The ICONIC MEETINGS
.....Meet Influential People.....

ABSTRACT BOOK

Global Congress on

Biomaterials and Regenerative Medicine

November 10-12, 2025

Valencia, Spain

INDEX

Keynote Speakers

7	**Title: Highly Ordered Mesoporous Bioactive Glass and Scaffold for Aspirin Sustained Delivery**
	Dr. James Ziemah, *University of Bremen, Germany*
8	**Title: Boosting therapeutic efficacy of induced pluripotent stem cells using functional biomaterials**
	Dr. Fei Zhu, *Xi'an Jiaotong-Liverpool University, China*

Featured Speakers

9	**Tittle: Peptide coacervates as intracellular delivery vehicles for synergistic cancer photothermal- and chemo-therapies**
	HUANG Congxi, *Nanyang Technological University, Singapore.*
10	**1Title: The Role of IL-6 in Bone Marrow Extract in the Acute Phase Response Induced by Different Implants.**
	Dr. GAFUR RAKICI, *Istanbul Medeniyet University, Turkey*
11	**Title: Breaking the Cycle of Conventional Spinal Implantation.**
	Ms. Feride Elif Can, *Istanbul University Cerrahpasa, Turkey*
12	**Title: Compositional and Structural Analysis of Osteoarthritic Subchondral Bone Using Infrared Spectroscopy**
	Dr. Saida Benhmida, *Higher Institute of Medical Technologies, Tunisia*
13	**Title: Long-gap sciatic nerve regeneration using 3D-printed nerve conduits with controlled FGF-2 release.**
	Dr. Diego Noe Rodriguez-Sanchez, *University of Campinas (UNICAMP), Brazil*

14 **Tittle: Development and characterization of electrospun implants based on Polyvinyl Alcohol/Gum Arabic/Maqui Extract to evaluate their effect on breast cancer cell viability**

Aline Valentina Alfaro Ramírez, *Universidad de Santiago de Chile, Chile*

15 **Title: mathematical design and experimental evaluation of a viscoelastic conductive Ox-Alg/Gel/Qch/GO**

Gholamreza Mohammadi Khounsaraki, *Institute of Materials Research, Slovakia*

16 **Tittle: Development and Characterization of an oxygen breathing and anti-oxidant Polymeric Composite System for Chronic Wound**

Debarchan Panda, Vellore Institute of Technology, Tamil Nadu

17 **Title: Muscle-directed nucleic acid delivery using PBAE polymer for GNE myopathy**

Divya Rao, *Institute of Genomics and Integrative Biology, India*

18 **Title: Effective doping of hydroxyapatite nanoparticles using wet precipitation**

Kornel Prystupiuk, *Warsaw University of Technology, Poland*

19 **Tittle: Haemostatic biomaterials**

Ashrit Nair, *Indian Institute of Technology, India*

20 **Tittle: Biomimetic pH-Tunable Fibrin mimetic Strain Stiffening Peptide-Polymer Conjugate to Augment Myogenesis**

Debasish Nath, *Institute of Nano Science and Technology, India*

21	**Title: Amphiphilic Gelator-Based Shear-Thinning Hydrogel for Minimally Invasive Delivery via Endoscopy Catheter to Remove Gastrointestinal Polyps**
	Harshil Dave, *Indian Institute of Technology, India*
22	**Properties for Infection-Resistant Wound Healing**
	Jiukai Yu, *Department of R&D, Regenologics, USA*
23	**Tittle: Assessment of starch hydrogel for 3D bioscaffold printing applications**
	João Ícaro Miranda Morais Garcia, *University of São Paulo, Brazil*
24	**Title: Enhancing Granular Hydrogel Stability via Surface Modulation for Improved Frictional Inter-Particle Interactions**
	Navid Tavoosi, *McGill University, Canada*
25	**Tittle: Self-assembled Bioactive Protein/HA/CUR-based amyloidogenic nanohydrogel dressing for rapid infected diabetic wound healing via enhanced angiogenesis and anti-inflammation**
	Saurabh Kumar Srivastava, *Indian Institute of Technology BHU, INDIA*
26	**Tittle: Plant-Based Bioink for High-Fidelity Extrusion 3D Bioprinting**
	Sonali Garje, *Indian Institute of Science, India*

27 **Tittle: Nanomaterial doped Polyethersulfone Hollow Fiber Membfranes for Bioartificial Kidney and Hemodialysis Applications**

Nidhi Pandey, *Indian Institute of Technology Bombay, India*

28 **Retrieving data. Wait a few seconds and try to cut or copy again.**

Md. Shakhawat Hossain, *Department of Criminology and Police Science, University of Chittagong*

29 **Title: Amniotic membrane ecm hydrogels: a regenerative biomaterial for diabetic wound healing**

Pratibha, *BRIC-Translational Health Science and Technology Institute, India*

30 **Tittle: DLP-Based 4D Printed Hydrogel for Soft Tissue Engineering**

Tejaswini Somnath Tadge, *Indian Institute of Science, India*

31 **Title: Self-assembled DNA-collagen bioactive scaffolds for enhanced cellular uptake and neuronal differentiation**

Nihal Singh, *Indian Institute of Technology Gandhinagar, India*

32 **Tittle: Ultrasound Responsive Bioactive Microbubbles for Enhanced Drug Delivery**

Niyati Shah, *Indian Institute of Technology Gandhinagar, India*

33 **Tittle: Electrospun Membranes for Tissue Regeneration: Functional Wound Dressings Based on Biopolymers and Bioactive Nanomaterials**

Sabrina Arcaro, *Universidade do Extremo Sul Catarinense, Criciúma, Brazil*

34 **Tittle: A protease-degradable self-assembling peptide hydrogel for spatiotemporal control of viral vector delivery in gene therapy within the nervous system**

Zahra Eivazi Zadeh, *University of Melbourne, Australia*

35 **Tittle: Contact Drawing Technique: A Tool-Assisted Approach for Fabricating High-Strength, Collagen Fibers for Corneal Tissue Engineering**

Manisha Marothia, *All India Institute of Medical Sciences, India*

36 **Tittle: Leveraging Thiol functionalized biomucoadhesive hybrid nanoliposome for local therapy of Ulcerative colitis**

Kanika, *Institute of Nano science and Technology, India*

37 **Tittle: In Silico Design and Evaluation of a DuoBody Antibody Targeting CD40 and 4-1BB Receptors for Enhanced Immunotherapy in Non-Small Cell Lung Cancer (NSCLC)**

Darsh Pratap Singh, *Eigen Sciences, Apex, USA*

38 **Tittle: Structure-Guided Design of Proteolysis-Targeting Chimeras (PROTACs) for the Selective Ubiquitin-Mediated Degradation of Glycogen Synthase Kinase3 Beta (GSK-3β) against Alzheimer's Diseases**

Manya Kumari, *Eigen Sciences, Apex, USA*

39 **Melanocytes from Autoimmune Cytotoxicity in Vitiligo**

Namyaa Kattela, *Eigen Sciences, Apex, USA*

Dr. Eduardo José Nassar

Universidade de Franca, Brazil

Luminescent Properties of Er^{3+} and Yb^{3+} ions in a Calcium Phosphate Matrix

Abstract

Calcium phosphates (CPs) are widely used in biomedical applications due to their excellent biocompatibility, crystalline structure, and low toxicity. These characteristics allow for structural modifications during synthesis, such as the substitution with lanthanide ions, which can confer luminescent properties to the matrix. In this study, a CP matrix was synthesized from phosphoric acid and calcium nitrate, featuring the partial substitution of calcium ions with the lanthanide ions erbium (Er^{3+}) and ytterbium (Yb^{3+}) at 1% and 10% concentrations, respectively. Characterization by X-ray diffraction revealed a mixture of CP phases. Infrared vibrational spectroscopy identified the characteristic bands of the host matrix. Photoluminescence analysis showed emission bands attributed to Er^{3+} in both the visible and near-infrared regions. In upconversion energy analyses, using a 980 nm laser with excitation power varying between 490 and 1000 mW, the most intense emissions were observed in the green region. The increase in emission intensity with laser power suggested a potential thermal effect on electron excitation. Furthermore, in temperature-dependent experiments (25–100 °C), the material demonstrated significant thermal sensitivity, confirming its potential for applications in optical temperature sensing. Finally, cytotoxicity assays indicated no impairment of cell viability at any of the tested concentrations, with results similar to the negative control at 24, 48, and 72 hours.

Biography

University Professor with a PhD in Materials Chemistry. My research focuses on biomaterials, including the development of materials with antimicrobial properties, controlled drug delivery systems, and luminescent nanothermometers for bone substitute applications.

Dr. Xin Huang

Zhongyuan University of Technology, China

Progress in the diagnosis and treatment of malignant tumors using novel platinum nanoclusters based chemotherapy drugs

Abstract

In recent years, platinum (Pt) based nanomaterials such as Pt nanoparticles (Pt NPs) or Pt nanoclusters (Pt NCs), have emerged as innovative chemotherapeutic agents. Capitalizing on their small-size effects and enhanced permeability and retention (EPR) effect, Pt-based nanomaterials showcase notable advantages. These include high tumor suppression rates at low dosages, reduced systemic toxicity, targeted accumulation, modulation of autophagy, and enhanced sensitivity to cisplatin. In comparison with Pt(II) and Pt(IV) chemotherapeutic agents, Pt NCs possess advantages such as small size, low toxicity, and multifunctionality, especially in alleviating the efflux of small-molecule drugs. They exhibit significant anti-proliferative effects against a variety of cancer cell lines, including breast cancer MDA-MB-231, human hepatocellular carcinoma HCCLM3, human acute leukemia K562, and epithelial ovarian cancer SKOV3. Currently, the proposed antitumor mechanisms of novel Pt nanoclusters (NCs) mainly fall into two categories: (1) DNA Damage-Mediated Apoptosis Mechanism: Due to their high surface-to-volume ratio, Pt NCs can adsorb an adequate amount of oxygen to facilitate water oxidation or decompose through acidic intracellular organelles like lysosomes and endosomes, generating platinum ions (Pt ions). These ions then induce S-phase cell cycle arrest via the P53 signaling pathway. This can occur either through mitochondrial involvement or by directly interacting with nuclear DNA, thus promoting tumor cell apoptosis. Moreover, Pt NCs can directly bind to the grooves of DNA double helices, synergizing with Pt ions to disrupt DNA integrity. (2) Autophagy Regulation Mechanism: Pt NCs regulate autophagy through the PI3K-AKT-mTOR pathway, ultimately leading to apoptosis. Notably, Pt NCs-mediated autophagy intervention effectively inhibits the proliferation, invasion, and migration of cisplatin-resistant tumor cells while enhancing their sensitivity to chemotherapeutic agents.

Biography

Xin Huang finished his PhD at 31 years old years from Osaka University. He is the academic vice Dean of the School of Intelligent Textiles and Electronic Textiles, the team leader of the intelligent light-responsive nano-composite materials team. He has Published in excess of 40 papers in in well-known nanotechnology journals.

Dr. Atefeh Malek-Khatabi
Italian Institute of Technology, Italy

Multi-Compartment Microneedles for Controlled mRNA Vaccine Delivery in a 3D Human Skin-on-a-Chip Model

Abstract

Polymeric microneedles (MNs) represent a minimally invasive and promising strategy for intradermal vaccine delivery, offering effective skin penetration and pain-free administration (1). Key advantages include sustained release, regenerative potential, and enhanced antigen uptake, which together strengthen immune responses and support post-operative treatments (2).

This study introduces an innovative "matryoshka-like" MN system that embeds mRNA-loaded lipid nanoparticles (LNPs) within poly(lactic-co-glycolic acid) (PLGA) microparticles (MPs). This multi-compartmental design enables rapid release of LNPs from the MN tip, combined with sustained release of mRNA from MPs in the MN body, thereby enhancing overall mRNA expression. mRNA stability and release were assessed by agarose gel electrophoresis, HPLC, and fluorescence assays. Nano- and microformulation size and morphology were characterised using dynamic light scattering, nanoparticle tracking analysis, and electron microscopy (SEM, TEM).

We advanced beyond 2D cell culture by employing a human dermal equivalent (HDE) (3) skin-on-a-chip platform to assess the functionality of the multi-compartmental MN system. Integrated into a custom optically accessible device, this platform enables live monitoring of GFP expression and extracellular matrix organisation by confocal microscopy, SHG imaging, histology, and TEM.

Results demonstrated efficient encapsulation of 80 nm mRNA-LNPs into 10 µm porous MPs, with confirmed mRNA stability in the multi-compartmental platform and sustained GFP

expression for up to one week, peaking at 72 h in the HDE model.

These findings validate the combination of minimally invasive, precise dermal targeting with enhanced mRNA stability and highlight the potential of this system for next-generation cancer vaccines. Future work will focus on integrating the stratum corneum and antigen-presenting cells (APCs) into the HDE model to more closely mimic in vivo conditions.

Biography

Dr. Atefeh Malek-Khatabi is a biomaterials engineering scientist with a Ph.D. in Pharmaceutical Biomaterials from Tehran University of Medical Sciences. She is currently completing her first postdoctoral fellowship at the Italian Institute of Technology.

Her research focuses on biomaterials and advanced drug delivery systems, particularly microneedle platforms and the design of micro- and nanoparticles using microfluidic devices for applications in drug delivery and regenerative medicine.

She also has extensive experience as a co-inventor and research scientist in startup projects in the field of drug delivery.

