GDAŃSKI UNIWERSYTET MEDYCZNY

BOOK OF ABSTRACTS

INTERNATIONAL CONFERENCE REGENERATIVE MEDICINE OF THE FUTURE

September 23, 2025 Gdańsk

PATRONAGE HONORARY

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Composition of the book of abstracts

Agata Tymińska M.Sc., Ph.D., Laboratory of Tissue Engineering and Regenerative Medicine, Division of Embryology, Department of Anatomy, Faculty of Medicine, Medical University of Gdańsk

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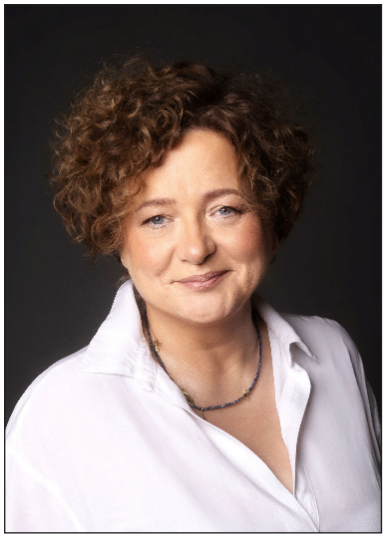


Prof. Edyta Brzóska-Wójtowicz, M.Sc., Ph.D.

Professor at the Institute of Developmental Biology and Biomedical Sciences, Faculty of Biology, University of Warsaw, Poland.

Title of presentation:

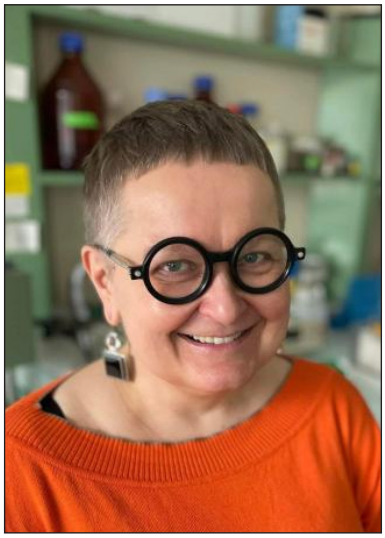
MicroRNA-Driven Communication Between Myoblasts and Endothelial Cells in Muscle Repair

Highlights:

- **Stem cell niche dynamics are influenced by microRNAs activity.**
- **MicroRNAs regulate signaling pathways involved in skeletal muscle regeneration.**
- **MicroRNA-126 regulates crosstalk between myoblasts and endothelial cells.**
- **MicroRNA modulation offers a promising avenue for supporting tissue reconstruction.**

Prof. Edyta Brzóska-Wójtowicz is an expert in regenerative biology, with a particular focus on skeletal muscle repair. Her scientific interests center on stem cell biology and the regulatory role of microRNAs in tissue reconstruction. Her research group investigates the mechanisms of stem cell differentiation, migration, and mobilization to injured tissues. She is also actively involved in studies on the application of stem cells and biomaterials to support the regeneration of damaged or dystrophic muscles. She has led numerous competitive research projects funded by the National Science Centre, the Foundation for Polish Science, the Polpharma Scientific Foundation, and the Ministry of Science and Higher Education. She is the author of 50 scientific publications.

She gained professional experience at the Department of Clinical Cytology at the Center of Postgraduate Medical Education in Warsaw. In addition to her academic work, she completed a research internship at Pierre and Marie Curie University in Paris, where she studied integrin-mediated cell interactions during myogenesis. She earned her PhD in 2005 and completed her habilitation in 2016 at the University of Warsaw. Her dissertation focused on the role of adhesion proteins and the cytokine SDF-1 in stem cell differentiation and their mobilization to skeletal muscle. In 2013, she received the Minister of Science and Higher Education Award for her teaching achievements. In 2014, she was a finalist for the Polityka Science Award, and in 2015, she received a L'Oréal Poland For Women in Science fellowship.



Prof. Maria Anna Ciemerych-Litwinienko, Ph.D., D.Sc.

Professor at the Faculty of Biology, University of Warsaw, in which she is head of the Department of Cytology as well as the Institute of Developmental Biology and Biomedical Sciences. She completed her M.Sc., Ph.D., and D.Sc. at the University of Warsaw. She is a Professor of biological sciences (title, 2012).

Title of presentation:

Multifaceted role of miR181 in pluripotent stem cell differentiation.

Highlights:

- **Pluripotent stem cells (PSCs) are perfect tools to study cell differentiation and design cell-based therapies.**
- **micro RNA regulate every cell prcessess.**
- **micro RNA can be used to direct stem cell differentiation.**
- **miR181 can improve neuro- and myogenesis of pluripotent stem cells.**
- **PSC – derived organoids serve as a model for neuro-myogenic interactions**

Prof. Maria Anna Ciemerych-Litwinienko is a developmental and cell biologist. From the beginning of her career, she was associated with the University of Warsaw, where she obtained both M.Sc. and Ph.D. degrees in biology, under the supervision of Prof. Andrzej K. Tarkowski. During her Ph.D., she completed one long-term internship at the University of Manchester and several short-term ones at the Institute Jacques Monod in Paris. After completion of Ph.D., MACL, as a visiting fellow, did her research first in Magda Żernicka-Goetz's lab at Wellcome/CRC Institute (currently Gurdon Institute)/Cambridge University and then as a postdoctoral fellow with Piotr Siciński at the Dana-Farber Cancer Institute/Harvard Medical School in Boston.

