6TH EDITION OF INTERNATIONAL CONFERENCE ON

TISSUE ENGINEERING AND REGENERATIVE MEDICINE

AND

6TH EDITION OF EURO-GLOBAL CONFERENCE ON

BIOTECHNOLOGY AND BIOENGINEERING

September 28-30, 2026

London, UK

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VIRTUAL:

BRITISH SUMMER TIME (BST)

6TH EDITION OF

INTERNATIONAL CONFERENCE ON

TISSUE ENGINEERING AND REGENERATIVE MEDICINE

&

6TH EDITION OF

EURO-GLOBAL CONFERENCE ON

BIOTECHNOLOGY AND BIOENGINEERING

HYBRID EVENT

28-30

SEPTEMBER 2026

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Keynote Speakers



Babak Faramarzi

Western University of Health Sciences, USA



Gokarneshan Narayanan

SSM College of Engineering (Formerly), India



Gunjan Mukherjee

Chandigarh University, India



Ivan Kelnar

Institute of Macromolecular Chemistry, Czech Academy of Sciences, Czech Republic



Julia Sidorova

Instituto Carlos III de Salud (CIBER-EHD), Spain



Katarzyna Gawron

Medical University of Silesia, Poland

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K.R. Aneja
Kurukshetra University, India



Kunal Mitra
Florida Tech, United States



Lucie Bacakova
Institute of Physiology of the Czech Academy of Sciences, Czech Republic



Luis Jesus Villarreal Gomez
Universidad Autonoma de Baja California, Mexico



Narendra Chirmule
Indian Institute of Technology (IIT), India



Patrizia Ferretti
UCL Great Ormond Street Institute of Child Health, UK



Sandeep Shrivastava
KLE Academy of Higher Education and Research, India

Keynote Speakers



Tania Limongi
University of Turin, Italy



Thomas J Webster
Brown University, United States



Vasiliki E Kalodimou
EUC School of Medicine - Frankfurt, Germany



Welcome Message

Dr. Ivan Kelnar

Institute of Macromolecular Chemistry, Czech Academy of Sciences, Czech Republic

Welcome Message

Dear Congress Visitors, my brief welcome remarks are intended to highlight that, despite extensive research and unprecedented progress in the application of modified polysaccharides in medicinal and environmentally friendly systems, there is still considerable potential for the development of new high-performance materials. A successful example is the preparation of glucan-based nanotubes using traditional and straightforward borate chemistry. This approach leads to a mechanically robust and bioresorbable nanomaterial that can serve, for example, as a building unit or reinforcement in scaffolds. Its application potential is further expanded by the intrinsic immunostimulating activity of glucan and its potential to function as a nanocontainer for drug delivery. These properties open new opportunities not only for upgrading existing materials but, especially, for developing new complex systems with multiple functions. I hope that this example will inspire further research into traditional natural materials and reveal new possibilities for their use in advanced applications. Thank you, and I wish you a successful and inspiring congress.



Welcome Message

Julia Sidorova

Instituto Carlos III de Salud (CIBER-EHD), Spain

Dear congress visitors, it is a distinct honor and pleasure to welcome you all to this year's event.

Looking back over the past five years, the collaborative work with a network of research hospitals has delivered significant, tangible advancements in novel biomarkers across a wide range of clinical specialties. These breakthroughs have directly paved the way for more accessible, affordable, and accurate diagnostics. As always, such progress relies heavily computational analyses and the rigorous, ingenious defense of scientific hypotheses.

Yet, we must ask: what has truly changed? To what extent can a data analyst now rely on artificial intelligence? Can we outsource critical thinking and compensate for gaps in competence? And how exactly should we redefine the educational curriculum for data analysis, statistics and bioinformatics?

In terms of methodology, deep learning is rapidly gaining ground, yet it comes with pitfalls—some of which easily evade standard quality control checks. Culturally and technologically, we now operate with higher efficiency. However, the AI era demands more knowledge, not less. It still fundamentally requires a knowledge of the core theory behind the R or Python libraries we employ, as well as a sharp awareness of new phenomena including information leakage.



Welcome Message

Prof. K.R. Aneja

Kurukshetra University, India

Esteemed Colleagues,

On behalf of the Organizing Committee, I am honoured and delighted to invite the eminent speakers, academicians, agricultural scientists, biotechnologists, industrialists and research students from around the globe to attend the 6th Edition of Euro-Global Conference on Biotechnology and Bioengineering (ECBB 2026) going to be held from 28-30 September 2026 in London, the beautiful city of United Kingdom. This conference is scheduled in Hybrid Format with both onsite and virtual versions.

It gives me great pleasure that ECBB-2026 includes all frontier topics in Biotechnology research, including Agricultural biotechnology, Biochemical engineering, Tissue engineering, focussing on theme Advancing Biotechnology and Bioengineering: From Concepts to Impact. This International Conference will provide a wonderful opportunity for presenting research work on a Global Stage, exchange ideas and share experience on researches carried out globally in diverse areas of biotechnology and bioengineering, especially obstacles, their solutions and developments. It will be highly beneficial for the younger scientists who would get feedback on their work, and solutions to challenges encountered by them, from the renowned scientists in their areas that would reshape their future course of action. Additionally, it will provide a golden opportunity in establishing research collaborations with academic and industrial houses for developing and commercializing their products of agricultural and industrial value at the international level.

Do join on September 28-30, 2026. Looking forward to seeing you with smiling faces in London to make ECBB 2026, a grand success.



Welcome Message

Kunal Mitra

Professor Biomedical Engineering, Florida Tech, United States

Dear Colleagues, Delegates, and Friends,

It is my great pleasure to welcome you to the 2026 Tissue Engineering and Regenerative Medicine Conference. You join us at an exciting inflection point for the field.

Translational research - moving discovery from bench to bedside - remains our defining challenge and our defining purpose. Engineered tissues, organoids, and stem-cell therapies are increasingly reaching patients, but closing the gap between laboratory insight and clinical impact demands sustained, deliberate collaboration across disciplines. Alongside this, artificial intelligence and machine learning are transforming how we design biomaterials, predict cell behavior, optimize bioprinting, and personalize regenerative therapies - compressing timelines for therapies and drug discoveries and opening possibilities once out of reach. Embracing these tools thoughtfully will shape the next chapter of our field.

I hope this conference gives you opportunities for new collaborations across biomedical engineering, biology, and computational research; sharper clarity on translating your own work; exposure to emerging AI-driven approaches; and rigorous, honest scientific exchange.

Every participant matters here - from first-time poster presenters to seasoned keynote speakers. I encourage you to attend widely, engage openly, and seek out conversations with colleagues you haven't met. The connections formed over these days are often as valuable as any single talk.

Thank you for joining us. I look forward to the discoveries and collaborations ahead.



Welcome Message

Dr. Lucie Bacakova

Institute of Physiology of the Czech Academy of Sciences, Czech Republic

Dear conference visitors, it is an honour and a pleasure to offer a few words of welcome to the 6th International Conference on Tissue Engineering and Regenerative Medicine. This year, we gather under a powerful and urgent theme: Advancing Tissue Engineering & Regenerative Medicine: From Principles to Patients. Our programme bridges the gap between fundamental laboratory discoveries and real-world clinical applications. Over the coming days, we will explore the core pillars shaping the future of healthcare. Key focus areas of the scientific programme will include stem cell research and engineering, such as new breakthroughs in cellular differentiation, pluripotency, and reprogramming; the development of next-generation bioactive matrices and smart materials; and the introduction of advanced technologies, such as 3D bioprinting, microfluidics, tissue- and organ-on-chips, cell spheroids and organoids, and artificial intelligence, not only for the creation of functional tissue replacements but also for in vitro tissue models for the study of serious pathologies, including tumours. Finally, this conference will focus on the clinical translation of the results obtained, i.e., overcoming regulatory hurdles to move discoveries from bench to bedside. This conference serves as a premier global platform for sharing disruptive research, debating ethical frontiers, and sparking cross-border collaborations. We trust that the insights from our speakers and the energy of our poster sessions will inspire your ongoing work. Thank you for contributing your expertise to a field that brings transformative hope to patients worldwide. I wish you a productive, inspiring, and successful conference!



Welcome Message

Dr. Luis Jesus Villarreal Gomez

Universidad Autonoma de Baja California, Mexico

Dear Colleagues, Attendees, and Honored Guests,

It is a great privilege and honor to welcome you to the 6th Edition of the Euro-Global Conference on Biotechnology and Bioengineering (ECBB 2026). As a member of the Organizing Committee, I am thrilled to see our global community gather once again in this versatile hybrid format to share groundbreaking discoveries and foster meaningful collaborations.

Biotechnology and bioengineering stand at the absolute forefront of scientific innovation, driving crucial solutions for global health, sustainability, and industrial advancement. This year's conference highlights the extraordinary resilience and creativity of our field, bridging the gap between fundamental research and real-world applications. Over the coming days, you will engage with inspiring keynote presentations, cutting-edge research tracks, and dynamic discussions designed to spark new ideas and accelerate technological breakthroughs.

Whether you are participating in person or virtually from across the globe, your insights, expertise, and passion are what truly enrich this event. I encourage you to actively connect, debate, and collaborate to shape the future of our discipline.

Thank you for your invaluable contributions to ECBB 2026. I wish you all an incredibly productive, inspiring, and successful conference.



Welcome Message

Prof. Sandeep Shrivastava

KLE Academy of Higher Education and Research, India

A Warm Invitation to TERM 2026 – London

It is my great pleasure and privilege to be part of the Organising Committee of TERM 2026, London.

TERM 2026 will bring together leading clinicians, scientists, researchers, innovators and young professionals from across the world to explore the rapidly evolving frontiers of regenerative medicine, tissue engineering and translational science.

The meeting will provide an exciting platform to discuss how advances in stem cells, biomaterials, tissue engineering, cellular therapies, bioengineering and regenerative technologies are moving from the laboratory towards meaningful clinical applications.

Beyond the scientific programme, TERM 2026 will be an opportunity to exchange ideas, share experiences, foster interdisciplinary collaborations and inspire the next generation of researchers and clinicians working to restore, regenerate and rebuild .

As an Organising Committee member, I warmly invite you to join us in London for TERM 2026. I look forward to welcoming colleagues from around the world and making this meeting a memorable celebration of innovation, collaboration and the future of regenerative medicine.

Let us meet in London to shape the future of regeneration together.

See you in London!



Welcome Message

Prof. Tania Limongi

Department of Drug Science and Technology University of Turin, Italy

Dear Congress participants,

It is a great honor and pleasure to welcome you to the 6th Edition of the Euro-Global Conference on Biotechnology and Bioengineering (ECBB 2026), taking place in London, United Kingdom.

Biotechnology and bioengineering are rapidly evolving fields that increasingly bring together fundamental science, technological innovation, and biomedical applications. The continuous development of advanced biological approaches, innovative materials, and engineering strategies is opening new opportunities to address complex challenges in human health, pharmaceutical sciences, environmental sustainability, and biotechnology.

Scientific conferences such as ECBB 2026 provide an important opportunity to share new findings, exchange perspectives, and establish collaborations among researchers from different disciplines and countries. The interaction between complementary areas of expertise is essential for transforming scientific discoveries into innovative and effective solutions with a meaningful impact on society.

I am therefore delighted to welcome all participants, speakers, researchers, and young scientists to this international meeting. I hope that ECBB 2026 will offer stimulating scientific discussions, encourage new collaborations, and inspire future developments in biotechnology and bioengineering.

I wish you all a productive, engaging, and successful conference.

About
Magnus Group

About

Magnus Group, a distinguished scientific event organizer, has been at the forefront of fostering knowledge exchange and collaboration since its inception in 2015. With a steadfast commitment to the ethos of Share, receive, grow, Magnus Group has successfully organized over 200 conferences spanning diverse fields, including Healthcare, Medical, Pharmaceutics, Chemistry, Nursing, Agriculture, and Plant Sciences.

The core philosophy of Magnus Group revolves around creating dynamic platforms that facilitate the exchange of cutting-edge research, insights, and innovations within the global scientific community. By bringing together experts, scholars, and professionals from various disciplines, Magnus Group cultivates an environment conducive to intellectual discourse, networking, and interdisciplinary collaboration.

Magnus Group's unwavering dedication to organizing impactful scientific events has positioned it as a key player in the global scientific community. By adhering to the motto of Share, receive, grow, Magnus Group continues to contribute significantly to the advancement of knowledge and the development of innovative solutions in various scientific domains

About
CPD Accreditation

About

Continuing Professional Development (CPD) credits are valuable for TERMC & ECBB 2026 attendees as they provide recognition and validation of their ongoing learning and professional development. The number of CPD credits that can be earned is typically based on the number of sessions attended. All the participants have an opportunity to avail 1 CPD credit for each hour of Attendance.

Some benefits of CPD credits include:

Career advancement: CPD credits demonstrate a commitment to ongoing learning and professional development, which can enhance one's reputation and increase chances of career advancement.

Maintenance of professional credentials: Many professions require a minimum number of CPD credits to maintain their certification or license.

Increased knowledge: Attending TERMC & ECBB 2026 and earning CPD credits can help attendees stay current with the latest developments and advancements in their field.

Networking opportunities: This Conference provide opportunities for attendees to network with peers and experts, expanding their professional network and building relationships with potential collaborators.

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KEYNOTE PRESENTATIONS





Babak Faramarzi

Western University of Health Sciences, College of Veterinary Medicine, Pomona, CA, USA

Biography: Dr. Babak Faramarzi obtained a DVM in 1995 and graduated with a master's degree and a PhD in biomedical sciences from the University of Guelph, Canada, in 2008. Faramarzi's work is mostly concerned with diagnostic imaging and gait analysis. Faramarzi is a tenured professor at the Western University of Health Sciences, USA, and has served as a practitioner and educator for the past 30 years, winning numerous honours including the Innovation Champion Award, Research Excellence Award, Teaching Excellence Award, and most recently induction into the International Equine Veterinarian Hall of Fame.

Steps and strides: Cross-species insights into movement and injury

Musculoskeletal disorders are a major cause of pain, functional limitation, and reduced quality of life, with increasing prevalence driven by aging, obesity, and physical inactivity. Early and accurate diagnosis remains a persistent clinical challenge, particularly when assessment relies on subjective observation of movement and patient-reported outcomes.

This presentation focuses on the role of objective gait and biomechanical analysis in improving the detection and monitoring of musculoskeletal dysfunction. Subclinical alterations in movement and weight-bearing often precede overt clinical symptoms, yet these changes are frequently undetectable through standard visual assessment.

Using a translational, cross-species framework, this work integrates advanced motion capture systems with pressure-based platforms to quantify spatiotemporal parameters, limb loading, and gait symmetry. These technologies provide high-resolution, reproducible data that can enhance clinical decision-making and support longitudinal monitoring of disease progression and treatment response. Advanced imaging modalities are incorporated when indicated to complement functional assessments with structural evaluation.

Comparative models offer a unique advantage in studying movement without reliance on subjective feedback, providing insight into biomechanical adaptations relevant to non-verbal or communication-limited patient populations. This approach also enables controlled investigation of injury mechanisms and therapeutic interventions.

The integration of objective biomechanical metrics into clinical and research settings has significant implications for improving diagnostic precision, optimizing rehabilitation strategies, and informing the development and evaluation of therapeutics and assistive devices. This cross-disciplinary perspective underscores the value of quantitative movement analysis in advancing musculoskeletal health and translational research.



Gokarneshan Narayanan

SSM College of Engineering (Formerly), India

Biography: Dr. Gokarneshan Narayanan is an accomplished academic, researcher, author and professional in the field of Textile Engineering and Technology, with a distinguished record of teaching, research, scholarly publication and academic leadership. Narayanan holds a Ph.D. from Anna University, India, and has formerly served as Professor at SSM College of Engineering, India. Areas of interest encompass advanced textile materials, technical textiles, fabric engineering, textile composites, tissue engineering and regenerative medicine, additive manufacturing, artificial intelligence and emerging interdisciplinary technologies. Narayanan is the author of 26 books and has published approximately 250 research papers in reputed national and international journals, in addition to numerous book chapters, and has served on the editorial boards of scholarly journals and on conference organizing committees. In recognition of these contributions, Narayanan has received several distinctions, including the Best Teacher Award and recognition among the Asia Top 50 Academicians and Researchers, and remains committed to integrating textile science with materials science, biotechnology, artificial intelligence and advanced manufacturing technologies while mentoring young researchers.

Role of textile materials in tissue engineering and regenerative medicine

The convergence of textile science, biomaterials engineering and regenerative medicine is creating new opportunities for the development of functional scaffolds capable of supporting tissue repair and regeneration. Textile materials are particularly attractive for tissue engineering because their hierarchical fibrous architecture can be engineered across fiber, yarn and fabric scales, enabling simultaneous control of porosity, surface characteristics, mechanical behavior, anisotropy and cellular microenvironment. Recent research demonstrates that weaving, knitting, braiding, spacer-fabric technology, electrospinning and other fiber-based manufacturing approaches can produce scaffolds tailored to the structural and functional requirements of different biological tissues.

Natural and synthetic biomaterials, including collagen, silk fibroin, chitosan, alginate, polycaprolactone and biodegradable polyesters, can be converted into fibers and assembled into two- and three-dimensional textile architectures. Electrospinning provides nanoscale fibrous structures that resemble important features of the extracellular matrix, while woven, knitted and braided structures offer superior control over bulk architecture, mechanical

strength, compliance and directional properties. These characteristics make textile-based scaffolds particularly relevant to skin, bone, cartilage, tendon, ligament, nerve, vascular, cardiac and other soft-tissue regeneration applications.

An important advantage of textile technology is the ability to establish structure–property–function relationships through precise manipulation of fiber diameter, orientation, yarn construction, fabric density, pore geometry and interlacement pattern. Furthermore, textile scaffolds can be combined with hydrogels, extracellular-matrix components, nanoparticles, growth factors and 3D-bioprinted structures to create multifunctional and multiscale regenerative platforms. Emerging developments in smart textiles, cell-laden fibers, digital manufacturing and artificial intelligence are further expanding the possibilities for personalized and responsive tissue-engineered constructs.

Despite these advances, challenges remain concerning vascularization, cell infiltration, degradation control, mechanical matching, sterilization, reproducibility, scale-up and clinical translation. Future research should therefore focus on hybrid textile–bioprinting strategies, gradient and patient-specific architectures, intelligent biomaterials and predictive computational design. The integration of textile engineering with cellular and molecular regenerative strategies has the potential to transform textiles from conventional structural materials into dynamic, biomimetic and biologically instructive platforms for next-generation tissue regeneration.



Gunjan Mukherjee

University Institute of Biotechnology, Chandigarh University, Mohali, Punjab, India

Biography: Dr. Gunjan Mukherjee is Director of the Institute of Biotechnology at Chandigarh University. With over 25 years of experience in industrial biotechnology, Mukherjee is an expert in microbial fermentation, biomass-based biofuel production, and reactor design, and has served as a Senior Scientist at PRAJ Industries Ltd. and The Energy and Resources Institute (TERI), New Delhi. Mukherjee holds six international patents, including a US patent on biomass-to-biofuel conversion, in addition to highly indexed publications. A Core Committee Member on Biofuels at TERI, Mukherjee also serves on editorial boards of reputed journals and has helped establish world-class R&D centers focused on sustainable bioprocess technologies.

Lignocellulosic biomass to biofuels and biochemicals: Microbial innovations for a sustainable future

This talk highlights innovative strategies for utilizing microbial systems to produce biofuels, biochemicals, and high-value biomolecules from lignocellulosic biomass and other renewable resources. Key focus areas include microbial fermentation, bioreactor design, enzymatic and biochemical pretreatment of biomass, and microbial production of value-added compounds such as natural pigments, melanin, resveratrol, hyaluronic acid, and vanillin. Special emphasis will be given to biorefinery concepts and technology transfer, including bioethanol production using modified yeast and antibiotic production through sustainable biomanagement of mycelial waste. These advancements demonstrate the critical role of microbial biotechnology in developing eco-friendly and economically viable alternatives for the bioeconomy.

Keywords: Lignocellulosic Biomass, Microbial Fermentation, Biorefinery, Bioethanol, Mycelial Waste Management.



Ivan Kelnar*, Miroslav Janata

Institute of Macromolecular Chemistry, Czech Academy of Sciences, Heyrovského nám. 2, Praha 162 00, Czech Republic

Biography: Ivan Kelnar is head of the Department of Nanostructured Polymers and Composites at the Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic. Kelnar's research is mainly focused on structure-properties relationships in polymer systems with complex structures, especially rigid/soft self-assembled nanostructures and interfaces also based on modified polysaccharides. Most of the research is done within national and international projects, published in more than 100 research articles.

Polysaccharide-based nanotubes: Structure, properties and medical applications

β-1,3-glucan polysaccharides are important biomaterials with a comb-like structure, which treat diseases and promote health in a number of important ways including antitumor, immune-stimulating activities, etc. Their well-known triple-helix conformation in water has so far been exploited for in-situ encapsulation of some drugs and nanoparticles; however, the range of medical applications of glucans is limited by solubility in water.

Using our original concept of successful modification and stabilization of triple-helix structure in water and simultaneous strengthening of nanotube walls by borate-based complex/covalent bonds formation, we have prepared stable insoluble Glucan Nanotubes (GNT). The nanotubes based on glucan isolated from *Auricularia auricula-judae mushroom* have a diameter of ~50 nm and wall thickness of several nanometers, i.e., the geometry similar to carbon nanotubes. The high reinforcing effect of GNT in a nanocomposite with methylcellulose matrix causing increase in modulus from ~3500 MPa to ~4000 MPa with 5% content indicates that modulus of GNT exceeds 10 000 MPa (according to Halpin-Tsai model with aspect ratio 20). The GNT represent a new class of medical material which can be used in tissue engineering as important component of scaffolds and for reinforcement of many medicinal systems. In addition to expected synergic contribution to medicinal activities, GNT have also a potential of exploitation as nanocontainer for drug delivery and controlled release.