Prof. Dongan Wang

Department of Biomedical Engineering, The Chinese University of Hong Kong, Sha Tin, Hong Kong SAR, China

Decellularized Tissue Engineering Hyaline Cartilage Graft for Articular Cartilage Repair and Its Forward-Looking Test for Space Medicine

Abstract

Articular hyaline cartilage, a tissue articulating skeleton at joints, is highly prone to damages caused by trauma, diseases and ageing; once injured, its self-regeneration is difficult and slow due to the avascular nature. To repair and regenerate damaged articular cartilage, we have innovatively developed decellularized tissue engineering hyaline cartilage graft (dLhCG). Good osteochondral defect healing and complete integration with adjacent native cartilage in in-situ implantation of dLhCG samples in large animal models. Investigative clinical trials have been completed in China with positive performance. Besides, a forward-looking space experiment is designed and performed with dLhCG for future space medicine too.

Dr. Alberto Vitali

National Research Council, Italy

Bioinspired Calcium Phosphate Nanostructured Surfaces: A Synergistic Approach to Infection Control and Bone Regeneration

Abstract

Antibacterial Nanostructured Surfaces (ANSs) have emerged as an innovative strategy to counteract antibiotic-resistant infections, one of the most critical challenges in global healthcare. These surfaces exploit their micro/nano-texture to induce bacterial death upon contact. However, conventional ANSs are often composed of bioinert materials, limiting their capacity to promote tissue regeneration-an essential feature for applications such as bone repair. In this study, we report the synthesis and characterization of bioactive calcium phosphate (CaP)-based ANSs doped with osteogenic ions and biomolecules, designed to combine antibacterial efficacy with regenerative potential. The ANSs were fabricated through a biomineralization-inspired bottom-up crystallization approach, leading to the formation of ordered arrays of CaP nanoneedles with tunable topographies. Their physicochemical properties were examined by SEM, XPS, FTIR, and TEM analyses. The antibacterial performance of the ANSs was tested against antibiotic-resistant strains of P. aeruginosa and S. aureus. Surfaces featuring thinner and less organized nanoneedles displayed enhanced bactericidal effects, achieving up to 75% bacterial mortality within 4 hours, likely due to synergistic mechanical disruption and oxidative stress induction. Conversely, ANSs with thicker and more organized nanostructures showed improved biocompatibility and osteoinductive behavior, promoting adhesion, proliferation, and differentiation of mammalian and human adipose-derived mesenchymal stem cells (Ad-MSCs). Overall, these bioinspired CaP nanostructured surfaces exhibit a unique dual function-effective antibacterial activity coupled with osteogenic bioactivity-highlighting their promising potential as next-generation biomaterials for the prevention and treatment of bone-related infections.

Biography

Dr. Alberto Vitali is a Senior Researcher at CNR-SCITEC in Rome, where he focuses on the discovery and development of new bioactive compounds of both natural and synthetic origin, as well as their delivery through nanodevices. He is actively involved in several research projects, including CHANCE—a project funded by the Italian Ministry of University and Research (MUR)—which aims to develop nanostructured materials functionalized with molecules that impart novel biofunctional properties.

Dr. Haroon Iqbal

Wenzhou Medical University, China

Fabrication of chondroitin sulfate functionalized albumin nanoparticles with taurine and necrostatin for targeted glaucoma treatment

Abstract

Glaucoma is the leading cause of irreversible blindness worldwide, characterized by progressive vision loss due to the selective damage to retinal ganglion cells (RGCs) and their axons. Oxidative stress is generally believed as one key factor of RGCs death. Recently, necroptosis was identified to play a key role in glaucomatous injury. Therefore, depletion of reactive oxygen species (ROS) and inhibition of necroptosis in RGCs has become one of treatment strategies for glaucoma. However, the therapeutic efficacy of existing drugs is limited due to low retinal permeation and low bioavailability due to a short drug retention time. Herein, we designed a chondroitin sulfate functionalized albumin nanoparticle with taurine and necrostatin (CS-NT@Alb NPs) for glaucoma. Chondroitin sulfate enhances the nanoparticles' ability to target specific areas within the eye, allowing for precise drug delivery. Albumin, a biocompatible protein, serves as a stable and safe carrier for the therapeutic agents. Necrostatin, a necroptosis inhibitor, helps prevent cell death in the optic nerve, thus preserving vision. Taurine, with its antioxidant properties, protects retinal cells from damage and supports overall eye health.
By combining necrostatin and taurine into single nanoparticles with a sustained drug release for extended period of time with an enhanced corneal permeation which will subsequently scavenge ROS in RGCs both in vitro and in vivo pathological glaucomatous injury model with reduced doses of frequency and superior biosafety. Further, the nanoparticles will effectively inhibit the necroptosis pathway, increasing the survival of RGCs with improved neuroprotection. This targeted treatment of glaucoma via CS-NT@Alb NPs will open a new avenue for the nanomedicine-based therapy of glaucoma
.

Biography

Dr. Haroon Iqbal studied Pharmacy at COMSATS University, Pakistan and graduated as MS in Pharmacy in 2016. He then joined the research group of Prof. Chen Huabing at the College of Pharmaceutical Sciences, Soochow University, Suzhou, Jiangsu, China. He received his PhD degree in Medicine at the same institution in 2020. After two years postdoctoral fellowship supervised by Prof. Xiao Run at Hangzhou institute of Medicine (HIM), Chinese Academy of Sciences, China he obtained the position of a Postdoctoral Researcher at the Affiliated Eye Hospital, and Assistant Professor (Research) at Wenzhou Medical University. He has published more than 40 research articles in SCI journals.

Dr. James Ziemah

University of Bremen, Germany

Highly Ordered Mesoporous Bioactive Glass and Scaffold for Aspirin Sustained Delivery

Abstract

Biomaterials for tissue engineering address health challenges like bone repair and wound healing, requiring multifunctional designs for antibacterial, antifungal, and analgesic properties while also finding applications in engineered food products. Highly ordered mesoporous bioactive glass (MBG) and silver-doped mesoporous bioactive glass (AgMBG) with composition (in mol% %) 78% SiO2, 20% CaO, 1.2% P2O5, and 0.8% Ag2O were successfully synthesized by the sol-gel technique coupled with supramolecular chemistry (ELISA process). The AgMBG was used to coat 45S5 BG scaffolds fabricated by using the foam replica technique. Both powder and scaffolds produced were loaded with aspirin, making use of the mesopores for possible pain relief during surgical healing. The multifunctional MBGs produced were characterized using FTIR, UV-Vis, EDS, and SEM. The materials showed high bioactivity within 1 day in SBF. They also showed high loading efficiency of aspirin and controlled release in Dulbecco's Phosphate Buffered Saline (PBS). The loading efficiency of aspirin was 90.18% and 89.10% for MBG and AgMBG, respectively. Silver-doped MBG and AgMBG-coated 45S5 BG scaffolds with drug delivery capabilities are interesting multifunctional biomaterials for wound healing and bone tissue engineering.

Biography

Dr. James Ziemah is a Ghanaian Analytical Chemist, Pharmaceutical Technology lecturer, and postdoctoral researcher at Constructor University in Bremen, Germany. His expertise encompasses Biomaterials and drug delivery, Material Chemistry, Green Chemistry, Sustainable Formulations, and Metabolomics, with a focus on Drug delivery systems, Biomaterials, and extracting and characterizing Phytochemicals for Phytotherapeutics. Dr, Ziemah worked on the design of biomaterials for drug delivery under the supervision of A. B. Boccaccini and doctoral research under Prof. Dr. Nikolai Kuhnert. he developed eco-friendly disinfectants derived from industrial byproducts, demonstrating significant antibacterial properties. This innovative work led to the startup "Waste to Disinfectant," which won the OnCampus round of the Hult Prize at Constructor University. Dr. Ziemah began at the University of Cape Coast, followed by advanced studies at the University of Bremen. He contributed to peer-reviewed publications on Chemistry, Genomics, and sustainable antimicrobial agents. He is committed to mentoring and promoting sustainable scientific practices.

Dr. Fei Zhu

Xi'an Jiaotong-Liverpool University, China

Boosting therapeutic efficacy of induced pluripotent stem cells using functional biomaterials

Abstract

Cell reprogramming represents a powerful approach to achieve the conversion of one type into cells of another type. In a groundbreaking study led by Yamanaka in 2006, the authors reported the generation of induced pluripotent stem cells (iPSCs) from mouse somatic cells via forced expression of OCT4, SOX2, KLF4 and c-MYC (OSKM), which has substantially changed the landscape in the field of developmental biology, regenerative medicine, disease modeling, and drug discovery. We have the robust generation of high-quality iPSCs using novel transcription factor cocktail (Published in Stem Cell Reports). Recently, we reported the robust reprogramming of different types of somatic cells into iPSCs by coordination of cell-reprogramming-inspired dynamically responsive hydrogel and phase separation of yes-associated protein (YAP). Mechanistic studies demonstrated that cell-reprogramming-inspired dynamically responsive hydrogel could faithfully sense metabolic remodeling and extracellular acidification during cell reprogramming, and respond by autonomously changing its mechanical properties (from softer to stiffer). The stiffening of the cell-reprogramming-responsive hydrogel elicited the nuclear translocation of YAP and the formation of YAP condensates with the appropriate timing during cell reprogramming, ensuring a faster and more efficient generation of iPSCs (Published in Advanced Materials). More recently, we have developed iPSC membrane-derived prophylactic cancer vaccine, which inhibited tumor progression by eliciting systemic anti-tumor memory T-cell and B-cell immune responses in several preclinical tumor models, such as melanoma, colon cancer, breast cancer and post-operative lung metastasis (Published in Nature Biomedical Engineering). In addition, iPSC membrane-derived prophylactic tumor vaccine was observed to have favorable safety profile.

Biography

Having obtained his Ph.D degree from University of Chinese Academy of Sciences, Dr. Zhu has developed expertise in the generation of iSPCs using cell reprogramming. Then he embarked on two rounds of postdoctoral research at School of Basic Medical Sciences of Peking University and National Center of Nanoscience and Technology, where he developed a wealth of expertise and experience in the design, construction and biomedical applications of patient-derived tumor organoids or pluripotent stem cell-derived organoids.

Dr. Zhu, as an Associate Professor at Academy of Pharmacy, Xi'an Jiaotong-Liverpool University, has an interdisciplinary research background covering pluripotent stem cells, regenerative medicine, and functional biomaterials. Currently, Dr. Fei Zhu' research team focuses on the following research topics:

1. Therapeutic interventions of chronic diseases using pluripotent stem cell-derived functional cells/organoids.
2. Disease modeling and therapeutic drug screening using novel cell reprogramming technologies.
3. The development of multifunctional biomaterials for cell reprogramming or cell therapy.

HUANG Congxi

Nanyang Technological University, Singapore

Peptide coacervates as intracellular delivery vehicles for synergistic cancer photothermal- and chemo-therapies

Abstract

Intracellular delivery of large molecular weight therapeutics poses a significant challenge in targeted cancer therapy, as conventional delivery vehicles often fail to achieve efficient cellular uptake and controlled release. This study presents a solution using GW26 coacervate microdroplets (CMs), a peptide-based system, as a dual-function platform that not only facilitates the controlled release of therapeutic cargos but also enhances cancer cell death through photothermal therapy (PTT). GW26 CMs exhibit high recruiting efficiency of photothermal (PT) materials—chlorin e6 (Ce6) and gold nanorods—with over 80% efficiency. These CMs demonstrate high cellular uptake in tumor cells, with 98% of CT26 colon carcinoma cells successfully internalizing Ce6-loaded CMs. Upon near-infrared laser irradiation, the PT materials generate localized heat within the therapeutic range for PTT, triggering coacervate disassembly, concomitant cargo release, and death of different human cancer cells, including cervical cancer cells HeLa, colon cancer cells HCT116, and colorectal adenocarcinoma cells HT29. The co-recruitment of cytotoxic proteins enables synergistic PT and chemotherapeutic cancer treatments among all these cells, further enhancing the therapeutic effect, in some cases exhibiting a near-complete loss in cell viability. This approach combines efficient recruitment, controlled cargo release, and enhanced therapeutic efficacy, positioning GW26 CMs as a promising platform for multimodal cancer therapies.

Biography

Congxi is currently a 5th year PhD candidate at Centre for Sustainable Materials (SusMat), School of Materials Science and Engineering, Nanyang Technological University (NTU). His research interest is about bioinspired materials and their application. Currently, he focuses on HBpep, a short peptide extracted from squid beak, as drug delivery vehicles for cancer therapies.

Dr. GAFUR RAKICI

Istanbul Medeniyet University, Turkey

The Role of IL-6 in Bone Marrow Extract in the Acute Phase Response Induced by Different Implants

Abstract

Background:
Rapid advances in tissue engineering have facilitated the development of novel implants designed for tissue repair and regeneration. Determining the long-term integration, function, and survival of biomaterials requires an understanding of the inflammatory response to these materials. The purpose of this study was to compare the acute inflammatory cytokine response in bone marrow extracts after the implantation of various materials, with an emphasis on interleukin-6 (IL-6), and to find possible immunomodulatory techniques to enhance patient outcomes.

Methods:
Twenty-eight male Wistar albino rats (10 weeks old, 250–300 g) were randomized into four groups: control (C), stainless steel (SS), titanium alloy (Ti), and titanium 500 (Ti-500) implants (n=7). Implants were surgically placed between the transverse and spinous processes of L4 and L5 vertebrae. On the third or seventh day after implantation, rats were sacrificed. Magnetic-activated cell sorting (MACS) was used to separate bone marrow cells and purify monocytes. ELISA was used to measure the amounts of many cytokines in bone marrow extracts, including TNF-α, IL-4, IL-6, IL-10, IL-1β, and TGF-β. The Mann-Whitney U test and the Kruskal-Wallis test were used for statistical analysis.