After returning to Poland, she contined her work at the Faculty of Biology at Warsaw University. She is an elected member of the Polish Academy of Arts and Sciences (PAU). During her academic career, she received a START Fellowship of the Foundation for Polish Science, the 'Stay with us' POLITYKA Fellowship, and L'Oreal/ UNESCO for Woman in Science Fellowship. She is a member of AdademiaNet.

She is also an academic teacher involved in many outreach activities, such as taking part in the EuroGCT network. In her research, she is focusing on the differentiation of stem cells, skeletal muscle regeneration, and finding the way to improve it. Several of her research projects were focused on the role of myogenic differentiation of pluripotent stem cells. She teaches at the Faculty of Biology as well as the Faculty of Medicine of the University of Warsaw, actively popularizing science. In her free time, she creates collages.

Associate Prof. Kasia Gurzawska-Comis, M.Sc., Ph.D.

Associate Professor and Lead of Oral and Maxillofacial Surgery and Oral Pathology Section at Department of Dentisty and Oral Health, at Aarhus University, Denmark.

Title of presentation:

GreenNanoBone – Advanced Approaches in Bone Regeneration

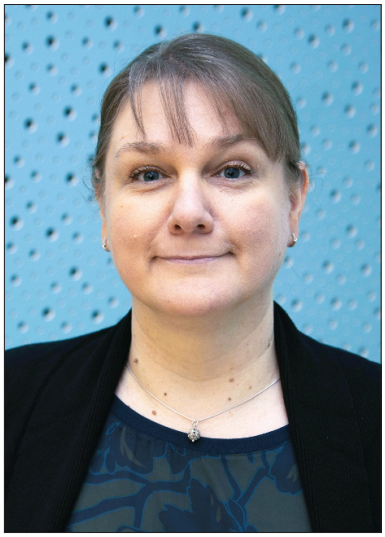
Highlights:

- **Plant-derived nanoparticles with osteogenic and anti-inflammatory properties.**
- **Biomaterials as carrier for nanoparticles.**
- **Treatment of side effect of cancer therapy with novel biomaterials.**
- **GreenNanoBone as advance approach to prevention and treatment of jaw necrosis.**

She is also Senior Lecturer and Honorary Cosultant in Oral Surgery at University of Liverpool. She graduated with DDS (doctor of dental surgery) from Medical University of Lodz. She obtained her first PhD in medical science at the University of Copenhagen and second PhD in bioengineering at the Technical University of Lodz and Danish Technical University (DTU). She continued her scientific career as Marie Skłodowska-Curie post-doc at the Charité Medical University Berlin and developed over years collaboration with multiple international universities. Clinically she completed NIHR speciality training at the University of Birmingham and obtained consultant position at University of Liverpool and as a member of Liverpool Head & Neck Centre (LHNC). Her future research goals focus on developing alternative biomaterials for autogenous bone grafts in ageing and compromised patients.

Prof. Kasia Gurzawska-Comis is a specialist and consultant in oral surgery. Her main clinical interest is the multidisciplinary approach to patient care, with specific interest in tooth autotransplatation, bone regeneration and dental implantology. Her research interest is in bone regeneration, stem cell therapy, nanotechnology and tissue engineering. She previously served as Principal Investigator in international and national research projects, including GreenBone funded by IADR and Osteology Foundation. Her focus is on translational research, bridging expertise from basic science into clinical applications.

Recently, Prof. Kasia Gurzawska-Comis secured EU Horizon funding and serve as a coordinator of GreenNanoBone project ("Sustainable 4D hydrogels functionalised with plant-based nanoparticles for bone regeneration in cancer patients," 2025–2029). She also leads a research team at the Aarhus University, Department of Dentistry and Oral Health within this project. In addition to her research and clinical activities, Prof. Gurzawska-Comis teaches both undergraduate, dental and medical students and postgraduate, doctoral students. She is also active in number of professional association.



Prof. Susanna Miettinen, Ph.D., Doc.

Full Professor of Cell and Tissue Technology at Tampere University, Finland, and leader of the Adult Stem Cell Group. She earned her MSc in biology from the University of Turku and her Ph.D. in cell biology from Tampere University, where she was later awarded the title of Docent in cell biology.

Title of presentation:

Vascularized and Innervated In Vitro Models Utilizing Adipose Stem Cells

Highlights:

- **Microfluidic chips as platforms for studying adipose tissue and adipose stem cells.**
- **Adipose stem cells' vasculogenic capacity compared with bone marrow stromal cells.**
- **Effects of obesity and weight loss on adipose stem cells.**
- **Effects of innervation on adipogenic differentiation and functionality of adipose stem cells.**

She has over two decades of experience in stem cell research and clinical translation. Her national and international leadership roles include serving as President of the International Federation for Adipose Therapeutics and Science and chairing major international scientific meetings, as well as holding several academic positions of trust. Throughout her career, Prof. Miettinen has supervised numerous doctoral and postdoctoral researchers.

Prof. Susanna Miettinen is an expert in cell and tissue technology, with a focus on human mesenchymal stem/stromal cells, tissue engineering, and advanced in vitro models for regenerative medicine. Her research group investigates how cells interact with their microenvironment and how these mechanisms can be harnessed to develop novel treatments for bone and soft tissue repair. She has secured substantial national and international competitive funding as Principal Investigator, including prestigious Research Council of Finland Centre of Excellence grants and several Horizon Europe projects.

She is the author of more than 200 peer-reviewed publications, holds patents and licensed innovations, and her team's research has been translated into clinical applications for bone defect and urinary incontinence treatments.

Prof. Michał Pikuła, M.Sc., Ph.D.

