-Bio printer is a novel technology controlling the flow and distribution of different cell types and biomaterials, enhancing the spatial organization and viability of the printed constructs.

Keywords: Microfluidics, Bio-Printer, Cartilage, 3D, Disease model

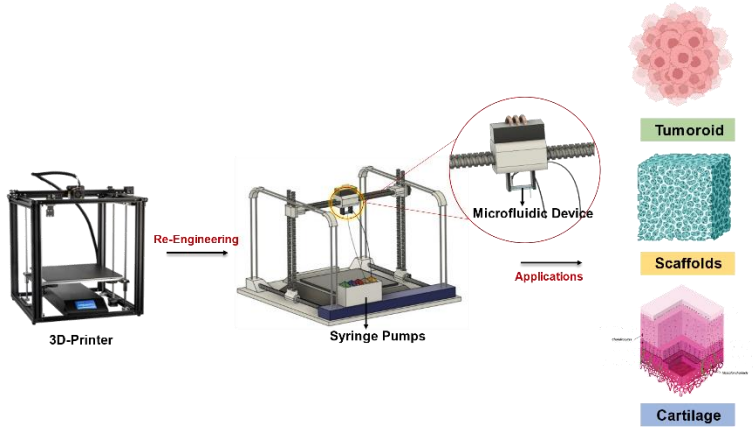

Figure: A graphical representation of the bio-fabrication using the micro-Fuse-Bio printer

OP-2: Fabrication of dual responsive drug encapsulated electrospun nanofiber for an effective wound healing

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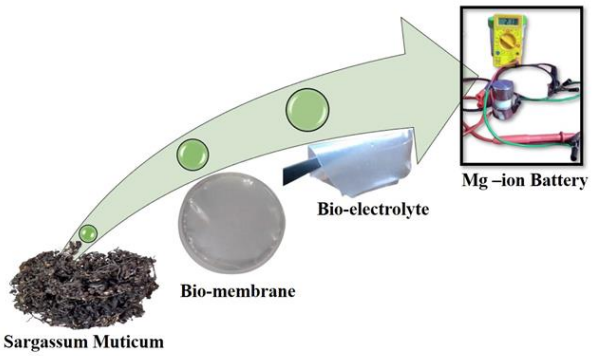
ABSTRACT

Emulsion electrospinning technology has gained a lot of interest from researchers in the development of novel nanofibrous scaffolds using a simple and flexible production procedure. It is a versatile method that offers high potential of encapsulating and delivering active ingredients within nanofibers for various applications. In this study, a polycaprolactone/polyvinyl alcohol, loaded with β-carotene and keratin hydrolysate as a sophisticated wound healing material was fabricated. The electrospinning parameters for the fabrication of nanofibers, and the morphological, chemical, thermal and mechanical properties of the resulting fibres were evaluated. An *in vitro* drug release studies revealed a prolonged release profiles and lower burst release rates of β-carotene. The degradation kinetics of the developed nanofiber were studied for 21 days and were found suitable for skin tissue engineering. The antioxidant capacity of the

composite material was assessed using the DPPH and ABTS assays. Cytotoxicity studies performed *in vitro* using cell lines showed that the developed electrospun nanofiber matrix did not show any negative impact on the growth of endothelial and fibroblast cells. Interestingly, β-carotene and keratin hydrolysate, which were delivered through nanofiber, had supported the cell proliferation. In conclusion, this study showed the potential of electrospun fibres derived from emulsions and it could be employed in wound healing when infused with β-carotene and keratin hydrolysate.

Keywords: Emulsion electrospinning, Encapsulation, Keratin hydrolysate, β-carotene, Nanofibrous biomaterial, Accelerated wound healing



OP-3: Investigating the Efficacy of Propolis-based Wound Healing Patches: Chemical Analysis, Cell Viability, and Patch Characterization.

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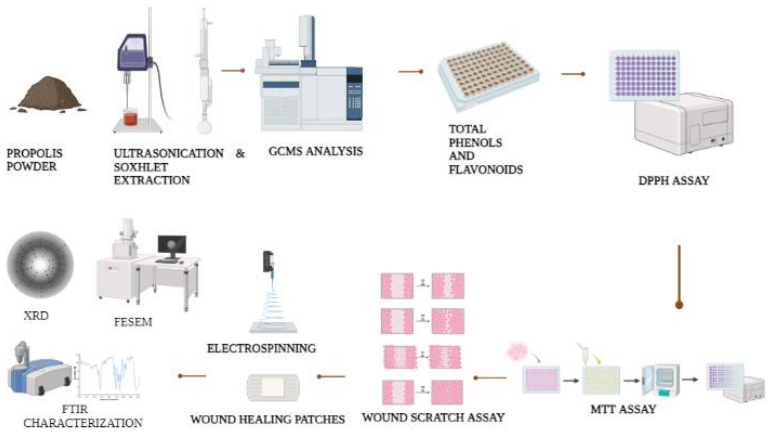
ABSTRACT

Wound healing interferes with myriad factors in most living beings. It also demands a solution, so this study outlines the probable effects of propolis to investigate its

efficiency in the wound healing firm. Propolis, also known as bee glue, is one of the finest by-products of honey bees. It treats many infectious diseases, is utilized in the biopharmaceutical industry, and has beneficial aids for humans. The analysis of its chemical components by Gas chromatography-mass spectrometry (GC/MS) detects the profound bioactive compounds present in the propolis with its concentration; moreover, the phytochemical screening of total phenolic and flavonoid contents in the sample. Other assays were also conducted anti-oxidant, cell viability, and wound scratch healing assay in the 3T3 mouse fibroblast. These exhibit the promising potential of the crude extract. The fabrication of propolis with chitosan and Polyvinyl alcohol (PVA) for wound healing patches yielded. Its further characterization includes X-Ray Diffraction (XRD), Fourier transform infrared (FTIR), and Field Emission Scanning Electron Microscopy (FESEM) for structural, chemical, and physical analysis of the procured patch. This study bears the outcome on the production of wound healing patches from propolis crude extract by employing the technology from tissue engineering.

Keywords: Propolis, 3T3 Cell line, Cell viability, Cell migration, Electrospinning, Wound healing patch



Overview of propolis patch fabrication.

OP-4: *In vitro* studies on Genistein incorporated Collagen-Fibrin Scaffold for Bone Tissue Regeneration

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ABSTRACT

Bone repair is complicated by bone trauma, tumors, and unintentional damage, which frequently results in slow bone regeneration. The use of tissue engineering concepts has come from the intense effort currently being made to improve bone regeneration. In tissue engineering, the extracellular matrix's constituent parts—which are crucial in aiding the development of new tissue—are replicated using biomaterials. Biomaterial must have great biocompatibility and biodegradability for tissue engineering to be successful. The construction of a collagen and fibrin scaffold that is combined with genistein and then cross-linked with genipin is the focus of the current investigation. The integration of genistein was confirmed through physical characterisation of the constructed scaffold using Fourier-Transform Infra-Red Spectroscopy (FTIR), and additional information was provided by Thermogravimetric Analysis (TGA) and Scanning Electron Microscopy (SEM) analysis. With genipin, the scaffold showed a 59.77% crosslinking percentage. Following biochemical evaluations revealed that the scaffold's porosity was 12.5%. MTT assay and Live/Dead cell labeling were used in *in vitro* analyses to show that naturally derived drugs were compatible with cells. Analysis of Alizarin red staining was also done. The scaffold will also have its biodegradability and osteogenic capacity for *in vitro* bone regeneration capability. Future animal model validation was necessary and was warranted in the future.

Keywords: Bone regeneration, collagen, fibrin, Genistein.

OP-5: Proangiogenic Cyclic Peptide Nanotubes for Diabetic Wound Healing

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ABSTRACT

Chronic wounds pose a significant global issue, since they account for around 2% to 3% of healthcare expenditures in the developed nations. Wound healing is hindered by a multitude of systemic and local factors, including bacterial infections, elevated ROS levels, degradation of growth factors, metabolic diseases like diabetes and impaired angiogenesis. Angiogenesis facilitates the supply of nutrients and oxygen to cells, hence playing a significant role in tissue regeneration. The framework for angiogenic signals by endothelial cells is composed of structural proteins found in the extracellular matrix, as well as growth factors such as VEGF, FGF-2, and glycosaminoglycans. The understanding of the interplay among these biomolecules can provide a basis for the development of synthetic biomaterials capable of promoting angiogenesis. Several proangiogenic strategies have been proposed in the literature, such as the modulation of inflammatory cells, administration of angiogenesis-related growth factors, transplantation of mesenchymal stem cells, and gene therapy. Nevertheless, their translation to the clinics is rare because of various constraints, including suboptimal gene conversion, immunological and inflammatory responses.Recent research has shown significant advantages associated with the utilization of functional peptides. Therefore, We developed cyclic peptide nanotubes (CPNTs) that mimic heparan sulphate proteoglycan to stimulate angiogenesis. Heparan sulfate proteoglycans possess the ability to interact with the proangiogenic growth factors as well as their corresponding receptors. This approach eliminates the need for external growth factors. We synthesized cyclic-hexapeptides having amine side chains functionalized with sulphate groups, such as, ^{D}Pro-^{L}Trp-^{D}Leu-^{L}Ser-^{D}Glu-^{L}Lys, ^{D}Pro-^{L}Trp-^{D}Leu-^{L}Lys-^{D}Glu-^{L}Lys, and ^{D}Pro-^{L}Glu-^{D}Leu-^{L}Lys-^{D}Phe-^{L}Lys. CPs self-assembled into nanotubes using pH-switching. Morphology was assessed using FE-SEM, and secondary β-sheet structure was validated by FT-IR spectroscopy. DLS measures

CPNTs sizes at 234-325 nm. Nanotubes were cytocompatible with murine fibroblast L929 and human umbilical vein endothelial cells, according to MTT and Live/dead assays. After 24 hours of CPNTs incubation with L929 cells, DCFDA test showed no ROS stress. The gene expression profile of pro-inflammatory cytokines (IL6, IL-1, MCP-1, MHC-II, TNF) in mouse macrophage RAW264.7 cells showed no immunotoxicity. In the presence of CPNTs, L929 (>95%) and human umbilical vein endothelial (>80%) cell lines showed considerable wound healing in 48 h as observed by scratch assay. The enhanced expression of proangiogenic genes VEGF, FGF2, Zeb1, eNOS, EGF, vWF, and CD31 in HUVECs was also observed under normal and hyperglycemic conditions. Protein expression was evaluated by western blotting. CPNTs under hyperglycemic conditions were examined for proangiogenic abilities like tube formation, cell migration, and invasion on HUVECs. In summary, a novel biomaterial has been developed that demonstrates its ability to induce angiogenesis without the exogenous administration of growth factors, stem cells, or drugs.

Keywords: Cyclic peptides, Cyclic peptide nanotubes, Angiogenesis, Chronic wound healing, hyperglycemia

OP-6: Engineered osteopromotive protein based biomimetic material to promote osteogenesis coupled angiogenesis of bone tissue

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ABSTRACT

Bone defects, shortage of bone matrix caused due to accidental factors, disease (osteoarthritis, osteoporosis, bacterial infections and primary tumor resection), orthopaedic surgery which often leads to non-union, delayed healing and local bodily dysfunction. Conventionally, vascularized autologous tissue sections have been a golden standard augmentation for treating bone defects, since it has a barrier to limit utilization such as donor site morbidity, limited availability, a requirement of a second

surgery, long hospital stay and impaired damaged tissue. On the other hand, animal derived protein has been envisaged as a pre-dominant material to develop a biomaterial for tissue regeneration. However, it lacks to address batch-to-batch variation and pathogenicity. Interestingly, our lab has developed a collagen like protein (CLP), which does not require post-translational modification and it is a non-cytotoxic and non-immunogenic cross-linkable biomaterial lacking biologically active sites making it a convenient "blank slate" for manipulation. This feature makes CLP the "next generation collagen" which could be altered based on the patient's need or end use application. Genetic code expansion enables the incorporation of non proteinogenic/ unnatural amino acids (UAA) in collagen to improve its stability, substrate specificity, and conjugation with drug molecules. UAAs are non-proteinogenic amino acids that are either synthesized chemically or naturally occurring, which contain a vast variety of functional groups to enhance the functions and biological applications of collagen. The present work reports a new route to prepare "smart biomaterial" by mimicking long-acting cellular growth factor showed enhanced cell-material interactions by promoting cell proliferation and angiogenesis. For that reactive non-proteogenic amino acid, 3,4- dihydroxyphenylalanine (DOPA) genetically introduced into the intrinsic triple-helical hierarchical structure forming protein to initiated hierarchical self-assembly to form macromolecular structure. The self-assembled scaffold displayed vascular endothelial growth factor mimicking the pro-angiogenic reactive group for repairing and remodelling of damaged tissue cells. Here, we customized the recombinant collagen-like protein (CLP) with DOPA to promote rapid wound healing and cell migrations. Selective incorporation of catechol in variable and C-terminal region of CLP enhanced interaction between inter and intra triplehelical collagen molecules that resulted in a structure resembling higher-order native collagen fibril. Turbidity analysis indicated that the triple-helical CLP self-assembled at neutral pH via catechol intra-crosslinking mechanism. After self-assembly, only DOPA encoded CLP formed branched filamentous structures suggesting catechol mediated network coordination. The catechol encoded CLP also acted as a "smart material" by mimicking long-acting cellular growth factor showed enhanced cell-material interactions by promoting cell proliferation and angiogenesis. It eliminates release rate, stability, and shelf-life of hybrid growth factor conjugated

biomaterials. The newly synthesized CLP has the potential to promote accelerated cell migration, pro-angiogenesis, and biocompatibility and could be used in the field of bone tissue engineering