Results:
Pro-inflammatory cytokines (TNF-α, IL-6, and IL-1β) were most elevated by SS implants and least by Ti-500 implants. Conversely, anti-inflammatory cytokines (IL-4, IL-10, TGF-β) were highest in the Ti-500 group and lowest in the SS group. IL-6 levels were significantly

elevated in SS implants compared to controls ($p<0.001$), moderately elevated in Ti implants, and significantly reduced in Ti-500 implants, with further reduction from day 3 to day 7. Similar trends were observed for TNF-α and IL-1β. Anti-inflammatory cytokines increased progressively in Ti and Ti-500 implants, with Ti-500 showing the strongest response ($p<0.001$).

Conclusion:
While lower IL-6 levels suggest improved immunological compatibility, excessive IL-6 release after implantation may cause persistent inflammation and implant failure. When IL-6 is considered a critical biomarker for biomaterial selection and evaluation, our study demonstrates that Ti-500 has a higher implantation success rate compared to other materials.

Biography

Gafur Rakıcı got his medical degree from Cerrahpasa Medical Faculty, Istanbul University Cerrahpasa, Istanbul in 2019. He has began his residency (which is equal to PhD in Turkey) at the same university in Physiology department. In 2024 he started working as postdoctoral lecturer in Istanbul Medeniyet University.

Ms. Feride Elif Can

Istanbul University Cerrahpasa, Turkey

Ti-500: Breaking the Cycle of Conventional Spinal Implantation

Abstract

For an implant to successfully integrate and remain functional long-term, the patient's age, gender, environmental exposures, lifestyle and the implant material should be carefully considered. Spinal implants are predominantly used in older adults; however, their application extends across a wide age range. Ti is a great biomaterial due to its non-corrosive, non-immunogenic and non-inflammatory properties. Ti-500 is a titanium-based biomaterial that not only suppresses inflammatory responses but also holds promise for the development of immunological therapeutic strategies in clinical practice. This study compares the immunological responses of the Ti and Ti-500 implant. This is a pilot study in spinal cord surgery, and more detailed research projects are needed to evaluate the results. The findings presented in our study are being introduced as a first. Since the effects of surgical trauma and anesthesia were applied equally across all groups, we believe that the observed results occurred in response to the materials used.

Biography

Prof. Dr. Sibel Akyol completed her specialization training in Immunology and Hematology at Istanbul University, Istanbul School of Medicine. Her second specialization is in Physiology, which they pursued at Cerrahpaşa School of Medicine. For many years, she worked on various projects in collaboration with Dr. D.D. Taylor at the University of Louisville, Department of Obstetrics, Gynecology and Women's Health. Between 2017 and 2021, she carried out various projects related to natural biomaterials and immune reactions with Prof. Dr. Besim Ben-Nissan at the Biomaterials and Biomimetics Group, University of Technology. In 2007, she established the Cytokine and Receptor Research Center at Cerrahpaşa School of Medicine. She is the first person to introduce Luminex technology to Turkey. She is currently serving as a faculty member at the Department of Physiology, Cerrahpaşa School of Medicine, Istanbul University-Cerrahpaşa.

Presenter/ Student:
Feride Elif Can studied molecular biology at the University of Pittsburgh. She worked as a lab assistant at an Merkel Cell Polyomavirus lab during her time at the university. After two years she transferred to Cerrahpaşa School of Medicine. She currently finished her second year of medical school and works with Prof. Dr. Sibel Akyol at her laboratory.

Saida Benhmida

Higher Institute of Medical Technologies, Tunis Tunisia

Compositional and Structural Analysis of Osteoarthritic Subchondral Bone Using Infrared Spectroscopy

Abstract

Osteoarthritis is a disease that affects the various components of a joint (cartilage, synovial membrane, subchondral bone, ligaments, and muscles) at different times and to varying degrees. Three factors worsen these lesions: inflammation, mechanical disorders, and genetic history. Thus, lesions of the subchondral bone can be primary or secondary. They are identified radiologically by bone condensations, geodes, and osteophytes. The main goal of infrared spectroscopy (IR) study of osteoarthritis subchondral bone is to find differences in mineral and organic components to define the chemical alterations linked to osteoarthritis. This method enhances our understanding of the disease's underlying pathogenic mechanisms. We collected seventeen (17) fresh bone samples from ten healthy patients and seven osteoarthritic knees during the study. The subchondral bone IR spectra were acquired using the KBr compression method. Then, they were pressed at 5 tons for 2 to 5 minutes into pellets suitable for FT-IR spectroscopy analysis using a Perkin-Elmer 2000 spectrometer. The resolution starting was 0.5 cm-1. The interpretation of spectral changes in an infrared spectrum of osteoarthritis subchondral bone reveals several characteristic aspects of osteoarthritis. A reduction in mineralization is often observed, visible as a decrease in phosphate peaks, which may indicate alterations in the bone's mineral structure. Additionally, an increase in degraded collagen content appears as changes in the amide I and II bands, suggesting fragmentation of the bone's structural proteins. Using IR spectroscopy to evaluate the effectiveness of new approaches based on nanotechnology and regenerative therapies could revolutionize the treatment of osteoarthritis.

Biography

Dr. Saida Benhmida studied Biophysics at the Higher Institute of Medical Technologies, Tunisia, and graduated with an MS in 2014. She then joined the research group of Prof. Hedi Trabelsi of Biomechanics, Biophysics, and Medical Technologies Laboratory. She received her Ph.D. degree in 2021 at the same institution. After one year of postdoctoral fellowship supervised by Prof Hedi Trabelsi at the Biophysics and Medical Technologies Laboratory, Tunisia, she has published many research articles. She has been serving as an editorial board member of several journals.

Dr. Diego Noe Rodriguez-Sanchez

Department of Manufacturing and Materials Engineering, University of Campinas (UNICAMP), Brazil

Long-gap sciatic nerve regeneration using 3D-printed nerve conduits with controlled FGF-2 release

Abstract

Peripheral nerve injuries (PNI) require reconstructive surgery, often with variable results and persistent sensory and motor deficits. Three-dimensional (3D) printing, enables the biofabrication of nerve guidance conduits (NGCs) with ability to release neurotrophic factors, showing a therapeutic potential. We developed a 3D printing process of NGCs using polycaprolactone (PCL) and gelatin methacryloyl (GelMA) integrated with a fibroblast growth factor-2 (FGF-2). GelMA hydrogels (2.5%, 5%, and 10% w/v) were characterized for ultrastructure, rheology, and mechanical strength. Biocompatibility was evaluated using S16 Schwann cells and human mesenchymal stem cells (hMSCs). FGF-2 release over 30 days was analyzed by ELISA, and the proliferative and gene expression of hMSCs were assessed after priming with FGF-2. Bilayer nerve guidance conduits (NGCs; 3 × 10 mm) were fabricated with a microextruded PCL (Mn 50,000) and GelMA (10% w/v) incorporating hyperstable FGF-2 (2 µg/mL). In a rat sciatic nerve injury model (8 mm gap), autografts (n=5), plain NGCs (n=5), and FGF-2-loaded NGCs (n=5) were implanted. Functional recovery was assessed over 12 weeks via CatWalk platform, Von Frey, electromyography (EMG), and transmission electronic microscopy (TEM). Immunofluorescence for S100, P75 receptor, neurofilaments (NF), and myelination markers was conducted to evaluate nerve regeneration. The synthesized GelMA at 10% (w/v) concentration showed superior viscosity, high storage modulus (G') and compressive modulus, along with adequate microporosity. Incorporating FGF-2 into the GelMA resulted in a controlled release pattern over 30 days with high viability and continuous increasing of metabolism in S16 Schwann cells and MSCs-laden GelMA hydrogels. MSCs exhibited proliferation and gene regulation linked to vascularization after FGF-2 stimulation.

The PCL facilitates the buildability of a high-resolution spiral-patterned tubular structure, which was functionalized with a combination of porous GelMA+FGF-2 and crosslinked via UV light. At 12 weeks, NGC implantation enhanced sensory and motor recovery, improved electrophysiological function, and promoted morphological and ultrastructural nerve reorganization and regeneration. By 4 weeks, there was significant Schwann cell proliferation (S100), expression of the pan-neurotrophin receptor (P75NTR), myelination of newly formed axons, and organized neurofilament (NF) alignment.The bioactive NGCs represent a promising alternative to nerve autografts for the repair of long-gap injuries.

Biography

Diego holds a Master's degree (2016) and a Ph.D. (2020) in Veterinary Medicine with an emphasis on Regenerative Medicine from São Paulo State University (UNESP). He is currently a postdoctoral researcher at the Nerve Regeneration Laboratory, Institute of Biology, University of Campinas (UNICAMP). Between 2024 and 2025, he completed a postdoctoral research fellowship in the field of Biomaterials at the Terasaki Institute for Biomedical Innovation (TIBI), United States. His research expertise lies in regenerative medicine and tissue engineering, with a particular focus on nerve regeneration. His core areas of interest include 3D bioprinting, functionalization and modification of biomaterials, controlled release of bioactive molecules, development of nanocomposites, preclinical animal models, and advanced microscopy techniques applied to the nervous system.

Aline Valentina Alfaro Ramírez
Universidad de Santiago de Chile, Chile

Development and characterization of electrospun implants based on Polyvinyl Alcohol/Gum Arabic/Maqui Extract to evaluate their effect on breast cancer cell viability

Abstract

Cancer is characterized by the uncontrolled growth of abnormal cells with the ability to form tumors, invade tissues, and spread through metastasis. Globally, it is the second leading cause of death, with breast cancer being the most prevalent and deadly among women. This cancer has a high recurrence rate, particularly in the triple-negative subtype, due to the lack of therapeutic targets and the presence of residual cells resistant to treatment.

Conventional therapies such as surgery, chemotherapy, radiotherapy, and immunotherapy are effective in early stages, but their efficacy decreases over time and they are associated with severe side effects. In this context, localized drug delivery emerges as a promising strategy, as it increases drug concentration at the tumor site, reduces systemic toxicity, and improves treatment effectiveness, enabling the development of controlled-release implants. An innovative technology for this purpose is the use of polymeric fibers, which mimic the extracellular microenvironment and allow the incorporation of bioactive compounds. These fibers can be obtained through electrospinning using polymers such as polyvinyl alcohol (PVA), synthesized by hydrolysis of polyvinyl acetate (PVAc) (Zahra et al., 2023). PVA is a semicrystalline synthetic polymer that is highly hydrophilic, biodegradable, non-toxic, and biocompatible, with excellent properties such as strength, water solubility, gas permeability, and favorable thermal characteristics, making it an excellent candidate for implant development. However, its bioactivity is lower than that of natural polymers, so blending synthetic and natural polymers is advisable to combine their desirable features for improved outcomes. For this reason, the incorporation of gum arabic can enhance the required biological response (Serio et al., 2021). Gum arabic (GA) is a natural, biocompatible, nontoxic, water-soluble

gum obtained from the acacia tree. It is an inexpensive polysaccharide widely used in the food industry (Sarika et al., 2014). In the pharmaceutical field, it is employed as a thickener, emulsifier, tablet binder, suspending agent, and for controlled drug release, as well as in wound healing applications (Koyyada et al., 2021). Therefore, its use can improve the properties of PVA for implant fabrication.

Another important source of bioactive compounds is medicinal plants. For centuries, humans have relied on plants as sources of food, flavorings, and medicines, using them for various ailments due to their antioxidant, anti-inflammatory, and antitumor properties. Their use as complementary therapy has been recognized by the WHO as a key component of comprehensive healthcare. Chile has a rich tradition of endemic medicinal plants, including boldo (Peumus boldus), quillay (Quillaja saponaria), matico (Buddleja globosa), and maqui (Aristotelia chilensis), all traditionally used by indigenous communities for treating different diseases. Maqui (Aristotelia chilensis) is a Chilean endemic berry with high anthocyanin content. Recent studies have shown that its hydroethanolic extract possesses significant anticancer properties, including reduced cellular invasion and viability in breast and endometrial cancer cell lines, as well as the ability to induce cell cycle arrest and apoptosis. This makes maqui a promising agent for the development of complementary anticancer therapies due to its outstanding biological properties.

Based on this, the present work proposes the development of an implant as a complementary treatment for breast cancer, composed of polymeric fibers of PVA, gum arabic, and maqui extract. The maqui extract was developed and characterized by LC-MS/MS, FT-IR, and TGA, and its total polyphenol content was evaluated using the Folin-Ciocalteu assay. Subsequently, its effect on cell viability was assessed in two breast cancer cell lines, MDA-MB-231 and MCF-7, through the MTT assay. In addition, PVA/GA/Maqui implants were fabricated using electrospinning and characterized by SEM to study their morphology, by TGA to evaluate their thermal properties, and by FTIR to analyze functional groups. Future work will involve determining the effect of the implant on the two breast cancer cell lines.

Biography

She graduated in 2017 with a degree in Biochemistry from the University of Santiago, Chile. From that year until 2023, she worked at the Center for the Development of Nanoscience and Nanotechnology (CEDENNA), where she contributed to the establishment of the first accredited Nanosafety Laboratory dedicated to assessing the toxicity of nanomaterials. In 2024, she began her PhD in Biotechnology at the University of Santiago, Chile, where she is currently carrying out her doctoral thesis. She has four scientific publications in prestigious journals.