Upgrade of GNT using modified borate complex and functionalization of glucan chains is highlighted. This study also includes application of other glucans, e.g. those isolated from Schizophyllum commune together with surface decoration of GNT with proteins and

polydopamine. GNT were applied to improve self-healing hyaluronate hydrogels based on Schiff base reaction. Important feature is possible replacement of reactive hyaluronic acid by GNT with identical functionality or their parallel application to control the network density. From the results of mechanical testing, it is obvious that application of neat and functionalized GNT can modify mechanical properties of a hydrogel in a wide range, which is accompanied by simultaneous contribution to its wound healing effectivity, as confirmed by the wound-healing assay with cell-based model.

This work was supported by Ministry of Education Youth and Sports of the Czech Republic (Grant LUAUS 23004).



Julia Sidorova

Instituto Carlos III de Salud (CIBER-EHD), Madrid, Spain

Biography: Dr. Julia Sidorova holds a PhD from Universidad Pompeu Fabra. Sidorova is a Research Scientist in service at the Bioinformatics Platform, CIBER, the Spanish national consortium of hospitals, part of Instituto Carlos III de Salud. As far as research is concerned, Sidorova's interests lie in classical data analysis vs deep neural networks — understanding their suitability or deficiencies.

Scientist's computational lawyer

I will review the tangible improvements my colleagues and I have achieved in novel biomarkers across various clinical specialties, and which have led to more accessible, affordable, and accurate diagnostics. Partially, these advances are due to non-trivial computational analyses and ingenious defense of the scientific hypotheses. I will outline the credo of a scientist's Computational Lawyer. A skilled one can rescue a flawed experimental design and successfully defend a scientific hypothesis, even when dealing with sub-optimally collected data. Should an analyst use AI? Yes, but only in a manner commensurate with their competence. It does not imply that a data scientist or bioinformatician can outsource her thinking or compensate for any deficiencies in competence with a magic black box of AI, even though she may believe it is reliable. The AI era demands more knowledge, not less. It fundamentally requires understanding the algorithms behind the employed R or Python libraries, as well as relatively new phenomena, for example information leakage.



Katarzyna Gawron

Department of Medical Microbiology, Faculty of Medical Sciences in Katowice, Medical University of Silesia, Medykow 18 St., 40-752 Katowice, Poland

Biography: Katarzyna Gawron, Ph.D., DSc., professor of Medical University of Silesia, Katowice, is a scientist, lecturer, supervisor of master's and PhD students, and laboratory diagnostician. Gawron graduated in 2000 from the Faculty of Pharmaceutical Sciences, Medical University of Silesia, defended a PhD thesis in 2007, completed a 2-year post-doc fellowship (2007-2009) at TJU, Philadelphia, USA, and a 6-year post-doc training at Jagiellonian University, Krakow, and held the assistant professor position (2016-2019). Since 2020, Gawron has been employed at Medical University of Silesia in Katowice. Gawron's research interest includes molecular mechanisms and new approaches to therapy of hereditary and infectious diseases of connective tissues associated with bone abnormalities, resorption and inflammation.

The role of gingival fibroblasts in periodontal diseases and regeneration

Gingival Fibroblasts (GFs) represent an abundant cell population of oral connective tissue. Their primary function is production and remodeling of Extracellular Matrix (ECM) and release of growth factors to maintain tissue integrity and structure, tissue regeneration and wound healing. These canonical functions of GFs can be affected in pathological conditions under various stimuli, such as, genetic factors, infections, some medications. Sustained exposure on pathological factors may induce phenotypic and functional variation of GFs. This phenomenon is observed in patients with Gingival Overgrowth (GO), a rare and painless condition, manifested by pathological and progressive enlargement of gingival tissue. Our previous studies revealed excessive production of collagen type I (Col I) by cultured fibroblasts from GO donors, elevated levels of HSP47, TGF-β1 and CTGF, and a shift in the TIMP-1/MMP-1 ratio, altogether indicating the fibrotic phenotype of GFs. Unlike fibroblasts derived from overgrowths, which did not present recurrence, fibroblasts derived from fibrotic and recurrent overgrowths showed high rate of proliferation *in vitro*. These results were confirmed by dense connective tissue with numerous blood vessels and abundant fibroblasts detected in tissue biopsies from recurrent GO.

GFs also represent the first line of defense against oral pathogens and are considered an important component of the innate immune system. However, their chronic activation due to persistent interaction with oral bacteria, which involves the secretion of large quantities

of cytokines, chemokines, matrix-degrading enzymes, and prostaglandins, significantly contributes to pathogenesis of Periodontitis (PD), the most common inflammatory disease of bacterial origin, characterized by the progressive degradation of the supporting tissues of the teeth, including the periodontal ligament and alveolar bone, and ultimately leading to tooth loss. Though the etiology of PD is multifactorial and modified by environmental and behavioral factors, one of key etiologic agent is the Gram-negative, anaerobic bacterium, *Porphyromonas gingivalis*, which induces dysbiosis, effectively manipulating the host immune system to create a nutrient-rich, inflammatory microenvironment promoting the initiation and progression of PD. Our studies demonstrated efficient adhesion/invasion of GFs and activation of Prostaglandin E2 (PGE2)-dependent pathway by *P. gingivalis,* an effect mediated by Peptidylarginine Deiminase (PPAD)-catalyzed citrullination of *P. gingivalis* Fim A protein and more pronounced in GFs from PD patients compared to healthy donors, suggesting the involvement of epigenetic regulation in the pathogenesis of PD. Furthermore, we observed that immune activation of GFs is determined by heterogeneity of ppad gene sequence and biochemical properties of produced variant(s) and correlated with periodontal tissue damage and the stage of PD progression.

Our more recent study investigated the reprogramming efficiency of GFs from PD and healthy donors to Induced Pluripotent Stem Cells (iPSCs). Analyses of the pluripotency markers Tra-1-60, Tra-1-81, and SSEA-4 showed ~95% of pluripotent cells among both tested cell lines, which was also confirmed by the negative pluripotency marker SSEA-1 identified in ~5% of analysed cells.

Taking together, beside the classical functions, our data revealed the functional plasticity and ability of GFs to serve as a source of therapeutic cells for tissue regeneration in periodontal diseases.



K.R. Aneja

Kurukshetra University, Kurukshetra (Haryana), India
Sardar Bhagwan Singh University, Dehradun (Uttarakhand), India

Biography: Prof. K.R. Aneja is the recipient of many Awards and Fellowships, the major ones being President of the Mycological Society of India, 2022 Lifetime Achievement Award, Recorder of ISCA, INSA-Royal Society Academic Exchange Fellowship, Best Citizens of India, Rashtriya Gaurav, ISWA lecture award, Shiksha Rattan Samman, and the 2023 Unnat Bharat Shewa Shree Award. Aneja served as the Governor's/Chancellor's nominee for Teacher's selection at Punjabi University, Patiala, a Member of the Research Advisory Committee of ICAR Weed Research Centre, Jabalpur, M.P., India, and an Expert Member of the ICFRE, Dehradun. Aneja received B.Sc., M.Sc. and Ph.D. degrees from Kurukshetra University, Kurukshetra, served the Departments of Botany and Microbiology, Kurukshetra University for 34 years, and joined the teaching faculty in the same institute, serving as Professor & Chairman for 11 years, supervised 23 PhD scholars and over 35 M.Phil. students, published 180 research papers/reviews/chapters and over 55 abstracts, attended over 35 national and international conferences, delivered lead lectures and chaired several sessions, authored/co-authored 16 books, edited 5 books, written 2 manuals, and Proceedings of an International Conference published by International Publishers (04) and National Publishers (19). Aneja is an Honorary Professor & Research Advisor at the Sardar Bhagwan Singh University, Dehradun (Uttarakhand).

Bioherbicides for eco-friendly weed management: From fields to commercialization, constraints and solutions for sustainable agriculture

Weeds outcompete crops for natural resources, reducing productivity (growth, yields) and quality of products. Globally, the annual worth of agrochemicals used to protect crops from weeds is estimated to US$75.3 billion. Blind use of chemicals to maximize production ensuring food security for an increasing population exerts many negative environmental impacts and development of resistance among the weed biotypes and creating superweeds against herbicides, even presenting a higher risk to soil microbiota and the environment, including human health.

Biological management of weeds through bioherbicides, an alternative to chemical herbicides, is an emerging eco-friendly strategy with decent potential for sustainable crop production with minimal environmental impact. Bioherbicides are the liquid or powder formulations based upon weed-specific live microorganisms (fungi, bacteria, viruses) or natural plant products (neem, citrus, clove) applied to overwhelm weed populations in a similar fashion as chemical herbicides. Based upon the biocontrol agent used in the formulation,

bioherbicides are classified as: microbial herbicides (microbes) and botanical herbicides (plant extracts/oils). Opportunities within the bioherbicides industry are abundant propelled by rising organic/natural farming, regulatory support, increasing resistance to synthetic chemicals, and environmental concerns. The global bioherbicides market valued at US$ 3.93 billion in 2025 and is projected to increase from US$ 4.53 billion in 2026 to US$ 14.06 billion by 2034, expanding at a CAGR of 15.22% from 2025 to 2034. (Precedence Research, December 4, 2025).

Researches on controlling weeds using biocontrol agents, especially foliar fungal pathogens, which had been initiated in 1970s took 10 years in developing and commercializing the first mycoherbicide DeVine in 1981 in the US market followed by the 2nd Collego in 1982. Since than over 26 microbial herbicides based upon fungi, bacteria and viruses have been developed globally, mainly based upon fungal taxa, hence the terms bioherbicides and mycoherbicides, are used interchangeably. Gibbatrianth, a formulation based upon the Indian isolate of Gibbago trianthemae, is the only mycoherbicide known from the developing countries. All the developed bioherbicides are not currently available in the market since they have not performed successfully under field conditions against specific weeds due to complexity of weed diversity across the world, short shelf-life, unable to grow and cause infection, and create epiphytotic on the targeted weeds due to environmental conditions of the area of application. For foliar pathogens, biological and environmental factors: temperature, free moisture (lengthy dew requirements) and protection from UV irradiation, all three, are critical for host's infection, short shelf-life and inconsistent efficacy.

To overcome the major constraints: virulence, stability, producing sufficient concentration of spores to be economically viable, host range, and dew requirement of the pathogen, the use of fungal biotechnology by genetic manipulation of potential mycoherbicidal agent by protoplast fusion, improvement of fermentors, spraying techniques, modification of the carriers in the inoculum, mass production of stable inoculum, enhancement of mycoherbicidal activity by the application of exogenous cellulases and/or pectinases, and developing consortia of host specific fungal pathogens for simultaneous broad-spectrum weed control.

Bioherbicides haven't progressed much in the past 50 years, but hopefully future will be more fruitful with the right technology applied to overcome the major barriers/constraints, to come up with bioproducts — that are fast acting, economical, safe and efficacious for variety of weed species. For fulfilment this task, a collaborative effort of plant pathologists, microbiologists, weed scientists, biotechnologists, and industrial houses, is needed for sustainable agriculture and getting foods free from carcinogenic herbicides.



Kunal Mitra

Biomedical Engineering, Florida Tech, Melbourne, FL, USA

Biography: Dr. Mitra is a Tenured Professor of Biomedical Engineering with joint appointment in Mechanical Engineering at Florida Tech. Mitra earned a BSME degree from Jadavpur University, Calcutta, India in 1991, then earned M.S. and PhD degrees in Mechanical Engineering from NYU School of Engineering in 1993 and 1996 respectively. Mitra is a Fellow of the American Society of Mechanical Engineers and the American Society for Laser Medicine and Surgery, and is also Associate Editor of four journals in the areas of medical device and tissue engineering. Mitra has published more than 150 articles in peer reviewed journals and conference proceedings.

AI-integrated high-throughput tissue-chip for space-based biomanufacturing applications

Predicting human drug responses from animal studies remains a persistent challenge in pharmaceutical development. Despite extensive optimization of preclinical protocols, fewer than 10% of drug candidates entering clinical trials ultimately receive approval, with failures frequently attributed to toxicities or efficacy gaps that animal models failed to anticipate. Acknowledging these limitations, the United States Congress passed the FDA Modernization Act 2.0 in December 2022, eliminating the longstanding requirement that investigational drugs undergo animal testing before human trials. The revised statute permits researchers to submit data from cell-based assays, computational models, or microphysiological systems — a regulatory change that has intensified interest in organ-on-chip technology. Bioprinting in space creates unique opportunities because of the microgravity environment. On Earth, gravitational forces often cause printed biological structures to collapse, requiring support materials. In space, however, the absence of gravity allows for the creation of more complex and stable three-dimensional tissues without external scaffolds. This capability is essential for producing advanced tissues and organs that closely resemble natural biological structures. It could enable astronauts on long-duration missions to bioprint tissues or organs on demand — for wound healing, organ replacement, or even studying disease progression in microgravity. This technology is not only vital for astronaut safety but also holds tremendous promise for the future of medical science on Earth. Research on tissue regeneration and disease modeling conducted in space may accelerate the development of new therapies. The integration of digital twin technology with space-based bioprinting in a microfluidic-based

organ-on-a-chip system is becoming a foundational element for deep-space exploration, enabling autonomous medical care and essential life-support capabilities far from Earth. Digital twin, virtual replicas of physical system, allows researchers to simulate and optimize the complex processes of bioprinting in microgravity. Without gravity, delicate and highly intricate soft tissues can be printed that would otherwise collapse under their own weight on Earth. Machine learning approaches could accelerate optimization of bioink formulations and process parameters for microgravity conditions, reducing dependence on iterative orbital experimentation. By combining real-time data from orbiting bioprinters, engineers on the ground can use AI-driven optimization to adjust printing parameters, predict potential failures, and validate tissue quality without extensive physical testing. Commercial space stations currently under development may eventually provide dedicated biomanufacturing capacity beyond what ISS shared laboratory modules permit. This presentation will address how AI is poised to unlock transformative personalized medicine through the convergence of generative AI and 3D bioprinting in microgravity environment.



Lucie Bacakova[1,2*], Yu-Chieh Wu[1], Julia Tomsu[1], Šimon Prazak[1], Irena Vackova[1], Marina Malic[1], Antonin Broz[1], Martina Doubkova[1], Jarmila Knitlova[1], Jarmila Havelkova[1,2], Yuriy Petrenko[1,2]

[1]Laboratory of Biomaterials and Tissue Engineering, Institute of Physiology of the Czech Academy of Sciences, Videnska 1083, 142 00 Prague 4, Czech Republic

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Biography: Assoc. Prof. Lucie Bacakova, MD, PhD, graduated from the Faculty of General Medicine at Charles University in Prague in 1984. Bacakova earned a PhD at the Institute of Physiology (IPHYS) of the Czechoslovak Academy of Sciences in 1992, and completed research fellowships at the University of Washington in Seattle, USA (Prof. S.M. Schwarz, 1996), the University of Pavia, Italy (Prof. Carlo Pellicciari, 2000), and the University of Pennsylvania (Prof. D. E. Discher, 2000-2001). In 2005, Bacakova founded a new Laboratory of Biomaterials and Tissue Engineering at IPHYS. In 2022, Bacakova received the prestigious Praemium Academiae award, and has published more than 300 articles (WOS: 10,433 citations, h-index 47).

Advanced 3D tissue models: Pioneering tools for investigating health and disease

In vitro tissue models are laboratory-grown biological systems that use isolated cells, tissues, or organs to simulate the structure and function of living organisms. Traditional models are two-dimensional (2D) cell cultures, in which cells are grown as a monolayer on flat surfaces. While cost-effective, they often fail to capture complex cell-to-cell and cell-matrix interactions. These models have therefore evolved into more sophisticated three-dimensional (3D) systems that more accurately replicate the native human microenvironment. These models present a major challenge for modern tissue engineering, which now serves not only to replace and regenerate damaged tissues in the body but also to research the physiological development of various issues, as well as the pathogenesis and potential treatment of various diseases. Relatively simple 3D tissue models are spheroids, cellular aggregates formed by primary cells or cell lines in suspension, used for basic drug toxicity and metabolic studies – for example, for glioblastoma research in our laboratory. More complex are organoids, i.e., stem cell-derived, self-organizing 3D structures that mimic the architecture and function of miniature organs (e.g., brain, heart, kidney, liver, or gut organoids). Advanced models include organ-on-a-chip microphysiological systems that combine 3D microtissues with microfluidic channels to simulate physiological conditions such as blood flow, nutrient

exchange, and mechanical forces, as well as 3D bioprinted models created by layer-by-layer patterning of living cells and bioinks (often hydrogels) to build complex tissue architectures with high spatial precision. Despite all this effort, even 3D tissue models are often simplified, lacking, e.g., vascular complexity. Therefore, in our laboratory, specific attention has been paid to the development of pre-vascularization in the models, usually through the self-organization of vascular endothelial cells and mesenchymal stem cells into tubular capillary-like structures in hydrogel matrices. In this way, we are developing models of physiological tissues, such as skin, the blood vessel wall with vasa vasorum, bone tissue, and the osteochondral interface, as well as various pathologies, such as hypertrophic scar, clubfoot, and Dupuytren's contracture. Our models aim to reduce or eliminate the use of laboratory animals in modern biomedical research, not only for ethical reasons, but also because some diseases lack relevant animal models or because these models do not accurately reflect conditions in the human body. Our models can be applied not only to disease modeling but also to drug discovery, toxicology, and precision medicine, which uses patient-specific cells to create tailored models for evaluating how an individual might respond to specific therapies.

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Luis Jesús Villarreal-Gómez[1*], Theodore Ng[2], Arturo Zizumbo-López[3], Tin Wui Wong[4], Idanawati Naharudin[4], Balqis Azman[4], Aracely Serrano-Medina[5], Lucia Margarita Valenzuela-Salas[6], Edgar Ramiro Mendez-Sánchez[6], Paris Astrid Mier-Maldonado[6], Juan Antonio Paz González[1], Ana Leticia-Iglesias[1], Graciela Lizeth Pérez-González[1]

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Biography: Dr. Luis Villarreal is a research professor at the Faculty of Engineering Sciences and Technology, Autonomous University of Baja California, Tijuana, Baja California, Mexico. So far, Dr. Villarreal has published 58 indexed articles, with a total of 1,555 citations in Scopus, and has participated in more than 80 national and international congresses. Villarreal is founder and editor-in-chief of the Revista de Ciencias Tecnológicas (RECIT), a member of the editorial board of important publishers such as Bentham, MDPI, Hindawi, and referee of 205 articles, and an evaluator of research projects in Mexico, Italy, Malaysia and Peru. Research lines include Biomaterials, Tissue Engineering, Drug-Release Systems and Biotechnology.

Evaluating cell compatibility and subcutaneous host response of silk fibroin–chitosan plug composites as potential resorbable implants

Silk Fibroin (SF) and Chitosan (CS) are biopolymers widely studied as resorbable scaffolds for regenerative medicine. In this study, SF/CS composite plugs were prepared at 70:30 and

60:40 ratios and compared with single-polymer controls to evaluate their physicochemical properties and preliminary biocompatibility. ATR-FTIR confirmed the presence of both components in the composites and showed band broadening and shifts consistent with increased intermolecular hydrogen bonding. Thermal analysis (DSC/TGA) indicated greater thermal stability in SF-rich formulations, while SEM revealed smoother, more homogeneous morphologies in the blended fibers. *In vitro* cytocompatibility assays with macrophages (J-774A.1) and fibroblasts (HFF-1) showed high metabolic activity in all SF/CS groups, with the 60:40 blend being the most favorable. Subcutaneous implantation in mice elicited a controlled foreign-body reaction characterized by granulomatous inflammation, fibrosis, and neovascularization, without signs of acute adverse responses. Together, these results indicate that SF/CS blends — particularly at 60:40 — exhibit tunable structural and thermal properties and early-stage biocompatibility supportive of their use as resorbable implantable biomaterials. Further studies in defect-specific models are needed to determine application-dependent performance and translational readiness.



Narendra Chirmule

Indian Institute of Technology (IIT), Mumbai and Delhi, India

Biography: Narendra Chirmule is a co-founder of Symphony Technologies, a data analytics company. Chirmule currently teaches drug development at UPenn and the Indian Institute of Technology, Mumbai and Delhi, and has contributed to the clinical development of several vaccines, biologics, and cell-and-gene therapies. Chirmule's TEDx talk and book Good Genes Gone Bad (Penguin Press) describe lessons learned from colossal failures in drug development. In 2025, Chirmule edited a textbook, Approved: Life Cycle of Drug Development (Springer).

Why do 90% of the drug's fail in development? An analysis of 82+ submissions; and a case study of immunotherapy

Despite unprecedented advances in molecular biology, genomics, biomarker discovery, artificial intelligence and translational science, the probability that a drug entering clinical development will ultimately reach patients remains remarkably low. Why do apparently promising molecules, targets and development programs fail?

This keynote presents a systematic analysis of failure across the drug-development continuum, integrating more than four decades of experience in immunology and more than two decades in biologics and clinical drug development with a structured analysis of 200+ U.S. FDA Complete Response Letters (CRLs) and development submissions/programs. Rather than viewing failures as isolated events, the analysis seeks to identify recurring patterns, failure modes and points in the development pathway where risk could potentially have been recognized earlier. The presentation will examine failures arising from efficacy, safety, clinical-trial design, patient selection, biomarkers, pharmacology, manufacturing and product quality, immunogenicity, regulatory expectations and the translation of preclinical findings into clinical benefit. The objective is to move from a retrospective description of failure toward a predictive framework for failure prevention and risk mitigation.

A detailed case study of cancer immunotherapy illustrates this concept. The success of immune-checkpoint blockade targeting CTLA-4 and PD-1/PD-L1 created enormous expectations that other inhibitory pathways would produce similar therapeutic benefits. However, despite compelling biological rationale and extensive clinical investigation, programs targeting TIGIT, LAG-3 and TIM-3 have produced disappointing or inconsistent

outcomes. Why did a successful therapeutic paradigm not generalize across apparently related checkpoint pathways?