Key words: collagen like protein, 3,4 dihydroxyphenylalanine, unnatural amino acid, osteogenesis and angiogenesis

OP-7: *In vitro* screening of chitosan mediated copper nanoconjugates synthesized from *Azadirachta indica* and its ability to function as a potential inhibitor of tuberculosis

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ABSTRACT

Tuberculosis (TB) is a chronic infectious disease that is caused by *Mycobacterium tuberculosis* and it generally affects the lungs. The drugs used in the treatment of this disease can lead to complications such as drug induced liver toxicity due to its prolonged usage and also multi drug resistant TB resulting in low efficiency. Drugs derived from natural sources have played a vital role in disease prevention and treatment since ancient times. Nanoparticles (NP) are known for their large surface to volume ratio owing to their small sizes and are being used successfully to treat a number of diseases. The present study focuses on the green synthesis of copper nanoparticles from the aqueous extract of *Azadirachta indica* and its characterization by UV spectroscopy, FTIR, SEM-EDX and Zeta potential analysis. The nanoparticles were then conjugated with chitosan which is a commonly used biopolymer and both the herbal nanoparticles (NP) and nanoconjugates (NC) were tested for its ability to inhibit the growth of the *Mycobacterium tuberculosis* strain H37Rv by broth microdilution method. The results indicated that the copper NC were able to inhibit the growth of *M. tuberculosis* at a lower minimum inhibitory concentration (MIC) of 125 µg/ml as compared to the copper NP which showed a MIC of 250 µg/ml indicating

that the chitosan mediated copper nanoconjugate could be a potential drug candidate in the treatment of tuberculosis.

Keywords: Tuberculosis, herbal copper nanoparticles, nanoconjugates

OP-8: Engineering *Escherichia coli* to sense the ciprofloxacin in the environment

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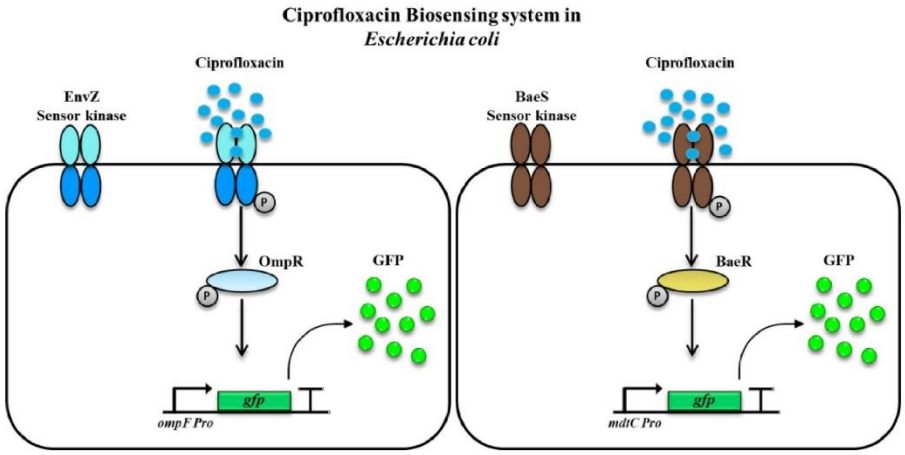
ABSTRACT

AMR is increasing globally in both developing and developed countries. WHO suggests antimicrobial resistance (AMR) as one of the top 10 global public health threats. The resistance level to a broad spectrum of antibiotics is rising every year by 5% to 10%. More than 70% of isolates of *Escherichia coli*, *Klebsiella pneumoniae,* and *Acinetobacter baumanni* and nearly half of all the *Pseudomonas aeruginosa* were resistant to antibiotics like fluoroquinolones. Bacterial-based biosensors are the potential and promising agents for environmental diagnostics as synthetic genetic circuits can be introduced into *E. coli* to achieve the desired sensing properties. In this study, we designed and applied a molecular biosensor for fluoroquinolone antibiotic namely ciprofloxacin. The bacteria utilize the two-component system to sense the changes in the environment by multiple signal components including antibiotics and control the gene expression in response to the changes in the signal molecules. *ompF* and *mdtC* promoters were selected from the genetic circuit of the EnvZ/OmpR and BaeSR two-component system and used green fluorescence protein to generate a signal from the constructed biosensor. The biosensor efficiently senses the ciprofloxacin with the calculated detection of 10ng respectively and is shown to be a sensitive and effective antibiotic monitoring system.

Keywords: *Escherichia coli*, ciprofloxacin, GFP, qRT-PCR, TCS, gene expression.



OP-9: AptaSteles: A Comprehensive Aptamer-Based Diagnostic Kit for Simplified PCOS Detection based on Biomarker Quantification

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ABSTRACT

Polycystic ovarian syndrome (PCOS) stands as the most prevalent reproductive disorder among women and is linked to cardiometabolic risk elements like type 2 diabetes, potentially elevating vulnerabilities to additional conditions such as endometrial cancer and non-alcoholic fatty liver disease. The current diagnostic methods are based on multiple criteria established across various medical boards, of which Rotterdam criteria are the most prevalent. To diagnose PCOS using the Rotterdam criteria, women need to fulfil a minimum of two of the following: irregular ovulation, hyperandrogenism, or polycystic ovary morphology. Exclusion of similar disorders is also crucial prior to confirming the diagnosis by the clinician. These challenges underscore the necessity for employing more simplified diagnostic methods for identifying PCOS. In this study, we present AptaSteles, an aptamer-based diagnostic kit for PCOS. This kit enables the quantification of specific biomarkers,

encompassing proteins, hormones, and microRNAs, within blood samples. The obtained results are then evaluated against a defined threshold value, thereby furnishing the user with information about their susceptibility to the syndrome. Aptamers are short oligonucleotide sequences which can specifically bind and detect biomarkers giving a corresponding fluorescent signal. Our detection kit comprises two detection modules. MicroRNA detection relies on fluorescent aptamer sensors for tracking miRNAs (FASTmiR) technique and miRNA recombinase polymerase amplification (miRPA). Protein and hormone detection is based on the dual aptamer approach involving two aptamers- one for biomarker binding and the other for fluorescence signalling. These individual modules are integrated onto a microfluidic chip. This compact platform, complemented by dedicated components for optical detection and data processing, constitutes the essential hardware configuration. We were able to validate most of our FASTmiR designs in-silico and wet-lab experiments consolidated some of our designs.

Keywords: Polycystic ovarian syndrome, Rotterdam criteria, Aptamer, Blood based biomarkers, Fluorescent signal, Fastmir, Mirpa, Dual aptamer, Microfluidic chip, Optical detection

References

Wiencek, J., McCartney, C., Chang, A., Straseski, J., Auchus, R., & Woodworth, A. (2019). Challenges in the Assessment and Diagnosis of Polycystic Ovary Syndrome.. Clinical chemistry, 65 3, 370-377. https://doi.org/10.1373/clinchem.2017.284331.

OP-10: Overexpression and regulation of carboxydotrophic metabolism for efficient syngas fermentation

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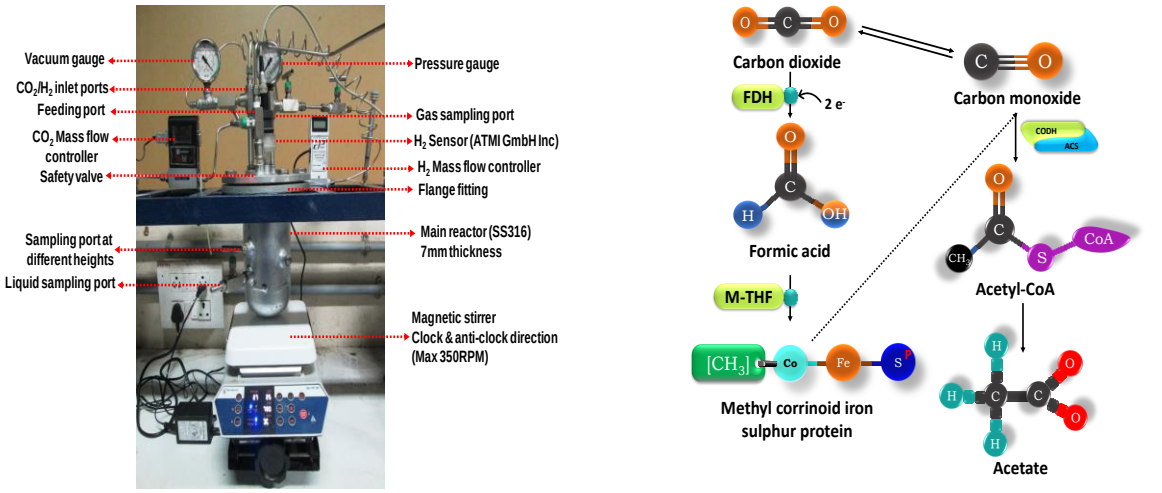
ABSTRACT

Carboxydotrophic mediated syngas fermentation in the current study aimed to regulate the Wood–Ljungdahl pathway (WLP) enzymes (CODH/ACS) for effective bioconversion of syngas into C2-C4 chemicals. The role of the headspace pressurised C1 gas supplementation along with additional H2 on carboxydotrophic metabolism will be evaluated. In-situ fabricated High-pressure gas fermenters (HPGF) will be going set up for the pressured experimental operation. Six different gas fermenters will be operated with varied head space pressure viz 2 bar (PF-2), 3 bar (PF-3), 5 bar (PF-5) and with electrode interventions PEF-2, PEF-3, and PEF-5. Along with syngas, additional H2 gas will be supplemented in (3:1) as an electron donor for C1 gas conversions. A control set of the experiment was designed with the similar L/D ratio without applied gas pressure will be used for the atmospheric control conditions. Previously treated enriched culture was used as the seed culture for all experimental conditions. A phosphate buffer (7.8 pH) along with reducing agents (L-Cysteine) acts as the growth medium for consortia. Higher productivity was observed with PEF-5 having 4 g/L acetic acid. Along with the enzyme regulation studies, profile of the biobased products in the medium will be analysed at regular intervals of time and pressure drop will be notified to predict the role of the headspace supplementation on syngas fermentation. The metagenomic analysis will be performed in both conditions to know the diversity changes in the different experimental conditions. Selected genes overexpressed using the gateway cloning approach further.

Keywords: Syngas fermentation, Enzyme regulation, Overexpression, Genomic taxon, Metabolic shift



High-Pressure gas fermenters and WL pathway

OP-11: Enhanced production of Nattokinase by *Bacillus sp.* isolated from fermented food products

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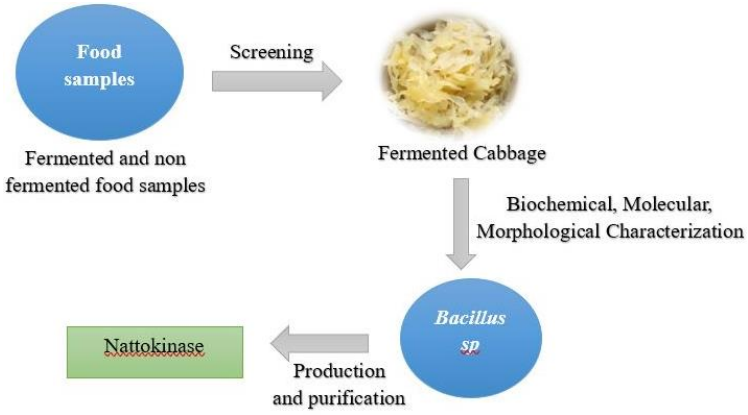
ABSTRACT

Nattokinase has gained attention in recent times due to its potential health benefits and applications, particularly for cardiovascular issues. Nattokinase has fibrinolytic activity and is most employed among several thrombolytic agents because of its low-cost production. The objective of the study was to enhance the production of nattokinase. In this study six different fermented and non-fermented food samples were screened for bacteria producing fibrinolytic protease. Out of twelve isolates screened, six strains were found to be potent protease producers. Among the six isolates, RK 6, derived from fermented cabbage, showed maximum fibrinolytic activity. Based on the morphological, biochemical and molecular characterization, the strain was identified as *Bacillus sp.* This study indicated that the maximum production was achieved under culture conditions when sucrose and ammonium chloride were used as carbon and nitrogen source at a pH of 10, an inoculum size of 2 µl and an incubation temperature of 37°C. The enzyme was purified by gel filtration

chromatography. The purified enzyme was found to have a molecular mass of 29kDa which also showed maximum fibrinolytic activity of 88.7% and exhibited a high yield of 11.05%. As a result, the study summarizes about the enhanced production of nattokinase by *Bacillus sp.* isolated from fermented cabbage.