Professor at the Laboratory of Tissue Engineering and Regenerative Medicine, Dpt. of Embryology, at the Medical University of Gdańsk (MUG), Poland and also a Professor at the Dpt. of Biochemistry, at the University of Physical Education and Sport, Gdańsk. He completed his M.Sc. from University of Gdansk (Molecular biology, 2003), M. Pharm. from Medical University of Gdańsk (Pharmacy Practice, 2005), and his Ph.D. in medical biology from Medical University of Gdańsk (specialty cell biology, 2007). He is a Professor of medical sciences and health sciences (title, 2020).

In addition to his scientific and academic training, he also completed Postgraduate Management Studies in Company Management in Health Care at the Gdańsk University of Technology (2011).

Title of presentation:

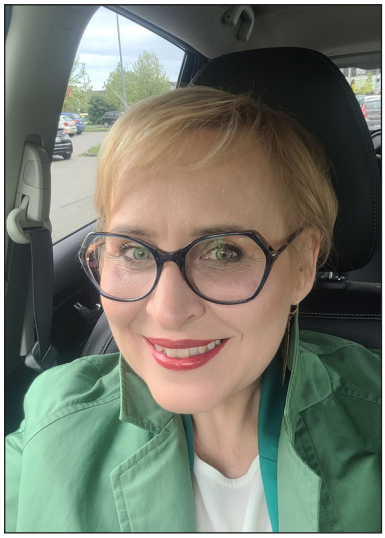
Adipose-derived mesenchymal stromal cells (AD-MSCs) as a versatile tool in regenerative medicine and drug screening models

Highlights:

- **AD-MSCs are abundant, accessible, and highly regenerative.**
- **They differentiate into multiple lineages and interact with biomaterials.**
- **AD-MSCs -derived organoids offer a robust 3D model for testing.**
- **scRNA-seq reveals key differences between AD-MSCs and fibroblasts.**

Prof. Michał Pikuła is a specialist in regenerative medicine, tissue engineering, and experimental dermatology. He previously served as Principal Investigator and group leader in several completed research projects, including a National Science Centre- funded projects. He was also the team leader in two research consortia: BIONANOVA, focused on nanomaterials for tissue engineering, and Regennova, which developed innovative regenerative therapies based on bioactive compounds.

Currently, Prof. Michał Pikuła leads a research team at the Medical University of Gdańsk (MUG), including a dedicated group working within the GreenNanoBone project ("Sustainable 4D hydrogels functionalised with plant-based nanoparticles for bone regeneration in cancer patients," 2025–2029), funded by the European Commission under the Horizon Europe programme. In addition to his research activities, Prof. Pikuła teaches both medical and doctoral students and currently serves as Deputy Director of the First Doctoral School at MUG.



Prof. Sylwia Rodziewicz-Motowidło, Ph.D., D.Sc.

Professor at the Faculty of Chemistry, University of Gdańsk, in which she is head of the Department of Biomedical Chemistry, a position she has held since 2012. She completed her M.Sc., Ph.D., and D.Sc. at the University of Gdańsk. She is a Professor of biological sciences (title, 2021).

Title of presentation:

Healing Waves from Gdańsk: Peptides in Regenerative Medicine

Her scientific interests focus on understanding the structure–activity relationships of biologically active peptides and proteins, with particular emphasis on the mechanisms of amyloid fibril formation and the design of functionalized peptides for therapeutic applications. Throughout her career, she has conducted extensive research on peptides with anticancer, antibacterial, and regenerative properties, as well as on the development of peptide-based nanostructures that can serve as innovative materials for tissue engineering and regenerative medicine. A major focus of her work has been the design of functionalized peptide fibrils and hydrogels capable of stimulating wound healing, supporting muscle regeneration, and acting as carriers for active substances in pharmacological therapies. Prof. Rodziewicz-Motowidło has been the principal investigator of numerous national and international research projects funded by NCN, NCBR, STRATEGMED, ERA-Net, and HORIZON programs. These include studies on immune checkpoint inhibitors targeting PD-1/PD-L1, molecularly targeted bionanoparticles for cancer therapy, and peptide-based hydrogels enhancing muscle cell regeneration. More recently, her research has also explored blocking TNF–TNFR2 interactions as a potential new strategy for ovarian cancer treatment. She is the author of around 150 peer-reviewed scientific publications, cited over 2300 times, with an h-index of 26. Her scientific achievements also include seven patents and twelve patent applications in the fields of biomedicine and pharmaceutical sciences. Her work has been recognized with numerous awards, including the Foundation for Polish Science Scholarship, the Grzegorz Białkowski Award, and the prestigious L'Oréal Poland for Women in Science Fellowship. Beyond her research activities, Prof. Rodziewicz-Motowidło has played an important role in academic leadership and research evaluation. From 2012 to 2016, she served as Vice-Dean for Science at the Faculty of Chemistry, University of Gdańsk, and since 2025 she has chaired the Gdańsk Branch of the Polish Chemical Society. She is also a member of expert panels evaluating scientific projects and fellowships for leading national institutions.

Dr. Habil. Aleksandra Rutkowska Ph.D.

Group Leader at the Department of Anatomy and Neurobiology

Title of presentation:

Immune Modulation and Lipid Synthesis: Dual Actions of a Fluorinated Oxysterol in Neurorepair

Highlights:

- **7α,25-OHC–EBI2 signaling regulates immune responses and myelination.**
- **CF_3-7α,25-OHC, a biostable analogue (half-life 10–12 h vs ~30 min for natural ligand), was developed for in vivo studies.**
- **Daily administration for two weeks in the cuprizone model accelerated remyelination in the cuprizone model of MS, upregulated lipids in the brain, and reduced lymphocyte counts in blood and brain.**
- **Ongoing work distinguishes EBI2 vs LXR contributions to these effects.**
- **Dual-action therapeutic potential: immunomodulation + pro-myelination via distinc EBI2 and LXR pathways.**

Her research team focuses on elucidating the cellular and molecular underpinnings of demyelinating, neuroinflammatory, and neurodegenerative diseases, with a particular focus on multiple sclerosis, aiming to identify novel strategies for remyelination and neuroprotection. Her work spans patient-derived immune cell studies, advanced in vitro models, and in vivo experiments, with a particular interest in oxysterol signaling and its therapeutic potential in multiple sclerosis. She is exploring how modulation of the EBI2/oxysterol pathway can influence immune cell trafficking, lipid metabolism in the brain, and repair mechanisms in neurodegenerative disease.