Gholamreza Mohammadi Khounsaraki

Institute of Materials Research, Slovak Academy of Sciences, Kosice, Slovakia

Mathematical Design And Experimental Evaluation of A Viscoelastic Conductive Ox-Alg/Gel/Qch/Go

Abstract

Recent advances in the mathematical modeling and material description of polymeric networks have opened new opportunities for the design and fabrication of hydrogels with tailored properties for specific applications such as tissue regeneration. In this study, we present a coupled mathematical framework developed to determine the optimal material composition required to achieve targeted viscoelastic and conductive properties in a hydrogel composed of oxidized alginate(Ox-alg), gelatin(Gel), quaternized chitosan (Qch), and graphene oxide (GO). For this purpose, a generalized Maxwell model and an Ohmic conduction equation were formulated to predict the viscoelastic and electrical response based on the kinetics and density of chemical bonds within the polymeric network.

The hydrogel was fabricated through in situ ionic and physical crosslinking according to the calculated optimal composition ratios. Relaxation tests revealed a pronounced viscoelastic response characterized by a high storage modulus and rapid modulus recovery, consistent with the predictions of the developed model. Electrical characterization performed using impedance spectroscopy demonstrated stable conductivity and strong correlation with the theoretical values obtained from the Ohmic conduction framework. This integrated modeling-to-experiment approach establishes a quantitative pathway for tuning both viscoelastic and conductive performance in multifunctional hydrogels, providing a foundation for designing next-generation self-healing, and conductive biomaterials for a variety of applications such as tissue regeneration.

Biography

Gholamreza (Reza) is currently a PhD student at the Institute of Materials Research, Slovak Academy of Sciences. After completing his Master's degree in Biomedical Engineering in IRAN, he moved to Slovakia to pursue his doctoral studies, focusing on the design and development of polymeric networks, including hydrogels, for biomedical applications such as wound dressing and musculoskeletal regeneration. His research integrates mathematical modeling and experimental approaches to establish a quantitative framework for tuning viscoelastic and conductive performance in multifunctional hydrogels, providing the foundation for next-generation of biomaterials.

Debarchan Panda

Department of Integrative Biology, Vellore Institute of Technology, India

Development and Characterization of an oxygen breathing and anti-oxidant Polymeric Composite System for Chronic Wound

Abstract

Prolonged hypoxia is a reported cause for impaired wound healing like: diabetic foot ulcer (DFU). Although hyperbaric oxygen therapy (HBT) has been well established in clinical settings, the sharp decrease in the intracellular oxygen level immediately after the exit of patient from the hyperbaric chamber is of not much benefit. Additionally, tissue hyperoxia and oxygen-mediated seizures can arise as a side effect of systemic oxygen delivery. Substantial research has been carried out for development of biomaterial-based localized and targeted oxygen delivery vehicle to combat chronic hypoxia and accelerate healing and regeneration of chronic wound. Considering the physiological demand for angiogenesis, epithelialization and granulation, a sustained and slow oxygen supply across a span of two week at the at wound microenvironment is inevitable. Hydrophobic synthetic polymer like: PLGA has widely been used as a delivery vehicle and solid peroxides or percarbonate like: Calcium peroxide (CaO_2), Magnesium peroxide (MgO_2), Sodium Percarbonate ($Na_2CO_3 \cdot 1.5H_2O_2$) have been demonstrated oxygen generating source. Being a FDA approved hydrophobic polymer, Polycaprolactone (PCL) is widely used in biomedical engineering because of its biocompatibility and and slower degradation into non-toxic products. However, there lies a void at using PCL as an oxygen delivery vehicle and use of hydrogen peroxide (H2O2) as an oxygen generating source. However, encapsulating a low molecular weight (Mw) and highly hydrophilic drug like: H2O2 inside a hydrophobic polymer like: PCL microsphere is difficult. Additionally, there is a risk of high oxidative stress at wound microenvironment due to elevated reactive oxygen species (ROS) generation. This study aims to develop a microsphere-scaffold composite system for sustained and targeted synergistic release of both oxygen and an anti-

oxidant drug at wound microenvironment. The objective focuses on modifying the traditional double emulsion method to achieve higher H2O2 encapsulation inside PCL microsphere, characterizing different components of the delivery system and executing sustained release of oxygen and an anti-oxidant drug in vitro for accelerated healing.

Biography

Debarchan Panda, has completed his Integrated M.Sc in Life Sciences from Central University of Jharkhand followed by one year Adavanced PG diploma course in Life Science Technologies at SRM Institute of Science and Technology. During his master's degree, he explored stem cell gene expression correlation with drug resistance gene in oral cancer and now exploring biomaterial and tissue engineering based stem cell therapy for Diabetic Foot Ulcer (DFU) during his Ph.D. He has two publications with one Indian patent.

Divya Rao
Institute of Genomics and Integrative Biology, India

Muscle-directed nucleic acid delivery using PBAE polymer for GNE myopathy

Abstract

GNE myopathy is an ultra-rare autosomal recessive disorder caused by a biallelic mutation in the GNE gene, which encodes for bifunctional rate-limiting enzymes involved in sialic acid biosynthesis. GNE myopathy is characterized by progressive skeletal muscle atrophy and weakness, which typically worsens over time and eventually leads to wheelchair dependence. The existing therapeutic option includes metabolic supplementation, but it cannot be used to completely cure the disease, and it can only help in the improvement of symptoms. Gene therapy can reverse the effect of the non-functioning gene with long-term treatment benefits, with potentially a single dose. One of the major limiting factors that hinders the success of gene therapy is development of appropriate vectors for gene delivery. Viral vectors have been extensively studied for many years; however, limitations such as immunogenic responses and limited packaging capacity have led to increased interest in non-viral delivery systems, including lipid-based vectors, polymers, cell-penetrating peptides, and inorganic materials. In this work, we are using poly (beta-amino ester)s (PBAE) based polymer to deliver nucleic acid to the muscle to alleviate GNE (UDP-N-acetylglucosamine2-epimerase/ Nacetylmannosamine-kinase) myopathy. PBAE possesses numerous advantageous properties, including biodegradability, low toxicity, low immunogenicity, endosomal buffering, structural diversity, chemical modification diversity, etc. These characteristic features contribute to their versatility and effectiveness in overcoming key biological barriers for gene delivery. Our results suggest that the PBAE polymer can efficiently deliver functional plasmid DNA to muscle cells. The polymers were also exhibited the capability for in vivo muscle tissue transfection when administered intramuscularly. We have hypothesized the modification of PBAE with muscle-directed moieties for enhanced delivery of the GNE gene towards muscle tissue, providing a potential therapeutic strategy for GNE myopathy. In vivo delivery of GNE

plasmid using the modified PBAE polymer is in progress.

Keywords: GNE myopathy, gene delivery, non-viral vectors, PBAE.

Biography

Divya is a PhD scholar at CSIR-IGIB, Delhi, India. She has qualified prestigious national-level exams such as CSIR-SRF, GATE, and DBT-BET. She is the author of two publications. Divya continues to pursue impactful research in her field.

Kornel Prystupiuk
Warsaw University of Technology, Poland

Effective doping of hydroxyapatite nanoparticles using wet precipitation

Abstract

Hydroxyapatite (HAp) is one of the most widely studied forms of calcium phosphate. It has been found in human bones and teeth, among others. HAp has the lowest solubility in aqueous media of all forms of calcium phosphate. Moreover, it has many properties as a promising biomaterial, which can be extended by incorporating ions of various elements into its structure. There are many methods for the synthesis of HAp and hydroxyapatite nanoparticles (nHAp), but precipitation is the most popular and straightforward method. Thus, we investigated the feasibility of two precipitation routes for the synthesis of doped nHAp.

For this purpose, two approaches to wet precipitation of nHAp from calcium and phosphate salts with magnesium, zinc, cobalt, strontium, or copper salts were carried out for doped nHAp production. In both investigated processes, the doping ion source was dissolved in calcium source solution, substituting 5% of moles of calcium in the solution with doping elements separately. First, we used the continuous reactor for wet chemical precipitation. Before using the continuous reactor for doped nHAp precipitation, the pH of the reactants was set at 10 using ammonia water. In the batch reactor, on the other hand, the reaction was carried out for 24 or 72 hours, at temperatures of 40 or 80 ○C, dosing ammonia water during the process to reach a pH value of about 10. This process is known in the literature as the precipitation/remodeling process. The product quality was determined by X-ray fluorescence spectrometry (XRF) and Fourier-transform infrared spectroscopy (FTIR), and the morphology of the particles was studied by scanning electron microscopy (SEM).

X-ray fluorescence spectrometry showed that the synthesis was successful in both investigated processes, and the metal ions were incorporated into the nHAp structure; however, their content depended on the metal used and the synthesis conditions, substituting between 0.5 and 5% moles of calcium by the dopant (doping efficiency from about 10% to about 100%). Fourier transform infrared spectroscopy indicated that the doped nHAps obtained by continuous synthesis had

hydroxyapatite-specific bonds in their structures. SEM images showed that the particles formed in the continuous reactor retained their spherical shape, whereas the morphology of the particles synthesized in the batch reactor in the precipitation/remodeling process depended on the dopant used and differed from the typical plate and rod shape expected from this process. The results showed that both the simple continuous precipitation process of doped nHAp and the batch precipitation process were successful. However, the characteristics of the particles obtained depended on both the synthesis process used and the dopant designed to be added to the resulting nHAp. Both presented processes could be used for the production of multifunctional biomaterials based on ceramic nHAp.

Biography

Kornel Prystupiuk received his MSc in Chemical and Process Engineering, specializing in Bioengineering, from the Warsaw University of Technology in 2022. Before that, he obtained a degree in Environmental Engineering, specializing in Bioeconomy, in 2021. Since 2022, he has been a PhD student in Chemical Engineering at the Warsaw University of Technology. His research interests include the synthesis and modification of hydroxyapatite for use as a biomaterial. He and his team investigate the influence of the hydroxyapatite precipitation method on the morphology of the resulting particles. He co-authored a paper on using nHAp with different morphologies in scaffold formation.

Ashrit Nair

Department of Textile and Fibre Engineering, Indian Institute of Technology, India

Haemostatic biomaterials

Abstract

Haemostasis is a highly intricate and regulated physiochemical process that focuses on arresting bleeding due to a traumatic injury. In cases of pre-hospital traumatic injuries, ~60% of the fatalities occuring prior to hospital arrival, are due to ex-sanguination. Therefore, researchers throughout the world have focused on technological advancements, resulting in the development of novel haemostatic agents. These haemostatic agents are developed using certain biomaterials involving major mechanisms such as- platelet activation and clot formation (e.g.chitosan, gelatin etc.), adhesion and mechanical barriers or simulation of ECM (e.g. self-assembly peptides like RADA16-I, catechols etc.). The biomaterials are selected in such as way that they exhibit robust haemostatic efficacy in severe haemorrhagic models, and exhibit minimal immunogenic and thrombotic risks. Although a lot of research has been conducted, a lot of these biomaterials have significant drawbacks including low yields, immunogenic effects, pH sensitivity, stability. Additionally,these materials require synnergistic effects from other biomaterials to boost their activity. This highlights the significance of combinational haemostatic agents, that employ the interactions of both synthetic and natural biomaterials, which can be tuned to suit the desired properties. Moreover, there has been a significant decline in the research on novel bio-inspired materials and mechanims. Our research involves a directional focus on the identification of biomaterials, for e.g., herbal moieties from coniferous trees (with high yield rates, haemostatic properties, mechanical properties etc.) and combining them with synthetic polymers (with tunable physical properties and biocompatibility) for the developement of next-gen haemostatic agents. The developed haemostatic agent was observed to exhibit quick haemostatic activity (~80 secs), significant adhesion to wet tissues (~23 kPa), tolerance to arterial pressure (~135 mmHg), minimal toxicity and self-administrability, allowing for applicability in various pre-hospital scenarios.

Biography

Ashrit Nair finished his M.tech from KIIT School of Biotechnology and joined the Department of Textile and Fibre Engineering Indian Institute of Technology, Delhi as a research fellow on the Department of Science and Technology project titled "Development of Formulations for Viral Decontamination of inanimate surfaces", during which he developed two technologies. Currently he is a PhD scholar at the Department of Textile and Fibre Engineering, Indian Institute of Technology, Delhi and is currently working on haemostatic management of pre-hospital traumatic injuries. He has published in excess of 13 papers in various jorunals, filed 5 patents (granted -1).

Debasish Nath

Chemical biology unit, Institute of Nano Science and Technology, India

Biomimetic pH-Tunable Fibrin mimetic Strain Stiffening Peptide-Polymer Conjugate to Augment Myogenesis

Abstract

Microenvironments play a crucial role in guiding cell proliferation and differentiation, yet controlling these factors in soft tissues remains challenging. In native muscle tissue, electrical and mechanical cues orchestrate cell behavior and development. Herein, we demonstrate a sophisticated synthetic method for creating stimuli-responsive stiffening network of peptide-polymer conjugates that exhibit numerous hierarchical controls. By modulating the pH, dynamic Schiff base crosslinking of semi-flexible peptide fibres with thermo-responsive poly(N-isopropylacrylamide) copolymer creates a covalent network. Owing to the lower critical solution temperature (LCST) of the polymer, the conjugates exhibit a macroscopic heat-stiffening response by producing inner stress through a coil-to-globule transition. We demonstrate for the first time a synthetic mimick of fibrin with characteristic non-linear mechanical response with pH- controlled heat- and strain-stiffening. Such molecular manipulation led to pH controlled bundled network with enhanced piezoresponse. Further, we show elegant feedback control using two antagonistic enzymes to regulate the pH and in situ transient stiffening of the hydrogel network. Finally, the electromechanical response of the hydrogel network enhances C2C12 myoblast adhesion, proliferation and maturation to myotubes in 48 h, a remarkable feat achieved for the first time to suggest its future potential toward designing muscle-mimetic synthetic ECM.