Keywords: Nattokinase, clot busters, cardiovascular diseases, fibrinolytic enzyme, fermented food



Nattokinase Production

OP-12: Whole exome sequencing identifies novel variants in *CDH23* and *WFS1* genes associated with profound sensorineural hearing loss in the third degree of consanguinity

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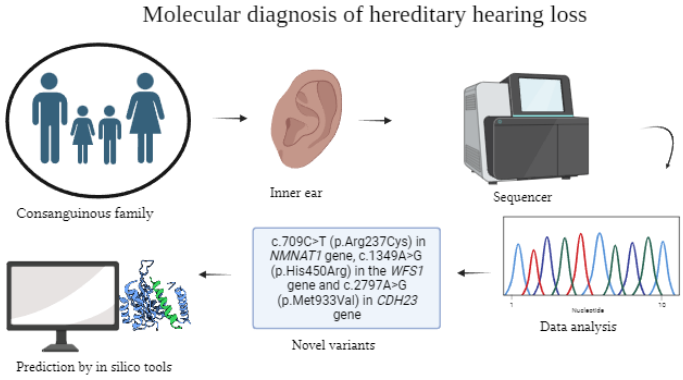
ABSTRACT

Importance: Hereditary hearing loss (HHL) is the most common genetic disorder, particularly among children. Nearly 120 genes have been identified, are associated

with auditory impairment. Even though, the disease is clinically and genetically complex, the chances of identifying deafness causing loci increases among the consanguineous families. The study emphasizes the phenotypic and genetic complexity of inherited Hearing loss in a South Indian consanguineous family. **Methods**: Whole exome sequencing was performed to identify the genetic variants underlying profound hearing loss in affected individuals of a family with two generations of third-degree consanguineous practice. **Results:** We identified pathogenic c.709C>T (p.Arg237Cys) in *NMNAT1* gene, along with novel missense variants c.1349A>G (p.His450Arg) in the *WFS1* gene and c.2797A>G (p.Met933Val) in *CDH23* gene. We predicted that the effects of variants in the genes of WFS1, CDH23 was found to be benign meanwhile *NMNAT1* variant showed high pathogenicity with the help of various in silico tools. **Conclusion:** The study highlights the genetic heterogeneity of hearing loss in consanguineous families and also suggesting whole exome sequencing would be a suitable technique for understanding the molecular mechanism and identifying the causative genes associated with disease phenotypes in consanguineous families.

Keywords: Sensorineural hearing loss, 3°consanguineous marriage, Genetic predisposition, *CDH23*, *WFS1*



OP-13: Quinone reductase activatable transmembrane ion transporter systems as prodrugs for targeted cancer therapy

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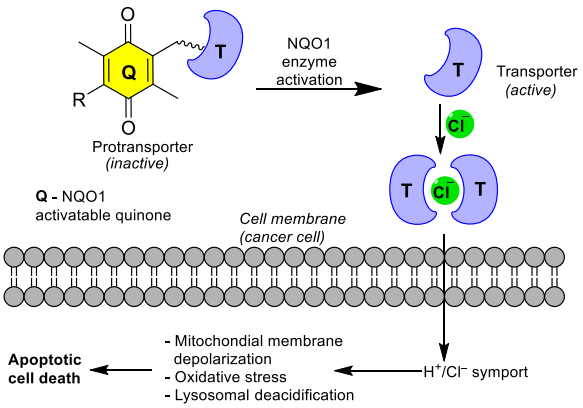
ABSTRACT

Targeted therapies using prodrugs eliminates the problem of off target activity and side effects which limits traditional chemotherapy. Yet this has failed to gain precedence due to the acquisition of resistance to the released drug from mutations in their target proteins. To overcome this limitation, we proposed the use of transmembrane ion transport systems capable of inducing cell death by destabilizing cellular ion balance, a non-target approach, as alternatives to traditional drugs. In this work, a salicylamide based H^+/Cl^- cotransporter was made into the prodrug (protransporter) form by tagging quinone based groups activatable by the NQO1 enzyme, which is vital for cell protection and overexpressed in cancer cells. Salicylamide transporters were synthesized and transport activity assessed in artificial liposomes, which showed them to be capable of H^+/Cl^- cotransport. The transport activity was caged by attachment of two different quinone based systems capable of activation by NQO1 to obtain the protransporters. The activation of these protransporters in the presence of NQO1 enzyme was verified through NMR, HRMS and HPLC analyses. *In vitro* studies of the protransporter systems showed them to be selectively toxic towards the MCF-7 breast cancer cell line over the non-cancerous MEF cell line. Mechanistic studies in MCF-7 cells indicated the compounds mediated apoptotic cell death via ion homeostasis destabilization-induced mitochondrial membrane depolarization, oxidative stress induction and lysosomal deacidification.

Keywords: Targeted therapy, Ion transport, Enzyme activation, prodrug



Protransporter activation in cancer cells

OP-14: Statistical approach for the production media optimization of VS *Serratia marcescens* isolated from soil

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ABSTRACT

Serratiopeptidase or serrapeptase is an anti-inflammatory enzyme produced by a Gram negative, Bacilli called *Serratia marcescens* which has immense application in medical and pharmaceutical industry. These microorganisms naturally produce serratiopeptidase, an enzyme with potent anti-inflammatory and proteolytic property. The organism and its ability to produce the enzyme acts as a key area in research related to microbial enzymology. The HPLC results and HRBC stabilization study confirmed the presence of serrapeptase in VS *Serratia marcescens.* The growth pattern of VS *Serratia marcescens* was deeply studied and the kinetics showed a maximum enzyme activity was at 24th hour. Nutrients like carbon and nitrogen along with temperature and pH was optimized. It which showed maximum activity of enzyme with maltose and peptone at pH 7 and temperature at 50°C. The production rate of serrapeptase was improved by one factor optimization and further statistically evaluated using Response Surface Methodology. There observed a significant increase in the production rate of serrapeptase produced by VS *Serratia marcescens*. Furthermore, significant enhancement in enzyme production was achieved by physical and chemical mutations. The current study emphasis on increasing the production

rate of this enzyme produced by soil isolate, VS *Serratia marcescens.* Bioprocess optimization, down processing and purification techniques are employed to isolate and purify serratiopeptidase from fermentation broth. The enzyme finds application pharmaceuticals, medicine, and healthcare, due to its therapeutic benefits on inflammation. The study focuses on evaluating the potential of a less exploited strain *Serratia marcescens* for its ability to produce the highly demandable serrapeptase enzyme.

Keywords: serratiopeptidase, *Serratia marcescens*, anti-inflammatory, RSM, optimization

OP-15: Therapeutic evaluation of *Achyranthes aspera's* lead compound and levodopa on mapk8 gene responsible in parkinson's disease

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ABSTRACT

The plant species *Achyranthes aspera* belongs to the Amaranthaceae family. Due to its widespread use by ethnic communities as a treatment for a variety of ailments, *Achyranthes aspera L.* is a very significant folk herbal medicinal plant. It grows as a typical weed in a lot of places. It is used as a cough remedy, is effective in treating piles and boils, and is renowned for its wound-healing abilities. The plant was collected and powdered. The sample was extracted with ethanol, and the extract is being analysed. On performing the phytochemical analysis, majority of the phytochemicals were identified. After the phytochemical analysis the ethanolic extract was sent to Gas Chromatography with Mass Spectroscopy for the analysis of compounds present in it. Then some of the bioactive compounds were selected and subjected to ADMET analysis, of which 10 compounds were found to be potentially

bioactive. These 10 potentially bioactive compounds were docked against the MAPK 8 protein, one of the genes responsible for Parkinson's disease, along with levodopa, a standard drug for treating the condition. The analysis then revealed 1,6-Octadiene to have a better binding energy than other bioactive compounds. Therefore, we draw the conclusion that 1,6-Octadiene can be employed as a synergic chemical in combination with levodopa in future clinical studies to boost the effectiveness of treating Parkinson's disease.

Keywords: *Achyranthes aspera*, ns-snp, MAPK8, Molecular Docking, Molecular Dynamics Simulation

OP-16: Comprehensive assessment of *Achyranthes aspera*: a promising traditional medicinal plant with diverse bioactive properties

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ABSTRACT

Achyranthes aspera, an Amaranthaceae plant, is well-known in traditional herbal medicine for its multiple medical advantages. However, much of its medicinal potential remains unexplored. In this study, we investigated the medicinal properties of *Achyranthes aspera*, including its antibacterial and antifungal activities, as well as its bioactive qualities such as antioxidant and anti-diabetic effects. The whole plant material was collected, dried, and powdered before being extracted using hexane, ethanol, and water in that order. According to phytochemical study, the ethanolic extract has more phytochemical components than the other extracts. Notably, the ethanolic extract exhibited the presence of bioactive phytochemicals such as saponins, flavonoids, coumarin, alkaloids, and tannins. HPTLC fingerprint analysis and qualitative analysis of ethanolic extract of *Achyranthes aspera* were carried out using

modern analytical techniques. There were at least 5 peaks exhibiting various components. The antibacterial assay demonstrated the potential inhibitory properties of the tested compounds against pathogenic bacteria, *Klebsiella pneumoniae* among the other three bacterias. However, the antifungal testing yielded negative results against *Candida albicans* and *Aspergillus niger*. Additionally, the plant extract showed significant antioxidant activity as determined by the DPPH and FRAP assays, with a maximum inhibition of 62.31% observed at a concentration 100 µg/ml. These findings highlight the promising therapeutic potential of ethanolic extract of *Achyranthes aspera*, which contains a variety of bioactive compounds and has significant antibacterial, and antioxidant properties. These findings suggest more investigation into the possible use of *Achyranthes aspera* as a beneficial medicinal agent in various human diseases.

Keywords: *Achyranthes aspera*, Phytochemical analysis, Antifungal activity, Antibacterial activity, Antioxidant activity.

OP-17: A comparative study of rapamycin's cytotoxicity in various cancer cell lines: MC63, MCF7, H9C2, A549 and HeLa cancer cell line

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ABSTRACT

This study delves into the potential of rapamycin as an anti-cancer agent through a comparative lens. The cytotoxic effects of rapamycin were assessed across multiple cancer cell lines, with A549 cells showing the most significant response a viability reduction to 31%. Notably, rapamycin treatment induced a remarkable increase in reactive oxygen species (ROS) levels within A549 cells. Furthermore, Fluorescence-Activated Cell Sorting (FACS) analysis unveiled rapamycin's role in triggering cell cycle arrest and apoptosis specifically in the A549 cell line. These findings underscore the targeted effectiveness of rapamycin against this particular cancer type, accentuating

its potential as a valuable therapeutic option. Such insights from comparative studies are pivotal in refining cancer treatment strategies for enhanced precision and efficacy.

Keywords: Rapamycin, Cytotoxic effect, Fluorescence-Activated Cell Sorting (FACS), Reactive oxygen species (ROS), Apoptosis and Cell cycle arrest

OP-18: *Bacillus spp.* isolated from intestine of *Oreochromis mossambicus*: Identifying a novel probiotic for Tilapia culture

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ABSTRACT

Oreochromis mossambicus is a commercially significant species of the cichlid family due to its richness in micro and macronutrients, adaptability and feed efficacy. Management of pathogenic infections and availability of healthy fingerlings are two major challenges faced by the tilapia farmers at present. The current research was conducted to identify a potent bacterial strain from the intestine of *O. mossambicus* with active probiotic properties. A potent *Bacillus* strain that surpassed the safety assessments and exhibited antagonistic activity against the potential aquaculture pathogens, *Staphylococcus aureus, pseudomonas aeruginosa* and *Bacillus cereus* were selected for determination of specific probiotic properties. The strain was tolerant to 0.3% bile, low pH (pH-2) and 5% NaCl concentrations, substantiating its potential to survive the hostile gut environment of the host. Additionally, the strain exhibited adherence capacity, that was confirmed by auto aggregation and hydrophobicity assays. It showed 63±3.32%. hydrophobicity and 56.65±1.65% auto aggregation in spectrophotometric studies. Moreover, it also demonstrated proteolytic activity that could benefit the host in the digestion processes. As the strain exhibited desirable probiotic traits, it was subjected to molecular characterization and identified as *Bacillus tropicus ACS1*. Further research is warranted to elucidate its complete potential in promoting the health, immunity and productivity of aquaculture industries.