Prof. Paweł Sachadyn M.Sc., Ph.D.

Completed his Ph.D. dissertation at the Faculty of Chemistry of the Gdańsk University of Technology in 2000

Title of presentation:

Epigenetic engineering of regeneration

Highlights:

- **Each cell of the body contains complete information on the tissue structures and functions, available from conception throughout its entire life.**
- **Foetuses and neonates display impressive regenerative capabilities that decline in adults.**
- **Genome-wide methylome and transcriptome profiling point to the epigenetic mechanism underlying the loss of regenerative capabilities in adults.**
- **Epigenetic inhibitors can transiently reverse the developmental repression of regenerative genes, while regulatory molecules can enhance the activity of the derepressed genes.**
- **The concept of epigenetic pharmacological therapy presented here involves combining epigenetic inhibitors and regulators of gene expression to induce regenerative response in vivo**
- **The concept was successfully applied to promote the ear pinna regeneration in mice using a DNA demethylating agent, zebularine and retinoic acid as a transcriptional activator.**
- **Further development of this approach, termed epigenetic engineering, will involve the coordinated use of epigenetic inhibitors and regulatory molecules to induce and coordinate the regeneration process.**

Dr. Sachadyn conducted research in molecular biotechnology and molecular diagnostics, concentrated on the application of the MutS protein to analyse mutations and pre-mutational changes in DNA. From 2005 to 2008, as a fellow of the Foundation for Polish Science, he conducted studies on mammalian regeneration in the Wistar Institute in Philadelphia. In the following years, Dr. Sachadyn developed his research on the molecular basis of mammalian regeneration, focusing on its epigenetic aspects and the role of the nervous system.

In 2015, Dr. Sachadyn initiated the Laboratory for Regenerative Biotechnology at the Gdańsk University of Technology. The Laboratory aims to delineate novel regenerative medicine strategies based on the pharmacological activation of endogenous regenerative potential using innovative epigenetic therapies.

Prof. Ken Suzuki, M.D., Ph.D.

Physician-scientist in cardiac surgery. Following his 10-year clinical training with PhD study on myocardial gene therapy in Osaka University, Japan, he was recruited to the Harefield Heart Science Centre, National Heart and Lung Institute, Imperial College London, UK in 1998.

Title of presentation:

Mesenchymal stem cell therapy for myocardial repair

Highlights:

- **Myocardial tissue repair by stem cell transplantation.**
- **Different sources for mesenchymal stem cells.**
- **Epicardial placement as a highly effective cell delivery route to the heart.**
- **The secondary paracrine effect through local reparative macrophages.**

In this distinguished Centre headed by Professor Sir Magdi Yacoub, Suzuki completed a series of research projects on stem cell therapy and gene therapy for heart diseases, in parallel to his surgical training. Subsequently, he took up the Chair of a research group within the William Harvey Research Institute, Faculty of Medicine and Dentistry, Queen Mary University of London, UK in 2007. Here, he continues to expand his basic and translational research to develop innovative therapies for heart failure, with a particular focus on cell-based therapy for myocardial repair and regeneration.

Programme

MedReg — Regenerative Medicine of the Future
September 23, 2025 Gdańsk

**Venue: Medical University of Gdańsk, University Clinical Centre,
Mariana Smoluchowskiego 17, 80-214 Gdańsk
(CMI building, Prof. Zdzisław Kieturakis Auditorium),
https://maps.app.goo.gl/THScNLaxSvMi2tYw9**

8:45–9:00	**Arrival & Registration**
9:00–10:30	**Panel 1 (stem cells and epigenetic regeneration)** Prof. Michał Pikuła (Medical University of Gdańsk) Prof. Susanna Miettinen (Tampere University – Finland) Prof. Paweł Sachadyn (Gdańsk University of Technology)
10:30–10:50	**Coffee Break**
10:50–12:30	**Panel 2 (biomaterials and regeneration)** Prof. Sylwia Rodziewicz-Motowidło (University of Gdańsk) Katarzyna Gurzawska-Comis, Ph.D. (Aarhus University, University of Liverpool) Prof. Ken Suzuki (Queen Mary University of London)
12:30–13:30	**Lunch**
13:30–16:10	**Panel 3 (orthopedic and muscles, nervous system regeneration)** Prof. Maria Anna Ciemerych-Litwinienko (University of Warsaw) Prof. Edyta Brzóska-Wójtowicz (University of Warsaw) dr hab. Aleksandra Rutkowska (Medical University of Gdańsk)
16:10–16:30	**Coffee Break**

EVALUATING ADRB2/ADRB3 VARIANTS IN RELATION TO VO_2MAX AND CARDIO–HEMATOLOGICAL MARKERS IN AN ACTIVE POLISH POPULATION

Bıçakçı B., Cięszczyk P., Michałowska-Sawczyn M., Humińska-Lisowska K.