By comparing successful and unsuccessful immunotherapy programs, the keynote will explore the distinction between biological plausibility and clinical validation, the importance of target biology, redundancy and context within the tumor microenvironment, patient selection, biomarker strategy, combination design and the limitations of extrapolating from one successful mechanism to another. The central message is that drug development failures are rarely random. Failure leaves patterns. Systematically capturing, classifying and modeling those patterns could enable developers to identify high-risk assumptions earlier, improve development decisions and ultimately increase the probability of successful translation from molecule to medicine.

Patrizia Ferretti[1*], Oliver Gardner[1], James Lee[1], Tawan Mungongcharoen[1], Reem Alkharji[1], Jenny Lange[1,2]

[1]Department of Developmental Biology and Cancer, Stem Cells and Regenerative Medicine Section, UCL Great Ormond Street Institute of Child Health, University College London, London, UK

[2]UCL UK Dementia Research Institute, University College London, London, UK



Biography: Patrizia Ferretti is Professor of Regenerative Biology at UCL Great Ormond Street Institute of Child Health, University College London, UK. Ferretti studied at Pisa University and at the Mario Negri Institute for Pharmacological Research, Milan, Italy, prior to moving to the Max Planck Institute, Goettingen, Germany, and then to London. Ferretti's group has made sustained and internationally recognized contributions to the regeneration and rare disease field, by identifying cellular and molecular mechanisms which play a role in response to injury and repair and establishing human disease models using

Stem cells for human disease modelling and potential for tissue repair

Understanding the mechanisms underlying human disease and translating this knowledge into therapeutic strategies remain major challenges, particularly for congenital disorders that affect multiple tissues and organs. A key issue is the importance of selecting the most appropriate cellular and experimental model for the biological question being addressed and for developing novel strategies for tissue repair.

Advances in patient-derived cellular models, including primary cells and Induced Pluripotent Stem Cells (iPSCs), have provided new opportunities to investigate disease processes in relevant human cell types and tissues. At the same time, the expanding range of culture systems available, from conventional two-dimensional cultures to three-dimensional self-organising or biomaterial-supported engineered tissue models, raises important questions about how best to investigate different aspects of human diseases and potential therapies.

Drawing on examples from our work on congenital disorders including microtia, acrodysostosis and Duchenne muscular dystrophy, I will explore how the choice of cell source and culture environment influences our ability to elucidate pathogenic mechanisms and engineer tissues. I will discuss what different patient-derived cell-based models can tell us about human disease, their respective strengths and limitations, and the types of questions they are best suited to address.

Finally, I will consider how insights gained from human disease modelling inform the broader goal of repairing diseased tissue and restoring function. While stem cell-based approaches hold considerable promise for future therapies and regenerative medicine, significant biological, technical and translational challenges remain. Understanding both the strengths and limitations of current models will be essential for maximising their potential impact on improving outcome for congenital disorders and other conditions affecting human health.



Sandeep Shrivastava

KLE Academy of Higher Education and Research (DU), Belagavi, Karnataka, India

Biography: Dr. Sandeep Shrivastava is MS, DNB, PhD. Shrivastava is Director-Professor of Orthopedics at J.N. Medical College, Datta Meghe Institute of Medical Sciences (DU), Wardha, Maharashtra, India, and is Group CEO, Meghe Group of Hospitals; Director, Centre of Regenerative Medicine; and Ex-Dean, J.N. Medical College. Shrivastava has 76 indexed publications, 4 books, and 15 copyrights, and has pioneered wound management with PRP by developing the clinical protocol of Sandeep's Technique for Assisted Regeneration of Skin (STARS Therapy). This work is widely published and presented across the globe. Shrivastava is the author of the book The Illustrative Guide on Platelet Rich Plasma.

Induction of neo angiogenesis - A way forward for reversing necrosis in complex wounds in orthopaedic practice

Introduction: The functional integrity of limbs depends on healthy bones, tendons, and soft-tissue cover. High-velocity trauma has led to an increase in complex wounds exposing these vital structures, often with extensive devitalization of overlying tissues. This precipitates a cycle of necrosis, infection, and progressive tissue loss. Conventional management — including debridement, medical care, and flap coverage — addresses the deficit but rarely restores compromised tissue. Regenerative strategies, particularly Platelet Rich Plasma (PRP), induce neo-angiogenesis, potentially transforming wound care from reparative to regenerative. This study evaluates whether targeted regenerative intervention can preserve and revive tissues otherwise destined for necrosis.

Study Design: This prospective clinical study investigates autologous Platelet-Rich Plasma (PRP) as a stand-alone therapy in complex orthopedic wounds. Freshly prepared PRP was infiltrated subcutaneously around, beneath, and within devitalized tissues using a standardized protocol, Sandeep's Protocol for Induction of Neo-Angiogenesis (SPIN).

Observations & Results: Outcome measures included tissue survival, wound healing quality, pain, infection control, and regenerative signs in necrosed zones. Application of the SPIN protocol consistently demonstrated:

- Revival of previously non-viable tissues
- Reduction in infection-related complications

• Effective pain management and improved healing trajectory

The protocol was safe, reproducible, and clinically adaptable.

Conclusion: Regenerative wound care through neo-angiogenesis represents a paradigm shift in orthopedic management. PRP, with growth-promoting, antimicrobial, and immunomodulatory properties, offers a biologic tool to break the necrosis-infection cycle. The SPIN protocol is simple, cost-effective, and accessible, bridging conventional coverage with true tissue regeneration and potentially redefining outcomes in complex trauma care.



Tania Limongi

Department of Drug Science and Technology (DSTF),
University of Turin, Italy,
EvaT Laboratory, Italy

Biography: Tania Limongi is Assistant Professor at the Department of Drug Science and Technology (DSTF), University of Turin (Italy), and head of the EvaT Laboratory. Research focuses on nanobiotechnology, Extracellular Vesicles (EVs), and bioengineered nanocarriers for drug delivery and regenerative medicine. Limongi has held multiple editorial roles, including Guest Editor and Editorial/Section Board Member for journals such as Cells, Nanomaterials, Materials, IJMS, and Pharmaceutics. Limongi spent three years abroad as a researcher at King Abdullah University of Science and Technology (KAUST), Saudi Arabia. Co-inventor on patents and reviewer for international journals, Limongi has co-authored numerous peer-reviewed publications and supervises graduate and postdoctoral researchers, bridging nanosystem–cell interactions with translational applications to improve therapeutic efficacy and safety.

Osmotic lysis–driven Extracellular Vesicle (EV) engineering

Extracellular Vesicles (EVs) are lipid bilayer–enclosed nanoparticles released by virtually all cells and are now recognized as key mediators of intercellular communication. Their capacity to transfer lipids, proteins, nucleic acids, and metabolites has spurred intense interest in both diagnostics and therapeutics across oncology, immunology, regenerative medicine, and neurosciences. EVs mirror the molecular signatures of their parental cells and can engage specific receptors on recipient cells, enabling targeted delivery and uptake. Coupled with their biocompatibility, low immunogenicity, stability, and ability to cross biological barriers, these properties have positioned EVs as promising nanocarriers. Nevertheless, the clinical translation of EV-based therapies is limited by challenges in scalable production, purity and batch consistency, endogenous cargo–related safety concerns, and the coexistence of native and exogenous payloads after engineering.

Here, I present an innovative, fast, reproducible, and sustainable strategy for EV engineering based on osmotic lysis. In this approach, EVs isolated via standard methods are rapidly diluted in a hypotonic aqueous solution to induce controlled membrane disruption through ionic imbalance, followed by spontaneous reassembly into structurally stable nanovesicles. This process yields vesicle populations with higher particle concentration and improved

purity while efficiently removing intraluminal cargo such as proteins and nucleic acids that may be associated with tumorigenic or immunogenic risk. By decoupling native cargo from the engineered product, the method mitigates safety liabilities and enables concurrent loading of exogenous therapeutic payloads without interference from endogenous material. Notably, the lipid–protein rearrangements occurring during lysis and reassembly enhance cellular uptake, particularly in tumor cells, suggesting improved targeting specificity.

Overall, osmotic lysis–driven EV engineering offers a versatile and scalable route to generate functional, customizable, and clinically oriented EV-based nanocarriers. The approach directly addresses key bottlenecks in yield, purity, and safety, and supports the rational design of next-generation EV therapeutics for drug delivery and diagnostic applications.



Thomas J. Webster

School of Health Sciences and Biomedical Engineering, Hebei University of Technology, Tianjin, China
Division of Pre-College and Undergraduate Studies, Brown University, Providence, RI, USA

Biography: Thomas J. Webster's (H index: 135) degrees are in chemical engineering from the University of Pittsburgh (B.S., 1995; USA) and in biomedical engineering from RPI (Ph.D., 2000; USA). Webster has formed over a dozen companies which have numerous FDA approved medical products currently improving human health in over 30,000 patients, and currently serves as CSO of Novaurum, which is pioneering the use of ALD in medical devices. Webster is also currently serving as a professor at Brown University, Saveetha University, Hebei University of Technology, UFPI, and others. Dr. Webster has numerous awards including: 2020 World Top 2% Scientist by Citations (PLOS); 2020 SCOPUS Highly Cited Research (Top 1% Materials Science and Mixed Fields); 2021 Clarivate Top 0.1% Most Influential Researchers (Pharmacology and Toxicology); 2022 Best Materials Science Scientist by Citations (Research.com); and is a fellow of over 8 societies. Prof. Webster is a former President of the U.S. Society for Biomaterials and has over 1,350 publications with over 55,000 citations, and was recently nominated for the Nobel Prize in Chemistry. Prof. Webster also recently formed a fund to support Nigerian student research opportunities in the U.S.

Eliminating implant failure in humans with nano chemistry: 45,000 cases and counting

Implant infection is rising with the U.S. Centers for Disease Control predicting one person every three seconds will die from a bacteria infection by 2050. Nanomedicine is the use of nanomaterials to improve disease prevention, detection, and treatment which has resulted in hundreds of FDA approved medical products. While nanomedicine has been around for several decades, new technological advances are pushing its boundaries. For example, this presentation will provide an over 25 year journey of commercializing nano orthopedic implants now in over 30,000 patients to date showing no signs of failure. Current orthopedic implants face a failure rate of 5 – 10% and sometimes as high as 60% for bone cancer patients. Further, Artificial Intelligence (AI) has revolutionized numerous industries to date. However, its use in nanomedicine has remained few and far between. One area that AI has significantly improved nanomedicine is through implantable sensors. This talk will present research in which implantable sensors, using AI, can learn from patient's response to implants and predict future outcomes. Such implantable sensors not only incorporate AI, but also communicate to a handheld device, and can reverse AI predicted adverse events. Examples will be given in which AI implantable sensors have been used in orthopedics to inhibit implant infection

and promote prolonged bone growth. *In vitro* and *in vivo* experiments will be provided that demonstrate how AI can be used towards our advantage in nanomedicine, especially implantable sensors. Lastly, this talk will summarize recent advances in nanomedicine to both help human health and save the environment.



Vasiliki E. Kalodimou

EUC School of Medicine, Frankfurt Branch, Germany

Biography: Dr. Vasiliki E. Kalodimou, PhD, MSc, BSc (Hons), CABP(H), is an internationally recognized scientist, educator, and mentor specializing in regenerative medicine, stem cell research, flow cytometry, and advanced biotherapies. Kalodimou is Assistant Professor at European University Cyprus – Frankfurt, Germany, and Director of Flow Cytometry, Research and Regenerative Medicine at IASO Hospital, Athens. Kalodimou has authored numerous scientific publications and books, contributed to global biotherapy standards, and holds patents in cellular therapies. A passionate advocate for STEM mentorship and innovation, Kalodimou inspires the next generation of scientists through research, education, and international collaboration.

The era of Artificial Intelligence (AI) and its use in regenerative medicine

The rapid evolution of Artificial Intelligence (AI) is reshaping the landscape of biomedical research and opening new possibilities in the field of regenerative medicine. Regenerative medicine aims to restore, replace, or regenerate damaged tissues and organs through the combined use of stem cells, biomaterials, tissue engineering, gene-based approaches, and advanced therapeutic strategies. However, the complexity of biological systems and the vast amount of multidimensional data generated by modern technologies present significant challenges that traditional analytical approaches cannot fully address. AI offers powerful computational solutions capable of transforming these challenges into opportunities for innovation.

Machine learning and deep learning algorithms are increasingly being integrated into regenerative medicine to analyse complex biological datasets, including genomic, transcriptomic, proteomic, imaging, and clinical information. These technologies enable the identification of critical molecular pathways, prediction of cell behaviour, optimization of stem cell differentiation protocols, and discovery of novel therapeutic targets. AI-assisted platforms are also accelerating the development of biomaterials and tissue-engineered constructs by predicting material properties, cellular responses, and optimal conditions for tissue regeneration.

One of the most promising applications of AI in regenerative medicine is the advancement of personalized therapies. By integrating patient-specific biological data with predictive computational models, AI has the potential to support the design of individualized regenerative treatments with improved efficacy and safety. Additionally, AI-powered imaging and monitoring systems provide accurate assessment of tissue development, organoid maturation, and therapeutic outcomes, thereby improving both research efficiency and clinical translation.

Despite its transformative potential, several challenges remain before AI can be fully integrated into regenerative medicine practice. These include the need for high-quality and standardized datasets, improved transparency and interpretability of AI models, ethical considerations, regulatory frameworks, and effective collaboration between clinicians, biologists, engineers, and data scientists. Overcoming these barriers will be essential to ensure the responsible and successful implementation of AI-driven regenerative technologies.

This presentation will highlight the current and emerging applications of artificial intelligence in regenerative medicine, focusing on its role in accelerating discovery, enhancing precision, and enabling next-generation therapeutic approaches. The convergence of AI and regenerative medicine represents a new era of biomedical innovation, with the potential to revolutionize tissue repair, disease modelling, and personalized healthcare.

6TH EDITION OF

INTERNATIONAL CONFERENCE ON

TISSUE ENGINEERING AND REGENERATIVE MEDICINE

&

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BIOTECHNOLOGY AND BIOENGINEERING

HYBRID EVENT

28-30

SEPTEMBER 2026

ORAL PRESENTATIONS



Abdulsada A. Rahi Al-Ghnaimawi*, Magda A. Ali Al-Rubaie*, Ali Abdulsada Al-Ghnaimawi*
Wasit University, Colleges of Science and Medicine, Iraq







Production of nanoliposomal amphotericin B 0.4% topical gel as effective treatment for human acne vulgaris

Acne (also known as acne vulgaris) is a persistent chronic skin inflammatory condition of the pilosebaceous follicles that affects people all over the world. Acne is projected to affect 9.4% of the global population, ranking it eighth among skin diseases. Acne affects more than 85% of teenagers, and the disease can persist into adulthood which often occurs in females and accounts for two-thirds of dermatologist consultations for acne. The unique lesions can be characterized as either non-inflammatory (open/black and closed/white comedowns) or inflammatory (papules, pustules, nodules, and cysts), leading to scar development and pigmentation on the skin, necessitating prolonged and persistent therapy. Typically, lesions are observed on the face, neck, upper back, and chest. Acne can't be stopped from occurring or cured, but it can be treated quite successfully. Moreover, acne is also connected with significant financial expenses. It is noteworthy that the number of research papers and scientific findings relevant to acne treatment regimens continues to increase, given the enormous interest in various research breakthroughs in this area. Much study has been conducted on acne, both in terms of the disease process and the numerous therapy approaches. The most recent advances in acne therapy involve the use of combination treatments that address the numerous pathogenic factors that are at the root of the condition. The most recent literature on acne treatment, which described several topical applications, novel treatments, and emerging treatments for successful acne-targeted therapy, includes topical retinoid that normalize abnormal hyperkeratinization in the infundibulum and novel topical retinoid with anti-inflammatory properties. The present invention aimed to give a clear picture of new treatment medication strategy was produced. Also highlighted the dosage forms which are in various trial phases, along with successful and commercially available dosage forms in the

market. The best results were found with nanoliposomal amphotericin B 0.4% topical gel. The study found a highly significant difference in mean recovery time between treatment groups ($p<0.001$). The mean recovery time for the nanoliposomal amphotericin B 0.4% group was 2.87 ± 0.67 (1-4) weeks, which was the shortest time ever documented.

Biography of Prof. Dr. Abdulsada Abdulabbas Rahi

Prof. Dr. Abdulsada Abdulabbas Rahi is currently working as Dean of the Science College of Wasit University, Iraq. Rahi received a Postdoctoral degree in Medical Parasitology from the University of Tehran of Medical Sciences (TUMS), Iran, completed a PhD in Biotechnology of *Leishmaniasis* from Al-Nahrain University, Iraq, and a Masters in Medical Microbiology from the University of Al-Anbar, Iraq. Rahi then worked at Wasit University, Iraq, serving as Professor in Medical Biotechnology. Dr. Rahi has authored several publications (90 published papers) in various reputed journals, reflecting research interests in Biotechnology and Medical Parasitology, and is Associate Editor of several journals including the Journal of Agri-Food and Applied Sciences (JAAS), Journal of Scientific Research and Studies, and Scholars Academic and Scientific Journals (SAS).

Dr. Scientist is serving as a member or fellow in Association of American Society for Microbiology (ASM). He is currently in charge of ongoing scholarly project Nanobiotechnology. Dr. Rahi is awarded Golden Prize by 10th International Exihibition of Inventions and Innovation Forum and 3rd World Inventions and Innovation Forum in China / Foshan and in SiriLanka, 2020. Dr. Rahi is awarded Golden Prizes from Germany 2021,2023, INTARG Poland 2023, 2024, 2025 and Thailand, 2026. Also, Dr. Rahi is awarded Scientific Day's Prize for Medical Research, 2014 by Iraqi Ministry of Higher Education and Scientific Research. Dr. Rahi is awarded Silver Prize by International Exhibition of Inventions and Innovation Forum in Germany / Nuremberg, 2021. Dr. Rahi is supervised PhD and MSc students and Scientific referee.

Research Interest: Interested in Molecular parasitology, Nanobiotechnology, Biotechnology of *Leishmaniasis*, Medical Parasitology, Medical Microbiology, Diagnostic methods, Kala-azar etc.

Responsibilities

1-Head of Medical Laboratory Technology dept. in Kut Technical Institute.
2-Head of Health Community dept.in Kut Technical Institute.
3-Head of Biology dept. in College of Science of Wasit university.
4-Consultant in Kut Textile Company.
5-Consultant of University Committee.
6- Scientific Referee at Ministry of Higher Education.
7- Dean of Science College/Wasit University (2012-2015).
8- Member of American Society for Microbiology

9- Dean of Science College / Wasit University / (2021-2024).
10- Member of International Inventors and Innovators Society (IFIA).
11- Member of American Society for Microbiology (ASM)

Biography of Prof. Dr. Magda A. Ali Al-Rubaie

Assist. Prof. Dr. Magda Abdulkalek Ali Al-Rubaie is currently working as academic staff of the Science College of Wasit University, Iraq. Al-Rubaie received a doctoral degree in Medical Parasitology/*Leishmaniasis* from Tehran University of Medical Sciences (TUMS), Iran, and completed a Masters in Medical Microbiology from the Faculty of Medicine, University of Al-Anbar, Iraq, then worked at the Faculty of Medicine at Wasit University, Iraq. Dr. Al-Rubaie has authored several publications (60 published papers) reflecting research interests in Biotechnology and Medical Parasitology, is a member of the American Society for Microbiology (ASM), and has received Golden and Silver invention awards in China, Sri Lanka, Thailand, Poland (Katowice) and Germany (Nuremberg). Dr. Al-Rubaie has supervised PhD and MSc students and serves as a scientific referee.

Research Interest: Interested in Molecular parasitology, Nanobiotechnology, Biotechnology of *Leishmaniasis*, Medical Parasitology, Medical Microbiology, Diagnostic methods, Cutaneous *Leishmaniasis* etc.

Biography of Dr. Ali Abdulsada Al-Ghnaimawi

Dr. Ali Al-Ghnaimawi is a committed and compassionate medical graduate with a Bachelor of Medicine and General Surgery (MBChB), equipped with a robust academic foundation and hands-on clinical experience, with proven ability to work effectively within multidisciplinary teams and participate in multiple operations with specialists across different specialties. Dr. Ali Al-Ghnaimawi has been awarded Golden and Silver Prizes by the International Exhibition of Inventions and Innovation Forum in Thailand, 2026.

Research Interest: Interested in reading medical journals, volunteering in health care organizations such as Red Crescent activity.





Abdulsada A. Rahi Al-Ghnaimawi*,
Magda A. Ali Al-Rubaie*,
Ali Abdulsada Al-Ghnaimawi*
Wasit University, Colleges of Science and Medicine, Iraq



Green synthesis and treatment of silver nanoparticles from *Leishmania major* in Iraq

Nanoparticles (NPs) play an important role in the diagnosis and treatment of diseases in consequence of their larger surface areas in comparison to the bulk material. Among the variety of nanomaterials, Metal Nanoparticles (MNPs) present unique physical, chemical and biological properties. The present study evaluated the anti-*Leishmania* effect of silver nanoparticles on *Leishmania major* based on investigation of their action on various cellular parameters of the parasite.

Silver nanoparticles were synthesized using Tannic Acid (TA) as both reducing agent and stabilizer and monitored by UV–vis absorption spectroscopy and Scanning Electron Microscopy (SEM) images that showed formation of spherical AgNPs ranging from 5 to 24 nm diameter. TA coating resulted in a red-shift and broadening of bands. *In vitro* assays of *Leishmania major* promastigotes showed an increase of anti-*leishmanial* activity for AgNPs-TA. This screening can contribute to the development of new, green, and fast-produced drugs aiming at leishmaniasis treatment. Moreover, these biologically synthesized nanoparticles were found to be highly effective against different multi-drug resistant human pathogens.

Silver nanoparticles synthesized using tannic acid have potential application as an anti-leishmanial treatment. Furthermore, the use of natural compounds contributes to the development of clean, nontoxic, biocompatible and environmentally benign methods to synthesize noble metal nanoparticles.