Keywords: Probiotic; Bacillus; Tilapia; Aquaculture; Growth promotion; Pathogens

OP-19: Exploring the antibacterial activity of plantaricin produced by *Lactobacillus plantarum* isolated from fermented drink toddy

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ABSTRACT

The nutritionally rich Toddy is a popular fermented drink in India. Fermented food and beverage contain Lactic acid bacteria (LAB) which has the ability to produce bacteriocin. Bacteriocins are natural peptides produced by LAB, which aim to inhibit the growth of other bacteria. This study aims to isolate, purify and characterize the bacteriocin, plantaricin produced by the *Lactobacillus plantarum* from a fermented drink Toddy. Dosa batter and toddy were the two samples collected and a total of 7 isolates were obtained from the samples. The bacteriocin produced from LAB isolates were subjected to well diffusion assay to screen the antibacterial activity against common food borne pathogens such as *Staphylococcus aureus* (MTCC3160), *Pseudomonas aeruginosa* (MTCC2582), *Klebsiella pneumoniae* (MTCC2653) and *Bacillus cereus* (MTCC121). The strain VITAMT03 showed potent activity against bacterial pathogens. Based on the morphological, biochemical and molecular characterization, the potent strain VITAMT03 was identified as *Lactobacillus plantarum*. Further the bacteriocin was extracted and purified and the protein content was found to be 1.09 mg/mL. The extracted bacteriocin was identified as plantaricin by high performance liquid chromatography. The molecular weight of the purified plantaricin was found to be 4.6 kDa. The strain *Lactobacillus plantarum* isolated from fermented drink toddy was found to be one of the potent producers of bacteriocin.

Key words: Toddy, Lactic acid bacteria, bacteriocin, *Lactobacillus plantarum*, plantaricin.

OP-20: Production of nattokinase from bacillus amyloliquifaciens mrs18; a bacterial strain isolated from fermented beans

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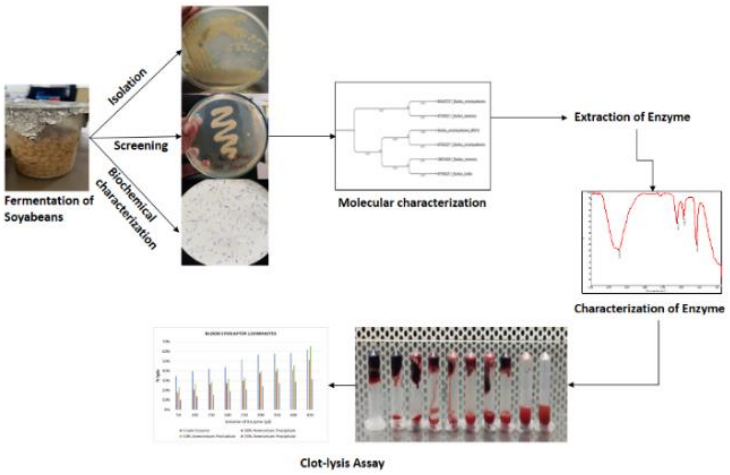
ABSTRACT

Nattokinase is a naturally occurring fibrinolytic protease enzyme, obtained from the traditional Japanese food called Natto and has several uses in the pharmaceutical and medical industries. Nowadays the most often used thrombolytic agent in the clinical field is Nattokinase, in part because it is less expensive than other thrombolytic medicines. The objective of this study is to investigate the screening, isolation and characterization of the Nattokinase enzyme-producing *Bacillus* strain from fermented Soya beans. The sample of fermented soya beans was tested for the presence of fibrinolytic protease-producing bacteria followed by the Screening, Extraction, Characterization and clot lysis assays. A total of three isolates were screened for caseinolytic activities by casein hydrolysis assay. Out of those isolates, MRS18 were found to be potent to produce the enzyme proteinase. To determine the taxonomy and phylogeny of these isolates, biochemical and molecular characterization has been carried out. *Bacillus amyloliquiefaciens MRS18* has been found with the highest caseinolytic activity. The clot lysing ability of the potent strain *Bacillus amyloliquiefaciens* was found to be 61.7% after 120 min and on further purification, by ammonium sulphate precipitation method the lysis percentage was found to be 65.6 % after 120 min. From the results of the present study, we concluded that *Bacillus amyloliquefaciens* isolated from the fermented soya beans produced Nattokinase enzyme that exhibits immense potential to lyse blood clots.

Keywords: Nattokinase, Clot busters, cardiovascular diseases, *Bacillus* sp. fermented soy bean, Fibrinolytic enzyme.



OP-21: Anticancer cytotoxicity and antifungal abilities of green-synthesized cobalt hydroxide ($Co(OH)_2$) nanoparticles using Lantana camara L.

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ABSTRACT

Green synthesis of metal nanoparticles with pharmaceutical applications is the current focus in the field of nanomedicine. This study aims at use of *Lantana camara L.* as a source of green reducing agent toward synthesis of cobalt nanoparticles. Fe3+-reducing assay demonstrated that Lantana camara methanol extract (LCM) has significant electron transfer potential. Gas chromatography mass spectroscopy (GC–MS) analysis of the crude extracts revealed the presence of 7 known and 17 unknown phytochemicals in LCM. Synthesis of cobalt nanoparticles was confirmed based on colour change of reaction mixture from light brown to dark brown. UV–visible spectrometry analysis showed that the synthesized particles had a λmax at 267.5 nm. Based on the two theta (2θ) and Miller indices (hkl) values obtained in XRD analysis, the particles were confirmed to be cobalt hydroxide ($Co(OH)_2$) nanoparticles. Further dynamic light scattering (DLS) analysis showed that the average size of the $Co(OH)_2$ nanoparticles is 180 nm. SEM image analysis of the particles revealed that they are

spherical mass of feather-like structure, contributing toward increased surface area of the particles. Further, the pharmaceutical potential of the $Co(OH)_2$ nanoparticles was evaluated against eukaryotic cancer and fungal cells. MTT cytotoxicity analysis showed that $Co(OH)_2$ nanoparticles have selective toxicity toward HCT-116 cancer cells with an IC50 value of 25 µg/ml and reduced cytotoxicity to non-cancerous VERO cells with an IC50 value of 200 µg/ml suggesting that the particles possess selective anti-cancerous cytotoxicity. Additionally, the particles demonstrated significant antifungal activity against 5 human fungal pathogens. Results of this study conclude that green-synthesized Co(OH)2 nanoparticles using Lantana camara L possess excellent eukaryotic cytotoxicity against cancer cells and fungal pathogens.

Keywords: *Lantana camara L.*, $Co(OH)_2$ nanoparticles, Green synthesis, Anticancer cytotoxicity, Antifungal

POSTER PRESENTATIONS

PP-1: An in vitro investigation of the hemostatic properties of Ca-SiO_2 nanocomposite

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ABSTRACT

Hemostasis is the process of stopping bleeding while accumulating blood in broken blood vessels. Although this is the first stage of healing, deep wounds continue to bleed. The formation of a fibrin mesh at the site of the wound, which is made possible by the stimulation of multiple coagulation factors, is how blood clots during hemostasis. Calcium ions can activate coagulation factors to promote hemostasis. In this study, SiO2 nanoparticles were added to Ca^{2+} ions to act as hemostatic agents. The structural and physicochemical properties of the material were analyzed using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and high-resolution transmission electron microscopy (HRTEM). In vitro blood tests, including hemolysis, clotting studies, coagulation time, and RBC aggregation tests, were performed to evaluate the hemostatic capability of the material.

Keywords: Hemostasis, hemolysis, biocompatibility, fibrin.

PP-2: An investigation of surface modified PLA with nanocomposites (Ti-HA) for orthopedic implant applications

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ABSTRACT

Biomaterials are crucial in the field of biomedical engineering. Many forms of modern medical diagnosis rely on biomedical innovations. When in contact with living tissue, biomaterials have the potential to replace, complement, or enhance the function of an organ or tissue. In terms of properties, Mg alloy was found to offer a great deal of

promise. Medical-grade polymers have been shown to be the best option for fabricating medical devices because of their many desirable properties, including biocompatibility, biodegradability, mechanical strength, and processability. Therefore, it is safe for usage inside the human body, as it is non-toxic and does not harm the environment. Despite this, they were unable to get proper tools due to some of the flaws. Despite their widespread adoption, nanocomposites have been shown to be structurally more complicated than micro composites. They are produced by polymerizing biopolymers. By interacting with implanted biomaterials, they speed up the recovery of damaged tissues and aid in the treatment of illness or injury. The purpose of this study is to fabricate and analyze the structural and functional effects of nanocomposites coated Poly Lactic Acid (PLA). Screws were designed in a time-efficient manner using solid works. The mechanical properties of a screw were studied with the help of Ansys. Ti-HA nanocomposites have the potential to assist bone healing because of their physicochemical properties, which make them very compatible. NSTS (Non Self Tapping screw) has the highest success rate for orthopedic implants. The major objective of this study is to compare two versions of Non-Self-Tapping Screws (NSTS) for orthopedic implants manufactured of PLA coated with nanoparticles. The implantation technique was found to be difficult due to the PLA material's lack of biocompatibility. A four-dimensional model of the screws was created in Solidworks. Later, mechanical parameters like stress, strain, and total deformation were improved with Ansys software. Finally, the screws were coated with Ti-HA nanocomposites that were manufactured utilizing the sol-gel technique and confirmed via characterization. The screw was coated with the nanocomposite, and the results of this study may one day lead to a more efficient and superior polymeric implant product that can be used to make medical equipment with enhanced functionality and stability.

Keywords: Biomaterials, Mg alloy, Screw, Nanocomposite and Ti-HA (Titanium – Hydroxyapatite).

PP-3: *In vitro* corrosion behaviour of modified zirconia-nanocomposites coated Ti–6Al–4V alloy for dental implant application

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ABSTRACT

Dental implants are designed to serve as a long-term solution for the restoration of lost teeth. A biocompatible dental alloy is utilized to establish integration with the jawbone via the process of Osseo integration. This establishes a robust foundation for the implant, enabling it to endure the mechanical stresses exerted during the processes of biting and chewing. Typically, dental alloys are exposed to a variety of oral environments, which are notorious for their complex corrosion potential. Corrosion has the potential to undermine the mechanical integrity of the implant, leading to implant loosening, micro-motion at the interface between the implant and bone, implant fracture, and potentially interfering with the Osseo integration process. To enhance the corrosion resistance of the alloy, its surface can be modified with Nano composites materials. These materials offer a protective layer to the alloy, establishing a physical barrier that effectively hinders corrosive agents from accessing the underlying bulk material. In this study, the surface of the dental alloy Ti–6Al–4V is modified with three different types of modified zirconia Nano composites and corrosion behaviour of these modified surfaces is then analysed in both simulated bodily fluid and artificial saliva solutions. The three modified zirconia Nano composites, such as Fluorapatite modified zirconia Nano composites, hydroxyapatite modified zirconia Nano composites and Titanium dioxide modified zirconia Nano composites are coated on Ti–6Al–4V alloy using Electrophoretic deposition method. The coated samples were subjected to characterization using Fourier-transform infrared spectroscopy (FTIR) and scanning electron microscopy with energy-dispersive spectroscopy (EDS). The investigation of corrosion was conducted on both coated and uncoated samples by the utilization of electrochemical techniques in simulated bodily fluid and artificial saliva solution. The corrosion tests revealed that all three modified zirconia Nano

composites-coated Ti–6Al–4V samples have superior corrosion resistance compared to uncoated Ti–6Al–4V substrates. Among the three samples of modified zirconia Nano composites coated Ti–6Al–4V, it was observed that the Fluorapatite modified zirconia Nano composites coated Ti–6Al–4V sample exhibited superior corrosion resistance in comparison to the hydroxyapatite modified zirconia Nano composites and Titanium dioxide modified zirconia Nano composites.

Keywords: Dental implant, modified zirconia Nano composites, Electrophoretic deposition method, Electrochemical techniques and corrosion behaviour

PP-4: Antibacterial Efficacy of Mono- and its Bimetallic Copper-Zinc Nanoparticles for Functional Biomaterial Applications: A Preliminary Study

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ABSTRACT

In this study, we investigated the antibacterial efficacy of monometallic and bimetallic nanoparticles containing copper and zinc. Synthesis of copper nanoparticles (Cu NPs), zinc nanoparticles (Zn NPs), and their bimetallic counterpart (Cu-Zn NPs) was achieved using a facile and cost-effective synthesis method. The obtained nanoparticles were characterized using various analytical techniques, including X-ray diffraction (XRD), Scanning Electron Microscopy (SEM), Energy-dispersive X-ray analysis (EDAX). Antibacterial efficacy of the nanoparticles were assessed against both Gram-positive and Gram-negative bacteria. The results demonstrated that the bimetallic Cu-Zn NPs exhibited better antibacterial efficacy compared to the monometallic Cu NPs and Zn NPs. Enhanced antibacterial efficacy of the bimetallic nanoparticles were attributed to the synergistic effect resulting from the combination of copper and zinc, which contributed to increased bactericidal activity. This preliminary study underscores the promising antibacterial efficacy of bimetallic Cu-Zn nanoparticles and their potential use as functional biomaterials for a wide range of

biomedical applications, such as wound dressings, implant coatings, and other antimicrobial devices. However, further investigations and optimization are essential to fully explore their applicability and understand the underlying mechanisms of their enhanced antibacterial performance as functional biomaterials.