Affiliations
Faculty of Physical Education, Gdańsk University of Physical Education and Sport, Gdańsk, Poland

Introduction

β-adrenergic receptors (βARs) modulate cardiac contractility, vascular tone, and adipose thermogenesis-processes central to exercise response. We examined whether ADRB2 rs1042713 and ADRB3 rs4994 relate to aerobic capacity and cardio-haematological markers, and whether these associations persist across fitness categories.

Materials and methods

1000 adults underwent anthropometry, graded cycling with VO_2max, Wingate testing, and fasting blood tests (morphology, lipids, iron). DNA was extracted from buccal swabs and genotyped by TaqMan assays. Continuous traits were compared across genotypes (Kruskal–Wallis; χ^2 for categorical). Fitness status contrasted High Fitness (HF; very good/outstanding, n = 311) versus Low Fitness (LF; very poor/poor/satisfactory, n=190). Logistic models tested genotype associations with HF vs LF.

Description

VO_2max stratification reproduced the expected HF phenotype: higher VO_2max, healthier lipids, lower WBC, smaller body size, and haematological shifts. ADRB2 rs1042713 AA carriers showed higher unadjusted VO_2max, HRmax, and Wingate indices versus AG/GG, but these did not persist in HF–LF models. ADRB3 rs4994 A/G appeared enriched in HF under dominant/overdominant models (OR≈1.7), yet this attenuated with age adjustment; G/G was extremely rare. Overall, effects of both loci were small and context-dependent, easily masked by covariates and the polygenic nature of endurance.

Conclusions

Objective VO_2max stratification (vs self-declared athlete/control) revealed no robust genotype-fitness associations, indicating that βAR variants likely exert small, context-dependent effects in non-elite adults. Current evidence does not support clinical stratification by ADRB2/ADRB3 alone. Larger, harmonized studies including haplotype and interaction analyses, with covariate-adjusted continuous endpoints, are needed to evaluate potential utility for precision exercise-as-medicine.

Funding
Commissioned research service (ZUB1/2020) "1000 Genomes – genetic basis of physical activity, sport level and human well-being project." Co-funded by the state budget, granted by the Minister of Education and Science under "Science for Society II" (NdS-II/SP/0503/2024/01).

MODULATION OF ADIPOSE-DERIVED MESENCHYMAL STEM CELL PROLIFERATION BY RECOMBINANT TGF-BETA1 AND SYNTHETIC TGF-BETA PEPTIDES

Czerwiec K.[1], Dzierżyńska M.[2], Deptuła M.[3], Skoniecka A.[3], Tymińska A.[3], Zieliński J.[4], Kondej K.[5], Rodziewicz-Motowidło S.[2], Pikuła M.[3]

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[5] Division of Plastic Surgery, Medical University of Gdańsk, Gdańsk, Poland

Background

Transforming growth factor beta is the prototypical member of the growth and differentiation factor family, encoded by 33 genes in mammals and containing homodimers and heterodimers1. TGF-beta plays a crucial role in early embryonic development and also essential for maintaining tissue homeostasis in adults, while also performing important regulatory functions in every organ of the body2 Dysregulation of TGF beta signalling is implicated in numerous pathologies, including cancer, fibrosis, Duchenne muscular dystrophy3. TGF-beta signaling plays a pleiotropic role in various biological processes, including cell growth and differentiation, development, apoptosis, cancer, fibrosis, and immunity4.

Aim

The aim of the study was to evaluate the effect of the TGF-beta peptide designed based on structure of the ligand-receptor complex and the commercial TGF-beta1 protein on the proliferation of mesenchymal stromal stem cells obtained from adipose tissue (AD-MSCs).

Methods

AD-MSCs were isolated from adipose tissue (constituted medical waste) from patients undergoing surgical procedures at the Department and Clinic of Surgical Oncology, Medical University of Gdańsk, and at the Department and Clinic of Plastic Surgery, Medical University of Gdańsk. AD-MSCs were isolated using mechanical and enzymatic methods. To assess the proliferation of AD-MSCs stimulated with peptides and TGF-beta1 protein were administered using the XTT assay. AD-MSCs without peptide/protein stimulation in DMEM LG medium were used as a negative control.

Results

Both TGF-beta peptide and protein modulated the proliferation of AD-MSCs, but their effects were not identical. The observed differences point to distinct modes of action and raise intriguing questions about the biological potential of the peptide. These findings suggest that although both forms are biologically active, their potency and efficiency in regulating proliferation differ.

Conclusions

Our findings demonstrate that both TGF-β peptides and recombinant protein regulate AD-MSC proliferation though with varying efficacy. These results underscore the potential of peptide-based modulators in regenerative medicine applications

Funding

This work was supported by the National Science Centre—Poland [grant number 2024/08/X/NZ3/01386 granted to KC] and the National Centre for Research and Development grant: TECHMATSTRATEG2/410747/11/2019, acronym BIONANOVA).

THE ACTIVITY OF PLATELET DERIVED GROWTH FACTOR AND ITS PEPTIDE DERIVATIVE ON SKIN FIBROBLASTS FROM HEALTHY DONORS AND PATIENTS WITH LIMB ULCERS – PRELIMINARY RESULTS

Deptuła M.[1], Zawrzykraj M.[2], Karpowicz P.[3], Brzeziński J.[4], Halman J.[4], Wojciechowski J.[4], Zieliński J.[5], Kondej K.[6], Rodziewicz-Motowidło S.[3], Pikuła M.[1]

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Wound healing can be impaired by various factors, leading to chronic, non-healing wounds such as diabetic or ischemic lower limb ulcers, which may ultimately require amputation. Platelet-derived growth factor (PDGF-BB) is a strong stimulant of wound repair, acting as a mitogen for endothelial cells, fibroblasts, and keratinocytes. PDGF2, its peptide derivative, in our previous experiments has demonstrated pro-regenerative potential and favorable safety in animal and in vitro studies.