Biography

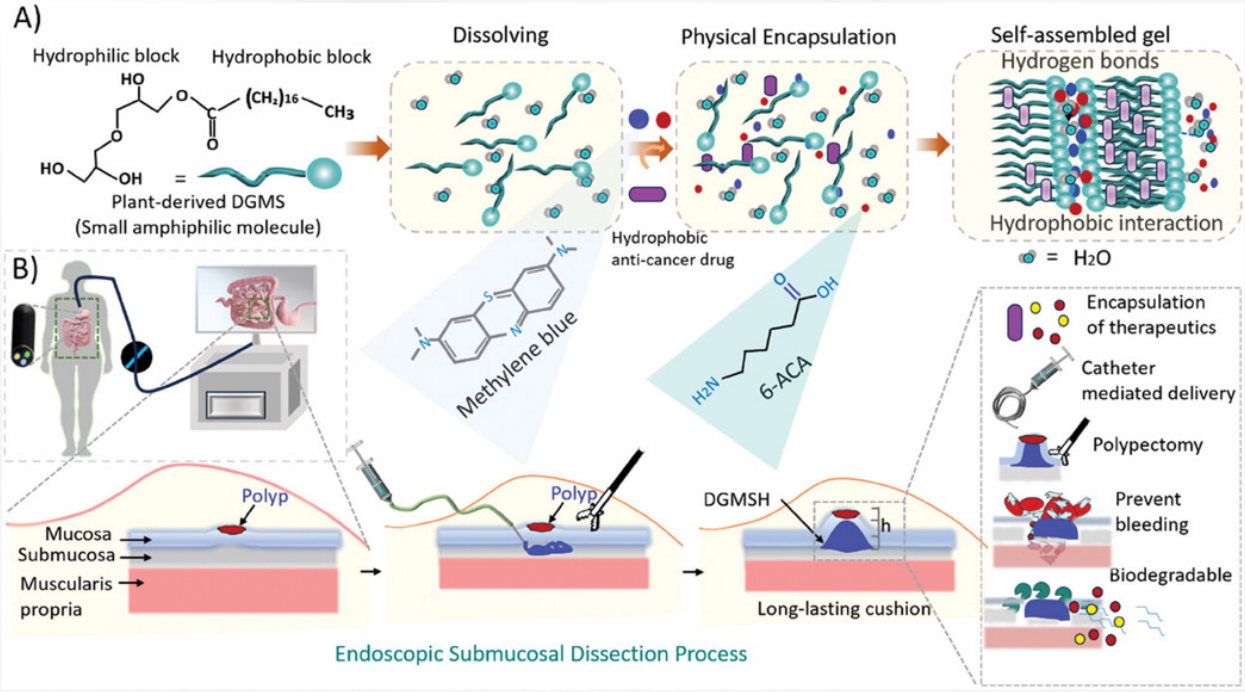
Debasish Nath is a Ph.D. scholar and Senior Research Fellow at the Institute of Nanoscience and Technology (INST), Mohali, affiliated with IISER Mohali, India. His doctoral research under Prof. Asish Pal focuses on biomimetic, strain-stiffening materials for tissue engineering. He holds an M.Sc. in Biotechnology from the University of Calcutta and a B.Sc. in Microbiology from University of Calcutta, India. His research spans non-linear rheology, peptide–polymer conjugates, supramolecular assembly, and self-healing hydrogels, with a strong emphasis on electrochemical and mechanobiological properties for tissue regeneration. Prior to his Ph.D., he worked at JNU, New Delhi, India on biosensors and scaffold development for bone tissue engineering. Debasish has co-authored in 17 peer-reviewed publications in leading journals such as Chemistry of Materials, Biomacromolecules, and ACS Applied Materials & Interfaces. He has received multiple awards for oral and poster presentations and is skilled in advanced characterization tools, cell culture, and electrochemical techniques.

Harshil Dave
Indian Institute of Technology, Gandhinagar, India

Amphiphilic Gelator-Based Shear-Thinning Hydrogel for Minimally Invasive Delivery via Endoscopy Catheter to Remove Gastrointestinal Polyps

Abstract

Injectable polymeric hydrogels delivered via endoscopic catheter have emerged as promising submucosal agents, offering durable, long-lasting cushions to enhance the efficacy of endoscopic submucosal dissection (ESD) for the removal of small, flat polyps from the gastrointestinal tract (GIT). However, polymer-based injections do not meet the easy-injectability criteria via catheter because their high viscosity tends to clog the catheter needle. To the best of our knowledge, for the first time, we report the fabrication of an amphiphile-based small molecule hydrogel of diglycerol monostearate (DGMS) that self-assembles to form a hydrogel (DGMSH) for delivery via an endoscopic catheter. Physicochemical characterization of the hydrogel reveals its fibrous morphology, shear-thinning behaviour, and easy injectability, along with its scalability and long shelf-life (6 months). Ex vivo studies on the goat's stomach and intestine demonstrate the ease of injectability through the catheters and the development of visible submucosal cushion depots with the desired height. Moreover, the hydrogel can encapsulate both hydrophobic and hydrophilic drugs/dyes. In vivo studies in small animals have found that the hydrogel depot is durable, biocompatible, non-immunogenic, and has a hemostatic effect. Endoscopic studies in the porcine model demonstrate a safe injection and endoscopic excision of GI polyps, acting as a suitable agent for ESD.



Biography

Harshil Dave is a Ph.D. scholar at IIT Gandhinagar in the Biomaterials and Drug Delivery Laboratory under Dr. Mukesh Danka. He completed his M.Tech in Biological Engineering from IIT Gandhinagar and his B.E. from LD College of Engineering, Ahmedabad. His research focuses on injectable amphiphilic hydrogel systems for minimally invasive endoscopic delivery. He has published research articles, reviews, and book chapters in reputed international journals and filed three Indian patents, with one granted. His work has progressed from bench studies to successful small- and large-animal trials.

Jiukai Yu

Department of R&D, Regenologics, Bridgewater NJ 08807, USA

Functional Hemostatic Dressing with Highly Tunable Drug Release Properties for Infection-Resistant Wound Healing

Abstract

Effective management of traumatic and noncompressible wounds remains a major challenge in combat and emergency medicine due to uncontrolled bleeding, infection, and delayed tissue repair. To address these issues, we developed an injectable chitosan–hyaluronan functional hemostatic dressing impregnated with drug-loaded microgels capable of providing rapid hemostasis and sustained local therapy for over 72 hours. The positively charged chitosan mini-sponge rapidly absorbs blood and expands to fill wound cavities, while its electrostatic interaction with negatively charged hyaluronan microgels enables immediate release of encapsulated agents upon blood contact. Each microgel is engineered for wound-stimuli-responsive degradation, allowing precisely timed delivery of antibiotics, analgesics, immune modulators, oxygenating agents, and regenerative factors to match distinct phases of healing. In vitro studies demonstrate strong antimicrobial efficacy, pH stabilization, and enhanced fibroblast viability and proliferation. This modular, biodegradable system integrates hemostasis, infection control, immune modulation, and tissue regeneration within a single platform, representing a promising advancement toward nextgeneration biomaterials for trauma and wound care applications.

Biography

Mr. Jiukai Yu is a Research Scientist at Regenologics with expertise in molecular biology, immunology, microbiology, and biomaterial development. He leads formulation and biological evaluation of injectable hemostatic systems, focusing on sustained drug delivery and immune modulation in wound healing. Previously, he conducted immunological research on dendritic cell communication and chemokine-mediated signaling at Thomas Jefferson University, elucidating pathways that bridge innate and adaptive immunity. Mr. Yu holds a Master of Biotechnology from the University of Pennsylvania and a B.S. in Biology from the University of Washington. His research integrates biomaterial engineering with molecular immunology to create infection-resistant and regenerative wound-care technologies.

Joao Icaro Miranda Morais Garcia
University of São Paulo, Brazil

Assessment of starch hydrogel for 3D bioscaffold printing applications

Abstract

Dry heat treatment (DHT) is a sustainable method that modifies the structure and functionality of starch. In this study, jackfruit seed starch was subjected to DHT at 130 °C for 2 and 4 h (TDH_2h and TDH_4h) to assess its potential application in 3D printing as a matrix for producing bioscaffolds for bone regeneration. The reduction in starch content observed in DHT_4h (85.12%) compared to DHT_2h (92.13%) and native starch (89.67%) suggests possible thermal degradation of the starch structure, accompanied by the release of reducing sugars. This is further supported by the lower final moisture content observed in the samples: native starch (13.49%), DHT_2h (7.33%), and DHT_4h (4.55%). X-ray diffraction analysis indicated that crystalline patterns A and C were preserved in the modified starches, although there was a reduction in crystallinity (~10%), which may be associated with the higher amylose content observed (~52%). Strain sweep under SAOS (small amplitude oscillatory shear) showed a progressive increase in the storage modulus (G') with the duration of heat treatment (DHT), indicating enhanced gel structuring: native (2043 Pa) < DHT_2h (2209 Pa) < DHT_4h (2201 Pa). Notably, the DHT_2h gel exhibited the highest strain at the crossover point (G'=G", 80.9%), indicating greater resistance to flow onset and the broadest linear viscoelastic region (50.7%) among all samples, which suggest a cohesive and well-structured gel network favorable for extrusion-based applications. These rheological results correlate directly with visual assessments. The DHT_2h gel formed continuous and stable filaments during plate extrusion and maintained structural integrity in the bridge test, even after 2 h of storage in the syringe. In contrast, the DHT_4h gel, while exhibiting higher G', displayed deformed filaments and collapses between gaps, indicating structural fragility and low recovery capacity. The native gel demonstrated intermediate performance, initially producing regular filaments but losing stability after 2 h. These findings support the use of DHT as a

strategy for modifying starch properties, with DHT_2h being selected for future development of 3D-printable biomaterial inks due to its favorable viscoelastic performance and deformation control.

Biography

João Garcia holds a bachelor's degree in Medical Physics (2021) and a master's degree in Materials Science and Technology (2024) from São Paulo State University "Júlio de Mesquita Filho" (UNESP). He also completed a teacher training program in Physics at Cruzeiro do Sul University (2022). He was awarded at the XV Congress of Applied Physics to Medicine (CONFIAM, 2019) for his research titled "Effect of Calcium Titanate Film on the Corrosion Susceptibility of Titanium." In 2023, he carried out a four-month research internship at the Institute of Materials Technology (ITM), Polytechnic University of Valencia, Spain. He is a PhD student in Materials Science and Engineering, where he investigates the development of biomaterials from agro-industrial waste. His academic interests include sustainable technologies, surface modification, and the interface between physics and biomedical materials.

Navid Tavoosi

Mechanical Engineering Department, McGill University, Montreal, Canada

Enhancing Granular Hydrogel Stability via Surface Modulation for Improved Frictional Inter-Particle Interactions

Abstract

Introduction

Granular hydrogels have gained significant attention in tissue engineering and bioprinting due to their shear-thinning and self-healing properties, along with their tunable porosity [1]. These hydrogels, composed of microgel particles larger than 10 microns, rely primarily on frictional interactions for structural integrity [2]. Traditional methods to enhance these interactions, such as interparticle cross-linking [3] or embedding microgels in a hydrogel matrix [4], often add complexity or compromise porosity. In this study, we introduce a phase separation-induced surface modulation technique to improve the interconnectivity of porosity and frictional interactions between microgels, enhancing the mechanical stability of granular hydrogels.

Materials and Methods

Microgels were fabricated using a water-in-oil batch emulsion method with a precursor solution consisting of 10% w/v poly(ethylene glycol) diacrylate (PEGDA), 5% w/v poly(ethylene glycol) (PEG), and 0.4% w/v lithium phenyl-2,4,6-trimethylbenzoylphosphinate (LAP). Photopolymerization was performed at 405 nm, and microgels were isolated via centrifugation and multiple washes to remove residual oil. The PEG was then leached out via controlled washing, inducing phase separation to create porous microgels with increased surface roughness. A control group without PEG was fabricated under similar conditions for comparison.

Results & Discussion

The phase separation technique successfully enhanced the surface roughness and porosity of the microgels. Rheological tests showed a 200% increase in viscosity at low shear rates (235 to 705 Pa•s) while maintaining shear-thinning behavior. Additionally, storage modulus

doubled during cyclic strain tests, indicating improved self-healing capabilities. The yield strain remained stable at approximately 20%, with a slight increase in PEG-leached samples, suggesting that the enhanced roughness facilitated stronger interparticle friction.
Injectability and printability tests using a 27G needle revealed that the modified hydrogel formed thinner fibers upon extrusion, while contact angle measurements showed improved stacking stability, preventing layer merging under gravitational forces. These results suggest that phase separation-induced porosity interconnectivity enhances frictional interactions between microgels, improving hydrogel structural integrity.

The findings highlight the effectiveness of phase separation in modulating microgel surfaces for improved mechanical stability. By increasing microgel roughness and porosity, frictional forces are enhanced, strengthening interparticle interactions without the need for additional cross-linking agents. This approach maintains the intrinsic advantages of granular hydrogels, such as tunable rheology and self-healing behavior, while improving printability and injectability.