Keywords: Monometallic, bimetallic, nanoparticles, antibacterial, functional biomaterial

PP-5: Development of PLGA/gelatin nanofiber containing $CaCO_3/SiO_2$ nanocomposite and quercetin for enhanced diabetic wound healing

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ABSTRACT

A diabetic foot ulcer is an open wound or sore that typically develops on the plantar area, or bottom, of the foot. 15% of people with diabetes get diabetic foot ulcers. Infection or another ulcer-related complication will send 6% of people who get foot ulcers to the hospital. Age and the length of diabetes both raise the risk of foot ulcers and limb amputation. Quercetin has a good antioxidant and anti-inflammatory property. Also, calcium carbonate/silica ($CaCO_3/SiO_2$) nanocomposite has a good anti-inflammatory property which will help to increase the wound healing rate. So, combining quercetin and $CaCO_3/SiO_2$ nanocomposite will enhance the wound healing rate. We have synthesized $CaCO_3/SiO_2$ nanocomposite in sol-gel method and characterized using XRD, FTIR and TEM. Then the quercetin incorporated $CaCO_3/SiO_2$ nanocomposite patch was prepared with the help of biocompatible polymers poly (lactic-co-glycolic acid) (PLGA) and gelatin. This PLGA/gelatin/$CaCO_3/SiO_2$/quercetin patch was prepared by electrospinning method. For the obtained patch, the anti-bacterial activity and hemocompatibility were analyzed. Further evidence that the patch enhanced the healing of diabetic wounds

came from in vivo tests using wistar rats. The PLGA/gelatin/$CaCO_3$/SiO_2/quercetin patch will enhance the healing of diabetic wounds.

Keywords: Wound healing; Diabetic foot ulcer; Quercetin; PLGA; Gelatin

PP-6: Exploring the microbial interactions of carbon nanospheres for diabetic wound healing

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ABSTRACT

If treated appropriately, diabetes mellitus can be practically painless, but the condition's very high blood glucose levels can cause serious issues. Diabetes related wounds are sores that develop as a result of blood vessel damage brought on by high blood sugar levels, which slows the healing process. The main reason for concern is the slow or poor healing of diabetic wounds. Due to lack of blood flow and nerve damage, patients with uncontrolled diabetes are more likely to experience non healing or infected wounds. As a result, we concentrated on synthesising carbon nanospheres using the probe ultrasonicator method and then performed additional characterization using XRD, FTIR, RAMAN, and TEM. Following that, we additionally monitor the haemolysis assay and antimicrobial activity with different concentrations of the nanomaterial followed in different bacterial cultures. And also, characterization of different bacteria incorporated with nanomaterials was done by TEM. Thus, it has been demonstrated that the carbon nanospheres showed enhanced anti-microbial activity against microorganisms.

Keywords: Diabetes mellitus, Wound healing, Carbon nanospheres, Anti-microbial activity

PP-7: Ultrasensitive fluorescent detection of drugs for public health monitoring by using carbon dots

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ABSTRACT

The hydrothermal synthesis method using pomegranate peel as a precursor yielded Carbon Dots (CDs) with favourable properties, including fluorescence when exposed to UV light. The UV-Vis spectrum displayed absorption peaks at 276nm and 246nm, indicating the presence of functional groups on the CDs. The CDs exhibited a size of 2.8nm, and nitrogen doping helped prevent aggregation. The negative zeta potential of -14.9 suggests electrostatic stability, which is crucial for dispersion in water-based systems. The CDs demonstrated high sensitivity, particularly at lower concentrations. This sensitivity was evident in the fluorescence intensity changes observed when exposed to different concentrations of samples. The CDs were shown to be non-toxic in Vero cell lines, suggesting their potential for safe use in biological systems. A significant aspect of the study is the application of CDs for sensing Naprosyn belonging to a class of pain killers known as non-steroidal anti-inflammatory drugs (NSAIDs) in water. The CDs were able to bind with the drug, leading to a reduction in the fluorescence intensity of the CDs. This interaction serves as a basis for developing sensors for drug detection in sewage/sample. This research proposes that the use of CDs as sensors can facilitate the real-time monitoring of sewage for various drugs and pathogens. This technology holds promise for assessing community-wide drug consumption patterns and providing early warnings for potential infectious disease outbreaks. Our study provides insight into the potential future use of CDs as a technology for rapid on-site sewage monitoring. This technology could play a significant role in public health assessments and interventions.

Keywords: CDs, water-based epidemiology, public health monitoring

PP-8: Screening of DNA Aptamers against Multi-Drug Resistance in Gram-Negative Bacteria

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ABSTRACT

Multi-Drug Resistance has become an alarming threat with the uncontrolled usage of antibiotics as either food supplement or in disease manifestation in poultry industries. With the increase demand for poultry-based foods and no regulation for the usage of antibiotics particularly in India, the threat has grown exponentially causing several ill-effects in humans. The molecular mechanism by which the bacteria develop MDR against a wide class of antibiotics is still unclear. Among the understood mechanisms – action of multidrug efflux pumps has been well studied. In this present study, an attempt has been made to design a universal DNA-based aptamer for detection of gram-negative bacteria which is a major contributor for MDR. The approach starts with the synthesis of DNA library using Markov chain, screening for potential aptamer based on the nucleotide composition and finally the efficacy of the aptamer is evaluated using Molecular Docking and Molecular Dynamics studies. The target protein - BamA of E.coli , a β-barrel efflux pump is selected for the study results from the MD studies reveal that screened aptamer DABA 7 pose a greater stability in binding with the target protein without altering the actual function of the protein. The study will be extended in developing a biosensor for the MDR diagnostics.

Keywords: Multi-drug Resistance, DNA Aptamers, Markov chain, BamA

PP-9: Correlation Analysis of CRISPR Cas system with Bacteriophage in Gut Microbiome of Livestocks through Integrated Omics approach

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ABSTRACT

Gut microbiota is responsible for richness of species, population structure and complexity while also creating a balance between commensal and detrimental microorganisms. The interaction between phage and the bacteria in the poultry, swine and cattle gut microbiome impacts the health of the organism and indirectly affects human health and well-being during consumption. A healthy gastrointestinal system supports higher and better-quality meat production, favouring the commercial prospects in the meat industry such as body weight, feed efficiency and energy balance. The structure of CRISPR loci represents a chronological history of past interactions between phages and bacteria. To understand the interplay between CRISPR regions and bacteriophage in the gut microbiome of poultry, swine and cattle — fifteen shotgun metagenomic bio-projects (5 bioprojects in each category - Poultry, Cattle and Swine respectively) comprising 186 samples was retrieved from MGnify (ENA Browser). Contigs were constructed using Spades and CRISPR regions were detected using CCtyper. From the unique spacers obtained, the phage regions were found using CRISPR target. Microbial and bacteriophage annotation was performed using Metaphlan3 and PhaBox respectively. Statistical and correlation analysis was done using R programming. The most prominent CRISPR Cas system in the samples analysed was found to be Type I – C (47%), II-A (11%) and I- E (11%). The CRISPR Cas locus was found to be abundant in Poultry samples (79%) whereas it was least abundant in Swine (19%) and Cattle (0.3%) samples. The taxonomical classification analysis at phyla and genera level across these livestocks reveals that *Firmicutes* (50%) followed by *Proteobacteria* (15%) were abundant phylum whereas *Lactobacillus* (44%), *Escherichia* (32%) and *Butyrivibrio* (23%) were abundant genera in the datasets analysed. This study reveals CRISPR spacer targeted phages were at least two fold higher than their plasmid counterparts. It was seen that 65% percent of the phages were from the poultry gut microbiome. A network analysis ($p < 0.05$, $s > 0.7$) between

abundant phage and genera revealed to have higher interconnected nodes with more than four modularity classes. A rise in CRISPR-mediated acquaintances was shown to coincide with an increase in the number of virulent phages, according to CRISPR-based phage-host interaction networks. The abundances of most phage taxa in poultry samples differ by up to two fold increase in comparison with swine and cattle datasets. The results indicate that the poultry dataset was identified to have abundant CRIPSR spacers and phage regions which are significantly correlated with gut microbiota.

Keywords: CRISPR, Livestock, Metagenome, Phage, Microbes, Correlation

PP-10: Metabolic Engineering in Escherichia coli for the production of the Novel carotenoid

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ABSTRACT

Novel synthetic isoprenoids have been synthesized in engineered microbial hosts by evolving terpene synthase or expressing heterologous terpene synthases. Recently, the native operon, crtMNaNb derived from Planococcus sp. PAMC21323, has isolated for potential industrial applications of C25 and C30 carotenoids. For the first time, novel C25 and C30 carotenoids were synthesized in *E.coli* expressing the crtMNaNb genes. The recombinant strains accumulate various sesquiterpene including 4,4 diapolycopene (red colour), 4,4 Diaponeurosporene (yellow colour), and 4,4 diapophytoene (no pigmentation), depending on the expression of the genetic elements of the crtNaNbM genes. Subsequently, the carotenoid extract from the cells harbouring PCESCrtMNaNb was analysed. This study will promote further engineering of *E.coli* to increase sesquiterpene productions .

Keywords: *Escherichia coli*, novel C25 and C30 carotenoids, Sesquiterpene, High performance liquid chromatography.

PP-11: Simultaneous Decontamination and Saccharification of Used Agar and Bio-electricity Production

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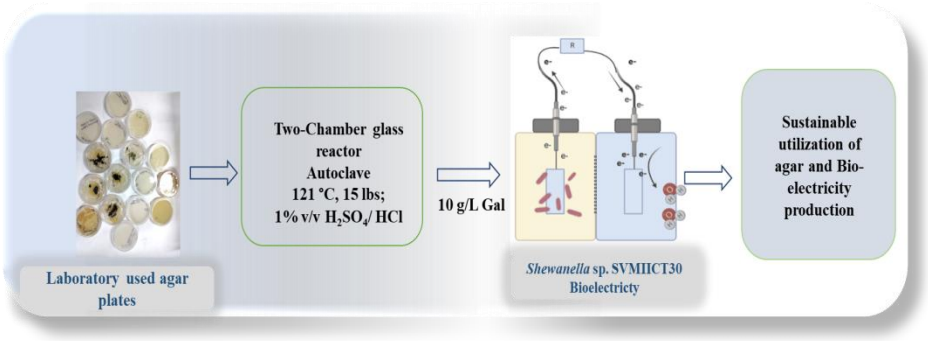
ABSTRACT

Agar, a major cell wall component of macroalgae, non-lignin, a linear polymer of galactose (Gal) and its derivati n ves are used as a solidifying agent in microbial media and gel preparation. Decontamination of used agar plates before disposal is a common and energy-intensive process that enables the discarding of agar. To efficiently utilise sugar-rich hydrocolloid, a two-compartment glass reactor was fabricated suitable for autoclave. The first one is a feed compartment perforated in the bottom which facilitates the pass of only melted agar into the second compartment, in which agar hydrolysis takes place in the presence of acid. Simultaneous decontamination and saccharification of agar were achieved using different acids. Complete liquefaction of agar was achieved by (1% w/v) H_2SO_4 and HCl on hydrolysis at 121°C for 15 min which yielded ~10 g Gal/L. Upon increasing the time to 30 min, HNO_3 and H_3PO_4 could also be able to hydrolyse agar into 8-10 g/L Gal. Simultaneously, agar-degrading bacterial consortia were developed, to hydrolyse the waste agar enzymatically. Further, Gal-rich acid hydrolysate was used as a feedstock for the production of bio-electricity. The novel strain *Shewanella* sp. SVMIICT30 isolated from marine algae, collected from Rameswaram, India, produced 0.2 mA electricity with 120 mV OCV from agar-hydrolysate. From a waste-to-wealth point of view, one-step decontamination and hydrolysis of agar, and the production of electricity from waste agar is considered to be a sustainable and innovative strategy.

Keywords: *Shewanella*, Bio-electricity, Used agar, Biorefinery, Galactose



Bio-electricity production by *Shewanella* sp. using waste agar hydrolysate as feedstock

PP-12: *Insilico* analysis and Identification unravel the structural consequences of missense mutations in the CYP17A1 gene.

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ABSTRACT

Polycystic ovary syndrome (PCOS) is a prevalent endocrine disorder characterized by hormonal imbalances and reproductive abnormalities. The CYP17A1 gene, which encodes the enzyme cytochrome P450 17A1, plays a vital role in steroidogenesis and hormone synthesis. Missense mutations in CYP17A1 have been implicated in PCOS pathogenesis due to their potential to disrupt normal enzyme function and subsequently alter sex hormone production. In this study, we used various insilico tools such as (sift, Polyphenv2, I-mutant, Mutpred, GERP, Consurf, and Project Hope modeling) to identify genetic variants which are highly damaging to the protein structure associated with the CYP17 gene and also to predict the pathogenic mutation. And through molecular docking studies (Autodock), we examined potential interactions between the CYP17A1 protein and its ligands. The results provide insights into how these mutations impact protein stability, active site configuration, and substrate binding affinity. This study provides the molecular mechanisms connecting CYP17A1 mutations and PCOS, offering valuable insights into potential therapeutic

targets and personalized treatment strategies for individuals with this complex disorder. Further experimental validation will be pivotal to confirm the functional implications of these mutations and their contribution to PCOS pathophysiology. The comprehensive in silico approach provides a valuable tool for assessing the effect of genetic variations on protein function and their potential role in disease development.