Skin samples were obtained from one healthy donor and two patients with ulcers (one diabetic, one non-diabetic/ischemic). Fibroblasts were isolated, cultured, and stimulated with PDGF2 or PDGF-BB. Proliferation was measured with EDU and XTT assays, while collagen synthesis, chemotaxis, and migration were also evaluated.

Results indicated that fibroblasts from the ischemic wound donor exhibited the weakest response. Migration did not increase after PDGF2 stimulation, and PDGF-BB had a weaker effect compared with cells from healthy and diabetic donors. These fibroblasts also showed the lowest proliferative capacity, although PDGF-BB at 10 ng/ml significantly improved proliferation. PDGF2 induced the strongest promigratory response in fibroblasts from a healthy donor, whereas PDGF-BB had the greatest effect on diabetic donor cells.

These findings highlight distinct cellular responses to PDGF-BB and PDGF2 depending on the origin of fibroblasts. Both compounds demonstrated regenerative potential, suggesting their future application in cell preconditioning strategies aimed at enhancing wound healing and reducing the risk of chronic ulcer-related complications.

Funding
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TUNING MYELIN REPAIR: EBI2 AND LXR AS LIPID SENSORS IN THE CNS

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7α,25-dihydroxycholesterol (7α,25OHC) is an oxysterol that activates Epstein Barr virus-induced gene 2 (EBI2) and Liver X Receptors (LXRs). Through EBI2, it regulates immune cell positioning and responses, glial function and (re)myelination. EBI2 is highly expressed in B and T cells, microglia, astrocytes, and oligodendrocytes. In CNS, EBI2 is transiently upregulated during oligodendrocyte maturation, and 7α,25OHC regulates OPC migration. EBI2 deficiency or blockade impairs remyelination, while the synthetic analogue CF3-7α,25OHC enhances remyelination, upregulates EBI2 expression, and supports lipid synthesis. LXRs, also via oxysterols, regulate cholesterol metabolism and inflammation. In CNS, LXR activation enhances myelin gene expression, promotes oligodendrocyte maturation, and supports remyelination. LXRβ loss disrupts myelin integrity and exacerbates demyelination in autoimmune encephalomyelitis models. This study aims to delineate immunoregulatory functions of 7α,25OHC in CNS – likely EBI2 mediated – from its roles in lipid regulation and (re)myelination, likely LXR mediated. Microglia and OPCs from wild-type and EBI2 knockout mice are treated with demyelinating and pro-inflammatory stimuli, 7α,25OHC (EBI2 and LXR agonist), GSK (LXR antagonist) and NIBR189 (EBI2 antagonist). Differentiation, maturation, demyelination and inflammatory responses are assessed; lipid synthesis and (re)myelination are evaluated in organotypic cerebellar slice cultures. Cholesterol phagocytosis is also examined. Preliminary results show that LXR provides a tonic "go" signal, while EBI2 remains largely inactive. Oxysterol alone engages LXR (primarily) and EBI2 (secondarily) to reduce phagocytosis. In wild-type microglia, EBI2 alone maintains ~90% of baseline uptake; in knockout cells, the uptake is minimal. Thus, microglia use LXR and EBI2 to fine-tune cholesterol clearance, balancing debris removal and preventing excessive engulfment.

TOWARDS REGENERATION, NOT ONLY RECONSTRUCTION: THE ROLE OF PLATELET-DERIVED BIOMATERIALS IN URETHRAL SURGERY

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Introduction

Urethral stricture disease remains a major challenge in reconstructive urology, with recurrence often driven by graft ischemia and fibrosis. While buccal mucosa graft urethroplasty is the gold standard, outcomes are limited by biological barriers. Regenerative approaches using platelet-derived products have been proposed to enhance outcomes by stimulating angiogenesis, modulating fibrosis, and improving tissue integration.

Materials and methods

A narrative review of PubMed (2010–2025) was performed, focusing on the potential applications of platelet-rich plasma (PRP) and platelet-rich fibrin (PRF) in urethral surgery. Clinical and experimental reports were analyzed and complemented by conceptual extrapolation from other surgical fields.

Description

PRP has shown signals of benefit in reducing short-term recurrence after internal urethrotomy, but evidence in urethroplasty is lacking. PRF membranes, with their sustained growth factor release, have been applied as biologic dressings in pediatric hypospadias repair, suggesting possible reduction in fistula and stricture recurrence rates. Other proposed roles – such as PRF underlay for spongiosum support, suture-line sealant, graft preconditioning, or as carriers for cells and drugs – are largely theoretical and require validation. Mechanistic insights from corpus spongiosum proteomics and organoid models provide biological plausibility but remain far from clinical translation.

Conclusions

Regenerative medicine can support reconstructive urology by directly improving how tissues heal. Most accessible information on PRP and PRF in urethral reconstruction is still theoretical or based on small pilot studies. Well-designed preclinical research and multicenter clinical trials are urgently needed to establish safety, efficacy, and standardized protocols before regenerative adjuncts can be integrated into routine urethral surgery.