Conclusions

This study demonstrates that phase separation-induced surface modulation is a viable strategy to enhance the mechanical stability of granular hydrogels. The improved interparticle friction achieved through increased porosity and roughness leads to better print fidelity and shape retention, making this technique promising for advanced tissue engineering applications.

Biography

Navid Tavoosi is a biomedical-focused mechanical engineer and MSc researcher at McGill University, specializing in hydrogel-based biomaterials and bioprinting. His current work develops porous granular hydrogels to improve vascularization and mechanical stability, combining microfluidics, emulsion techniques, and advanced characterization methods. At VascuBio Innovation Inc., he integrates real-time sensors into microcontroller-based bioreactor systems for long-term monitoring of bioprinted constructs. Navid's expertise bridges engineering and biology, with a focus on designing functional biomaterials and scalable platforms for regenerative medicine and organoid modeling.

Saurabh Kumar Srivastava

Department of Physics, Indian Institute of Technology BHU, INDIA

Self-assembled Bioactive Protein/HA/CUR-based amyloidogenic nanohydrogel dressing for rapid infected diabetic wound healing via enhanced angiogenesis and anti-inflammation

Abstract

Infected diabetic wounds present a significant clinical challenge due to impaired healing, persistent inflammation, and heightened risk of infection. In this study, we report a novel self-assembled hybrid nanohydrogel composed of Bovine Serum Albumin (BSA)-based amyloid fibrils, hyaluronic acid (HA), and the natural anti-inflammatory agent curcumin, designed as a 3D-printed dressing for effective treatment of infected diabetic wounds. The incorporation of curcumin enhances the antimicrobial and antioxidant properties of the hydrogel, while HA contributes to moisture retention, angiogenesis, and anti-inflammatory response. BSA amyloid fibrils offer structural integrity and self-assembly behavior, forming a mechanically stable yet tunable scaffold. The resultant BSA–HA–Curcumin hydrogel demonstrates excellent water retention, shear-thinning behavior, and biocompatibility, providing a moist healing microenvironment. In vitro assays reveal significant reduction in bacterial burden and enhanced NIH-3T3 fibroblast migration. In vivo diabetic wound models confirm accelerated wound closure, reduced inflammation, enhanced collagen deposition, and neovascularization in infected sites. These findings suggest that the BSA–HA–Curcumin composite hydrogel holds substantial promise as a multifunctional, translational dressing for managing infected diabetic wounds.

Biography

Mr. Saurabh Kumar Srivastava is pursuing his Ph.D. at the Department of Physics, Indian Institute of Technology (IIT) BHU, Varanasi, under the supervision of Prof. Avanish Singh Parmar. Prof. Parmar completed his Ph.D. and postdoctoral research at the University of South Florida and the Center for Advanced Biotechnology and Medicine, Rutgers University, USA. He is currently an Associate Professor at IIT BHU and has published over 50 research articles. Saurabh's research focuses on nanoscience and nanotechnology for healthcare applications. His group develops novel functional materials such as hydrogels, ointment membranes, and bio-composites using natural biomolecules (proteins, DNA), cellulose, and medicinal plants for applications in chronic wound healing, tissue regeneration, implants, bioimaging, and drug delivery.

Sonali Garje
Department of Materials Engineering, Indian Institute of Science, India

Plant-Based Bioink for High-Fidelity Extrusion 3D Bioprinting

Abstract

Extrusion-based 3D bioprinting is a widely used additive manufacturing technique that fabricates three-dimensional structures by extruding bioinks containing living cells through a nozzle layer by layer. The bioink plays a critical role in 3D bioprinting by providing a microenvironment conducive to cell attachment, growth, and proliferation needed for tissue regeneration. Materials used for bioink formulation must satisfy specific criteria, including printability, high shape fidelity, viscoelasticity, shear-thinning behavior, bioactivity, biocompatibility, and appropriate mechanical properties tailored to the target tissue regeneration application. Natural polymers such as gelatin, hyaluronic acid, alginate, and collagen are commonly used in bioink formulations due to their biocompatibility and bioactivity. However, these polymers exhibit limitations, including poor printability, low shape fidelity, and insufficient mechanical strength. To overcome these drawbacks, synthetic polymers are frequently blended with natural polymers; nevertheless, this approach often reduces cell attachment and biocompatibility due to the generation of toxic byproducts and the absence of cell adhesion motifs in synthetic materials. Therefore, there is a pressing need to identify natural materials that possess all the requisite properties for bioink applications.

A novel plant-based material rich in glycoproteins, containing carbohydrates (230 ± 60 µg/mg), proteins (71 ± 20 µg/mg), polyphenols (30 ± 5 µg/mg), and essential minerals like potassium, calcium, and magnesium, has been investigated as a bioink candidate. This material mimics the extracellular matrix, promoting cell growth and proliferation. It exhibits favorable rheological properties, including high viscosity at low concentrations and consistent printability with excellent shape fidelity between 40 and 60 mg/mL (Figure 1a). Its shear-thinning (Figure 1b) and viscoelastic behavior (Figure 1c) fulfill extrusion-based bioink requirements. The material's abundant hydroxyl groups are modified with photocrosslinkable groups, confirmed by FTIR and NMR (Figure 1d) analysis, enabling visible light (405 nm)

crosslinking (Figure 1e) to improve mechanical strength. After crosslinking, SEM analysis showed a porous morphology of the prepared scaffold with an average pore size of 83 ± 16 µm, which is favorable for cell migration and growth, as well as for efficient nutrient and oxygen transport (Figure 1f). Biocompatibility tests using NIH-3T3 fibroblast cells showed over 100% cell viability in MTT assays (Figure 1g) and confirmed cell attachment and proliferation via live-dead assays (Figure 1h). Additionally, the material's inherent antioxidant properties help neutralize reactive oxygen species (ROS), protecting cells from oxidative damage. Its easy availability, cost-effectiveness, and biodegradability make this plant-derived bioink a sustainable and promising candidate for regenerative medicine applications.

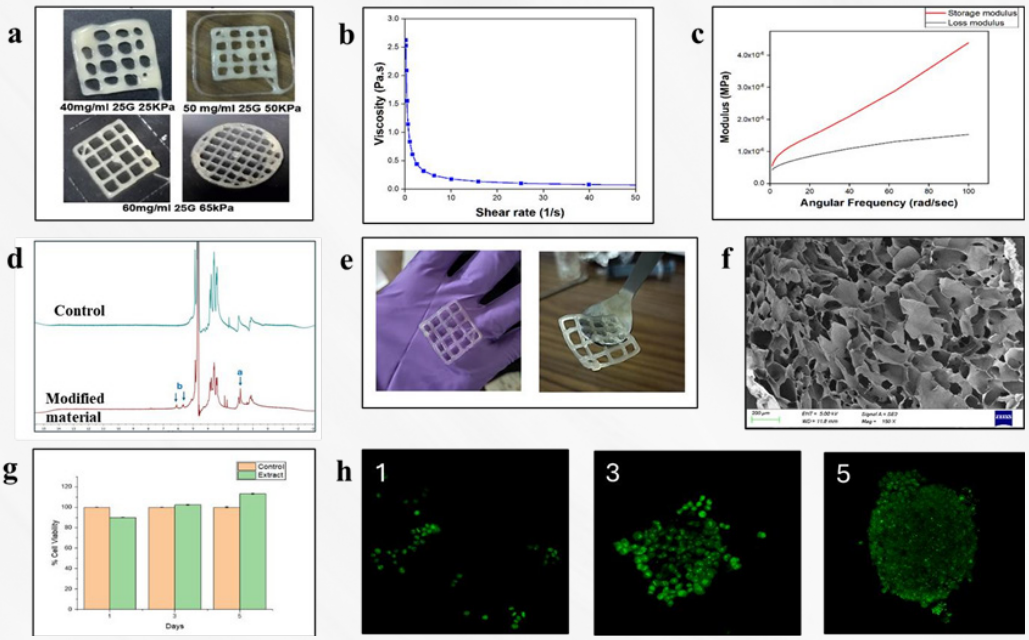


Figure 1. (a) Shape fidelity of the bioink at different concentrations. (b) Shear-thinning behavior of material (5mg/ml). (c) Frequency sweep analysis of material (5mg/ml). (d) NMR analysis of chemically modified material. (e) Photo-crosslinked scaffolds after exposure to visible light (409 nm). (f) SEM analysis of crosslinked scaffold. (g) Cell viability assessment using the MTT assay. (h) Live/dead assay using acridine orange and propidium iodide showing cell attachment and proliferation on days 1, 3, and 5.

Biography

I am a third-year Ph.D. student in the Materials Engineering Department at the Indian Institute of Science (IISc), Bangalore. I hold a Bachelor of Pharmacy degree and an M.S. in Medical Devices, which has provided me with a broad background in pharmaceutical science, biomaterials, and biomedical engineering. My doctoral work focuses on exploring novel materials for the development of sustainable bioinks for 3D bioprinting for tissue regeneration and disease modelling applications. By integrating principles of materials science with biomedical innovation, I aim to contribute to the development of next-generation bio-fabrication technologies for regenerative medicine.

Nidhi Pandey
Department of Chemical Engineering, Indian Institute of Technology Bombay, India

Nanomaterial doped Polyethersulfone Hollow Fiber Membfranes for Bioartificial Kidney and Hemodialysis Applications

Abstract

Chronic kidney disease (CKD) remains a major global health concern affecting one tenth of world population, with current treatment options limited to hemodialysis and organ transplantation. While hemodialysis provides partial detoxification by removing small water-soluble toxins, it is ineffective in eliminating middle molecular weight and protein-bound toxins. Organ transplantation, though a definitive solution, is constrained by high costs and limited donor availability. Thus, the development of a bioartificial kidney (BAK) represents the most viable long-term solution for CKD patients.

Hemodialysis and bioartificial kidney (BAK), which mimic both physical and biological functions, can significantly impact chronic kidney disease (CKD) patients. Here we report on Hollow fiber membranes (HFMs) with enhanced separation of uremic toxins along with enhanced hemocompatibility and biocompatibility that also promote the growth of kidney cells. Fabricated HFMs were concentric, cross-section having finger-like structure, inner surface being porous. Modified HFMs showed enhanced separation performance (KUF: 152.86 ±5.01ml/m2.h.mmHg) and toxins removal of low molecular weight (urea, creatinine), middle molecular weight (lysozyme) and protein bound toxins (indoxyl sulfate). Hydrophilicity of the modified HFMs were more as compared to plain PES. Modified HFMs also showed better biocompatibility to allow the growth and proliferation of HEK-293 cells on the HFMs. The confocal images of the HFMs seeded with kidney cells showed HEK-293 cells were gathered together to form spheroid. FACS analysis also confirms that the low percentage of dead cells in the modified HFMs. The membranes also showed better hemocompatibility (< 5% hemocompatibilty limit) and low value of complement activation.

Biography

I am Nidhi Pandey, currently pursuing Ph.D. in Chemical Engineering at the Indian Institute of Technology Bombay, India, under guidance of Prof Jayesh Bellare. I am receipient of the Prime Minister's Research Fellowship (PMRF) award during my PhD tenure to carry out my research work in recognition of academic excellence and research potential. My research work focuses on the development of Hollow Fiber Membranes for Bioartificial Organs. I have numerous papers published in reputed peer-reviewed journals listed below and patents in the pipeline for submission.

Nidhi Poddar
Vellore Institute of Technology, India

Engineered Microneedle Assisted Sandwich Hydrogel Systems for Targeted ROS Scavenging and Angiogenesis in Wound Healing

Abstract

Chronic wounds, particularly in diabetic patients, present a significant challenge in clinical wound management due to persistent inflammation, microbial infection, and impaired tissue regeneration. In this study, we developed a sandwich-structured hydrogel patch using digital light processing (DLP) 3D printing, incorporating a microneedle-assisted delivery system to enhance therapeutic efficiency. The hydrogel was fabricated layer-by-layer, incorporating a bioactive top hydrogel layer, a middle conductive layer enriched with polydopamine (PDA) and carbon nanotubes (CNTs), and a bottom microneedle layer. Each layer of the sandwich-structured hydrogel was designed to enable the controlled, sequential release of therapeutic agents (PDA-CNTs) onto infected wound sites. Every layer also has distinct functions, including hemostasis, conductivity, and deep tissue drug delivery. The conductive middle layer also enables photothermal efficacy, potentially facilitating externally triggered release. By tuning the composition and thickness of each layer, the platform allows for spatially controlled and potentially sequential drug release to the wound site. In vitro evaluations demonstrated excellent cytocompatibility, hemocompatibility, and mechanical integrity of the hydrogel system. The incorporation of microneedles further enhanced the penetration and bioavailability of therapeutic agents in the wound bed. This multifunctional hydrogel design offers a promising approach for treating diabetic wounds by combining structural precision, smart drug delivery, and minimally invasive administration through a microneedle-assisted interface.

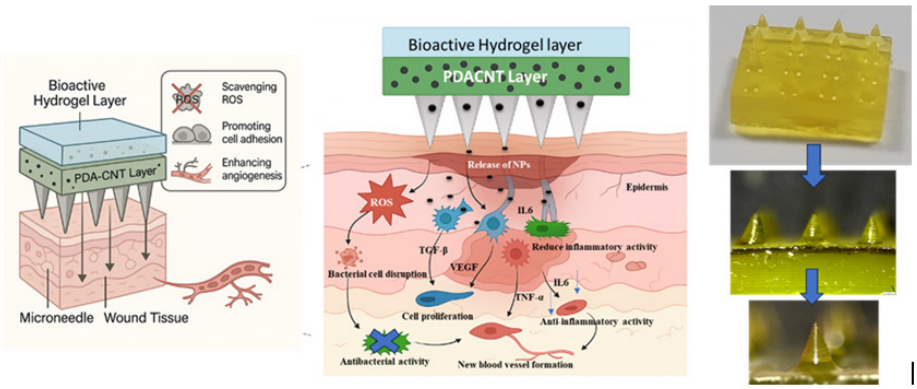


Figure: Schematic representation of a multifunctional sandwich-structured microneedle hydrogel system for enhanced wound healing.