Keywords: PCOS, CYP17A1, Missense mutation, Molecular docking.

PP-13: In silico Characterization of Deleterious Mutations in the Homeodomain of PITX2 Gene: Implications for Developmental and Cardiac Disorders.

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ABSTRACT

Background: Paired-like homeodomain transcription factor 2 (PITX2) mutations have been linked to developmental disorders such as Axenfeld-Rieger syndrome and cardiac conditions like atrial fibrillation. Identifying functional single nucleotide polymorphisms (SNPs) within the PITX2 gene is crucial for understanding disease mechanisms. We conducted an *insilico* analysis to identify highly deleterious non-synonymous SNPs (nsSNPs) in the PITX2 homeodomain. **Methods:** A total of 1766 PITX2 missense mutations were retrieved from NCBI-dbSNP and Ensembl databases, and 95 nsSNPs were analyzed using *in silico* prediction tools including SIFT, PolyPhen-2, Mutpredv 1.2, I-Mutant 2.0, Consurf, and Project HOPE. Structural and functional consequences of identified mutations were evaluated in terms of stability, conservation, and phenotypic effects. **Results:** Among the nsSNPs, five mutations (E53D, R62H, R69H, V74M, and R84G) were identified within the homeodomain as highly damaging by SIFT and PolyPhen-2. I-Mutant 2.0 analysis indicated decreased stability for these mutations, while Consurf analysis revealed the conservation of these residues. Molecular modeling using Project HOPE corroborated the deleterious effects of these mutations on the protein's structural integrity. **Conclusion:** This *in silico*

investigation highlights potentially pathogenic nsSNPs within the homeodomain of the PITX2 gene, shedding light on their potential role in the etiology of atrial fibrillation. The findings underscore the importance of PITX2 in developmental and cardiac processes and provide a foundation for prioritizing mutations for future genetic and functional studies. This study aids researchers in evaluating variant pathogenicity, contributing to advancements in diagnostics and therapies for PITX2 gene-associated diseases.

Keywords: PITX2, Homeodomain, In silico analysis, Genetic Polymorphism, Missense mutations.

PP-14: Production and purification of cellulase from *Streptomyces tuirus* isolated from desert soil of Rajasthan

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ABSTRACT

Actinomycetes are widespread slow-growing Gram-positive bacteria that can thrive in extreme climatic conditions and are the primary sources for secondary metabolites and enzymes. Actinomycetes produce various extracellular enzymes such as lipase, amylase, protease, cellulase which have applications in food, agriculture, detergent and various industries. The present study involves the screening of *Streptomyces tuirus* isolated from desert soil for the production of multienzymes. *Streptomyces tuirus* was screened for the production of different extracellular enzymes like amylase, protease, cellulase and lipase. *Streptomyces tuirus* strain showed maximum cellulase activity when compared to protease, amylase and lipase. Further optimization studies were carried out, and the optimum temperature was found out to be 25℃ at pH 7, with tryptone as the nitrogen source, fructose as the carbon source and leucine as the amino source for maximum production of cellulase enzyme. Purification was carried out using gel filtration chromatography. SDS-PAGE was carried out to determine the

molecular weight of the protein, where two bands of molecular weight 66kDa and 43kDa were obtained. Enzymes play a pivotal role in biotechnological and biomedical applications, where enzymes produced by microorganisms have grabbed the major attention of various industries, becoming a greener substitute for chemical catalysts.

Keywords: Actinomycetes, *Streptomyces tuirus*, cellulase, optimization, Multi-enzyme.

PP-15: Chitosan loaded biopolymer nanocomposite incorporated with AgNP for sustainable antimicrobial applications

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ABSTRACT

In our study, chitosan has been used as matrices of controlled release of active substances. Chitosan is particularly promising due to its ability to store and deliver AgNps in a more controlled and effective manner. In the present study, we have developed silver-loaded chitosan wound dressing for antimicrobial application. Initially, the AgNps were prepared using the Frens method and characterized using DLS-ZETA, UV-Vis Spectrometry, and XRD. The particle size of the synthesized nanoparticle was found to be 43.5nm with a zeta potential of -23.4. UV-Vis Spectrometry a broad absorption band appeared in the visible region at the wavelength of 432 nm. X-ray diffraction analysis showed that the particles were crystalline in nature with a face-centered cubic structure and the antimicrobial efficacy evaluated using zone of inhibition studies against *staphylococcus aureus* and *Escherichia coli* is 16mm and 15mm respectively. The polymer solution has been prepared by adding 3% of chitosan in 1% acetic acid and stirring for 30 min followed by the addition of glycerol of 6 %. The prepared silver nanoparticle (100 ppm) has been added to the polymer solution and stirred for 15 min. The solution has been cast into films at room temperature using a simple glass casting method. The casted films have been subjected to antimicrobial. The antimicrobial efficiency was evaluated using the suspension time kill test (ASTM E2315) method against *Escherichia coli*, results

exhibited 99% inhibition against test microorganism on 30 seconds of contact with Ch-Ag patches. These results concluded that Ch-Ag patches have efficient Anti-microbial properties.

Keywords: Chitosan, Silver nanoparticles, Antimicrobial, Biopolymer.

PP-16: Biomembrane/Bioelectrolyte from Sargassum Muticum for Electrochemical and Wound healing applications

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ABSTRACT

The origination of the product conception (bio-membrane from plant extract-PVA blend) is due to provide a bio-degradable, renewable and eco-friendly material at a low cost. The disadvantages of the earlier available electrolytic membranes from synthetic and biopolymers which were widely used in the market are their limited biocompatibility and some environmental threats during disposal. This led us in devising a membrane of sustainability with naturally occurring sources of materials enriched with sulfonated polysaccharides, alginates, and many polyphenolic compounds. The end product is the incarnation with anomalous properties like biodegradability, biocompatibility, sustainability, and renewability. The preferred embodiment comprises the following chemical constituents (i) Polymer with good mechanical stability (ii) Polymer with water solubility and film-forming capacity (iii) A component having polyphenolic compounds. A primary Lithium/magnesium-ion conducting battery has been constructed with the highest conducting bio-electrolyte membrane and an open circuit voltage of 2.18 V validates the application of this bio-membrane as a promising solid electrolyte for energy storage devices. This bio-based membrane acts as a good candidate for fuel cell, battery, and also in supercapacitors. Their enriched composition enables them to furnish a stable membrane that can be utilized for food packaging and wound healing applications.

Keywords: Biomembrane, Coin cell, Electrochemical device from biomass

PP-17: *In Silico* Analysis of HIV-1 Reverse Transcriptase interactions with *Garcinia morella* Phytocompounds

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ABSTRACT

This study focuses on investigating the inhibitory potential of phytocompounds sourced from *Garcinia morella* against HIV-1 reverse transcriptase (RT), a pivotal therapeutic target in the context of human immunodeficiency virus (HIV) infection and acquired immunodeficiency syndrome (AIDS). The weakening of the immune system in HIV-infected individuals renders them susceptible to various infections and malignancies, necessitating the exploration of novel treatment avenues. Utilizing molecular docking analysis, the research identifies a specific phytocompound demonstrating notable anti-HIV-1 activity, with a remarkable binding energy of -12.4 kcal/mol which surpasses the binding energy observed in Dolutegravir, an FDA-approved HIV medication. The assessment of Absorption, Distribution, Metabolism, and Excretion (ADME) properties, for the top five phytocompounds reveals encouraging attributes such as favourable drug-like characteristics, acceptable bioavailability, and adherence to Lipinski's rule of 5. The study underscores the multifaceted potential of *Garcinia morella*, renowned for its diverse bioactive constituents encompassing antiviral, hepatoprotective, anticancer, anti-inflammatory, antibacterial, and larvicidal properties. The findings accentuate the promising nature of specific phytoconstituents from *Garcinia morella* as drug candidates for future anti-HIV-1 drug development endeavours. In addition to this the drug-receptor complex shows stable characteristics resulting from molecular dynamics simulations, such as root mean square deviation and radius of gyration. This research not only advances our understanding of natural compounds therapeutic efficacy against HIV-1 RT but also underscores the feasibility of harnessing such phytoconstituents for novel antiretroviral strategies, thus contributing to the evolving landscape of HIV/AIDS treatment modalities.

Keywords: *In Silico* Analysis, *Garcinia morella,* ADME, Molecular Docking and Molecular Dynamics Simulations

PP-18: Extracellular Polymeric Substances (EPS) production in *Lactiplantibacillus plantarum* Biofilms and its potential applications

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ABSTRACT

Lactiplantibacillus plantarum is a well-known probiotic bacterium with numerous health-promoting properties. *L. plantarum's* functionality is in its ability to form biofilms and produce extracellular polymeric substances (EPS). EPS imparts biofilm formation, stability, and resilience improving probiotic effectiveness. However, the EPS production levels in *L. plantarum* biofilms does not meet the requirements for specific applications. In the present study, the biofilm's environment is optimized to support enhanced EPS synthesis. Nutrient-rich media and minimal media, supplemented with appropriate carbon (glucose, sucrose) and nitrogen (amino acids) sources, are compared for EPS biosynthesis. Previous studies report that modulation of AI-2/LuxS quorum sensing in probiotics increases EPS production in *L. plantarum*. Biofilms of *L. plantarum* strains are cultivated in controlled conditions. An enhanced EPS production is observed in comparison to control as analysed by spectrophotometric methods. Environmental challenges and media optimization resulted in improved probiotic's functionality including biofilm stability, adhesion, and resistance to environmental stresses. The probiotic strain with improved EPS production has applications in gut health, food fermentation, and oral health. Further studies will involve the use of synthetic biology QS circuit modulatory approach to enhance the ability of *L. plantarum* probiotic bacterial biofilms in EPS production.Thus, by optimizing probiotic functionalities, its utility can be expected in diverse fields of health and sustainability.

Keywords: Biofilms, Probiotics, Exopolymeric substances, Quorum sensing, Synthetic biology

PP-19: Combined efficacy of Green tea (*Camellia sinensis)* with select botanicals: A power duo to mitigate metabolic syndrome

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ABSTRACT

Metabolic syndrome is a condition characterized by the simultaneous presence of several risk factors, such as high blood sugar, elevated body weight, high blood pressure, and abnormal lipid levels. These contribute to the development of diabetes and cardiovascular diseases, making it a prevalent global health concern. In such associated comorbidities, the treatment regimens are complex with a variety of synthetic drugs leading to off-target effects and drug-drug interactions resulting in increased adverse effects and poor management of the actual condition. In spite of advances in management strategies, the consistent prevalence of metabolic syndrome among populations highlights the need for the development of suitable interventions to reduce its occurrence globally. *Camellia sinensis*, a constituent of the Theaceae family, is ubiquitously consumed across the globe in diverse forms such as unoxidized green tea, semi-oxidized oolong tea, and fully oxidized black tea. These variants exhibit promising implications for human health and in mitigating the risk factors of metabolic syndrome. However, meta-analysis data suggested that the clinical efficacy is mild when compared to in vitro and in vivo outcomes. The efficiency of *Camellia sinensis* can be elevated by infusing certain botanicals already known for their antioxidant properties and their effectiveness in addressing metabolic syndrome. This study is designed to evaluate the infusion of Ginger (rhizome), Cinnamon (bark), and Moringa (leaves) with Green tea (leaves), for its in vitro and in vivo efficacy against metabolic syndrome.

Keywords: Metabolic syndrome, Phytotherapy, Green tea, Antioxidant, In vitro, In vivo

PP-20: Network pharmacology and molecular docking-based strategy to explore the potential phytocompound of *Moringa oleifera* against Liver cancer

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ABSTRACT

Liver cancer is also known as hepatic cancer which starts in the cells of liver. Liver cancer can be benign at first and become a malignant cancer. Based on network pharmacology study, 100 bioactive compounds and 3986 targets of the liver cancer were obtained, forming a compound-target network. Molecular docking tests showed tight docking of these compounds with predicted proteins. The protein-protein interaction (PPI) network graph of M. oleifera phytoconstituents and the liver cancer has 460 common genes. These genes are processed using string-db which used to identify the target. PTGS2 as an important therapeutic target for the treatment of liver cancer. This study aims to investigate the potential phytocompounds from *Moringa oleifera* in inhibiting PTGS2 using network pharmacology and molecular docking. M.oleifera is known to contain various bioactive compounds like anti-inflammatory, anticancer, hepatoprotective properties. In silico analysis of 100 compound revealed that few specific compounds have highest binding anti PTGS2 activity. It exhibits the lowest binding energy of -11.5. These findings suggest that certain phytoconstituents of M. oleifera have the potential for PTGS2-targeted liver cancer drug screening and design.