Conclusion: An eco-friendly route for silver NPs by TA was demonstrated for anti-*leishmanial* activity. A one-container synthesis based on chemical reduction was used to prepare silver NPs. TA gains attention as a naturally derived polyphenolic compound and due to its unique biological properties. UV–vis absorption spectroscopy and SEM images showed formation of spherical AgNPs ranging from 5 to 24 nm diameter.

Workflow: Samples collection → Culture → PCR → Synthesis of Ag-NPs → UV–vis spectroscopy and SEM.

Biography of Prof. Dr. Abdulsada Abdulabbas Rahi

Prof. Dr. Abdulsada Abdulabbas Rahi is currently working as Dean of the Science College of Wasit University, Iraq. Rahi received a Postdoctoral degree in Medical Parasitology from the University of Tehran of Medical Sciences (TUMS), Iran, completed a PhD in Biotechnology of *Leishmaniasis* from Al-Nahrain University, Iraq, and a Masters in Medical Microbiology from the University of Al-Anbar, Iraq. Rahi then worked at Wasit University, Iraq, serving as Professor in Medical Biotechnology. Dr. Rahi has authored several publications (90 published papers) in various reputed journals, reflecting research interests in Biotechnology and Medical Parasitology, and is Associate Editor of several journals including the Journal of Agri-Food and Applied Sciences (JAAS), Journal of Scientific Research and Studies, and Scholars Academic and Scientific Journals (SAS).

Dr. Scientist is serving as a member or fellow in Association of American Society for Microbiology (ASM). He is currently in charge of ongoing scholarly project Nanobiotechnology. Dr. Rahi is awarded Golden Prize by 10th International Exihibition of Inventions and Innovation Forum and 3rd World Inventions and Innovation Forum in China / Foshan and in SiriLanka, 2020. Dr. Rahi is awarded Golden Prizes from Germany 2021,2023, INTARG Poland 2023, 2024, 2025 and Thailand, 2026. Also, Dr. Rahi is awarded Scientific Day's Prize for Medical Research, 2014 by Iraqi Ministry of Higher Education and Scientific Research. Dr. Rahi is awarded Silver Prize by International Exhibition of Inventions and Innovation Forum in Germany / Nuremberg, 2021. Dr. Rahi is supervised PhD and MSc students and Scientific referee.

Research Interest: Interested in Molecular parasitology, Nanobiotechnology, Biotechnology of Leishmaniasis, Medical Parasitology, Medical Microbiology, Diagnostic methods, Kala-azar etc.

Responsibilities

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Assist. Prof. Dr. Magda Abdulkalek Ali Al-Rubaie is currently working as academic staff of the Science College of Wasit University, Iraq. Al-Rubaie received a doctoral degree in Medical Parasitology/*Leishmaniasis* from Tehran University of Medical Sciences (TUMS), Iran, and completed a Masters in Medical Microbiology from the Faculty of Medicine, University of Al-Anbar, Iraq, then worked at the Faculty of Medicine at Wasit University, Iraq. Dr. Al-Rubaie has authored several publications (60 published papers) reflecting research interests in Biotechnology and Medical Parasitology, is a member of the American Society for Microbiology (ASM), and has received Golden and Silver invention awards in China, Sri Lanka, Thailand, Poland (Katowice) and Germany (Nuremberg). Dr. Al-Rubaie has supervised PhD and MSc students and serves as a scientific referee.

Research Interest: Interested in Molecular parasitology, Nanobiotechnology, Biotechnology of *Leishmaniasis*, Medical Parasitology, Medical Microbiology, Diagnostic methods, Cutaneous *Leishmaniasis* etc.

Biography of Dr. Ali Abdulsada Al-Ghnaimawi

Dr. Ali Al-Ghnaimawi is a committed and compassionate medical graduate with a Bachelor of Medicine and General Surgery (MBChB), equipped with a robust academic foundation and hands-on clinical experience, with proven ability to work effectively within multidisciplinary teams and participate in multiple operations with specialists across different specialties. Dr. Ali Al-Ghnaimawi has been awarded Golden and Silver Prizes by the International Exhibition of Inventions and Innovation Forum in Thailand, 2026.

Research Interest: Interested in reading medical journals, volunteering in health care organizations such as Red Crescent activity.



Akanksha Singh*, Mrinal Kumar Maiti, Ramkrishna Sen

Department of Bioscience and Biotechnology, Indian Institute of Technology Kharagpur, Kharagpur, India

Process parameter optimization for enhancing pigment productivity in *Chlorella vulgaris*

Microalgae are recognized as promising biofactories for producing a range of industrially valuable and economically significant products. Microalgal cultivation for high-value pigments often suffers from economic bottlenecks due to low productivity under standard conditions. This study focuses on *Chlorella vulgaris,* as it is one of the most promising industrial microalgal species, because it has high photosynthetic efficiency, robust cellular makeup, and produces high-value tetraterpenoids, primarily lutein, β-carotene, violaxanthin, and zeaxanthin. The present study aims to improve pigment productivity of the wild-type microalga C. vulgaris via optimization of the growth parameters. The impact of independent parameters like culture medium pH, salinity, light intensity, and photoperiod regimes was screened. The results indicate that precise optimization of these single parameters can produce a large metabolic shift in the wild-type strain. Upon this single-factor optimization of C. vulgaris, an increase of 1.4-fold was observed in the pigment productivity compared to the un-optimized control. This result provides evidence that large productivity improvements can be achieved through optimizing a few physical parameters. These single-parameter changes are a great first step to maximizing natural output, but there is a limit to process optimization. The future work focuses on the genetic engineering of this C. vulgaris strain to overcome these biological limits. This study will allow us to target specific metabolic pathways to engineer regulatory bottlenecks that will help increase pigment productivity for industrial and commercial applications. In addition to the genetic modifications, process parameter optimization needs to be performed to achieve improved carotenoid accumulation without significantly hampering the biomass concentration.

Keywords: Biomass, *Chlorella vulgaris*, Genetic Modification, Pigment Productivity, Single-Parameter Optimization.

Biography

Akanksha Singh is a Ph.D. scholar at the Indian Institute of Technology (IIT) Kharagpur, India. Singh's research focuses on genetic and bioprocess engineering in microalgae, specializing in transgenic strain development, bioprocess optimization, and scaling up high-value bioproducts like carotenoids. By integrating *in silico* modeling with upstream and downstream bioprocess strategies, the work aims to optimize photosynthetic cell factories for sustainable biotech applications. In addition to research, Singh actively contributes to academics by instructing B.Tech and M.Tech students in laboratory experiments and core biotechnology coursework.



Alice Sharma
Department of Biosciences and Biotechnology, MIET, Meerut-250005, Uttar Pradesh, India

Nanoparticle based targeted drug delivery systems for cancer therapy

Cancer is a major reason of death worldwide in human beings and traditional chemotherapy is usually connected with poor specificity, systemic toxicity and unwanted side effects. Nanoparticles based targeted drug delivery systems have come out as a favourable approach to overcome these drawbacks by providing selective delivery of therapeutic agents to the tumour tissues with minimal damage to healthy cells. Various nanocarriers such as liposomes, polymeric nanoparticles, dendrimers and lipid based nanoparticles have shown important possibilities for improving drug bioavailability, enhancing pharmacokinetic profiles and achieving controlled drug release. Recent advancements in surface modification and ligand-mediated targeting have further improved the specificity and effectiveness of nanoparticle-based therapies. These systems take advantage of the passive targeting by the Enhanced Permeability and Retention (EPR) effect as well as the active targeting by specific molecular interactions with the receptors on the cancer cells. Moreover, nanotechnology has facilitated the co-delivery of different therapeutic agents, which has led to synergistic anticancer effects and reduced drug resistance. However, despite remarkable progress, long-term safety, large-scale manufacturing, regulatory approval, and clinical translation remain a major obstacle for general application. In this review, we discuss recent advances in nanoparticle based targeted drug delivery for cancer therapy, its therapeutic benefits and limitations, and future prospects of nanomedicine in precision oncology. The ongoing advances in nanotechnology are predicted to transform cancer therapy by enhancing therapeutic results, minimising adverse effects, and facilitating personalised treatment strategies.

Keywords: Nanoparticles, Cancer, Drug Delivery, Enhanced Permeability and Retention (EPR), Liposomes.

Biography

Alice Sharma is a third year BSc Biotechnology student affiliated with the Department of Biosciences and Biotechnology at MIET, India. Sharma is a research-oriented person and is the author of multiple published conference abstracts and a review paper, and is associated with two published patents, including a utility patent and a design patent. Sharma's work has been presented at international academic conferences, and Sharma aims to pursue advanced research in biotechnology and biomedical sciences.



Anabella E. Gallardo
Organización Agroproductiva, Argentina

Biostimulants: Advances toward more efficient and sustainable agriculture

The concept of biostimulants has become firmly established worldwide as a key strategy in modern, sustainable agriculture, aimed at enhancing crop yield and resilience. These tools act as a complement that potentiates natural physiological processes, improving nutrient-use efficiency and productivity under conditions of climatic stress, and helping to increase tolerance to both biotic and abiotic stresses. Biostimulants include humic and fulvic substances, protein hydrolysates and amino acids, seaweed extracts, microbial compounds, phosphites, silicon, and other components, and they are used in field crops, vegetables, fruit trees, and ornamentals. Among the agronomic benefits observed are enhanced root growth; increased nutrient uptake and use efficiency, with the potential to reduce chemical fertilization; improved tolerance to abiotic stress (drought, salinity, cold, heat); and improved physiological parameters (seedling vigor, mitigation of crop damage), among others. Improvements have also been observed in raw-material quality (the chemical composition of grains or fruits) and in soil health, through the stimulation of beneficial microbiota. The existence of yield gaps in agricultural systems highlights the potential to increase productivity, and biostimulants emerge as a complementary tool to help close these gaps. This remains an ongoing challenge for agriculture, and the goal for the coming years is to narrow these gaps by approximately 20%, approaching yield potential at a lower cost per unit area, in a manner that is both economically viable and environmentally sustainable. Application technology and timing are of great importance in determining the expression of the beneficial effects of biostimulants. Beyond their effects on the crop, they can be applied together with fertilizers and/or crop protection products, reducing operating costs, machinery traffic, and potential soil compaction. Taken together, the international evidence shows that biostimulants are already widely used across diverse crops and environments, with average yield increases of between

10 and 20% (depending on conditions), quality improvements, and greater stress tolerance. In maize, yield increases of around 20% have been documented under water-stress conditions. These technologies also help mitigate early establishment problems and damage caused by biotic factors, such as pest damage. In soybean, during the phase when roots and nodules begin to lose efficiency in capturing soil nutrients, products enriched with micronutrients and amino acids minimize the impact of stress and improve grain quality. A key benefit observed with these products is their capacity to mitigate the phytotoxicity and carryover caused by herbicides, favouring crop recovery, which is reflected in the improvement of certain yield components. Among the global challenges and prospects, the world market is worth several billion dollars and is growing at more than 10% per year; however, variability in efficacy, a lack of standardization, and disparate regulatory frameworks persist. Despite consistently positive trends, statistical significance often depends on environmental conditions and the prior nutritional status of the field. Effective use requires local trials and careful selection of both the biostimulant and the application strategy. In conclusion, biostimulants represent a promising tool for more sustainable and productive agriculture — a key factor for maximizing productivity and resilience in modern agricultural systems.

Biography

Gallardo holds a degree in Agricultural Engineering from the National University of Entre Ríos (UNER), Argentina, where the undergraduate thesis focused on the molecular characterisation of Linum usitatissimum genotypes. Gallardo subsequently obtained a Doctorate from the National University of the Littoral (UNL), Argentina, with a thesis addressing wheat production and breadmaking quality, including the use of food additives. During doctoral studies, Gallardo was awarded an Erasmus Mundus scholarship, which enabled part of the research to be carried out at the University of Porto (Portugal). Gallardo also holds a Postgraduate Diploma in Responsible Agriculture from the National University of Mar del Plata (UNMdP), Argentina. Gallardo's professional career includes research positions at CONICET (National Scientific and Technical Research Council of Argentina) and INTA (National Institute of Agricultural Technology), as well as teaching appointments at Argentine universities. Gallardo currently serves as Director of Organización Agroproductiva, a company dedicated to research and development in the agricultural sector.



Andrey Belousov[1,2*], Ekateryna Belousova[1]

[1]Laboratory of Applied Nanotechnology of Belousov, Ukraine
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From biophysics to clinical application: Investigating the antibacterial potential of magnetite nanoparticles (MCS-B)

This study investigated the effects of physical factors induced by magnetite nanoparticles (specifically, constant magnetic fields and sorption activity) on microorganisms belonging to various taxonomic groups. Biomarkers included the intensity of Free Radical Lipid Peroxidation (FRLP) and bacteriostatic activity. It was found that magnetite nanoparticles elicited differentiated responses in microorganisms. The primary influencing factor for *Candida albicans, Escherichia coli,* and *Pseudomonas aeruginosa* was the magnetic field, whereas for *Staphylococcus aureus,* sorption played a more significant role. A statistically significant reduction in the rate of lipid free radical consumption was observed across all tested strains following treatment with magnetite nanoparticles. Microbiological studies revealed pronounced bacteriostatic effects of magnetite nanoparticles on *Escherichia coli, Klebsiella pneumoniae,* and *Staphylococcus aureus*. A similar effect was observed when physiological saline pre-treated with these nanoparticles was applied. A correlation was demonstrated between the degree of bacteriostatic activity and the intensity of FRLP reactions. The maximum effect against *Staphylococcus aureus* was achieved under conditions where sorption was the dominant mechanism, whereas for *Escherichia coli* and *Klebsiella pneumoniae,* the greatest effect was observed under the predominant influence of the magnetic field. Of particular interest was the pronounced bacteriostatic effect exhibited by physiological saline pre-treated with magnetite nanoparticles. This phenomenon is presumed to result from changes in the polarization structure of water induced by the applied magnetite nanoparticles, which likely affects microbial viability.

Biography

Andrey N. Belousov, MD, PhD, Professor, is a Ukrainian medical scientist and pioneer in nanotechnology, who developed the world's first biocompatible nanomedical drugs (Micromage-B, MCS-B, ICNB), officially registered and introduced into clinical practice since 1998. Belousov's work established a translational foundation for medical nanotechnology, linking fundamental biophysics with clinical applications in detoxification, hemocorrection, and neuroprotection. Belousov has published more than 340 scientific works on the application of nanotechnology preparations in experimental and practical medicine, and is currently the Head of the Laboratory of Applied Nanotechnologies and Professor of Kharkiv National Medical University, Ukraine.



Aradhana Kasimsetty[1,2*], Min Jae Song[1], Ruchi Sharma[3,4], Kapil Bharti[4], Ronit Mazor[2], Marc Ferrer[1]

[1]3D Tissue Bioprinting Laboratory, Early Translation Branch (ETB), NCATS, USA

[2]Gene Transfer and Immunogenicity Branch, CBER, FDA, USA

[3]Ocular Stem Cells and Translational Research, OSCTR, USA

[4]National Eye Institute, NEI, USA

Developing iPSC-derived 3D outer blood-retinal barrier disease models of choroideremia for gene therapy evaluation

Inherited Retinal Dystrophies (IRD) impact millions of people and are leading causes of blindness globally. IRDs can be caused by over 300 different genetic mutations and many of the individual disorders are rare diseases with low prevalence and few treatment options. One treatment modality for IRDs is Adeno-Associated Virus (AAV)based gene therapy and the success of FDA-approved Luxturna has been promising. However, gene therapy for other IRDs has not been so successful. Choroideremia (CHM) is one such rare inherited disease, primarily affecting the blood-retinal barrier. Many AAV gene therapies for choroideremia are being developed yet fail to meet primary endpoints. To explore why these therapies may be less efficacious in diseases such as choroideremia, we have engineered a 3D bioprinted multi-cellular outer blood retinal barrier model. We develop a vascularized choroid by bioprinting human iPSC derived fibroblasts and primary pericytes and endothelial progenitor cells on the basal side of a 96 well plate transwell membrane. Once this vascular structure has been established, we seed the apical side of the membrane with human iPSC derived immature Retinal Pigment Epithelial Cells (RPE). These RPE are matured for 7 weeks to form hexagonal cells and an RPE-choroid like barrier. With our optimized conditions, the vasculature remains healthy and stable for at least 7 weeks and is dependent on cellular interactions with the RPE. Thus, we have produced a more physiologically relevant model for studying diseases of the outer blood retinal barrier. The use of human iPSC-derived cell types allows for modular addition of patient derived iPSC cells and evaluating cell-cell interactions in healthy versus disease settings. Additionally, disease models developed in our 96 well format can be used for high-throughput screening of small molecules as well as gene therapy variants. This work provides a platform for studying many therapies across many diseases, accelerating drug discovery for rare inherited retinal dystrophies.

Biography

Aradhana Kasimsetty, Ph.D., obtained a Bachelor's/Master's in Medical Microbiology in May 2019/2020 from Arizona State University College of Liberal Arts and Sciences. Kasimsetty's PhD degree in Cell and Molecular Biology (Gene Therapy and Vaccines) was conferred from the University of Pennsylvania School of Medicine in August 2025. Kasimsetty is currently a postdoctoral trainee in the Translational Science Interagency Fellowship at the National Center for Advancing Translational Sciences (NCATS) under the National Institutes of Health (NIH). Kasimsetty's research focuses on bioprinted models of the outer retinal barrier as a model of rare disease for gene therapy applications.



Arjun Sankhla*,
Somdeb Bose Dasgupta
Department of Bioscience and Biotechnology, Indian Institute of Technology Kharagpur, Kharagpur, India

Novel diagnostic approaches towards RR-TB detection: Advancing the fight against MDR-TB control

Tuberculosis (TB) ranks as one of the most widespread infectious diseases in the world due to the fact that Multidrug Resistant (MDR), Extensively Resistant (XDR), and Totally Resistant (TDR) strains are becoming more prevalent. Therefore, in order to curb this widespread, there is an ardent need for rapid, accessible, and affordable diagnostic systems or approaches towards drug-resistant TB. In this study, we introduce two specialized nucleic acid probes, targeting the most prevalent point mutations associated with Rifampicin-Resistant TB (RR-TB), an easy analyte generation protocol involving Loop-Mediated Amplification (LAMP), and simple molecular diagnostic approaches for the rapid detection of RR-TB, a critical surrogate for MDR-TB. These probes are rationally designed, and are Locked Nucleic Acid (LNA)-enhanced for specifically targeting the conserved *Mycobacterium tuberculosis* sequences associated with RR-TB. One of the diagnostic approaches introduced in the study is based on fluorescence anisotropy and the other one is based on a biosensing platform as a proof-of-concept. Through systematic optimization of hybridization conditions, probe design, LAMP protocol, electrochemical parameters, and modification of Gold Screen Printed Electrodes (Au-SPE), these approaches deliver outstanding accuracy, specificity, sensitivity, and robustness. Testing of clinical samples show the results to be in strong concordance with the gold standard DST and Xpert MTB/RIF, with lower turnaround time and cost. This dual probe system is modular and scalable, providing a prospect of translating into a portable point-of-care format as these diagnostic approaches pave a way toward democratizing MDR-TB diagnostics, and reinforces the path toward rapid and inclusive TB eradication strategies.

Keywords: TB, MDR-TB, RR-TB, LAMP, LNA, Au-SPE.

Biography

Arjun Sankhla is a senior research scholar at the Indian Institute of Technology (IIT) Kharagpur, India. Sankhla's research focuses on novel diagnostics in tuberculosis, specializing in the development of a biosensing platform as a proof-of-concept for the detection of MDR-TB specific biomarkers. By integrating molecular biology techniques with translational research approaches, the work aims to design the biosensing platform, and a related patent has already been published. In addition to research, Sankhla actively contributes to academics by instructing bachelors' and masters' students in laboratory experiments and core biotechnology coursework.



Audrey Cherblanc[1*], Paul Frobert[2], Hugo Despert[2], Marilou Gleizes[1], Charly Livret[1], Morgan Dos Santos[1], Amélie Thepot[1], Caroline Durand[1]

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A resorbable and biomimetic 3D-printed natural hydrogel scaffold driving large-volume soft tissue repair: Evidence from a large animal study

Breast cancer is the most common form of cancer in women, often requiring total mastectomy. In the US, 38% of affected women undergo this procedure, yet only 33% opt for reconstruction. Despite the availability of multiple reconstruction methods, a study conducted in the US between 1998 and 2007 reported that 45% of women who underwent mastectomy chose not to proceed with reconstruction, primarily due to concerns about postoperative sequelae, the need for multiple surgeries, and the use of synthetic implants. Recent advances in 3D printing and regenerative medicine have paved the way for a novel approach: 3D-printed scaffold implants designed to promote autologous tissue ingrowth. Our team has developed a 3D-printed biomimetic prosthesis made from a hydrogel composed of natural, biologically derived materials. This scaffold temporarily provides volume and shape to soft tissue while promoting cell colonisation. *In vitro,* it demonstrates a favourable cytotoxicity profile and supports tissue ingrowth by several biologically relevant cell types, including adipocytes, fibroblasts and endothelial cells, resulting in the formation of connective tissue. *In vivo* rodent studies have shown that the bioprosthesis promotes neovascularisation, is well tolerated, and degrades over time, leaving behind functional autologous tissue. Bioprostheses ranging from 75 to 300 cc were implanted in large animals and followed for up to 8 months. Long-term and scale-up studies demonstrated that the implant is easy for surgeons to handle, maintains its softness and mechanical resistance, and exhibits good tolerance and performance. No necrosis (a common complication) or significant capsule formation around the prosthesis was observed. Progressive resorption kinetics and central tissue colonisation with non-inflammatory fibroconnective tissue were noted. This 3D-printed bioprosthesis offers a biomimetic and safe alternative for breast reconstruction by promoting natural tissue

regeneration. It maintains volume over time with good tolerance and no complications. These results support its potential for future clinical applications.

Keywords: Tissue Engineering, Soft Tissue Regeneration, Regenerative Medicine, Breast Reconstruction, Preclinical Model, Large Animal.