Biography

N. Poddar is currently a full-time Ph.D. research scholar at Vellore Institute of Technology (VIT), India. She holds an M.Sc. in Biotechnology degree and has over 4.5 years of research experience, including a tenure as a Junior Research Fellow at NIPER Guwahati, India. Her research focuses on multifunctional biomaterials, with a particular interest in conductive hydrogels, scaffolds, tissue engineering, and 3D printing (Extrusion and light-based printing). She has 6 publications in peer-reviewed journals and is actively involved in projects integrating nanotechnology and tissue engineering. Her current work focuses on developing photocurable, conductive hydrogels for diabetic wound healing, aiming to bridge the gap between materials science and translational medicine.

Pratibha

BRIC-Translational Health Science and Technology Institute, India

Amniotic membrane ecm hydrogels: a regenerative biomaterial for diabetic wound healing

Abstract

Decellularized extracellular matrix (ECM) hydrogels are increasingly recognized as promising biomaterials for regenerative medicine owing to their ability to recapitulate the native tissue microenvironment. The human amniotic membrane (AM), a readily available and ethically acceptable tissue, is particularly rich in ECM components with inherent wound-healing potential. In this study, we developed and characterized thermosensitive hydrogels (AM ECM) derived from decellularized AM and evaluated their suitability for diabetic wound healing. AM was decellularized using a detergent enzymatic protocol, which effectively removed nuclear content while preserving key ECM proteins, collagens and glycosaminoglycans. The acellular ECM was lyophilized, cryo-milled, and digested with pepsin under acidic conditions at three concentrations, followed by neutralization and thermal gelation at 37 °C, resulting hydrogels. Physicochemical analyses revealed moderate gelation kinetics, high swelling capacity, interconnected porous architecture, and concentration-dependent mechanical stiffness and degradation rates. In vitro, AM ECM hydrogels exhibited excellent biocompatibility with fibroblasts, keratinocytes, and endothelial cells, as confirmed by live/dead staining and MTS assays. Additionally, it do not induce intracellular ROS production or apoptosis, while supporting cytoskeletal organization and cell migration. Proteomic profiling confirmed the retention of native matrisome and bioactive proteins linked to epithelial differentiation, skin development, regulation of angiogenesis, and cell migration. In vivo, AM ECM hydrogel accelerated favorable wound healing responses in a diabetic murine skin wound model. These findings highlight the influence of ECM concentration on hydrogel functionality and therapeutic efficacy. AM ECM hydrogels represent a clinically translatable biomaterial for diabetic wound healing. Future studies will focus on optimizing gelation parameters, sterilization methods, and degradation profiles to advance clinical application.

Biography

Pratibha is a Ph.D. scholar at Translational Health Science and Technology Institute (THSTI), specializing in biomaterials and regenerative medicine. Her doctoral research is centered on the development and characterization of extracellular matrix (ECM)-derived hydrogels for soft tissue repair and diabetic wound healing applications. She has expertise in biomaterial fabrication and characterization, including digestion and gelation kinetics, swelling, porosity, biodegradation and rheology. Her work further involves comprehensive biological evaluations, such as cytocompatibility and hemocompatibility assays, oxidative stress and apoptosis analysis, cell migration and cytoskeletal organization, as well as in vivo studies using diabetic wound healing models. She is experienced in applying advanced techniques including immunostaining assay for tissue characterization. With a interdisciplinary background bridging biomaterials, cell biology, and translational applications, she aspires to contribute to innovative strategies for wound healing and tissue regeneration in postdoctoral research.

Tejaswini Tadge
Department of Materials Engineering, Indian Institute of Science, India

DLP-Based 4D Printed Hydrogel for Soft Tissue Engineering

Abstract

Digital Light Processing (DLP)-based 4D printing has emerged as a transformative technology in biomedical engineering, enabling the fabrication of smart, stimuli-responsive structures with high spatial resolution. In this study, we present a novel DLP-based 4D printed hydrogels tailored for soft tissue engineering applications. The hydrogel formulation incorporates biocompatible, photo-crosslinkable polymers with shape-morphing capabilities triggered by physiological stimuli such as water.

Leveraging the high precision of DLP printing, we engineered hydrogels with intricate, patient-specific geometries capable of undergoing controlled deformation over time. Initially, we investigated a glycoprotein-based biomaterial ink for its methacrylation efficiency, printability, porosity, shape-morphing ability, cytocompatibility, and cell adhesion properties. The biomaterial ink demonstrated successful methacrylation and was highly suitable for 3D printing using the DLP technique (figure 1.a, 1.b). Gradient crosslinking achieved via DLP-based printing induced shape-morphing behavior in the hydrogels, driven by the differential swelling of their layered structures (figure 1.c). Specifically, the printed flat sheets transformed into tube-like structures upon exposure to water (figure 1.d). Furthermore, the morphological analysis of the 3D printed glycoprotein-based hydrogel revealed a porous structure with pore sizes in the range of 5–30 µm, which is ideal for supporting cell migration and the exchange of nutrients, gases, and metabolic waste (figure 1.e). Mechanical characterization showed that the Young's modulus of the hydrogel ranged from 50 to 160 kPa, and can be tuned to match the mechanical properties of different soft tissues. In vitro studies further confirmed that the glycoprotein-based hydrogels were cytocompatible and supported cell adhesion (figure 1.f, 1.g). Overall, our findings demonstrate the potential of DLP-based 4D printed hydrogels in advancing regenerative medicine and enabling personalized healthcare solutions.

Biography

I am a third-year PhD student in Materials Engineering at the Indian Institute of Science. My academic path started with a bachelor's in Pharmacy, followed by a master's focused on Medical Devices, which sparked my interest in merging healthcare with engineering. My research revolves around developing 3D and 4D printed smart materials for tissue engineering, aiming to create materials that adapt and support tissue regeneration. Passionate about research that directly impacts patient care, I am driven by the vision of integrating material science innovations with clinical applications to address umnet medical challenges.

Nihal Singh
Department of Biological Sciences and Engineering, Indian Institute of Technology Gandhinagar, India

Self-assembled DNA-collagen bioactive scaffolds for enhanced cellular uptake and neuronal differentiation

Abstract

Different modalities of DNA-Collagen complexes have been utilized primarily for gene delivery studies. However, very few studies have investigated the potential of these complexes as bioactive scaffolds. Further, no studies have characterized the DNA-Collagen complex formed from the interaction of self-assembled DNA macrostructure and collagen. Towards this investigation, we report herein the fabrication of novel bioactive scaffolds formed from the interaction of sequence-specific, self-assembled DNA macrostructure and collagen type I. Varying molar ratios of DNA and collagen resulted in highly intertwined fibrous scaffolds with different fibrillar thicknesses. The formed scaffolds were biocompatible and presented as a soft matrix for cellular growth and proliferation. Cells cultured on DNA/Collagen scaffolds promoted enhanced cellular uptake of transferrin, and the potential of DNA/Collagen scaffolds to induce neuronal cell differentiation was further investigated. The DNA/Collagen scaffolds promoted neuronal differentiation of precursor cells with extensive neurite growth in comparison to control groups. These novel, self-assembled DNA/Collagen scaffolds could serve as a platform for the development of various bioactive scaffolds with potential applications in neuroscience, drug delivery, tissue engineering, and in vitro cell culture.

Biography

Nihal Singh is currently a Ph.D. scholar at the Indian Institute of Technology (IIT) Gandhinagar under the supervision of Dr. Dhiraj Bhatia. He completed his bachelor's in biotechnology from Vellore Institute of Technology in 2018 and his master's in biosciences and bioengineering from the Indian Institute of Technology Kanpur in 2021. His current research focuses on developing DNA-based hybrid materials for biological applications utilizing DNA nanotechnology.

Niyati Shah

Department of Physics, Indian Institute of Technology Gandhinagar, India

Ultrasound Responsive Bioactive Microbubbles for Enhanced Drug Delivery

Abstract

Protein-coated microbubbles have become one of the emerging platforms in biomedical research as theranostic agents. Due to their unique dynamics under ultrasound, which includes oscillations, non-linear responses, microstreaming, and shell rupture, they are also being probed as targeted drug delivery agents in cancers, tumors, and neurodegenerative diseases. The major drawback of such studies, however, is that after bubble collapse, the drugs rely simply on passive diffusion to navigate towards the target site, resulting in drug loss and decreased uptake efficiency. To overcome these limitations, we fabricated an ultrasound responsive bioactive microbubble system which is capable of enhancing the diffusion of drug molecules and pushing them towards the target site using natural enzyme-substrate reactions. This system mainly comprises of native bovine serum albumin coated microbubbles, doxorubicin, and urea-urease reactions. After testing various doxorubicin loading strategies onto the bubbles, their oscillatory and collapsing response under external ultrasound was characterized. Lastly, in vitro cell culture experiments were performed wherein cancerous HeLa cells were treated with these drug loaded bubbles and urea-urease in presence of ultrasound. As enzymes during catalysis generate significant mechanical fluctuations, the diffusions of the drugs increased resulting in a significant cellular uptake and decreased cell viability. These insights are expected to contribute to the development of better therapeutic strategies by overcoming limitations imposed by slow molecular diffusion under complex environments.

Biography

Niyati Shah is currently a PhD scholar at Indian Institute of Technology (IIT) Gandhinagar, working in the field of active matter physics. She completed her Bachelor's in Science in physics from St. Xavier's College, Ahmedabad in 2020 and her Master's in Science in physics from IIT Gandhinagar in 2022. Her current research is focused on developing microbubble formulations for target imaging and enhanced drug delivery using ultrasound.

Sabrina Arcaro

Universidade do Extremo Sul Catarinense, Brazil

Polymeric Matrix Microparticles with Mesoporous Hydroxyapatite for the Controlled Release of Attractants against Aedes aegypti

Abstract

The control of Aedes aegypti, the main vector of arboviruses such as dengue, Zika, and chikungunya, remains one of the major global public health challenges. The mosquito's high adaptability to urban environments and rapid reproductive cycle make long-term control strategies particularly difficult. Among emerging alternatives, the use of attractant traps has shown promise both for monitoring and population reduction, especially when combined with chemical attractants such as lactic acid. However, the limited stability of these compounds and the high cost of longlasting commercial products—mostly imported—highlight the need for national technologies that combine efficiency, affordability, and sustainability. In this context, the present study aimed to develop polymeric microparticles based on a matrix of polylactic acid (PLA) and sodium alginate, incorporating mesoporous hydroxyapatite derived from tilapia bones, with the goal of achieving controlled and prolonged release of chemical attractants against Aedes aegypti. The hydroxyapatite was synthesised from biological waste through thermal cleaning, comminution, treatment at 600 °C, and high-energy milling. It was characterised by thermal analysis (DSC/TG), X-ray diffraction, and a 2^2 factorial design to determine crystallinity and crystallite size. Microparticles were produced using the extrusion technique by combining three systems: an aqueous dispersion of alginate, a hydroxyapatite suspension, and a PLA solution in chloroform. The mixtures were dripped into a calcium chloride solution, promoting ionic crosslinking of the alginate and resulting in microparticle formation. Different polymer ratios were tested to optimise the structural and stability properties of the material. The formulations were evaluated in terms of rheology, morphology, thermal stability, swelling behaviour, dimensional control, and structural integrity. The

precursor solutions exhibited pseudoplastic behaviour with an average viscosity of 4.66 Pa•s, enabling controlled extrusion. The most promising formulation, with a PLA/alginate ratio of 1.6, produced spherical microparticles with a homogeneous surface and an average diameter of 0.86 ± 0.040 mm. Swelling tests indicated less than 1% mass variation after 24 hours, confirming dimensional stability. Differential scanning calorimetry (DSC) analysis revealed interactions between the polymers, leading to improved thermal stability. Furthermore, the microparticles maintained their structural integrity for up to 48 hours, demonstrating good physicochemical stability. In conclusion, the hybrid PLA/alginate system containing mesoporous hydroxyapatite exhibited suitable rheological and morphological behaviour for controlled-release applications. The incorporation of hydroxyapatite obtained from tilapia residues not only enhanced the sustainability of the process but also improved the diffusion control of the attractant compounds. This system thus represents a promising national alternative for the environmentally responsible and cost-effective control of Aedes aegypti.

Biography

Sabrina Arcaro holds a PhD in Materials Science and Engineering from the Federal University of Santa Catarina, with a research internship at the Institute of Ceramics and Glass (Spain). She completed a postdoctoral fellowship at the Federal University of Rio Grande do Sul and is a CNPq Level 1D Researcher. She serves as Professor and Coordinator of the Graduate Programme in Materials Science and Engineering (PPGCEM) and as Director of Research and Postgraduate Studies at UNESC. She leads the Research Group on Biomaterials and Nanostructured Materials, focusing on bioceramics, glass materials, and the synthesis of nanostructures. With over 140 scientific papers published and six patents filed, she has extensive experience in training master's and doctoral students. She is an editor for national and international journals, a Director of the Brazilian Ceramic Association, and a mentor of the Young Ceramists Network of Brazil. She has received the "Women in Science" and "ALESC Women in Science" awards, recognising her leadership in materials research.