NEW-GENERATION ANTIMICROBIAL THERAPEUTICS: PEPTIDE FIBRIL-BASED NANOCONJUGATES FOR ENHANCED STABILITY AND WOUND HEALING

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Antimicrobial resistance (AMR) is a significant and growing problem that poses a serious threat to global health. According to the World Health Organization (WHO), it is one of the top health concerns worldwide, making bacterial infections harder to treat and leading to prolonged hospital stays, higher medical costs, and increased mortality. The problem is particularly severe in cases where the body's natural barrier against bacteria, i.e. the skin, is damaged or interrupted. While minor wounds can be treated with disinfectants, the challenge becomes far greater in cases involving surgical wounds, diabetic ulcers, or skin conditions such as atopic dermatitis. The presence of bacteria in such wounds often leads to chronic conditions, making them difficult to heal, promoting inflammation, and increasing the chances of complications and even death. This is why overcoming the barrier of drug resistance is critical – it's necessary to „outsmart" resistant bacteria and find new therapeutics that can replace traditional antibiotics. The question is: is it possible? Our approach involves developing a novel nanoconjugates that combine an antimicrobial peptide with a self-assembling peptide nanocarrier. By combining the AMPs with a peptide nanofibril, we want to create a nanoconjugate with higher stability and lower toxicity, without compromising its antimicrobial properties. A new nanomaterial may be more attractive for certain applications, particularly in antimicrobial treatment and wound healing.

FUNCTIONAL CHARACTERIZATION OF THE ENDOTHELIAL CELL MITOCHONDRIA IN HERITABLE THORACIC AORTIC DISEASE (HTAD)

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Introduction

Loeys-Dietz syndrome (LDS) is a rare autosomal dominant connective tissue disorder caused by pathogenic variants in genes encoding components of the transforming growth factor-β (TGF-β) signaling pathway. This condition may be characterized by vascular manifestations, including aneurysm formation and aortic dissection. In addition to fibroblast dysfunction, LDS has been associated with impaired vascular endothelial cell homeostasis and alterations in mitochondrial bioenergetics.

Objective

The present study aimed to isolate and culture human aortic endothelial cells from a patient with genetically confirmed LDS and to investigate the effects of sodium-glucose cotransporter-2 inhibitors (SGLT2i-flozins) on mitochondrial function and cellular energy metabolism.

Methods

Endothelial cells were obtained from a fragment of aortic tissue excised from a 34-year-old male patient with LDS, carrying a pathogenic SMAD3 mutation. Endothelial cells were isolated using magnetic microbeads conjugated with anti-CD31 and expanded in specialized culture medium until 80% confluence. Mitochondrial function was assessed in passage 1 using the Seahorse XFp metabolic analyser following 24-hour in vitro exposure to SGLT2i (dapagliflozin or empagliflozin).

Results

Both dapagliflozin and empagliflozin exerted a favorable impact on mitochondrial bioenergetics. Notably, improvements were observed in basal respiration and mitochondrial-dependent adenosine triphosphate production.

Conclusions

This study demonstrates the successful isolation and expansion of primary aortic endothelial cells from an LDS patient and provides that SGLT2 inhibitors can enhance mitochondrial oxidative phosphorylation in this cellular model. These findings suggest a potential role for flozins in modulating endothelial bioenergetics in LDS.

THE IMPACT OF OMEGA-3 FATTY ACIDS ON SKELETAL MUSCLE REGENERATION

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Introduction

Omega-3 polyunsaturated fatty acids (n-3 PUFAs): eicosapentaenoic acid (EPA) and docosahexaenoic (DHA) are found in oily marine fish: mackerel, herring, salmon, sardines and selected species of algae, e.g. Schizochytrium sp. Those essential fatty acids, which should be derivated with food, demonstrate beneficial role in various therapeutic areas, including skeletal muscle regeneration.

Materials and methods

The research of science papers publicated between the first of January 2005 and the first of September 2025 on PubMed and Scholar database. The words use for searching: „EPA", „DHA", „n-3 PUFA", „regeneration", „muscle regeneration" and its combinated. Review articles, studies on humans and cell lines (human and animal) were included.

Description

N-3 PUFA such as EPA and DHA exhibit proregenerative capabilities on humans skeletal muscles in many ways. EPA and DHA are substrates in the production of specialized proresolving mediators (SPMs): resolvins, protectins and maresins with potent antiinflammatory and proresolving properties. N-3 PUFAs may activate satellite cells in muscle tissue and stimulate rates of muscle protein synthesis (MPS). Potential effect on muscle regeneration involves also a change in cell membrane fluidity, which promotes the fusion of myoblasts during myotube formation. The effect of n-3 PUFAs on muscle regeneration is particularly studied in sports, in studies involving supplementation: during recovery after intense exercise and in cases of mechanical muscle damage.

Conclusions

EPA and DHA influence muscle recovery through multiple mechanisms. However, further research is needed to understand some of these processes.

INTEGRATED BIOINFORMATIC ANALYSIS IDENTIFIES SRI, SMC2, PSIP1, TLE4, AND MSX1 AS POTENTIAL DIAGNOSTIC AND THERAPEUTIC BIOMARKERS IN OSTEOARTHRITIS

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Introduction

Osteoarthritis (OA) is the most prevalent degenerative joint disorder, causing chronic pain and functional impairment. OA is defined by progressive cartilage degradation and synovial hyperplasia in diarthrodial joints, most commonly the hip and knee. Stem cell–based regenerative therapies have recently emerged as promising strategies for disease modification. While magnetic resonance imaging (MRI) can track structural changes, reliable molecular biomarkers of joint regeneration remain limited for both diagnostic and in vitro applications.

Materials and methods

Transcriptomic data from articular cartilage (chondrocytes) and synovium of OA patients were retrieved from the Gene Expression Omnibus (datasets: GSE179716, GSE206848, GSE239343, GSE48556). Bioinformatic analyses were conducted using GEO2R, FunRich, C-Big, The Human Protein Atlas, STRING, Orange data mining, JASP, Gene Ontology, and Reactome platforms.