Biography

Audrey Cherblanc is a Scientific & Innovation Manager specialised in Class III implantable medical devices. Cherblanc holds a dual Research Master's degree in Innovative Materials for Health (Ecole Centrale de Lyon) and an engineer's degree in Chemistry (CPE Lyon). With over six years of experience in R&D and preclinical development, Cherblanc's expertise includes biomaterials, tissue engineering, *in vitro* and *in vivo* biological evaluation studies. This work focuses on the development and clinical translation of 3D-printed resorbable implants for soft tissue regeneration.



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Pomegranate peel ellagitannins ameliorate fructose-induced metabolic dysfunction in rats: Potential mechanisms of action

Pomegranate fruit is recognized for its potential benefits to oxidative and vascular health, effects that have been partly attributed to its ellagitannin constituents. However, whether pomegranate ellagitannins can attenuate the adverse metabolic effects associated with excessive consumption of added sugars, such as fructose and sucrose, remains unclear. This study investigated the ameliorative effects of pomegranate peel ellagitannins on fructose-induced metabolic alterations in rats. An ellagitannin-rich fraction was recovered from the peel of *Punica granatum L.* (Wonderful cultivar) using Amberlite XAD16N resin and characterized by LC–MS. Sprague–Dawley rats received a 20% fructose solution as a replacement for drinking water for 6 weeks, with or without oral administration of the ellagitannin-rich fraction (200 mg/kg body weight). Food intake, body weight, blood glucose and lipid profiles were assessed, followed by determination of insulin levels, glycogen content, oxidative stress and inflammatory markers, hepatic histology, and HOMA-IR. Hepatic phosphorylation of Akt and expression of phospho-PI3K were also evaluated.

Fructose consumption reduced food intake and increased body weight gain, while elevating insulin levels and impairing glucose tolerance (AUC, 246 vs. 208 mg·h/dL) and insulin sensitivity (HOMA-IR, 5.8 vs. 2.0). Fructose also induced dyslipidaemia, characterized by increased triglycerides (4.2 vs. 1.7 mmol/L) and LDL-cholesterol (3.0 vs. 1.4 mmol/L), together with reduced HDL-cholesterol (0.4 vs. 0.8 mmol/L). These metabolic alterations were accompanied by hepatic histopathological abnormalities, increased inflammation, as indicated by elevated IL-1β, and enhanced hepatic and systemic oxidative stress. Treatment with the ellagitannin-rich fraction improved glucose tolerance (AUC, 230 mg·h/dL) and insulin sensitivity (HOMA-IR, 4.0), accompanied by enhanced hepatic Akt phosphorylation and phospho-PI3K expression. It

also improved the lipid profile, reducing triglycerides and LDL-cholesterol and increasing HDL-cholesterol (3.7, 1.9 and 0.6 mmol/L, respectively), while attenuating hepatic histopathological alterations and inflammation. Furthermore, treatment reduced lipid peroxidation and enhanced hepatic superoxide dismutase and catalase activities. LC–MS analysis identified several bioactive ellagitannins, including punicalagin, corilagin and pedunculagin, together with catechins. Overall, pomegranate peel ellagitannins attenuated fructose-induced insulin resistance, dyslipidaemia, inflammation and oxidative stress, potentially through modulation of PI3K/Akt-mediated insulin signalling and antioxidant defence. These findings support pomegranate peel ellagitannins as promising dietary polyphenols for mitigating sugar-induced metabolic and oxidative disturbances.

Biography

Chika Ifeanyi Chukwuma is an Associate Professor and National Research Foundation (NRF) C2-rated scientist with extensive expertise in molecular pharmacology, diabetes research, neuropharmacology, functional foods, and natural product drug discovery. Chukwuma has more than nine years of postdoctoral and independent research experience, leading multidisciplinary projects, establishing national and international collaborations, mentoring postgraduate students, obtaining competitive research funding, and translating laboratory findings into therapeutic applications.



Elizabeth Vinod

Department of Physiology, Christian Medical College, Vellore, Tamil Nadu, India; Centre for Stem Cell Research, Christian Medical College, Vellore, India

Understanding exosomes in cartilage repair: From cartilage-derived cells to cell-free regenerative therapy

Articular cartilage has a limited intrinsic capacity for repair, and the development of durable hyaline-like cartilage remains a major challenge in regenerative medicine. Although cell-based therapies using mesenchymal stromal cells, chondrocytes, and cartilage-derived progenitor cells have shown promise, growing evidence suggests that much of their therapeutic activity may be mediated by paracrine mechanisms. Extracellular vesicles, including exosomes, have therefore emerged as important mediators of cell–cell communication and potential cell-free therapeutic agents for cartilage repair.

Our research has focused on cartilage-resident chondroprogenitors and their regenerative potential, with increasing emphasis on their secretome and extracellular vesicle-mediated effects. We have investigated extracellular vesicles derived from human cartilage-derived chondroprogenitors, articular chondrocytes and bone marrow mesenchymal stem cells, and evaluated their reparative and immunomodulatory potential in preclinical models of osteoarthritis. Our work has also included the evaluation of chondroprogenitor-derived exosomes for cartilage repair and regeneration in an experimental osteoarthritis model.

This presentation will provide an overview of the biological rationale for using extracellular vesicles and exosomes in cartilage regeneration, with particular emphasis on how the identity of the parent cell may influence vesicle-mediated effects. Comparative studies of vesicles derived from chondroprogenitors, chondrocytes and mesenchymal stem cells provide an opportunity to understand differences in their reparative and immunomodulatory signatures. The presentation will also highlight the potential role of extracellular vesicles in modulating the osteoarthritic joint environment, promoting cartilage-associated responses, and influencing interactions between transplanted or resident cells and the host tissue.

Finally, the talk will consider the opportunities and challenges in translating exosome-based approaches from experimental models to clinically relevant cell-free therapies, including the importance of defining vesicle identity, biological potency, source-cell characteristics and reproducible manufacturing strategies.

Together, these findings support the concept that understanding the secretome of cartilage-resident cells may provide new avenues for developing biologically active, cell-free strategies for cartilage repair.

Biography

Dr. Elizabeth Vinod is an Associate Professor in the Department of Physiology and Adjunct Scientist at the Centre for Stem Cell Research, Christian Medical College, Vellore. Vinod holds an MD in Physiology and a PhD from The Tamil Nadu Dr. M.G.R. Medical University. The research focuses on cartilage-derived chondroprogenitors, extracellular vesicles, cartilage regeneration, preclinical models of osteoarthritis, and clinically translatable cell-based and cell-free regenerative strategies. Vinod has published extensively in cartilage biology and regenerative medicine and received the ICRS–Sachdev Translational Innovation Fellowship in 2026.



Fairooza Alam
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Physics-guided modelling for optimising cell alignment in lab-grown meat scaffolds

The development of lab-grown meat and engineered tissues for healthcare applications is constrained by the challenge of controlling cell organisation within three-dimensional structures. In particular, achieving aligned and functional tissue architecture remains difficult due to the complex interplay between mechanical forces and the cellular microenvironment, leading to inefficient trial-and-error design approaches.

This research presents a physics-driven computational modelling framework to optimise scaffold design and guide cellular organisation in engineered tissues. Building on the Contractile Network Dipole Orientation (CONDOR) model, the work integrates theoretical principles of mechanics and diffusion to predict how cells orient and organise in response to both structural and environmental cues. The model specifically identifies optimal positioning and structural configurations within scaffolds that promote aligned tissue growth.

By incorporating the interaction between mechanical forces and oxygen transport, the framework enables prediction of how cells adapt their orientation under physiologically relevant conditions. This is particularly relevant for thick tissue constructs, where oxygen gradients strongly influence cell viability and structural integrity. The modelling approach allows virtual testing of scaffold geometries and conditions, significantly reducing the need for experimental trial-and-error.

Experimental validation is conducted using stem-cell-derived tissue cultured in controlled environments, where scaffold structures and oxygen conditions are systematically varied. Quantitative imaging and analysis are used to compare predicted and observed cell alignment, enabling iterative refinement of the model.

The outcomes of this research provide a predictive design tool for engineering structured tissues with improved functionality. In the context of cultivated meat, the work enables the production of thicker, more realistic products with controlled texture and structure. In healthcare, the framework supports the design of engineered tissues for regenerative medicine and disease modelling.

By linking theoretical modelling with experimental validation, this research advances a scalable and efficient approach to tissue design, transforming current empirical methods into predictive, physics-based strategies.

Biography

Dr Fairooza Alam is an EPSRC Doctoral Prize Fellow at The Open University, specialising in biophysical modelling and tissue engineering. Alam's research focuses on developing predictive computational frameworks to guide cell organisation in engineered tissues, with applications in cultivated meat and regenerative medicine. Alam completed a PhD in Biochemical Engineering at University College London, developing mechanistic models for cellular systems. This work combines mathematical modelling with experimental validation, including stem cell culture and scaffold design. Dr Alam's interdisciplinary expertise bridges theory and experiment to advance scalable, physics-based solutions in bioengineering.



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3D *in vitro* model of Dupuytren's disease

Dupuytren's Disease (DD) is a common fibrotic disorder of the hand, characterized by progressive thickening and contracture of the palmar and digital fascia. Surgical excision remains the primary treatment; however, there are currently no therapies to prevent disease progression or recurrence. This study aims to develop a 3D *in vitro* model to test novel antifibrotic therapies. The model is based on decellularized pathological DD tissue seeded with patient-derived fibroblasts, capturing the role of both cellular and extracellular matrix components in disease progression.

Fibrotic DD tissues were obtained from surgical excisions, sectioned, and decellularized. In parallel, primary fibroblasts were isolated from patient samples. The Decellularized Extracellular Matrices (dECMs) were characterized with respect to biochemical composition, collagen structure, and mechanical properties. Fibroblasts were seeded onto the dECMs and cultured stepwise to initially promote proliferation, followed by differentiation into myofibroblasts. We assessed the composition of newly synthesized and deposited ECM by mass spectrometry and compared it with conventional 2D cultivations (standard polystyrene dish and nanofiber membrane). We proved that cells cultured on 3D dECM produce a higher number of fibrosis-associated proteins than those cultured on 2D surfaces. We tested the antifibrotic effect of 0.5mM minoxidil, an inhibitor of collagen crosslinking. The responsiveness to the drug minoxidil was significantly more complex in the 3D model than in 2D cultures. We demonstrated that dECM seeded with DD fibroblasts represents a relevant 3D *in vitro* model of Dupuytren's disease. This system provides a reliable platform for antifibrotic drug screening as demonstrated by the testing of minoxidil.

This project was supported by the European Union (project No. CZ.02.01.01/00/22_008/0004562) and co-funded by the Czech Academy of Sciences, Praemium Academiae Grant No. 2202.

Biography

Jarmila Knitlova obtained an MSc degree in Genetics at the Faculty of Science, Charles University in Prague. Since 2016, Knitlova has been working at the Department of Biomaterials and Tissue Engineering at the Institute of Physiology of the Czech Academy of Sciences. Knitlova is currently pursuing a PhD focused on models of fibrotic diseases, with a particular interest in the pathology of Dupuytren's disease and clubfoot.



Ki Ji Lee
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New treatment of muscle regeneration through activation, proliferation, and differentiation of muscle stem cells (satellite cells) through mitochondrial dynamics

Skeletal muscle has remarkable regeneration capabilities, mainly due to its resident muscle stem cells (satellite cells: SCs). Following satellite cell activation, several factors drive asymmetric cell division to generate a stem cell and a proliferative progenitor that forms new muscle. The balance between symmetric self-renewal and asymmetric division significantly impacts the efficiency of regeneration. Satellite cells become exhausted, resulting in diminished population and functionality during aging. This decline in SC function impairs intercellular interactions as well as extracellular matrix production, further hindering muscle regeneration. Isolation, culture, and translation of SCs are still being studied. The study of their functional potential depends on the availability of methods for the isolation and expansion of pure SCs with preserved myogenic properties after serial passages *in vitro.* The mitochondrial dynamics are essential for the successful regenerative capacity of satellite cells. The loss of mitochondrial fission in satellite cells — due to aging or genetic impairment — deregulates the mitochondrial Electron Transport Chain (ETC), leading to inefficient Oxidative Phosphorylation (OXPHOS) metabolism and mitophagy and increased oxidative stress. Regenerative functions can be restored in fission-impaired or aged satellite cells by the reestablishment of mitochondrial dynamics (by activating fission or preventing fusion), OXPHOS, or mitophagy. So this review showed that muscle regeneration is dramatically improved through activation, proliferation, and differentiation of quiescent muscle stem cells by mitochondrial dynamics.

Biography

Ki Ji Lee was formerly a professor at Busan Medical University and Go Sin Medical University, and a National Research Foundation Researcher. For 20 years, Lee has been studying the activation of quiescent muscle and neural stem cells by mitochondrial dynamics. While modern conventional medicine focuses on incubating and reinjecting embryonic stem cells, Lee recently confirmed that quiescent muscle and neural stem cells that exist in the body can be activated, proliferated, differentiated, and matured to regenerate quickly without side effects, finding the human body's fast regeneration ability remarkable. This may have a significant impact on patients' pain relief and recovery and on medical development (15 medical books published).



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Signal Transducer and Activator of Transcription (STAT)-mediated epigenetic and epitranscriptomic regulation of T helper cell differentiation in non-small cell lung cancer

Non-Small Cell Lung Cancer (NSCLC) remains difficult to treat because nearly half of cases lack targetable mutations and often develop therapy resistance, making epigenetic reprogramming an attractive therapeutic strategy. The current study investigates how Signal Transducer and Activator of Transcription (STAT) proteins, especially, STAT1, STAT2, STAT3, and STAT4 regulate epigenetic and epitranscriptomic events during CD4+T Helper (TH) cell differentiation in NSCLC, with the goal of enhancing antitumor immunity. Peripheral Blood Mononuclear Cells (PBMCs) from NSCLC patients and healthy donors were isolated by Ficoll-Hypaque density-gradient centrifugation, followed by CD4+T-cell purification using Magnetic-Activated Cell Sorting (MACS). STAT genes were individually knocked out or overexpressed using CRISPR/Cas9-based approaches, and qRT-PCR was used to assess 5-mC, m6A RNA methylation, gene expression, and transcription factor binding. The study also examined R-loop accumulation at T_H-cell-specific loci, given that persistent DNA-RNA hybrids can drive genomic instability and DNA damage. Functionally, STAT1 and STAT4 depletion increased R-loop formation, DNA methylation, histone deacetylation, and repressive histone methylation, while reducing m6A RNA methylation and NSCLC cell cytotoxicity; their overexpression produced the opposite pattern. In contrast, STAT2 and STAT3 depletion or overexpression caused opposite effects, highlighting distinct roles among STAT family members. Overall, STAT1 and STAT4 emerge as key positive regulators of TH-cell differentiation and antitumor immunity in NSCLC, suggesting that targeting these pathways may offer a promising epigenetic therapeutic approach.

Keywords: STAT1, STAT2, STAT3, STAT4, R-Loop, T Helper Cells, Epigenetic, Epitranscriptomic.

Biography

Dr. Koustav Sarkar is a Research Associate Professor in Biotechnology at SRM Institute of Science and Technology, Kattankulathur, Chennai, India, having earned a PhD at age 28 from Chittaranjan National Cancer Institute/Jadavpur University, Kolkata, India. With 24 years of research experience including a PhD and three postdocs from different universities of the USA, Sarkar has published 89 high-impact papers and presented at over 100 conferences. Sarkar's key contributions include isolating immunomodulatory neem leaf glycoprotein with cancer-preventive functions (patent #259434, granted 2014) and discovering WASp's novel nuclear role in Th1 differentiation via epigenetic regulation of the T-BET promoter. Sarkar currently studies epigenetic and epitranscriptomic mechanisms in T helper cells of lung cancer.



Sebastian Bode, Tatjana Krampitz, Laura Pasitka*, David Vorländer, Ruediger Goehmann
GEA Liquid Technologies Germany GmbH, Germany

Process intensification for the continuous production of alternative proteins

Optimizing equipment utilization in biotechnological manufacturing systems remains a central challenge during the scale-up transition from laboratory to industrial production. Substantial research and development focus on process intensification and transforming batch and fed-batch cultures into continuous bioprocesses with automated process control. At GEA, we have developed a perfusion system that allows for the continuous removal of spent culture medium from a bioreactor-driven cultivation process, enabling increased space-time yield for biomass and extracellular protein production. With separators already being utilized in large-scale processing of proteins, the perfusion system is a readily scalable alternative to traditional filtration-based perfusion systems. We further explore how enhanced bioreactor process data, integrated with advanced process control strategies and predictive modelling, can improve equipment utilization by aligning scale-up more closely with actual process requirements.

Biography

Laura Pasitka discovered her passion for bioreactor and bioprocess design during her B.Sc. and M.Sc. studies in biotechnology and bioengineering. Following her research in microfluidic cell separation at Linköping University in Sweden, she pursued her Ph.D. at the Hebrew University of Jerusalem in Israel, playing a key role in developing a cost-effective production process for FDA- and USDA-approved cultivated meat in collaboration with the start-up Believer Meats. The peer-reviewed publications resulting from this research have had a significant impact on the cultivated meat industry, driving both academic advancements and global strategic partnerships. In her current position as R&D Project Manager at GEA in Germany, she develops processing equipment and technologies for the biotech and cellular agriculture sector, with a particular focus on bioreactors. She actively pursues collaborations

with research institutions and remains engaged with cutting-edge innovations shaping the future of this rapidly evolving field.



Lisa Martin[1*], Pierre Caullet[1], Agathe Neukelmance[1,2], Frédérique Mittler[1], Amandine Pitaval[1], Emily Tubbs[1], Yohann Thomas[2], Yohann Couté[3], Julia Novion Ducassou[3], Isabelle Texier-Nogues[2], Vincent Haguet[1], Xavier Gidrol[1], Arnaud Millet[1], Flora Clément[1]

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An adipose-derived dECM hydrogel as a versatile ECM platform for pancreatic diseases

Pancreatic Ductal Adenocarcinoma (PDAC) accounts for approximately 90% of pancreatic cancers and remains one of the deadliest malignancies in the worldwide, with a 5-year survival rate of only 8–13%. PDAC arises from the exocrine compartment (ductal and acinar cells) which acquires pre-neoplastic lesions before progressing to invasive carcinoma. Obesity and diabetes are major risk factors for PDAC, yet the molecular links between metabolic disorders and pancreatic cancer initiation remain poorly understood.

To address this issue, we aim to develop a physiologically relevant 3D model to investigate how the metabolic microenvironment influences pancreatic cancer development. Our strategy relies on the use of Decellularized Extracellular Matrix (dECM) to better recapitulate key features of the cellular microenvironment. We generated hydrogels from Adipose Tissue–Derived dECM (atdECM), an abundant and easily accessible tissue source compared to pancreatic tissue, with biomechanical properties similar to pancreatic tissue, to support pancreatic cell and organoid culture under defined metabolic conditions, including disease-associated microenvironments.

Proteomic analyses revealed limited batch-to-batch variability in atdECM composition. In parallel, we established and characterized a biobank of Pancreatic Organoids (PDOs) by RNA-seq analysis. We found that atdECM hydrogels supported healthy and tumor-derived PDOs growth while preserving the exocrine cell phenotype. We are currently developing atdECM derived from patients at risk for PDAC and have already observed structural differences compared to healthy atdECM. This model will be used to investigate the impact of the at-risk microenvironment on both healthy and tumor pancreatic organoids and to identify early PDAC

biomarkers. To better mimic the physiopathology of pancreas, pancreatic islets of Langerhans were cultured on atdECM hydrogels and remained viable, with endocrine functionality currently under evaluation. This suggests that atdECM could also support pancreatic endocrine cells, further highlighting the versatility of this biomaterial platform.

Ultimately, this hydrogel system may also offer promising perspectives for regenerative medicine, particularly for applications related to metabolic disorders, as well as providing a versatile platform for personalized medicine and fundamental research.

Biography

Lisa Martin is a postdoctoral researcher in cell biology and bioengineering, developing microphysiological pancreatic models to investigate epithelial neoplastic transformation in pathological metabolic contexts. Trained in tissue engineering, Martin works with 2D and 3D cell cultures, patient-derived organoids, and omics approaches. Martin's expertise includes the development and characterization of decellularized extracellular matrices, advanced microscopy, cell biology, molecular biology, and proteomics.



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MXene-based biomaterials in tissue engineering and functional implant coatings: Recent advances and future prospects

MXenes — two-dimensional transition-metal carbides and nitrides — have emerged as transformative materials in regenerative medicine. These materials, particularly Ti3C2Tx, offer a unique combination of metallic conductivity, hydrophilic surface chemistry, and robust mechanical properties. This presentation reviews recent breakthroughs in using MXenes to engineer advanced tissue scaffolds and smart biomaterial coatings. In tissue engineering, for example, MXene-infused hydrogels and 3D-bioprinted constructs dramatically enhance electroactive tissue regeneration. These materials accelerate neurite outgrowth on neural substrates and promote myogenic differentiation in cardiac patches. Furthermore, their rich surface termination groups (-O, -OH, -F, and -NH2) optimize cell anchoring and drive stem cell osteogenesis, even without exogenous growth factors. In bone implant applications, MXene-based coatings offer superior osseointegration and antibacterial activity against biofilm formation. They also provide Near-Infrared (NIR) and pH-responsive drug-delivery capabilities for localized therapy. Importantly, recent advances in fluoride-free green synthesis methods (e.g., alkali and electrochemical etching) have mitigated the risk of cytotoxicity, and biopolymer hybridization has overcome long-standing challenges in aqueous oxidation. In the first set of our experiments, Ti3C2Tx MXenes with different functional groups (-COOH and -NH2) were deposited on slightly heated tissue culture polystyrene (up to 60°C), improving adhesion to the substrate. The moderately hydrophilic MXenes functionalized with -COOH groups stimulated the proliferation of human adipose-derived mesenchymal stem cells. In contrast, the more hydrophobic MXenes functionalized with -NH2 groups stimulated the osteogenic differentiation of these cells, as evidenced by expression of collagen I and alkaline phosphatase. This expression was measured at the mRNA level by real-time qPCR.