Keywords: Hepatic cancer; PTGS2; drug target; phytoconstituents; anticancer

PP-21: Homology Modelling of Papaya Ring Spot Virus for In-Silico Analysis of Antiviral Compounds from Fungi

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ABSTRACT

Papaya Ring Spot Virus (PRSV) poses a significant threat to papaya crops, leading to substantial economic losses worldwide. The search for effective antiviral compounds is a critical endeavor to mitigate PRSV infections. In this study, homology modelling technique using Swiss model to construct a three-dimensional structural model of the PRSV coat protein, a key target for antiviral intervention. The model was refined and validated using PROCHECK, ensuring accuracy and reliability. Subsequently, a comprehensive library of fungal compounds with potential antiviral properties was screened in-silico against the PRSV coat protein model. Molecular docking and binding energy calculations were employed to predict the interaction between the fungal compounds and the coat protein. Compounds demonstrating strong binding affinity were further analyzed to decipher their mode of interaction and potential inhibitory mechanisms. Our results reveal a subset of fungal compounds with promising interactions, suggesting their potential as PRSV antivirals. Insights gained from this in-silico analysis provide a rational basis for the selection and prioritization of candidate compounds for further experimental validation. The homology modelling-driven in-silico analysis of antiviral compounds from fungi against PRSV contributes to the development of cost-effective and environmentally friendly novel strategies for crop protection.

Keywords: Papaya, molecular docking, Swiss model, crop protection.

PP-22: Hibiscus leaf extract mediated synthesis of nanohydroxyapatite for bone and dental filling

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ABSTRACT

Plant extracts have been known to cure many diseases since ancient times. One of the main disadvantages in bone and dental filling materials is that they may cause infection in the areas of filling. These infections are mostly caused by microorganisms like bacteria and fungi. This can be cured by preparing a biomaterial using plant extracts as one of the precursors. Hibiscus leaves are excellent source of antioxidants and possess antimicrobial properties and can be used to prepare biomaterials. Nanohydroxyapatite (nHAp) is one of the common biomaterials used for bone and dental filling .This research works aims to develop plant mediated hydroxyapatite. The plant mediated synthesis of nHAp is done using microwave assisted synthesis. The pant extract is then analysed for its spectral characterization using XRD, FESEM, EDAX and FTIR. These studies confirm the formation of nanohydroxyaptite using hibiscus leaf which can be used as a bone and dental filling applications. The prepared nHAp is expected to cure infections that are caused by microorganisms such as bacteria and fungi.

Keywords: Nanohyroxyapatite (nHAp), plant extract, microorganisms, dental filling.

PP-23: Identification of novel drug targets using Genome scale metabolic models for drug repurposing against MDR *Klebsiella pneumoniae*

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ABSTRACT

Klebsiella pneumoniae (*Kp*) is a gram-negative opportunistic pathogen belong to Enterobacteriaceae family. Due to the spread of antimicrobial resistant *Kp* (AMR-*Kp*) in health care environment, an urgent call of action is needed for its better control. *Kp* is a bothersome pathogen that has developed resistance to the *carbapenem and colistin* antibiotics, which are the last line of defense. The same have also been reported worldwide from the blood and urine isolates of several patients. Furthermore, *Kp* is a clear threat to the society as it is the reason behind 32.8% of nosocomial infection. The mortality rate of 54.30% globally and 68% from India has been reported for the patient suffering from *Kp* mediated blood stream infection (BSI). The urological origin of MDR-*Kp* strains makes the situation more disquieting; as in India, the urinary-tract infection (UTI) accounts for a high-percentage of nosocomial infections. Using tools offered by systems biology, the proposed work seeks to uncover the novel drug-targets of MDR-*Kp* followed by prediction of FDA approved drugs that could bind to those predicted target. Flux-balance analysis (FBA) would be used as an *in silico* strategy to screen new therapeutic targets. Incorporating host like growth condition as constrain environment, FBA offers a mechanism to pinpoint the drug-targets that are essential for biomass flow in MDR-*Kp* during infection. Further network analysis would also be conducted to determine critical targets. The screened potent drugs from the Drugbank database would be tested against MDR-*Kp in vitro* to combat *Kp* mediated BSIs and UTIs. In result, drugs will be repurposed against novel targets of MDR-*Kp*.

Keywords: Multidrug resistance, *Klebsiella pneumoniae,* Drug repurposing, Genome-Scale Metabolic Model, Drugs targets

PP-24: Surface characterization and antibacterial activity of cross-linked sericin and chitosan on titanium implants

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ABSTRACT

Bacterial attachment and biofilm formation increase the failure risk of implants. Titanium based implants are among the most promising in orthopedic and dental surgeries owing to its biocompatibility, corrosion resistance and strength but slightly lacks antibacterial properties while, bacterial infection leads to implant failure complications. Antibacterial coating for titanium implant surfaces has been developed using a range of techniques to inhibit infection along with different surface modifications on titanium to enhance cell adhesion and drug binding efficiency. In this study, titanium implants were etched using the acid etch method and the etched titanium surface was salinized with aminopropyltriethoxysilane (APTES). Eventually, sericin and chitosan which stimulate osseointegration were crosslinked on salinized titanium surfaces for effective implantation. The following study aims to analyze samples at intermediate steps to evaluate coating strategies for salinization and bioconjugation optimization and their anti-bacterial efficiency for the surface coated titanium disk employed in vitro to analyze the growth of bacteria with stranded protocol for anti-bacterial and anti-biofilm efficacy.

Keywords: Titanium implants, Bacterial infection, Surface modification, salinization, Anti-biofilm

PP-25: Assessment of 3D printed Poly Lactic Acid (PLA) Scaffolds using Mesenchymal Stromal Cells for potential osteogenic applications

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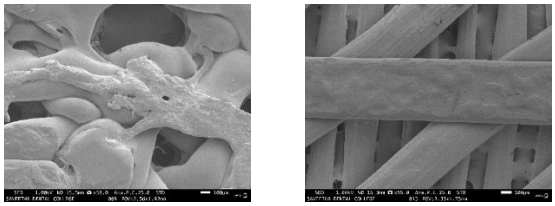
ABSTRACT

Making new alloplastic biomaterials that can serve as three-dimensional (3D) scaffolds for cell migration, angiogenesis, mineralization and regeneration has been a challenge for researchers in the field of bone tissue engineering (BTE). As opposed to conventional methods for producing 3D porous scaffolds, such as solvent-casting, gas foaming, and electrospinning techniques, customised transplants can be made with constructions that are precisely designed based on the 3D image data of patients. With sufficient pore connectivity and form, and ideal porosity, current 3D printing techniques provide prospects for superior conventional bone substitutes. Due to their biocompatibility, bioresorbability and good thermal and physical properties aliphatic polyesters, such as polylactic acid (PLA), have distinguished themselves in the manufacture of sutures, manufactured orthopaedic parts, microspheres for controlled release of drugs, and support for tissue regeneration. Without the use of enzymes or other catalysts, PLA can be degraded by simple hydrolysis of its ester linkages, which eliminates the need for a second procedure to remove implants. The current study aims to evaluate the 3D printed Polylactic acid (PLA) scaffolds for potential osteogenic applications. Customised PLA discs and sheets were designed using the AUTOCAD software and printed by Fused Deposition Modeling (FDM)/Extrusion 3D printing process. They were examined for their surface topography and elemental contents by performing SEM and EDX analysis respectively. This was followed by cytotoxicity assessment by MTT assay at two different time points – 48hrs and 120hrs which revealed that both, the PLA discs and sheets were biocompatible. Adipose-derived MSCs (commercial) were used to assess the osteoinductive potential of these scaffolds.

They were cultured in Osteogenic Differentiation Medium (ODM) for 14 days and analysed for osteogenic differentiation by Alizarin Red S staining. It was observed that the PLA discs show a higher degree of mineralisation than the PLA sheets.

Keywords: 3D printing, Mesenchymal stem cells, 3D scaffolds



SEM images of PLA disc and sheet

PP-26: Nano-Biopesticide from *Gracilaria edulis*, and *Cuscutta Spp.*

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ABSTRACT

Organisms such as Algae, Fungi, and plants exhibit a fascinating ability to produce a diverse array of primary and secondary metabolites, each with unique properties. These metabolites have harvested significant interest due to their valuable applications in various industries, including the formulation of biopesticides, medicinal products, and fragrant oils. However, the quest for sustainable and environmentally friendly solutions has led researchers to explore the potential of these natural metabolites as alternatives to synthetic pesticides, offering a dual benefit of enhanced soil fertility and improved plant product quality. One promising avenue of exploration lies in the promotion of biopesticides among farmers. Biopesticides, derived from natural sources, hold great potential in addressing the limitations posed by synthetic pesticides. In a recent study, researchers focused on harnessing the potential of two intriguing species, *Gracilaria edulis* and *Cuscutta Spp.*, to develop an effective biopesticide. By extracting natural products from these organisms, a

synergistic formulation was created, aiming to enhance the overall efficiency of pest control. Moreover, the study delved into the innovative realm of nanoparticle-based biopesticides. Through a meticulous synthesis process, nano-sized particles were derived from *Gracilaria edulis* and *Cuscutta Spp*. The characterization of these nanoparticles using SEM analysis revealed their remarkably diminutive size, measuring less than 50nm. This breakthrough not only highlights the cutting-edge nature of the research but also suggests the potential for enhanced biopesticide efficacy through nanoparticle-based delivery systems. In essence, the ongoing pursuit of utilizing nature's arsenal of metabolites, coupled with advancements in nanoparticle technology, signifies a pivotal step towards sustainable pest management. By capitalizing on the inherent strengths of organisms like *Gracilaria edulis* and *Cuscutta Spp.*, researchers aim to pave the way for a more ecologically sound approach to agriculture, one that simultaneously safeguards soil health and elevates the quality of cultivated products.

Keywords: Biopesticides, Natural products, Nanoparticle-based biopesticide, Sustainable pest management

PP-27: pH responsive PEGylated polymeric nanoparticle loaded with quinine for lung cancer

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ABSTRACT

Lung cancer incidences have been rising quickly in recent years; in order to prevent this, an efficient and targeted delivery system is required. We have developed a pH-responsive PEGylated polymeric nanoparticle for lung cancer in this study. Quinine loaded to the PEGylated polymeric nanoparticle (Q-PEG-PNPs) was synthesized using homogenization. Q-PEG-PNPs was subjected to optimization, invitro release profile at different pH showed around 84%, 78%, 64% release for pH 6.5, pH, 5.5, pH 7.4 at 48 h respectively. Particle size analysis and Zeta potential of the optimized Q-PEG-PNPs was 212 ± 2.3 nm and -24.5 mV, respectively. Molecular studies was performed on

different protein that are responsible for lung cancer such as ALK, EGFR, KRas, p13k showed the efficiency of quinine to bind with the protein. Therefore, the developed Q-PEG-PNPs would be promising solution for lung cancer.

Keywords: Polymeric nanoparticles, pH responsive, targeted drug delivery, Quinine, Lung cancer

PP-28: Sustained Transdermal Delivery and Enhanced Cellular Uptake of Triple Helical Protein for Skin Regeneration

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ABSTRACT

We have developed a method for transporting high molecular weight collagen for skin regeneration. An independent engineered enzymatic vehicle that has the ability for efficient transdermal delivery of regenerative biomaterial was developed for tissue regeneration. Collagen has been well recognized as a skin regeneration molecule due to its interaction with the extracellular matrix to stimulate skin cell growth, proliferation, and differentiation. However, the transdermal delivery of collagen poses a significant challenge due to its high molecular weight as well as a lack of efficient approaches. Here, to improve the transdermal delivery efficiency, α-1,4-glycosidic hydrolase was engineered with genetically encoded 3,4-dihydroxy-L-phenylalanine, which enhanced its biological activity as revealed by microscale thermophoresis. The remodeled catalytic pocket resulted in enhanced substrate binding activity of the enzyme with a predominant glycosaminoglycan (chondroitin sulfate) present in the extracellular matrix of the skin. The engineered enzyme rapidly opened up the skin extracellular matrix fiber (15 min) to ferry collagen across the wall, without disturbing the cellular bundle architecture. Confocal microscopy indicated that macromolecules had diffused three times deeper into the engineered enzyme-treated skin than the native enzyme-treated skin. Gene expression, histopathology, and hematology analysis

also supported the penetration of macromolecules. Cytotoxicity (mammalian cell culture) studies revealed that the congener enzyme could potentially be used as a penetration enhancer, which is of paramount importance for the multimillion cosmetic industries. Hence, it offers a pharmaceutical enzyme for bio enhancement and dermatological applications.

Keywords: α-1,4-glycosidic hydrolase, DOPA (3,4-dihydroxy-L-phenylalanine), Collagen Like Protein (CLP), Transdermal delivery, Chondroitin sulfate.