Zahra Eivazi Zadeh

Department of Biomedical Engineering, School of Engineering and IT, University of Melbourne, Melbourne, Australia

A protease-degradable self-assembling peptide hydrogel for spatiotemporal control of viral vector delivery in gene therapy within the nervous system

Abstract

The main reason for the failure of gene therapy in clinical trials is the inability of vectors to reach the target site. This project will develop a new and urgently needed technology to circumvent current limitations in the delivery and distribution of the viral vectors, while also shielding them from the host inflammatory response. In this project, we aim to design a smart delivery system for viral vectors within the nervous system that enables payload release at a time of interest while protecting it from degradation and neutralization. To reach this goal, we hypothesized that a system based on self-assembling peptides (SAP) alongside a selective and bio-orthogonal enzyme prodrug which specifically detects the degradable primary sequence in developed peptides would advance delivery methods. We developed two types of SAP systems with the detectable sequence for the enzyme prodrug that spontaneously forms desired thermodynamically stable supramolecular nanostructures at physiological pH (7.4). We confirmed that both systems are responsive to the application of enzyme prodrug, which initiates a nanostructural change in the SAP system and release of their payload in the target tissue. We also showed that the developed system and enzyme prodrug are completely cytocompatible and the gradual degradation of the SAP system after enzyme prodrug application, can create a 3D scaffold for cells to grow inside the structure. Importantly, we showed that the enzyme prodrug application can activate the release of viral vectors from the SAP system, and the released viral vectors are functional. This smart delivery system can solve multiple challenges in using viral vectors in clinical trials including protection from host immune responses, reduction of the

required viral vector dosage, and minimising the offtarget delivery (spatial control); as well as activate the transfection process at the time of interest (temporal control), which totally can have a huge impact on the transduction efficiency of viral vectors and success of the gene therapy in clinical trials.

Biography

Zahra Eivazi Zadeh is a 3rd-year PhD student at the University of Melbourne, Australia. Her research focuses on developing advanced delivery systems for viral vectors in gene therapy. Zahra earned both her master's and bachelor's degrees from Amirkabir University in Iran. She has publication record, with papers spanning various fields such as synthetic vascular grafts, stem cells, cell reprogramming, and gene therapy.

Manisha Marothia

Department of Plastic, Reconstructive and Burns Surgery, All India Institute of Medical Sciences, India

Contact Drawing Technique: A Tool-Assisted Approach for Fabricating High-Strength, Collagen Fibers for Corneal Tissue Engineering

Abstract

Corneal disease is a leading cause of visual impairment, with corneal opacities responsible for approximately 4% of global blindness. Although corneal transplantation is the standard treatment for severe corneal damage, its clinical application is constrained by a shortage of donor tissue, risk of graft rejection, and potential transmission of infectious diseases. These limitations highlight the urgent need for biomimetic corneal substitutes with high mechanical strength and optical transparency.[1,2]

Native corneal transparency is primarily attributed to the orthogonal alignment of collagen fibers in the stromal lamella. However, replicating this highly ordered architecture in vitro remains a significant challenge in tissue engineering. In this study, we present a contact drawing technique, a 3D printing-assisted tool-based approach, to fabricate aligned collagen fibers with improved mechanical and optical properties.[3]

This method utilizes an entangled polymer solution and a pin-array system to form microfibers via the controlled extension of liquid bridges. The resulting fibers exhibit a uniform orientation and enhanced tensile strength, along with efficient light transmission that are the key parameters for functional corneal repair materials.

Our findings suggest that the contact drawing technique provides a scalable, reproducible, and physiologically relevant strategy to engineer collagen-based scaffolds, offering promising potential for future clinical applications in corneal tissue regeneration.

Biography

1. Chen, Z., Liu, X., You, J., Song, Y., Tomaskovic-Crook, E., Sutton, G., ... & Wallace, G. G. (2020). Biomimetic corneal stroma using electro-compacted collagen. Acta Biomaterialia, 113, 360-371.
2. Sun, X., Yang, X., Song, W., & Ren, L. (2020). Construction and evaluation of collagen-based corneal grafts using polycaprolactone to improve tension stress. ACS omega, 5(1), 674-682.
3. Verma, S. K., Yaghoobi, H., Kreplak, L., & Frampton, J. P. (2023). Nonwoven hemostatic dressings formed by contact drawing of interposed polyethylene oxide (PEO)-fibrinogen and PEO-thrombin microfibers. Advanced Materials Interfaces, 10(4), 2202119.

Kanika

Institute of Nano science and Technology Mohali SAS Nagar Mohali Punjab, India

Leveraging Thiol functionalized biomucoadhesive hybrid nanoliposome for local therapy of Ulcerative colitis

Abstract

Directly administering medication to inflamed intestinal sites for treating ulcerative colitis (UC), poses significant challenges like retention time, absorption variability, side-effects, drug stability and non-specific delivery. Recent advancements in therapy to treat colitis aim to improve local drug availability that is enema therapy at the site of inflammation, thereby reducing systemic adverse effects. Nevertheless, a key limitation lies in enemas' inability to sustain medication in the colon due to rapid peristaltic movement, diarrhea and poor local adherence. Therefore, in this work, we have developed site-specific thiolated mucoadhesive anionic nanoliposomes to overcome the limitations of conventional enema therapy. The thiolated delivery system allows prolonged residence of the delivery system at the inflamed site in the colon, confirmed by the adhesion potential of thiolated nanoliposomes using in-vitro and in-vivo models. To further provide therapeutic efficacy thiolated nanoliposomes were loaded with gallic acid (GA), a natural compound known for its antibacterial, antioxidant, and potent anti-inflammatory properties. Consequently, Gallic Acid-loaded Thiolated 2,6 DALP DMPG (GATh@APDL) demonstrates the potential for targeted adhesion to the inflamed colon, facilitated by their small size 100nm and anionic nature. Therapeutic studies indicate that this formulation offers protective effects by mitigating colonic inflammation, downregulating the expression of NF-κB, HIF-1α, and MMP-9 and demonstrating superior efficacy compared to the free GA enema. The encapsulated GA inhibits the NF-κB expression, leading to enhanced expression of MUC2 protein, thereby promoting mucosal healing in the colon. Furthermore, GATh@APDL effectively reduces neutrophil infiltration and regulating immune cell quantification in colonic lamina propria. Our findings suggest that GATh@ APDL holds promise for alleviating UC and addressing the limitations of conventional enema therapy.

Keywords: Ulcerative colitis, thiolated liposome, Gallic acid, MUC2 protein, inflammation, enema therapy.

Biography

I am a final-year PhD student in drug delivery, highly motivated and deeply interested in developing innovative biomaterials for more effective therapeutic delivery. My research focuses on designing and synthesizing novel biomaterials and nanocarriers that can specifically target pro-inflammatory markers, with applications in inflammatory disorders such as ulcerative colitis and rheumatoid arthritis. I have developed expertise in creating target-specific amphiphiles that self-assemble into functional nanostructures for site-specific drug delivery. In addition, I have extensive experience in formulation development, characterization, and evaluation through in vitro and in vivo models. Currently, my work is centered on synthesizing biomaterials for NLRP3-targeted formulations, aiming to advance therapeutic strategies for managing inflammatory disorders.

Darsh Pratap Singh
Eigen Sciences, Apex, USA

In Silico Design and Evaluation of a DuoBody Antibody Targeting CD40 and 4-1BB Receptors for Enhanced Immunotherapy in Non-Small Cell Lung Cancer (NSCLC)

Abstract

Non-Small Cell Lung Cancer (NSCLC) accounts for approximately 85% of all lung cancer cases and remains a major cause of cancer-related mortality due to limited treatment efficacy in advanced stages. To address this, we aimed to design a DuoBody antibody that targets both CD40 and 4-1BB (CD137) receptors to enhance T-cell-mediated anti-tumor responses. Using in silico methods, we predicted the 3D structures of the CD40 and 4-1BB receptors through AlphaFold 3 and verified their topology with PROTTER and the Human Protein Atlas. We performed structure-based virtual screening of multiple scFv fragments using GRAMM and HDOCK to evaluate their binding to each receptor. Binding sites were predicted using P2Rank and ScanNet, followed by docking interaction profiling with PLIP and binding affinity calculations using PRODIGY. Among the candidates, scFv 1lk3 for CD40 and 3g6d for 4-1BB demonstrated the most favorable interactions, with binding energies of –19.4 and –26.5 kcal/mol, respectively, and strong interfacial interactions including hydrogen bonds and salt bridges. To further assess the structural stability and dynamics of the antibody-receptor complexes, we conducted molecular dynamics (MD) simulations. The MD results confirmed the conformational stability of the selected complexes and revealed minimal fluctuations in the binding interface over time, supporting the reliability of the docking predictions. Together, our results demonstrate a computationally driven framework for designing DuoBody antibodies with high specificity and stability, offering a promising strategy for improving immunotherapy in NSCLC.

Keywords: DuoBody Antibody, Non-Small Cell Lung Cancer (NSCLC), CD40 and 4-1BB Receptors, Molecular Docking, Molecular Dynamics Simulations .

Biography

Darsh Pratap Singh is a student researcher from Cary, North Carolina, with a strong interest in biotechnology and computational biology. He actively contributes to innovative biomedical projects through in silico modeling and analysis. Currently, he is working as a research assistant at Eigen Sciences, Apex, USA, under the guidance of Dr. Gaurav Sharma.

Manya Kumari
Eigen Sciences, Apex, USA

Structure-Guided Design of Proteolysis-Targeting Chimeras (PROTACs) for the Selective Ubiquitin-Mediated Degradation of Glycogen Synthase Kinase3 Beta (GSK-3β) against Alzheimer's Diseases

Abstract

Alzheimer's disease (AD) is a neurodegenerative disorder that is caused by a buildup of amyloidbeta plaques and neurofibrillary tau tangles in the brain. Glycogen synthase kinase-3 beta (GSK-3β) is an enzyme that contributes to tau phosphorylation and amyloid-beta production. Therefore, degrading this protein could be a potential therapeutic strategy targeting AD. Proteolysis-targeting chimeras (PROTACs) are bifunctional molecules designed to mediate the selective degradation of target proteins (such as GSK-3β) by conjugating them to E3 ubiquitin ligases. This proximityinduced interaction facilitates the ubiquitination of the target protein, leading to its subsequent degradation by the ubiquitin-proteasome system. We hypothesize that PROTAC P1 interacts with both GSK-3β and E3 ligases, facilitating the proteasomal degradation of GSK-3β. The 3D models of GSK-3β and E3 Ligase were predicted using AlphaFold, and the PROTAC structure was obtained from previous research and was designed using the YASARA software. Finally, the GSK3β protein and PROTAC interactions were computed using the HDOCK software. The interactions between the GSK-3β–E3 ligase complex and the PROTAC molecule were identified using the Protein–Ligand Interaction Profiler (PLIP) analysis tool. The binding energy was calculated using the PRODIGY software. These results indicate that PROTAC P2 is the most suitable candidate for this research, as it exhibits the highest binding affinity of -9.2 kcal/mol. Finally, we have explored the basis of protein–protein interactions by considering the electrostatic surface potential and hydrophobicity as contributing factors. The current study will pave the way for PROTAC-based therapeutics targeting GSK-3β as a treatment for AD.

Keywords: Alzheimer's Disease, GSK-3β, PROTAC, Protein Degradation, Protein Modeling.

Biography

Manya Kumari is a student at John H. Guyer High School in Denton, Texas. She earned a perfect ACT score of 36 and is active in the school's robotics team. Currently, she is working as a research assistant at Eigen Sciences, Apex, USA, under the guidance of Dr. Gaurav Sharma.

Namyaa Kattela
Eigen Sciences, Apex, USA

Structure-Based Simulation of CD8αβ Receptor Blockade to Protect Melanocytes from Autoimmune Cytotoxicity in Vitiligo

Abstract

Vitiligo is a skin condition in which the immune system destroys the body's melanocytes, the cells responsible for producing skin pigmentation, resulting in white patches without pigmentation on the skin. Autoimmunity in vitiligo refers to the immune system mistakenly attacking and destroying the body's melanocytes. CD8 receptors are proteins that are found on the surface of cytotoxic T-cells that help recognize and destroy infected cells, including melanocytes in autoimmune conditions such as vitiligo. We hypothesize that binding to the predicted binding site, specifically the CD8αβ receptor, prevents T cell activation and mitigates its autoimmune activity against melanocytes. The 3D structure of the CD8αβ receptor was obtained using AlphaFold, a protein structure prediction tool. The molecular structure of the exopolysaccharide was retrieved from the PubChem database. The interaction between the CD8αβ receptor and the exopolysaccharide was analyzed using the HDOCK protein-ligand docking platform. The exopolysaccharide binds to the CD8α-CD8β receptor interface, forming strong hydrogen bonds and hydrophobic interactions. The results show that exopolysaccharide binds to the binding site of the CD8αβ receptor and could favorably prevent the interactions with the melanocyte. Finally, we have also performed chemical alterations to the exopolysaccharide using the CReM. This research will help in validating the predicted CD8αβ receptor binding site as a therapeutic target to prevent T cell activation and reduce autoimmune destruction of melanocytes in vitiligo.

Biography

Namyaa Kattela is a student at Alpharetta High School in Alpharetta, Georgia. Currently, she is working as a research assistant at Eigen Sciences, Apex, USA, under the guidance of Dr. Gaurav Sharma.