In the second set of experiments, Ti3C2Tx MXenes were electrophoretically deposited onto Ti substrates, which are clinically used to construct bone implants. The -NH2 functionalization was used to support osteogenic cell differentiation and to protect the MXene from oxidation and degradation. This functionalization was achieved by either a diazonium salt approach or an (Aminopropyl)triethoxysilane (APTES)-based approach. During aging, oxidation of unprotected MXene flakes and formation of TiO2 reduced the number of attached human bone marrow mesenchymal stem cells. However, prior protection of the flakes allowed the cells to grow and maintain metabolic activity on the aged flake surface. These results indicate that engineering the surface of MXenes is critical for controlling cell performance on these materials. Taken together, these promising results position MXenes at the forefront of next-generation, clinically viable biointerfaces.

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Biography

Assoc. Prof. Lucie Bacakova, MD, PhD, graduated from the Faculty of General Medicine at Charles University in Prague in 1984 and earned a PhD at the Institute of Physiology (IPHYS) of the Czechoslovak Academy of Sciences in 1992. Bacakova completed research fellowships at the University of Washington in Seattle, USA (Prof. S. M. Schwartz, 1996), the University of Pavia, Italy (Prof. Carlo Pellicciari, 2000), and the University of Pennsylvania (Prof. D. E. Discher, 2000–2001). In 2005, Bacakova founded a new Laboratory of Biomaterials and Tissue Engineering at IPHYS, and in 2022 received the prestigious Praemium Academiae award. Bacakova has published more than 300 articles (WOS: 10,816 citations, h-index 48).



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Silk-derived sericin at the interface of atopic dermatitis and wound healing: Modulation of inflammation and epidermal repair

Atopic Dermatitis (AD) is a chronic inflammatory skin disease characterized by immune dysregulation, epidermal barrier impairment, and defective tissue repair. Because mechanisms involved in barrier restoration overlap with those governing wound healing, biomaterials that simultaneously suppress inflammation and promote regeneration may offer particular therapeutic value. This study evaluated silk-derived sericin as a modulator of AD-associated inflammation and wound-repair pathways using complementary *in vitro* and *in vivo* models.

Sericin isolated from *Bombyx mori* cocoons was characterized by FTIR, SEM, and mass spectrometry. *In vitro*, human HaCaT keratinocytes, fibroblasts, and THP-1-derived macrophages were exposed to sericin, with inflammatory, barrier, and regenerative responses assessed by viability assays, scratch-wound analysis, RT-qPCR, and Western blotting. In keratinocytes, sericin at 600 µg/mL enhanced viability and migration, increased expression of repair-associated cytokeratins KRT16/KRT17 and the junctional protein JAM-A, and modulated inflammatory signaling. In fibroblasts, sericin promoted pro-remodeling and pro-angiogenic responses. In macrophages, sericin reduced IL-1β and TNF-α, increased IL-10, and favored an M2-like phenotype.

To assess translational relevance in AD, DNCB-induced dermatitis was established in rats and evaluated using clinical observation, histology, scratching behavior, and infrared thermography. Topical 2% sericin reduced erythema, normalized thermographic profiles, modulated inflammatory markers, and improved skin architecture compared with untreated lesions.

These findings indicate that sericin may bridge anti-inflammatory treatment of atopic dermatitis with activation of wound-healing and barrier-repair mechanisms. Its combined effects on keratinocyte migration, epithelial repair, macrophage polarization, and tissue inflammation support further development of sericin-based topical biomaterials for wound healing and inflammatory skin disorders associated with impaired barrier regeneration.
Grant No. 2025/59/B/NZ4/00228.

Biography

Marek Konop, PhD, DSc, is an Associate Professor at the Medical University of Warsaw, Poland, working in the Department of Experimental Physiology and Pathophysiology. Konop's research focuses on experimental dermatology, wound healing, regenerative medicine, and the development of bioactive biomaterials for skin repair. Current work particularly explores keratin- and silk-derived biomaterials, including sericin, as modulators of inflammation, macrophage polarisation, and epidermal regeneration in acute and chronic wounds. Konop is also actively involved in international research collaborations, scientific publishing, and editorial activities in dermatology and regenerative medicine.



Md Monir Hossain[1,2*], Foong Yong[1], Vipul Bansal[1,2], Ravi Shukla[1,2]

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Phage display-based biosensing for rapid detection of neonatal Group B Streptococcal (GBS) infection

Group B *Streptococcus* (GBS) is a leading cause of neonatal infection, meningitis, and pneumonia, yet existing diagnostic methods are time-consuming or dependent on specialised laboratories, limiting their use for early screening during pregnancy. To address this challenge, we used M13 phage display to discover peptide probes that can detect GBS with high specificity while discriminating against a broad range of clinically relevant bacteria and fungi. Through a subtractive biopanning strategy, a single phage clone, designated as P17, emerged as the most selective candidate, consistently demonstrating a strong affinity toward GBS while showing negligible interaction with non-target microorganisms. Validation using plate-based binding assays confirmed that P17 strongly favours GBS over all other tested species. To enable direct visual detection, the P17 clone was conjugated with Fluorescein Isothiocyanate (FITC), producing a fluorescent probe that retained its binding selectivity. When exposed to GBS, FITC-labelled P17 generated a clear and uniform fluorescent signal under microscopy. These findings establish P17 as a highly selective, phage-displayed peptide probe that can be converted into a fluorescent biosensing element without loss of specificity. The ability of this probe to directly label GBS cells underscores its strong potential for translating into rapid, low-cost diagnostic formats, such as lateral flow tests, paper-based devices, and microfluidic point-of-care platforms, designed to support improved maternal and neonatal health outcomes.

Keywords: Group B *Streptococcus,* GBS, Neonatal Infection, Phage Display, Biosensor, Peptide-Based Biosensing, Fluorescent Phage Probe, FITC-Labelled Phage, Lateral Flow Diagnostics, Point-of-Care Testing.

Biography

Md Monir Hossain is a final-year PhD candidate at RMIT University, Melbourne, Australia, where Hossain is developing phage display-based biosensing technologies for the rapid detection of infectious pathogens, particularly Group B *Streptococcus* (GBS). Hossain completed both a B.Sc. and M.Sc. in Biotechnology and Genetic Engineering at Jahangirnagar University, Bangladesh, and later worked as a Graduate Research Assistant at Kanazawa University, Japan, contributing to nanotechnology, bioimaging, and biomedical research. Hossain's research spans phage display, microbiology, molecular biology, biosensors, nanobiotechnology, and antimicrobial nanomaterials. Hossain has authored multiple peer-reviewed publications and is passionate about translating fundamental science into practical healthcare solutions through innovative diagnostic technologies and interdisciplinary collaboration.



Melissa Morra[1,2*], Alberto Varalda[1,2], Julien Bourquin[2], Beste Ozgumus Nitride[2], Gabriele Sergio Colangelo[1,2], Luisa Marena[2]

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Genetic engineering for the reduction of high mannose species in biopharmaceutical-producing CHO cells

In biopharmaceutical manufacturing, approximately 60-70% of all recombinant proteins are produced in mammalian cells, with Chinese Hamster Ovary (CHO) cells representing the preferred expression system. Clinical efficacy and safety can be significantly affected by the glycosylation profile of the product.

High Mannose (HM) species are immature glycoforms that may reduce drug half-life and increase the risk of off-target effects, particularly in Antibody-Drug Conjugates (ADCs). As HM levels are considered a Critical Quality Attribute (CQA), clones exhibiting elevated HM are often discarded (potentially leading to the loss of high-producing clones) or manufacturing processes are modified through manganese supplementation to reduce HM content. Both strategies increase process complexity, timelines, and costs.

To enable glycan maturation and reduce HM species, we engineered 4 CHO cell lines to overexpress MGAT1 gene, which encodes for Alpha-1,3-Mannosyl-Glycoprotein 2-Beta-N-Acetylglucosaminyltransferase involved in the maturation of M5, the most represented HM forms.

An additional copy of MGAT1 gene was integrated into the CHO genome using two strategies: (i) one-step integrase-based insertion and (ii) a landing-pad approach. Construct integration and its stability were assessed by Digital Droplet PCR (ddPCR). MGAT1 overexpression was evaluated by RT-ddPCR and Western blotting.

Engineered lines were cultured in batch and fed-batch conditions to assess growth profiles, viability, and monoclonal antibody titer. HM species were quantified using lectin-based assay and LC-MS.

ddPCR confirmed single-copy integration of MGAT1 gene in all engineered lines. RT-ddPCR and Western blotting demonstrated robust overexpression at both transcript and protein level. Across batch and fed-batch cultures, MGAT1 integration and overexpression did not adversely affect cell growth, viability or titer. Lectin-based profiling and LC-MS analyses confirmed a reduction in released HM species in MGAT1-overexpressing lines compared with controls.

These findings demonstrated that MGAT1 overexpression is an effective cell-line engineering strategy to reduce HM species while maintaining viability and productivity. This approach can facilitate meeting glycosylation CQA targets and may support improved safety and efficacy of the product while reducing the need to discard high-producing clones and limiting reliance on manganese supplementation, ultimately saving time and costs.

Biography

Morra gained a Bachelor's degree in Biotechnology from the University of Eastern Piedmont (UPO, Italy) with a thesis on the development of a metagenomic Open Reading Frame library, and earned a Master's degree in Medical Biotechnologies at UPO with a thesis in pharmacology investigating the correlation between single-nucleotide polymorphisms in bitter taste receptors and asthma. These experiences built a strong background in molecular biology, and Morra is currently a PhD student at the University of Turin, conducting research at Merck KGaA (Italy) on the development of biopharmaceutical-producing cell lines with reduced impurities.



Mohd Sameer

College of Biotechnology, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh, India

AI-driven prediction and surveillance of antimicrobial resistance using integrated multi-source data: A one health approach

Antimicrobial Resistance (AMR) is no longer a looming threat — it is an active crisis. The World Health Organization estimates that drug-resistant infections already claim over 1.27 million lives annually, with projections suggesting the toll could reach 10 million per year by 2050 if left unaddressed. What makes this crisis particularly intractable is not just the biology of resistance but the structure of how we monitor it. Surveillance systems remain fragmented, nationally siloed, and largely limited to clinical settings, leaving the animal and environmental reservoirs of resistance practically invisible to policymakers and public health agencies.

The One Health framework addresses this directly. By treating human, animal, and environmental health as interdependent rather than parallel domains, One Health surveillance forces a reckoning with the full ecological context of AMR emergence and spread. Resistant genes do not respect taxonomic or geographic boundaries; they move through agricultural runoff, livestock operations, hospital wastewater, and community transmission with indiscriminate efficiency. Capturing this movement requires data that is equally indiscriminate in scope.

This study presents a conceptual framework for integrating multi-source AMR data using machine learning and data analytics to enable predictive surveillance at scale. Public datasets — including WHO GLASS, NCBI Pathogen Detection, and environmental monitoring repositories — serve as the input layer. Data preprocessing pipelines standardize resistance profiles, geographic metadata, and temporal indicators across human clinical isolates, veterinary isolates, and environmental samples. Graph-based integration models are then applied to identify cross-domain transmission events, while gradient boosting and spatial

interpolation algorithms generate resistance trend forecasts at district, national, and regional levels.

Expected outcomes include identification of high-burden AMR hotspots currently missed by single-domain surveillance, early detection of novel resistance gene circulation before clinical emergence, and predictive risk scores for resistance propagation linked to land use patterns and antibiotic consumption data. These outputs are designed to interface directly with public health policy tools, supporting targeted antibiotic stewardship programs, veterinary regulation reform, and environmental intervention priorities.

The broader implication is straightforward: fragmented surveillance is not just inefficient — it is dangerous. An integrated, AI-driven One Health surveillance system can close the gap between where resistance actually spreads and where public health infrastructure currently looks. As resistance patterns grow more complex and geographically diffuse, computational approaches capable of synthesizing heterogeneous multi-domain data are not a supplement to traditional epidemiology; they are becoming its necessary infrastructure.

Biography

Mohd Sameer is a 3rd Year B.Tech Biotechnology student at Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, India. Sameer's research interests sit at the intersection of computational biology, AI-driven genomics, and global health surveillance, with particular focus on antimicrobial resistance and infectious disease dynamics. Sameer has hands-on experience in molecular docking, ADMET prediction, and structural bioinformatics through participation in The InSilico Lab CADD Training Program. As an Editor of the academic textbook Cell Biology and co-author of the forthcoming academic textbook Biodiversity and Disaster Management, Sameer approaches research communication with both technical precision and clarity.



Kristy Derr-Mierzwa, Shayne Frebert, Ty Voss, Min Shen, Marc Ferrer, Paige Derr*

National Institutes of Health, National Center for Advancing Translational Sciences, USA

High-throughput drug screening using 3D bioprinted human skin models to identify therapeutic candidates for melanoma and squamous cell carcinoma

Melanoma and squamous cell carcinoma are among the most common skin cancers worldwide, with rising incidence and significant clinical impact. To enhance the translational relevance of preclinical drug discovery, we developed high-throughput, three-dimensional (3D) bioprinted human skin cancer models for compound screening in 96 well format. The platform incorporates fluorescently labeled human fibroblasts, keratinocytes, and either A375 melanoma or A431 squamous cell carcinoma cells, enabling concurrent evaluation of tumor-selective efficacy and host tissue toxicity. Using a tiered screening workflow, 971 small molecules from the NCATS MIPE 5.0 library were tested across both tumor types. Compounds were prioritized based on selective reduction of cancer cell viability while preserving fibroblast viability, resulting in the identification of 18 melanoma-selective and 8 squamous cell carcinoma–selective hit compounds with diverse mechanisms of action. Across both cancer models, hit compounds exhibited enhanced maximal responses and altered potency in 3D tissues compared with conventional 2D cultures, underscoring the improved sensitivity and physiological relevance of the 3D system. These findings demonstrate that bioprinted 3D skin cancer models provide a robust and scalable platform for identifying therapeutically promising compounds across multiple skin cancer types that may be overlooked by traditional screening approaches.

Biography

Paige Derr, Ph.D., is a Staff Scientist at the National Center for Advancing Translational Sciences within the National Institutes of Health. Derr received a PhD in Physics from the University of Pennsylvania. Derr's research focuses on tissue-engineered skin disease models to identify therapeutics, and Derr also explores the intersection of quantum technologies and biology. Derr is Co-Chair of the SPIE Conference Nonclassical Biology and Quantum Biophotonics, founder of the NIH Quantum Special Interest Group, and a member of the Editorial Board for the SPIE journal Advanced Quantum Photonics.



Panagiotis Mallis

Hellenic Cord Blood Bank, Biomedical Research Foundation
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Extensive characterization of umbilical cord-lining stem cells and their potential use in tissue engineering and regenerative medicine applications

Background: Mesenchymal Stromal Cells (MSCs) are representing a heterogenous non hematopoietic stem cell population of mesodermal origin, with significant differentiation and immunoregulatory properties. The Umbilical Cord (UC) represents a perinatal tissue for the isolation of fetal derived MSCs. Moreover, significant differences have been observed between the adult and fetal derived MSCs, in terms of proliferation, differentiation and immunoregulatory potential, with the latter to exhibit better properties. Beyond the Wharton's Jelly (WJ) tissue of the UC, stem cells can be isolated also from the cord-lining membrane. Cord Lining (CL) membrane represents the extension of the placenta, originated from the primitive endoderm formed during the embryogenesis. Typically, the differentiation potential of MSCs has been limited to cellular populations of mesodermal origin including the osteocytes, chondrocytes and adipocytes. However, CL-MSCs may exhibit also endodermal differentiation potential, showing advanced properties regarding the tissue regeneration.

Aim: The aim of this study primarily was to comprehensively explore the biology of CL-MSCs. Moreover, to assess their stemness and plasticity profile to cellular populations beyond mesodermal origin, differentiation to Insulin Producing Cells (IPCs) using defined medium was performed. For this purpose, UC (n=10) were used for the MSCs isolation, derived from end term pregnancies (gestational weeks>38), after signed informed consent obtained from the parents. The MSCs isolation was performed immediately or in less than 24 hrs after the reception of the UC to the HCBB laboratory. Briefly, the UC were washed to remove any blood clots, and using sterile instruments, the outer layer was isolated, trimmed in small pieces, placed in 6-well plates and incubated at 37 °C and 5% CO2. After 18 days of culture, the

cells were trypsinized, detached and placed in 75 cm2 flask, until confluency observed. The same procedure was repeated until reached passage 4 (P4). Population Doubling (PD) and Cell Doubling Time (CDT) were estimated. Moreover, CL-MSCs submitted to differentiation to osteocytes, chondrocytes and adipocytes using defined culture media. To validate their successful differentiation histological stains including alizarin Red S, Toluidine Blue and Oil Red O, to detect the presence of calcium deposits, GAGs formation and oil droplets were performed, respectively. Moreover, immunophenotypically analysis using the CD73, CD90, CD105, CD34, CD45, HLA-DR, CD11b and CD326 (EpCam) was performed. Molecular analysis involved the performance of real time PCR for the genes OCT4, KLF4, NANOG, PAX1, FOXA2, REX1, SOX17, ALP and GAPDH. Additionally, CL-MSCs submitted to RNA-seq analysis to comprehensively explore their gene expression. Finally, the differentiation of CL-MSCs (n=6) to IPCs using defined medium, was evaluated. The obtained IPCs submitted to low and high glucose assay, and the supernatants were used for detection of insulin with the ELISA method. As control group, WJ-MSCs (n=10) were used for all assays.

Results: The results of this study showed the efficient isolation and expansion of CL-MSCs. The PD and CD values of CL-MSCs were statistically significant difference compared to the WJ-MSCs. Immunophenotyping analysis of CL-MSCs showed high expression of CD73, CD90, CD105 (>95%) and low expression of CD34, CD45, HLA-DR (<3%), and were comparable with the WJ-MSCs. On the other hand CD326 appeared to expressed only in the CL-MSCs. CL-MSCs successfully differentiated to osteocytes, chondrocytes and adipocytes as it was confirmed by the histological stains. Molecular analysis showed the upregulation of a set of 50 genes including the PAX1, FOXA2 and ALP. Finally, the CL-MSCs presented greater differentiation potential towards IPCs compared to the WJ-MSCs as it was confirmed by the higher insulin production in the ELISA method.

Conclusion: The results presented herein showed the efficient isolation of CL-MSCs from the UCs. CL-MSCs may represent a unique subpopulation of MSCs derived from the UC, which is not limited to mesodermal origin, as it was confirmed by their successful differentiation to IPCs. The understanding of biology of CL-MSCs may represent a fundamental step towards the utilization of this population in tissue engineering and regenerative medicine approaches to combat life-threating human pathological conditions.

Biography

Panagiotis Mallis, MSc, PhD, is a Biomedical Scientist, Affiliate Researcher, and Laboratory Manager of the Hellenic Cord Blood Bank at the Biomedical Research Foundation of the Academy of Athens. Mallis obtained a PhD in Regenerative Medicine from the National and Kapodistrian University of Athens and holds an MSc in Molecular Medicine. Mallis's research focuses on hematopoietic stem cells, mesenchymal stromal cells, immunomodulatory cell therapies, biobanking, and Advanced Therapy Medicinal Products (ATMPs). Mallis has authored more than 45 peer-reviewed scientific publications and is actively involved in translational research and the clinical implementation of cell-based therapies.

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Covalent Jo-In complexes for the assembly of artificial cellulosomes

Lignocellulose is the primary structural component of plant cell wall, and Earth's most abundant renewable organic resource. Certain anaerobic bacteria are able to efficiently degrade lignocellulose through cellulosomes, large extracellular multienzyme assemblies with exceptional enzymatic diversity and catalytic synergy. These systems have inspired the work of Designer Cellulosomes (DC) for biomass deconstruction. However, DC architectures rely on non-covalent interactions, whose intrinsic flexibility and potential for cross-reactivity can limit the precise control of the fused enzymes.

This project aims to explore a covalent assembly system, named Jo-In, derived from the *Streptococcus pneumoniae* RrgA adhesin. This system facilitates the spontaneous formation of an intramolecular isopeptide bond, providing a robust and irreversible linkage. This system has been previously validated in-house for *in vitro* enzyme fusion applications. The project focuses on the identification and characterization of orthogonal Jo-In pairs to enable the modular assembly of multi-component enzymes with enhanced structural stability and defined stoichiometry. To achieve this, we screened multiple Jo-In candidates and evaluated their cross interaction through covalent bonding assays. We further investigated their 3D structure using X-ray crystallography, revealing a large interface within the complex, stabilized by two conserved salt bridges across all studied pairs. Guided by these structural insights, we engineered rational mutations that directly impacted complex formation. Finally, we examined the shape and size of a newly designed Jo-In fusion pair using Small-Angle X-ray Scattering (SAXS) experiments, providing low-resolution envelopes consistent with the expected overall conformation.



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Rapid electrical impedance analysis as a cost-effective method for characterizing doped bio composites to be used in clinical applications

Metal ion-modified hydroxyapatites constitute the primary inorganic matrix of bone tissue and are approved for integration into bio-composites and protective coatings for surgical implants. Zinc enhances bone metabolism, cellular proliferation, and tissue regeneration. Numerous studies have documented the successful incorporation of zinc into the hydroxyapatite crystal lattice, verifying the resulting structural and morphological changes through advanced analytical methods such as X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM). However, conventional analytical techniques remain energy-intensive, costly, and labor-demanding. To address these constraints, this study evaluates structural modifications using Electrical Impedance Spectroscopy (EIS). Standardizing EIS parameters against zinc-induced lattice alterations provides a rapid, cost-effective screening tool to accelerate the clinical translation of Zn-Doped Hydroxyapatite (ZnHA).

Biography

Dr. Payal Bhardwaj is an accomplished life sciences specialist with over 10 years of experience managing high-value research operations and cross-functional teams, with expertise in financial oversight (₹32 Lakhs budget management), regulatory compliance, and translating complex scientific data into actionable project milestones. Recently certified in Clinical Trial Management and Advanced Operations by Johns Hopkins University, Bhardwaj demonstrates a commitment to corporate SOPs, vendor management, and global clinical standards, with expertise in bone health research, immunodiagnostics and bone biomechanics.