PP-29: A study on pure and green synthesis of TiO_2 using *Leucas aspera* and *Justicia adhatoda* leaf extracts

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ABSTRACT

In this research work, the chemical synthesis and green synthesis of Titanium dioxide nanoparticles using *Leucas aspera* and *Justicia adhatoda* leaf extracts were successfully synthesized with titanium isopropoxide as the precursor. In this green synthesis method, medicinal leaves like *Leucas aspera* and *Justicia adhatoda* leaf extracts were used as stabilizing and reducing agents because these leaves contains photochemical compounds (saponins, alkaloids etc.). The Titanium dioxide nanoparticles are widely used in various fields such as biomedical application (antibacterial, antifungal, anticancer etc.), photocatalytic activity and for energy storage devices etc. The Titanium Dioxide was synthesized using low cost and ecofriendly method. The morphology, crystalline size, functional group and bandgap of the synthesized Titanium dioxide nanoparticles were confirmed by Scanning Electron Microscope, X-Ray Diffraction, Fourier Transform Infrared Spectroscopy, Ultra Violet Visible Spectroscopy techniques and Antibacterial applications carried out by disc diffusion method. Titanium Dioxide has got good potential exposure in antibacterial application.

Keywords: Titanium dioxide, *Leucas aspera*, *Justicia adhatoda*, SEM, XRD, green synthesis

PP-30: Remediation of heavy metal by nanocomposite synthesized by metal tolerant strain

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ABSTRACT

Heavy metal contamination is one of the major issues that are being addressed globally as it has adverse effects on the environment as well as on human health. Nanoparticles along with microbes have proven to be more efficient than other methods of contaminant removal. Nanobioremediation is an extended upcoming branch of nanotechnology which shows various new techniques better than the conventional and chemical methods for better removal of pollutants from the site of contamination by utilizing biogenic nanoparticles. Nanobioremediation has enormous potential for large scale environmental clean-up at low cost and with minimal amount of toxic consequences, thus it is cost effective. The utilization of nanofiltration membranes and nanoabsorbants has emerged as one of the most effective methods of heavy metal ion removal from wastewater due to their efficient operation, adaptable design and affordability. These advanced materials are popular due to their ability to depollute wastewater in a variety of circumstances. Tailoring the nanofilters, nanoabsorbants and nanomembranes efficiently remove heavy metal ions from wastewater and soil additionally with the help of few techniques like interfacial polymerization and grafting techniques have proven to be the most effective modification methods. In this review, the importance of metal tolerant bacterial strain mediated nanoparticles synthesize and its benefits are highlighted and further the usage of synthesized nanoparticles in wide area of heavy metal remediation in soil and water is spotlighted.

Keywords: Heavy metal contamination, Nanobioremediation, Metal tolerant bacteria, Nanofilter

PP-31: In-Silico Analysis of Therapeutic properties of Human Breast Milk (HBM) metabolites

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ABSTRACT

Human milk is a complex fluid that provides vital nutrients, immune factors, and protective compounds to newborns, enhancing their growth, development, and defense against infections. Among the numerous components of human milk, proteins play a crucial role in shaping the infant's immune system and modulating interactions with the microbial environment. In this study, we employed an in-silico approach to analyze human milk proteins and their potential interactions with bacterial proteins, aiming to gain insights into the mechanisms underlying host microbial interactions. These findings provide a foundation for further experimental validation and functional characterization of the identified interactions. In vitro and in vivo studies can elucidate the therapeutic potential of human milk proteins, either alone or in combination, in preventing or attenuating sepsis-associated complications. In conclusion, our in-silico analysis sheds light on the potential interactions between human milk proteins and sepsis-causing bacterial proteins.

Keywords: Human milk proteins, sepsis, bacterial proteins, in silico analysis, protein-protein interactions.

PP-32: Process development for the enhanced vitamin B_{12} production from a novel microorganism

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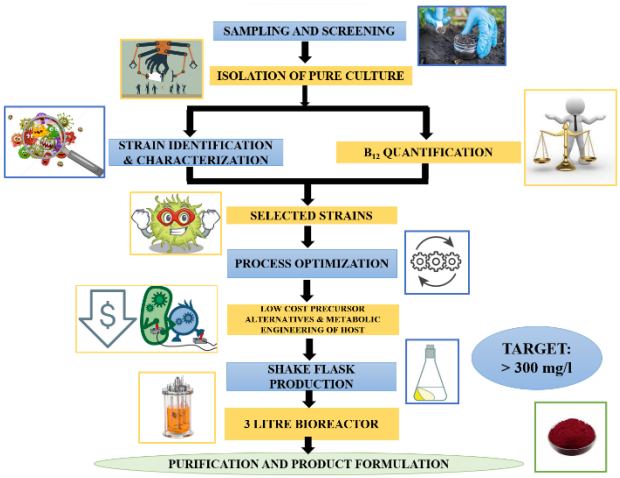
ABSTRACT

Vitamin B_{12} (B_{12}) is a cofactor for many important enzymes in the synthesis of DNA, fatty acids and myelin in human. B_{12} deficiency is the cause for pernicious anemia and distributed among all age groups of world population. In India, B_{12} deficiency is prevalent over 50% of total population. As animal meat is the major source of B_{12}, the deficiency among Indians is high due to religious beliefs and affordability. Hence, it is inevitable to develop an alternative technology to produce B_{12} to overcome the mentioned challenges. This study aims to develop a strategy for cost-effective production of B_{12} from novel microorganisms. *Pseudomonas sp.*, being an industrially recognized natural B_{12} producers was chosen as the potential screening target for the microbial production. The samples were collected from soil sources near algal growth enriched lake and different assay methods were used to identify and screen the targeted organisms. The ability of the isolated strains to synthesize B_{12} was found by the bioassay using mutant Salmonella typhimurium auxotroph. So far, a total of 27 strains have been found positive for *S. typhimurium* assay. Among these two strains were found to be high B_{12} producers and 16s rRNA characterization revealed them as *Pseudomonas otitidis* and *Bacillus cereus* respectively. Media optimization and screening of cheaper carbon sources such as wheat bran, corn steep liquor and Beet molasses further would lead for cost effective production of vitamin B_{12} using the isolated strains.

Keywords: Vitamin B_{12}, Microorganism, Fermentation, Bioassay.



Strategies for B_{12} production using novel microbes

PP-33: Microbial secondary metabolites as a source of biomaterial synthesis for efficient drug delivery to control nosocomial infections – New therapeutical approach

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ABSTRACT

Enterococcus faecalis, a normal commensal organism of the gastrointestinal tract, is also known to be an opportunistic pathogen and a cause of hospital acquired infections. It causes several infections like prosthetic joint infections, abdominal pelvic infections, endocarditis and urinary tract infections etc. Gram positive bacteria produces oligopeptides as the quorum sensing molecule. Regulators of the bacteria's system produce four proteins: Fsr A protein (response regulator), Fsr B protein (transmembrane protein), Gelatinase biosynthesis- activating pheromones (GBAP) produced by Fsr D protein, transmembrane histidine protein kinase Fsr C. Due to its high virulence factor and multidrug resistance nature, antibiotics has no positive effect in reducing its pathogenicity. Certain species of actinomycetes produce

secondary metabolite named siamycin I that inhibit autophosphorylation of histidine kinase (Fsr C) , fungal secondary metabolite named ambuic acid binds to Fsr B and prevents the proteolytic modification of Fsr D protein thus preventing biofilm formation. Silencing the autoinducer molecules by microbial secondary metabolites incorporated with cyclodextrin is the new therapeutic approach. Cyclodextrin based polymers are used as biomaterials to carry the secondary metabolites therefore enhancing effective drug delivery. With antibiotic resistance on the rise, immunotherapy to target these surface antigens is strongly being considered as alternative approach.

Keywords *Enterococcus faecalis*, nosocomial infections, Quorum sensing, Fsr -Faecalis system regulator, Quorum sensing, multidrug resistance, cyclodextrins

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PP-34: Perspective in three-dimensional printing of bioceramic for human scaffolds and constructs

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ABSTRACT

The development of technologies that could ease the synthesis of customizable tissue or organ specific biomedical constructs, having the required biomechanical and

regenerative properties is the need of the hour. The biomedical components that can substitute damaged tissues, cartilages and bones and scaffolds that can foster regenerative tissue healing has become a prerequisite with the advances in the medical technology. Bio-ceramics are a special set of fully, partially, or non-crystalline ceramics that are designed for the repair and reconstruction of faulty body parts/tissues. The bioceramics are preferred for fabrication of biomedical components and scaffolds by virtue of their inherent properties, which include high density, high durability, wear resistance, corrosion resistance, and inertness. However, bioceramics also has some limitations in their properties, which include hardness and brittleness, poor mechanical properties and low ductility. The biocompatibility and cell adhesion are the properties that distinguish bioceramics from other ceramics. A continuous research efforts are noted towards development of improved class of bioceramics for versatile applications. A categorical and systematic understanding of the development can strategize the future development goals. One goal of the present effort is aimed in that direction. Other than the materials of construction, the method of fabrication play a huge role towards advances in the synthesis of biomedical constructs and scaffolds. In recent years, additive manufacturing or otherwise known as three-dimensional printing (3DP) has shown promises in fabrication of biomedical components and scaffolds. 3DP has been able to generate biomaterials and scaffolds for utilization in hard tissue engineering. In this regard, 3DP of bio-ceramics for human anatomical scaffolds has received research attention in biomedical field. But 3DP of bioceramics are linked with several criticalities related to processing parameters, design features, and structure-property relationship of the fabricated components. A 3D printed bioceramic scaffolds exhibit hierarchical structure that can provide anchoring sites for cell expansions, promote cell spread, and further govern cell network development and tissue growth. The extrudate composition of 3DP on the other hand plays a crucial role in its mechanical, chemical, and biological characteristics of the desired product. Thus, another aim of the present effort is to understand and analysis these criticalities with regard to 3DP of bioceramics and thereby identify the scope towards improved fabrication of bioceramic constructs and scaffolds which will ultimately affect the quality of the life the beneficiaries.

Keywords: bio-ceramics; 3D printing; scaffolds; biomedical constructs;

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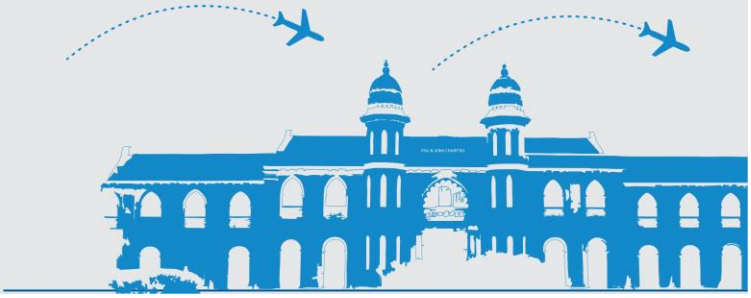

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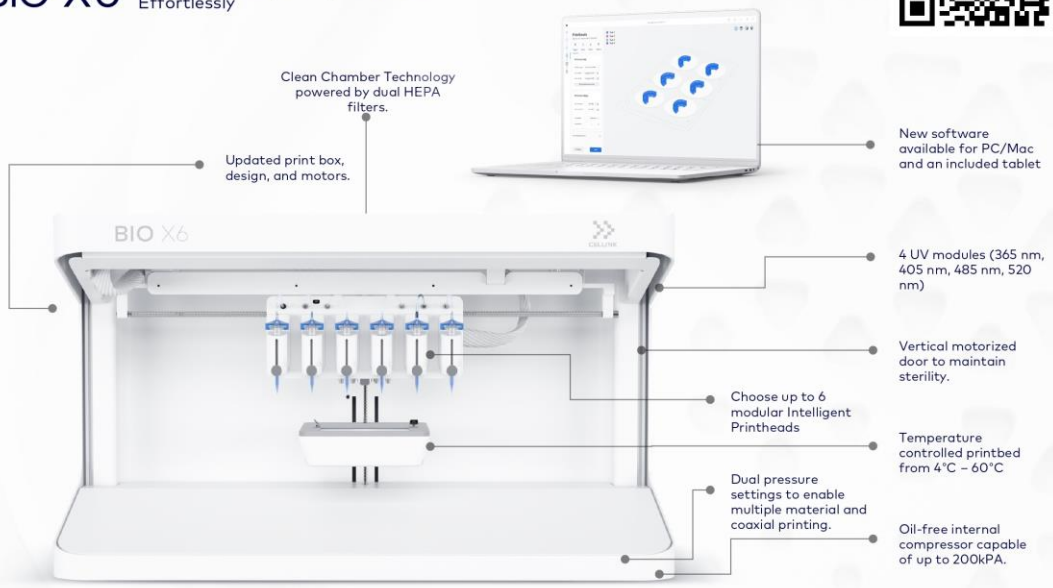

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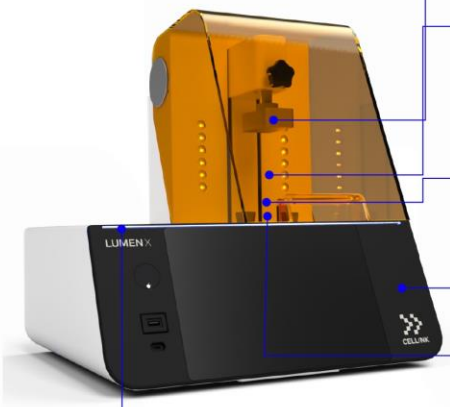

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