Prashant Sakharam Bhokardankar
Datta Meghe Ayurvedic Medical College, Hospital and Research Centre, Nagpur, Maharashtra, India

Ancient wisdom, modern science: Biotech services transforming Ayurveda

Health systems and health trends are always changing. Since no health system is flawless, a complement is required. As a result, practitioners of Western Medicine (WM) are searching for Traditional Medicine, Ayurveda (TM), and vice versa, since TM is better at treating chronic illnesses while WM is better at treating emergencies. Despite having different ideas and approaches, both systems have comparable goals, which is a comfort. Despite its promise, the scientific community's recognition of TM remains restricted globally due to a lack of scientific proof of its advantages and effectiveness.

One of the world's oldest TM systems, Ayurveda continues to benefit humanity despite changes in the environment, geography, weather, and soil composition that lead to the emergence of new diseases. The problem of maintaining excellent health is so emerging. As a result, it is necessary to conduct research that both satisfies the principles of biomedical research and is applicable in its own way. Multidisciplinary study integrating Ayurvedic specialists and technology is the most effective method for achieving this. Biotechnology uses naturally occurring materials, such as plants, animals, and minerals, to provide methods for both illness diagnosis and therapy.

The current evaluation is only a summary of the potential applications of Ayurveda in the current situation. Biotechnology is similar to the service provider, but Ayurveda is the science of life. As a result, biotechnology has all the methods needed to fully benefit Ayurveda and humanity as a whole. By fusing biotechnology with Ayurveda, it might even lead to a novel strategy.

Keywords: Ayurveda, Rassayan, Diabetes, Herbs.

Biography

Dr. Prashant Bhokardankar is not only a prominent personality in Ayurveda; he is an innovator transforming the landscape of conventional medicine. Holding an MD in Ayurveda with a focus on Rasshastra from the esteemed Government Ayurveda College, Nanded, India, he has, since 2005, devoted his career to enhancing the pharmaceutical elements of Ayurveda. As an energetic Professor and Department Head at Datta Meghe Ayurvedic Medical College, Hospital and Research Centre, Nagpur, Maharashtra, India, he motivates the upcoming generation of Ayurvedic professionals while also engaging in the worldwide conversation on traditional medicine. His notable career encompasses significant positions at prestigious pharmaceutical firms like Dabur and Arya Vaidya Pharmacy, where he refined his skills in the Ayurveda pharmaceutical field. Dr. Bhokardankar is an accomplished researcher, having authored many national and international publications in indexed journals. His dedication to the field goes beyond academia, having arranged numerous seminars and workshops, enthusiastically imparting the knowledge of Ayurvedic medicine. Dr. Bhokardankar, a highly sought-after speaker at international conferences in Spain, France, Italy, and Dubai, continues to connect ancient wisdom with modern science, demonstrating the significance of Ayurveda on a worldwide stage. His role as a principal investigator on several funded research initiatives highlights his commitment to enhancing Ayurvedic pharmaceutical understanding. With his vast expertise and forward-thinking perspective, Dr. Bhokardankar genuinely represents the essence of innovation in the realm of Ayurveda.



Santosh Kumar Mishra

Independent Researcher (Scholar), Retired from Population Education Resource Centre, Department of Life Long Learning and Extension, S. N. D. T. Women's University, Mumbai, Maharashtra, India

An insight into sustainable practices in Environmental Biotechnology (EB)

Environmental Biotechnology (EB) implies application of biological systems to solve ecological problems, manage waste, and reduce pollution. Biological systems refer to microorganisms, plants, and enzymes. EB touches upon biochemistry, microbiology, and environmental engineering for developing sustainable and eco-friendly technologies. Sustainable practices in EB play a crucial role in sustainable environmental management by utilizing biological systems to mitigate pollution, conserve resources, and promote ecosystem health.

Primary objective of this research is to present evidence-based discussion on sustainable practices in EB in the broader context of sustainable environment management. Also, key areas of intervention for realizing full potential of EB has been touched upon. Appropriate examples have been quoted in support of application of sustainable practices. Secondary data (largely 'qualitative' in nature) have been used. Data were collected from sources such as books, book chapters, journal articles, and publications of government departments and inter-governmental agencies. Method of data analysis is descriptive, involving desk-based research approach. Descriptive analysis summarize the attributes of a data set.

Analysis of data indicates that EB applies biological systems for addressing pressing environmental problems the international community is confronted with. Sustainable practices (with twin objectives, namely, protection of natural ecosystems, and long-terms sustainability) focus on developing eco-friendly solutions for: waste management, pollution control, and renewable energy production.

Sustainable practices, through application of biotechnological tools (like microorganisms) aims to seek to (a) clean contaminated environments, (b) generate biofuels, and (c) recycle waste materials. Research and development (R & D) in EB enable sustainable practices in following broad areas:

Waste Treatment: EB envisages a series of processes that combine biological and engineering techniques for addressing environmental problems in a sustainable way. This initiative aims at the treatment and stabilization of waste to eliminate or reduce harmful effects on environment and ecology.

Pollution Control: Biological systems help remove contaminants from soil, water, and air. Bioenergy generation: Organic waste is converted into biofuels like biogas, ethanol, and biodiesel.

Biodegradable Materials: It supports the creation of green chemicals and eco-friendly materials that reduce environmental harm.

By integrating biotechnology into industrial, agricultural, and urban systems, this field minimizes ecological footprints, mitigates climate change, and supports the vision of sustainable development. Further, it is pertinent to note that EB advances sustainable methodologies while addressing the challenges posed by an ever-growing population and depleting resources that are key for human survival. Furthermore, integrating biological systems with EB has created opportunities whose applications include (a) agriculture, (b) industry, (c) energy, and (d) environmental monitoring.

In order to unlock the full potential of EB, a collective approach involving governments, industries, and research institutions is needed. Integration of EB with policy, innovation, and community action will accelerate the transition to a green economy.

This abstract briefly concludes that EB envisages using living organisms and biological processes to address environmental issues and promote sustainability. It is applied in various sectors such as wastewater treatment, air pollution control, solid waste management, and renewable energy generation. The ultimate objective is securing cleaner and greener planet.

Keywords: Environmental Biotechnology (EB), Sustainable Practices, Sustainable Environmental Management, Biological Systems, Microorganisms, Environmental Engineering, Eco-Friendly Technologies.

Biography

Dr. Santosh Kumar Mishra is an Independent Researcher (Scholar), retired from the Population Education Resource Centre, Department of Lifelong Learning & Extension, S.N.D.T. Women's University, Mumbai, India. With a Ph.D. qualification, Mishra has authored 6 booklets, 4 books,

31 book chapters, 109 journal articles, 2 monographs, 7 research studies, and 119 papers for national & international conferences. Mishra has been awarded the Certificate of Excellence in Reviewing in 2017, 2018, 2021, 2022, and 2024, and was Judge for IHA's 20th Annual Virtual Health Literacy Awards, including Edson Awards for the 2025 & 2026 seasons.



Santosh Kumar Mishra

Independent Researcher (Scholar), Retired from Population Education Resource Centre, Department of Life Long Learning and Extension, S. N. D. T. Women's University, Mumbai, Maharashtra, India

Contribution of bioengineered food in addressing hunger and Food and Nutrition Security (FNS)

Despite advancements in agriculture and farming over the years, hunger (defined as an uncomfortable or painful physical sensation caused by insufficient consumption of dietary energy) continues to increase in some parts of the world. The author of this work argues that innovative engineering solutions have the potential to help solve hunger crisis. Agricultural Biotechnology (AB): also termed as agribiotech or green biotechnology], e.g., can contribute to greater Food and Nutrition Security (FNS). It is in this context that bioengineered food [also known as Genetically Modified Organisms (GMOs)] has gained increased significance. Bioengineered food refer to food that contains genetic material that has been modified through laboratory techniques. It is pertinent to note that FNS is achieved when all people, at all times, have physical, social, and economic access to safe, adequate, and nutritious food to meet their dietary needs and preferences for an active and healthy life.

This research work primarily aims to look into significance of bioengineered food in addressing hunger and FNS. Also, appropriate examples of innovations in AB in the context of bioengineered food have been quoted by the author. Secondary data (largely 'qualitative' in nature) have been used. Data were collected from sources such as books, book chapters, journal articles, and publications of government departments and inter-governmental agencies. Method of data analysis is descriptive, involving desk-based research approach. Descriptive analysis summarize the attributes of a data set.

Analysis of data in this work suggests that foods that are bioengineered can (a) increase yields, (b) boost nutrition levels, and (c) enhance crops' resistance to diseases. Agricultural engineers are vital to the development of bioengineered food technology. An advanced engineering education can prepare aspiring agricultural engineers to support the fight against hunger,

now and at all times. Bioengineered food or GMOs are outcome of various biotechnological interventions. Agricultural scientists use the term GMOs to refer to any organism (including plants and animals) that has been created or altered at the genetic level through Genetic Engineering (GE).

Some prominent examples of innovations in AB that have resulted in bioengineered food are herbicide-tolerant and pest-resistant crops, nutritiously dense crops, and conservation tillage. Detailed description of these innovations is presented below:

Resilient Crops: New seed technologies have enabled farmers increase crop production. AB scientists have developed stacked corn varieties genetically engineered to offer multiple protective traits, such as (a) herbicide tolerance, (b) pest resistance, and (c) drought tolerance.

Golden Rice: It is genetically enhanced variety of rice with provitamin A contents: a nutrient not available in other grown rice. Importantly, provitamin A supports healthy skin, vision, and immune system functioning.

Conservation Tillage: It refers to an agricultural practice that aims to prevent soil erosion, conserve water, and improve long-term soil health.

This work briefly concludes that agricultural biotechnology has numerous applications, which can help minimize food insecurity. GMO foods, for instance, have the potential to provide food that is healthier and produced with greater efficiency and sustainability. GMOs can relieve global food shortages to a significant extent.

Keywords: Hunger, Agricultural Biotechnology (AB), Innovative Engineering Solutions, Bioengineered Food, Food and Nutrition Security (FNS), Genetically Modified Organisms (GMOs), Genetic Engineering (GE).

Biography

Dr. Santosh Kumar Mishra is an Independent Researcher (Scholar), retired from the Population Education Resource Centre, Department of Lifelong Learning & Extension, S.N.D.T. Women's University, Mumbai, India. With a Ph.D. qualification, Mishra has authored 6 booklets, 4 books, 31 book chapters, 109 journal articles, 2 monographs, 7 research studies, and 119 papers for national & international conferences. Mishra has been awarded the Certificate of Excellence in Reviewing in 2017, 2018, 2021, 2022, and 2024, and was Judge for IHA's 20th Annual Virtual Health Literacy Awards, including Edson Awards for the 2025 & 2026 seasons.



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The effects of botulinum toxin type A and ascorbic acid on elastic cartilage regeneration: A comparison of single and combined experimental applications

Investigation of agents that may enhance tissue regeneration in elastic cartilage damage is important for the development of regenerative therapies. Botulinum Toxin Type A (BTXA) is known for its ability to induce muscle paralysis, but also because it can modulate the inflammatory response and enhance fibroblast activity. Ascorbic Acid (AA) supports collagen biosynthesis and possesses potent antioxidant properties. However, no experimental study has been found in the literature comparing the effects of these two agents on elastic cartilage regeneration or evaluating the potential synergistic effect of their combination. The aim of this study is to evaluate the regenerative effects of BTXA and AA, administered separately or in combination, in an induced model of elastic cartilage damage in rabbits, using histochemical and immunohistochemical methods. The study was ethically approved by the Mugla Sitki Kocman University Animal Experiments Local Ethics Committee (MUDEM-HADYEK; 2025/01-01/25, 11/02/2025) and supported by The Scientific and Technological Research Council of Turkey (TÜBİTAK; Project No. 125S270). The study utilised 20 six-month-old female New Zealand white rabbits. Three identical elastic cartilage wound models, each 2 mm in diameter, were created in the rabbits' ears, and the rabbits were randomly divided into four groups: control, BTXA, AA and BTXA+AA. The experiment was terminated on day 30, and the tissues were examined. In histochemical assessments, haematoxylin and eosin, orcein, Masson's trichrome and safranin-O/fast green stains were used; in immunohistochemical analyses, anti-TGF-β3 and anti-Ki-67 antibodies were applied, and the samples were examined using a light microscope. All groups were assessed in terms of epimorphic regeneration score, elastic fibre regeneration score, proportion of safranin-O-positive areas and H-Score. The epimorphic regeneration score was significantly higher in the BTXA group compared with

the control and AA groups (p<.05; p<.001). In the BTXA+AA group, it was significantly higher than in the control, BTXA and AA groups (p<.001). The elastic fibre regeneration score in the BTXA group was higher than in the control and AA groups (p<.001). In the safranin-O/fast green staining, the percentage of safranin-O-positive area in the BTXA+AA group was significantly higher than in the control and AA groups (p<.001). The Ki-67 score was significantly higher in the BTXA group compared with the AA group (p<.05). The Ki-67 H-score was significantly higher in the BTXA+AA group compared with all other groups (p<.001, p<.01 and p<.001). TGF-β3 immunoreactivity was significantly increased in the BTXA group compared with the control group (p<.001), and also significantly higher in the AA group compared with the control group (p<.05). The findings show that BTXA induces the regeneration of elastic cartilage. AA contributes to tissue repair by supporting regenerative pathways, but cannot provide a sufficient level of regeneration on its own. However, the combination of BTXA and AA demonstrated the most pronounced regenerative effect in terms of epimorphic cartilage regeneration, matrix organisation and cellular proliferation. These results suggest that the combination of BTXA and AA may represent a promising new approach to the treatment of elastic cartilage damage.

Biography

Sefike Merizan Avci Yalcin, MD, is a physician in the Department of Histology and Embryology at the Faculty of Medicine, Mugla Sitki Kocman University, Türkiye. Avci Yalcin's academic interests include histology, embryology, tissue regeneration, regenerative medicine, and experimental research, with current research focusing on the histochemical and immunohistochemical evaluation of tissue regeneration and the investigation of potential therapeutic approaches for cartilage repair.



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Enhanced osteogenic differentiation of human mesenchymal stem cells: Impact of surface terminations of nanocrystalline diamond coatings

The existing bone implant materials lack sufficient mechanical stability and surface properties for effective cell-material interactions, thereby limiting osseointegration. Nanocrystalline Diamond (NCD) coatings are promising materials for bone biomimetics because of their compelling biocompatibility and exceptional surface tunability. NCD surfaces can be chemically functionalized to regulate their surface wettability and cell-material interactions, promoting bone implant integration.

NCD films were fabricated on silicon substrates by microwave plasma-enhanced chemical vapor deposition and surface-terminated with Oxygen (NCD-O), Hydrogen (NCD-H) and Fluorine (NCD-F) atoms. Human Mesenchymal Stem Cells (hMSCs) were seeded on the prepared materials and cultured for 21 days. Evaluation of cytocompatibility and cell metabolic activity was performed using a resazurin assay on days 1, 3, 7, 14, and 21. Initial cell adhesion on materials was evaluated by immunofluorescence staining of cytoskeletal components F-actin and vinculin. The hMSCs on NCD-F exhibited significantly higher intensity of cytoskeletal vinculin signal than on NCD-O, NCD-H and control polystyrene. Osteogenic differentiation of hMSCs was assessed via measurement of Alkaline Phosphatase (ALP) activity, and by quantifying the production of both collagen and osteocalcin.

All tested materials support long-term cell viability/metabolic activity and proliferation throughout the entire culture period. The hMSCs on NCD-O demonstrated the highest

resazurin activity, compared to both NCD-F and NCD-H on day 3, and compared to NCD-F on day 7. In later time intervals, the values were similar for all NCD samples.

The ALP activity normalized to resazurin was the highest on NCD-F on day 7, suggesting a strong osteoinductive effect of NCD-F on hMSCs. Collagen was produced by the hMSCs on all surfaces from day 7 and mature collagen fibres were detected from day 14. On day 7, the percentage area covered with collagen was the highest on both NCD-O and NCD-H, and the lowest on NCD-F. On day 14, the lowest collagen production by the hMSCs was observed on NCD-F compared to all other samples.

Osteocalcin expression also followed a similar trend: on day 14, NCD-O and NCD-H exhibited significantly higher osteocalcin fluorescence intensity per cell than the control. Whereas the percentage area coverage of osteocalcin on day 14 showed significant differences between NCD-H compared to NCD-O and NCD-F.

The results suggest that NCD materials are osteoconductive, osteoinductive and support the adhesion, growth and osteogenic differentiation of hMSCs, with potential for bone tissue engineering.

The study was supported by the project No. CZ.02.01.01/00/22_008/0004631 Materials and technologies for sustainable development (MATUR) within the Jan Amos Komensky Operational Program of the Ministry of Education, Youth and Sports of the Czech Republic, co-funded by the European Union. Further support was provided by the Czech Academy of Sciences (Praemium Academiae grant No. AP2202).

Keywords: Nanocrystalline Diamond, Bone Implants, Osteoblast, Collagen.

Biography

Shanaya Phal Desai is a PhD student at the Second Faculty of Medicine, Charles University, Prague, Czech Republic, working in the Laboratory of Biomaterials and Tissue Engineering, Institute of Physiology of the Czech Academy of Sciences. Phal Desai's research focuses on biomimetic materials that can enhance osteogenic differentiation of mesenchymal stem cells and improve vascularisation to promote osteointegration of bone implants, addressing challenges of insufficient vascularisation limiting bone repair and regeneration.



Surbhi Priyadarshi

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Redefining oral cancer detection: The role of AI-based biotechnological methods beyond conventional technologies—A systematic review

Background: Oral cancer, particularly Oral Squamous Cell Carcinoma (OSCC), remains a major global health concern, with delayed diagnosis contributing substantially to morbidity and mortality. Conventional clinical examination, imaging and histopathological assessment remain the cornerstone of diagnosis but may have limitations related to accessibility, sampling, subjectivity and recognition of early molecular changes. Recent advances in biotechnology have enabled the identification of molecular, biochemical, metabolic and spectral signatures associated with oral carcinogenesis. Integration of these technologies with Artificial Intelligence (AI) may facilitate automated and non-invasive detection of oral cancer.

Objective: This systematic review evaluated the diagnostic performance of AI-based biotechnological methods for oral cancer detection beyond conventional diagnostic technologies and examined differences in performance according to the underlying biotechnology and AI methodology.

Materials and Methods: A systematic literature search was performed in PubMed/MEDLINE, Scopus, Web of Science, Embase, Google Scholar and IEEE Xplore from 2010 to 2026 (until June 2026). The terms used for the search were: oral cancer, oral squamous cell carcinoma, OPMDs, artificial intelligence, machine learning, biotechnology, molecular biomarkers, saliva, metabolomics, genomics, epigenomics, transcriptomics, microbiome, spectroscopy, biosensors. Overall, 1,304 records were found. There were 884 records after duplicates were removed, which were screened by title and abstract. Eighty-four full-text articles were evaluated for eligibility, 46 of which were excluded for prespecified reasons. There were 38

eligible manuscripts. After reconciling duplicate publications and overlapping and secondary cohorts, 34 independent studies were included in the final narrative synthesis. Studies with only traditional photographs, radiographs or histopathological images were not included. Due to significant heterogeneity in biological samples, biotechnology platforms, AI algorithms, reference standards, and validation strategies, a meta-analysis was not performed.

Results: Studies included molecular and epigenomic profiling, salivary transcriptomics and microbiome analysis, metabolomics, Raman and Fourier-Transform Infrared (FTIR) spectroscopy, Surface-Enhanced Raman Spectroscopy (SERS), electronic biosensors and multimodal approaches. Generally, molecular assays had the best reported diagnostic performance. In one study, the AUC for salivary DNA methylation with machine learning was 1.00, and the AUC for salivary metabolomic models was near 0.99. The Area Under the Curve (AUC) for salivary metatranscriptomic models ranged up to 0.90, with a specificity reported up to 97.9%. Raman-based deep-learning techniques showed classification accuracy of >90% in selected datasets, and FTIR-based techniques showed classification accuracy of ~95% in selected precancerous tissue datasets. More recent SERS-based liquid-biopsy methods were shown to exhibit promising performance, such as AI-assisted salivary exosome profiling and breath/saliva biosensing.

Conclusion: Oral cancer detection is set to be transformed by an emerging paradigm of AI-based biotechnological approaches that go beyond traditional technology based on morphology. A wide range of approaches are available that might allow the detection of biological signatures relevant to oral carcinogenesis with minimal invasiveness, such as salivary molecular profiling, epigenomics, metabolomics, microbial transcriptomics, Raman/FTIR spectroscopy and SERS. However, the current evidence is mostly exploratory. In future studies, prospective multicentre validation, patient-level data partitioning, and independent external validation should be considered before widespread clinical use.

Keywords: Artificial Intelligence, Oral Cancer, Oral Squamous Cell Carcinoma, Biotechnology, Molecular Biomarker, Saliva, Metabolomics, Spectroscopy, Biosensors.

Biography

Surbhi Priyadarshi is an Assistant Professor in the Department of Public Health Dentistry, Faculty of Dental Sciences, SGT University, with a keen interest in clinical dentistry, interdisciplinary research in healthcare, dental education, and public health. Priyadarshi is currently interested in the study of evidence-based approaches to improving healthcare delivery, novel teaching and learning techniques, preventive and community dentistry, and the use of emerging technologies within healthcare, with a particular research interest in the application of AI, biotechnology and digital technologies in clinical and educational practice. Priyadarshi has participated actively in research, academic teaching, community-based health programmes, and scholarly pursuits, particularly in bridging cutting-edge scientific research to impactful healthcare and educational outcomes.

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Artificial intelligence as a control layer in tissue engineering: Toward cognitive biomaterials for autonomous regenerative therapies

Despite substantial advances in scaffold chemistry, architecture, and biofunctionalization, tissue engineering systems continue to be fundamentally constrained by open-loop design paradigms in which cellular responses are assumed to be predictable and static. Such assumptions are incompatible with the spatiotemporal heterogeneity, nonlinearity, and patient-specific variability that govern tissue regeneration *in vivo*. In conclusion, the limited clinical translation of engineered tissues is increasingly understood to reflect not a lack of material sophistication, but rather the absence of autonomous control frameworks capable of interpreting and responding to dynamic biological feedback.

In this review, the emerging paradigm of AI-integrated cognitive biomaterials is critically examined as a necessary evolution in regenerative medicine, enabling a transition from responsive yet preprogrammed scaffolds toward adaptive, self-regulating tissue engineering systems. Recent advances in stimuli-responsive polymers, mechanotransduction-informed scaffold architectures, and embedded bioelectronic interfaces are evaluated through the lens of closed-loop cell–material interactions. Particular emphasis is placed on conductive hydrogels, integrated micro- and nanosensors, and organic electrochemical transistors capable of continuously monitoring cellular metabolism, mechanical stress, and adhesion dynamics within engineered tissues.

In the absence of artificial intelligence, such sensing platforms are rendered functionally underutilized, as the complexity and dimensionality of biological data exceed the capacity of rule-based control strategies. Machine learning and adaptive control algorithms are therefore

positioned as enabling technologies for real-time inference and autonomous modulation of scaffold properties, including stiffness, degradation kinetics, and bioactive ligand presentation, in response to evolving cellular states.

The concept of bio-digital twins is further explored as a translational framework linking *in vitro* tissue development with *in vivo* regenerative outcomes, facilitating predictive optimization of tissue maturation, vascularization, and functional integration prior to implantation. Current challenges related to sensor biocompatibility, data latency, algorithmic interpretability, regulatory classification, and manufacturing scalability are critically assessed to distinguish technical barriers from conceptual limitations.

By reframing biomaterials as adaptive cyber-physical systems rather than passive constructs, AI integration is positioned as a defining requirement for autonomous tissue engineering and the clinical transla tion of personalized regenerative therapies.

Keywords: Cognitive Biomaterials, Artificial Intelligence, Closed-Loop Biointerfaces, Autonomous Tissue Engineering, Mechanotransduction, Bio-Digital Twins, Regenerative Medicine.

Biography

Prof. Dr. Terin Adali studied Chemistry at the Middle East Technical University, Turkey, and graduated with an MS in 1997. Adali then joined the research group of Prof. Yilmaz at the Eastern Mediterranean University, Department of Chemistry, and received a PhD in 2007 at the same institution. Adali is currently working in the Faculty of Medicine, Medical Biochemistry, at the position of Professor at Girne American University, and has published more than 20 research articles in SCI (E) journals.



Udaybhan Yadav

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Harnessing plant-derived bioactive compounds and microbial biotechnology to combat antimicrobial resistance

Antimicrobial Resistance (AMR) has evolved as major public health challenges worldwide. Disease causing microorganism become resistant day by day due to various factors. The speedy evolution of multidrug-resistant disease causing microorganisms necessitates the development of innovative, sustainable, and biologically relevant therapeutic strategies. Biotechnology offers a promising platform for discovering novel antimicrobial agents by integrating the therapeutic potential of medicinal plants with advances in microbial biotechnology. This findings explores the role of plant-derived bioactive compounds and beneficial microorganisms in addressing antimicrobial resistance through multidisciplinary biotechnological approaches.

The antimicrobial potential of selected medicinal plant extracts and their synergistic interactions with conventional antibiotics against clinically important bacterial pathogens. Emphasis will be placed on the diverse phytochemicals, including phenolics, flavonoids, alkaloids, terpenoids, and essential oils, which exhibit broad-spectrum antimicrobial properties through multiple mechanisms of action. Their ability to enhance antibiotic efficacy, inhibit biofilm formation, disrupt bacterial quorum sensing, and reduce the emergence of resistant strains will be discussed. Furthermore, microbial biotechnology approaches, including the screening of beneficial microorganisms for antimicrobial metabolite production, enzyme-mediated biotransformation, and eco-friendly & sustainable bioprocesses, will be presented as sustainable alternatives for developing next-generation antimicrobial therapeutics.

The presentation also focuses the importance of integrating phytochemical research biotechnology, microbiology, molecular biology, and bioengineering to accelerate the discovery and validation of novel antimicrobial agents. Recent advances in plant tissue culture, metabolomics, microbial fermentation, and nanobiotechnology have significantly expanded the scope of producing standardized bioactive compounds with improved quality, stability, bioavailability, sustainability and therapeutic efficacy. Such interdisciplinary approaches contribute to reducing dependence on synthetic antibiotics while promoting environmentally sustainable healthcare solutions.

By bridging natural bioactive product research with microbial biotechnology, this work demonstrates how biotechnology can contribute to combating antimicrobial resistance and improving global health populations. The presentation aligns with current international efforts to develop innovative antimicrobial strategies and supports the conference theme, Advancing Biotechnology & Bioengineering: From Concepts to Impact, by emphasizing translational research that transforms scientific discoveries into practical healthcare applications. This integrated approach has the potential to inspire future collaborative research and accelerate the development of safe, effective, and sustainable antimicrobial interventions.

Biography

Dr. Udaybhan Yadav is a University of Mumbai-approved Assistant Professor of Botany at Thakur Shyamnarayan Degree College, Mumbai, India, a recognized Ph.D. Guide in Botany at MK University, Patan, Gujarat, and a Mentor under the National Mission for Mentoring (NMM), Government of India. Yadav's research spans plant biotechnology, microbial biotechnology, antimicrobial resistance, natural products, and sustainable bioengineering. Yadav has authored over 60 research publications, books, patents, and copyrights, and serves as an editor and reviewer for international journals, including Scopus-indexed publications. A Young Scientist Award recipient, Yadav advances translational research, innovation, and global scientific collaboration.



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ATE1-mediated cell death and its role in tumour suppression

Regulation of cell death plays an important role for cellular adaptation to stress and associated signaling processes. Previous studies suggested that arginylation, a protein post-translational modification catalyzed by the evolutionarily conserved enzyme arginyltransferase 1 (Ate1), is involved in cellular stress responses and cell death regulation. Ate1 also plays an important role in diverse biological processes, and its dysfunction is linked to embryonic lethality, cardiovascular defects, and aging-related diseases. Downregulation of Ate1, frequently observed in various cancer types, increases cellular tolerance to different stressors. In contrast, Ate1 expression is elevated under acute oxidative stress and promotes apoptosis in both yeast and mammalian cells. However, the molecular mechanism of Ate1-mediated cell death remains poorly understood. Here, we investigated the role of Ate1 in stress-induced cell death in budding yeast and mammalian cells. In yeast, we found that Ate1 predominantly localizes in the cytoplasm under normal conditions but translocates to mitochondria under oxidative stress, where it becomes essential for Ate1-mediated cell death. Furthermore, Ate1-mediated cell death depends on components of the Mitochondrial Permeability Transition Pore (MPTP). Moreover, knockouts of MPTP components or co-expression of the anti-apoptotic protein Bcl2xL, which prevents mitochondrial membrane permeabilization, also rescue cells from Ate1-induced cell death. However, this process does not rely on mitochondrial electron transport chain activity or the Reactive Oxygen Species (ROS) they generate. Similarly, in the mammalian system, wild-type MEF cells exhibited higher levels of cell death upon apoptotic stimulation compared with ATE1-knockout MEF cells. Further analysis revealed that Ate1 protein expression is reduced across multiple cancer types, while higher Ate1 expression correlates with increased drug sensitivity and improved patient survival. In conclusion, we identify Ate1 as a proapoptotic regulator of cell death and highlight its potential relevance in cancer therapeutics.

Biography

Vikash Maurya is a Ph.D. research scholar in the Department of Botany, Institute of Science, Banaras Hindu University (BHU), Varanasi, India, working under the supervision of Dr. Akhilesh Kumar. Maurya's research focuses on understanding the role of arginyltransferase 1 (ATE1) in cell death, mitochondrial dysfunction, and tumour suppression. The work integrates molecular and cellular biology, proteomics, metabolomics, and mitochondrial biology to investigate ATE1-mediated regulation of cellular stress responses and cancer-related processes, with a particular interest in elucidating the molecular mechanisms linking ATE1, mitochondrial function, and therapeutic response.



Xiaochun Cao-Ehlker[1*], Mari Hambardzumyan[2], Ruochan Li[3], Tengis Tschaidse[4], Stefanos Michaelides[4], Erfan Rasouli[2], Philipp Linke[5], Robert Fürst[2], Zeno Guttenberg[5], Bernhard Renz[3], Sebastian Kobold[4], Stefan Zahler[2], Mathias Völkl[2], Stefan Munker[2,3,6]

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Planar MicroOrganoPit-based co-culture platform (MICA) for studying tumor-immune interactions in patient-derived tumoroids

Mechanistic studies of tumor-immune interactions and preclinical evaluation of immunotherapies require *in vitro* models that closely recapitulate the tumor microenvironment. Although patient-derived tumor organoids preserve key structural and functional features of native tumors, existing immune co-culture systems often lack spatial control, scalability, and robust methods to monitor immune-cell infiltration and tumor responses within a physiologically relevant extracellular matrix.

Here, we present the MicroOrganoPit Co-culture Assay (MICA), a planar, matrix-based platform for studying immune-tumor interactions in patient-derived tumoroids. Built on patented MicroOrganoPit (MOP) technology developed with ibidi GmbH, MICA stabilizes thin planar hydrogel layers, creating a defined 3D microenvironment that enables the controlled spatial organization of tumoroids and immune cells while remaining fully accessible to high-resolution live-cell microscopy.

MICA allows activated lymphocytes to migrate through the collagen matrix and infiltrate tumoroids, thereby inducing tumoroid disruption and enabling direct visualization of infiltration dynamics and immune-mediated cytotoxicity in a single system. In preliminary proof-of-concept experiments, EGFR-targeted CAR T cells showed enhanced infiltration and tumoroid killing compared with control CAR T cells.

Overall, MICA provides a scalable, high-throughput, microscopy-compatible, and quantitative platform approach for investigating tumor-immune interactions and evaluating preclinical immunotherapies in patient-derived tumoroids, hereby offering a versatile tool for translational immuno-oncology research.

Biography

Xiaochun Cao-Ehlker, Ph.D., is a Scientific Business Manager at HTCR-Services GmbH in Munich, Germany, where Cao-Ehlker leads translational projects using patient-derived biomaterials. Cao-Ehlker previously worked at the Max Planck Institute of Biochemistry, Harvard Medical School, and Dartmouth Medical School, conducting diverse studies in Biochemistry, Cell Biology and Immunology, and currently collaborates with academic and industry partners to develop more physiologically relevant *in vitro* models for drug testing and precision medicine.



Zuchang Pei
Independent Researcher, Canada

Regulatory integration as a systems-biology framework for organizational state transitions

Biological systems can undergo transitions between alternative organizational states, including cellular differentiation, developmental reorganization, multicellular organization, and other forms of biological restructuring. A central question is whether the degree of regulatory integration within a biological system can be quantified and related to such state transitions. Here, we develop a systems-biology framework in which regulatory integration is represented by a dimensionless quantity, Φ, describing the effective coordination and organization of interacting biological components. A reduced nonlinear dynamical model is used to examine how changes in regulatory integration can reshape the system's attractor landscape, generating multistability, threshold behavior, hysteresis, and transitions between alternative organizational states. To connect the theoretical framework with measurable biological networks, we introduce an empirical regulatory-integration estimator, Φ_E, derived from network properties including global regulatory influence, local connectivity, and hierarchical modular organization. Preliminary analysis of BioGRID interaction networks across five representative biological systems—*E. coli*, *S. cerevisiae*, *D. melanogaster*, *M. musculus*, and *H. sapiens*—reveals an increasing Φ_E gradient from prokaryotic to mammalian systems. This result provides initial empirical evidence that regulatory integration can be operationalized as a quantitative network property and that its magnitude may be associated with differences in biological organization.

The framework does not assume that increasing regulatory integration alone determines biological complexity or specifies a universal mechanism of evolutionary change. Rather, it provides a quantitative systems-level description linking network organization to the dynamical stability and reorganization of biological states. By connecting network-based measurement with nonlinear dynamical theory, the approach offers a testable framework for

investigating how changes in regulatory integration may contribute to developmental, cellular, and organizational state transitions.

Keywords: Regulatory Integration; Systems Biology; Organizational-state Transitions; Nonlinear Dynamics; Multistability; Bifurcation; Hysteresis; Biological Networks; Attractor Landscapes; Network Organization.

Biography

After completing undergraduate studies in 1982, Zuchang Pei began developing the bioevo-cybernetic concept and, in 1988, published an article on the concept with Professor XS Pei in Nature 11(2), China. During M.Sc. studies in Canada (1992–1993), Ph.D. studies (1993–1997), and since retirement in 2019, Pei has continued research in bioevo-cybernetics, theoretical biology, evolutionary systems biology, and evolutionary dynamics. This work investigates regulatory integration, entropic dissipation, self-regulation, and the cybernetic mechanisms underlying major biological transitions, developing mathematical frameworks that connect ecological and evolutionary dynamics with regime shifts, organizational change, and self-organization, with particular emphasis on multiscale regulatory integration and evolutionary transitions as nonlinear dynamical systems. Pei's research also examines how biological systems self-regulate and reorganize to maintain adaptability in changing environments.

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POSTER PRESENTATIONS





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In vitro evaluation of lyophilized Dedifferentiated Fat Cells (DFAT) impregnated artificial dermis

Objective: Dedifferentiated Fat Cells (DFAT) were infiltrated into an artificial dermal collagen sponge under reduced pressure, followed by lyophilization to create lyophilized DFAT-impregnated artificial dermis. In this study, the release of bioactive substances was examined *in vitro*.

Method: DFAT was prepared by ceiling culture of human subcutaneous fat tissues. Using a simple vacuum infiltration device, 0.25 ml of DFAT suspension (4.0 × 106 cells/ml) was sprayed onto artificial dermis (Pelnac, single-layer collagen-based artificial dermis, GUNZE, Japan) and then vacuum-treated at -70 cmHg for 1 minute to create DFAT-impregnated artificial dermis. The DFAT-impregnated artificial dermis was divided into the following three groups: 1) fresh group (not preserved), 2) frozen group (frozen and preserved at -80°C for 2 weeks), and 3) lyophilization group (vacuum freeze-dried) (n=8 per group). Each group was immersed in DMEM medium, and the supernatant was collected, and the amounts of human VEGF and bFGF were quantified by ELISA. In addition, the release capacity of physiologically active substances was comprehensively characterized for the 1) fresh group and 3) lyophilization group. A vacuum freeze-drying machine (CHList, ALPHA1-4/2-4LSCplus, KUBOTA) was used for lyophilization.

Results: DFAT was confirmed within the collagen sponge of the DFAT-impregnated artificial dermis, and although it aggregated after lyophilization, the cell morphology was maintained. Comprehensive qualitative analysis of physiologically active substances showed that none were lost by the vacuum freeze-drying process, which suggest that properties of DFAT remained unchanged by lyophilization.

Quantitative results for physiologically active substances showed that both VEGF and bFGF were significantly higher in group 3) lyophilization group than in the other groups.

Discussion: DFAT aggregated after lyophilization, but maintained its cellular morphology. Furthermore, returning to a humid environment demonstrated the release of bioactive substances. The amounts released were greater than those in fresh or frozen storage, suggesting that the release occurred all at once due to cell breakdown.

Biography

Kazutaka Soejima is a professor in the Department of Plastic Surgery at Nihon University School of Medicine. Soejima graduated from the University of Tsukuba in Japan in 1988 and completed training in plastic surgery at the Department of Plastic Surgery at Tokyo Women's Medical University in Tokyo, Japan. Soejima received a Doctor of Medicine in 2000 and has been in the current position since 2020.



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Self-pumping scaffolds for skin tissue engineering: A systematic review

Background: Effective wound healing depends on maintaining a balanced local environment at the wound site. Excessive wound exudate can prolong inflammation, increase infection risk, cause maceration of surrounding tissue, and interfere with cell migration and extracellular matrix formation. Although conventional absorbent dressings can temporarily retain wound fluid, they may become saturated and often fail to provide continuous, directional exudate transport. Self-pumping wound dressings have therefore emerged as advanced biomaterial systems designed to transfer excess fluid away from the wound while preserving adequate moisture for tissue repair. These dressings may also function as platforms for drug delivery and biological stimulation. This systematic review aimed to examine recent progress in their design, fabrication, fluid-transport mechanisms, and regenerative effects.

Materials and Methods: A systematic search was conducted using PubMed, Scopus, and Google Scholar. Studies published between 2022 and 2025 were screened, with emphasis on self-pumping, asymmetric, Janus, and directionally transporting wound dressings developed for skin tissue engineering and wound healing. The included studies were assessed according to fabrication method, structural organization, surface wettability, exudate-transport mechanism, incorporated therapeutic agents, carrier systems, and reported cellular or tissue-level outcomes.

Results: The reviewed studies showed that self-pumping wound dressings are commonly fabricated by electrospinning, freeze-drying, or a combination of both techniques. Most systems contain two or three functionally distinct layers arranged to create a wettability gradient. Typically, a hydrophobic or less-wettable layer is positioned away from the wound, whereas a

hydrophilic layer remains close to the wound surface. This asymmetric organization generates capillary pressure and promotes unidirectional movement of exudate toward the external absorbent region. Hydrogels, nanofibrous membranes, porous sponges, and composite scaffolds were frequently used as structural components. Fluid transfer was further improved through interconnected pores, aligned microchannels, conical channels, or differences in pore size between adjacent layers. Several dressings were loaded with therapeutic compounds, including curcumin, antioxidants, and antibacterial agents, to reduce oxidative stress, limit microbial contamination, and support tissue repair. Micro- and nanoparticle systems, such as PLGA particles and microspheres, were also incorporated to protect bioactive compounds and provide sustained or controlled release. In addition to exudate drainage, these dressings were reported to reduce reactive oxygen species and inflammatory mediators within the wound microenvironment. These effects may contribute to macrophage phenotype regulation, improved angiogenesis, enhanced fibroblast migration and proliferation, increased collagen deposition, re-epithelialization, and, in some models, hair follicle regeneration.

Conclusion: Self-pumping wound dressings represent a promising generation of multifunctional biomaterials that combine directional exudate transport, moisture regulation, and therapeutic delivery. Their ability to modify both the physical and biological wound environment may offer advantages over passive absorbent dressings. However, differences in material composition, testing methods, and evaluation criteria currently limit direct comparison among studies. Further research is needed to standardize performance assessment, examine long-term biosafety, and validate these systems in large-animal models and human clinical trials.

Keywords: Self-Pumping Wound Dressings, Directional Fluid Transport, Wound Exudate Management, Skin Regeneration, Drug Delivery, Advanced Biomaterials.

Biography

Sarvin Mostafavi is currently a PhD student in Tissue Engineering at Royan Institute, with an academic background in Developmental Biology. Mostafavi's research interests include skin tissue engineering, regenerative medicine, biomaterials, controlled drug delivery, wound healing, and immunomodulation. Mostafavi has experience in developing collagen-based scaffolds, cell culture, biomaterial characterization, and evaluating cellular and inflammatory responses, and aims to develop advanced biomaterial-based strategies that promote tissue repair and regeneration.



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Evaluating an electrically stimulated RN22–NG108-15 co-culture platform for peripheral nerve tissue engineering

Introduction: Peripheral nerve regeneration remains challenged by the limited effectiveness of current clinical repair strategies, including autologous nerve grafting. The development of physiologically relevant *in vitro* models that reproduce neuron–Schwann cell interactions while incorporating bioelectrical cues is essential for advancing peripheral nerve tissue engineering. Although electrical stimulation is recognized as a regulator of neuronal behavior, its application within multicellular peripheral nerve models remains insufficiently explored.

Objectives: To develop and evaluate an electrically stimulated RN22–NG108-15 co-culture as an *in vitro* platform for peripheral nerve tissue engineering.

Methods: RN22 Schwann-derived cells and NG108-15 neuron-like cells were individually characterized for viability and proliferation prior to establishing a co-culture using an optimized hybrid culture medium. Electrical stimulation was applied through integrated electrodes under standardized stimulation conditions. Cell viability was evaluated using the WST-1 assay, while optical and immunofluorescence microscopy were employed to assess cell morphology, neurite development, phenotype preservation, and neuron–Schwann cell interactions.

Results: The optimized co-culture maintained high viability and stable growth, demonstrating compatibility between both cell populations throughout the experimental period. Immunofluorescence analysis confirmed preservation of both Schwann and neuronal

phenotypes under co-culture conditions. Electrical stimulation induced a significant improvement in cellular behavior, evidenced by enhanced neuronal differentiation, increased neurite extension and neurite network formation, and improved neuron–Schwann cell interactions compared with unstimulated cultures. Furthermore, a positive relationship was observed between electrical stimulation and physiological cellular behavior, as demonstrated by improvements in cell viability and neurite-related parameters, supporting the beneficial role of bioelectrical stimulation in promoting a regenerative cellular microenvironment.

Conclusions: The proposed electrically stimulated RN22–NG108-15 co-culture constitutes a reproducible *in vitro* platform that reproduces key cellular features of the peripheral nerve microenvironment. By integrating multicellular neuron–Schwann cell interactions with controlled electrical stimulation, this model provides a versatile platform for investigating peripheral nerve regeneration mechanisms, evaluating biomaterials and regenerative therapies, and supporting the development of tissue engineering strategies while contributing to the reduction of animal experimentation.

Biography

Tamara Andrea Inostroza Leiva is a Biochemist and Research Assistant at the Universidad Técnica Federico Santa María, Chile. Inostroza Leiva's research focuses on cell culture, immunofluorescence, microscopy, and the development of *in vitro* models for peripheral nerve regeneration, with experience in neuronal and Schwann cell co-culture systems and the evaluation of regenerative strategies for tissue engineering applications. Scientific interests include regenerative medicine, neural tissue engineering, biomaterials, and translational biomedical research, with a commitment to advancing innovative approaches that contribute to nerve repair and the development of reliable experimental models for biomedical research.

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