Description

Comparative analyses revealed differential regulation of aurora A and B signaling in OA chondrocytes and synovium. Despite these differences, major biological pathways were consistently enriched. Key genes identified as potential molecular biomarkers of OA progression and mesenchymal stem cell–mediated regeneration included SRI, SMC2, PSIP1, TLE4, and MSX1. Furthermore, in peripheral blood mononuclear cells (PBMCs) from OA patients, PSIP1 exhibited reduced expression, while TLE4 was upregulated at the mRNA level.

Conclusions

Gene expression profiling suggests that specific mRNA signatures may serve as indicators of OA progression in vitro. Notably, the PSIP1:TLE4 mRNA ratio in PBMCs may provide a clinically accessible biomarker for monitoring OA progression.

BIOACTIVE PEPTIDES AND THEIR CHITOSAN COMPOSITES AS INNOVATIVE MATERIALS FOR BONE TISSUE REGENERATION

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Introduction

Bone diseases, including osteoporosis and osteoarthritis, represent a major global health challenge, particularly among individuals over 50 years of age, where they account for nearly half of all chronic conditions. Although bone tissue possesses an intrinsic capacity for remodelling, in cases of pathological fractures or large defects regeneration is often insufficient. This process is further hindered by systemic diseases, infections, and poor vascularization. While autologous bone grafts remain the clinical "gold standard," their application is limited, highlighting the urgent need for novel bioactive materials to support bone regeneration.

Materials and methods

Three types of chitosan conjugates were developed: (i) chitosan covalently conjugated with peptide ug4, (ii) a physical mixture of chitosan with free peptide ug51, and (iii) chitosan with peptide fibrils ug52. The peptides contained sequences recognized by MMP-7, enabling enzymatically triggered, site-specific release of the active sequence. These conjugates were used to fabricate chitosan-bioglass composite discs. The materials underwent physicochemical characterization (HPLC, spectroscopy, SEM) and biological evaluation (cytotoxicity and osteoblast proliferation).

Description

Selected composites were subjected to preclinical implantation tests, which confirmed their safety and favorable tissue response, including the absence of acute toxicity and appropriate local bone reaction.

Conclusions

The developed composites represent an innovative biomaterial platform, enabling controlled presentation of bioactive sequences and creating an environment conducive to bone regeneration. The results confirm their potential as next-generation implantable materials for the treatment of bone defects. This research contributes to the advancement of interdisciplinary strategies in regenerative medicine, offering novel solutions for bone tissue engineering.

COMPARATIVE EVALUATION OF ULTRACENTRIFUGATION AND SIZE-EXCLUSION CHROMATOGRAPHY METHODS FOR THE ISOLATION OF PLASMA SMALL EXTRACELLULAR VESICLES IN RATS

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Introduction

Small extracellular vesicles (sEVs) are lipid-bilayer nanoparticles that carry proteins, nucleic acids, and metabolites, mediating intercellular communication under physiological and pathological conditions. Their role in homeostasis, disease, and regeneration has been increasingly recognized, making them promising biomarkers and therapeutic tools. Importantly, physical exercise is one of the potent stimuli for the release of circulating sEVs. The aim of this study was to optimize the method of sEVs isolation from rat plasma.

Materials and methods

Blood was collected from adult male Sprague-Dawley rats, including sedentary (n = 4) and trained (4 weeks of 30-min treadmill sessions, n = 10) animals. Two methods were compared: ultracentrifugation (UC), regarded as the gold standard, and size-exclusion chromatography (SEC). Isolated vesicles were characterized using nanoparticle tracking analysis (NTA), transmission electron microscopy (TEM), and Western blotting (WB).

Description

Both methods successfully isolated sEVs from as little as 500 µl of plasma. SEC fractions 4–6 were particularly promising, showing a relatively uniform size distribution confirmed by NTA and higher purity compared with UC, while maintaining similar vesicle yield. TEM confirmed vesicle morphology, and WB verified the presence of sEV markers (CD9, TSG101). Marker abundance increased in later SEC fractions, but this coincided with rising lipoprotein contamination (ApoA1).

Conclusions

SEC proved to be a more optimal approach, with selected fractions showing higher purity compared with UC. This method may serve as a valuable tool for studies investigating the role of sEVs in systemic adaptations to exercise, muscle regeneration, and various disease conditions.

Funding

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IS THERE ANY DIFFERENCE BETWEEN PRIMARY AND SECONDARY OSTEOBLASTS IN THEIR RESPONSE TO PROINFLAMMATORY LIPOPOLYSACCHARIDE?

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Introduction

Primary and secondary cell models vary in origin and feature so their response to proinflammatory factors including lipopolysaccharide (LPS) may be different.

The aim of the study was to verify the hypothesis that proinflammatory LPS may inhibit osteoblast metabolism and function and to compare the effect of LPS in primary and secondary osteoblast.

Materials and methods

Primary osteoblasts (pOB), isolated from the human bones and on the immortalized hFOB 1.19 cell line, derived from human fetal osteoblasts were used.

Osteoblasts were cultured with LPS (1-200µg/mL) for 48 hours. The effect of LPS on cell metabolism and survival was analyzed spectrophotometrically. The activity of alkaline phosphatase (ALP), succinate dehydrogenase (SDH) and lactate dehydrogenase (LDH) was measured.

Description

In pOB, LPS significantly inhibited the activity of ALP, SDH at concentrations of 25–200 µg/mL, while in hFOB LPS decreased ALP activities at lower LPS concentrations (5 µg/mL). Next, LPS at a concentration of 25–200 µg/mL inhibited the activity SDH in pOB, whereas in hFOB the effect of LPS was observed in concentration starting from 5 µg/mL. LPS (5–200 µg/mL) inhibited LDH activity in both types of cells and at the same time increased the release of LDH into the extracellular space.

Conclusions

LPS reduced metabolism and all cell survival, both pOB and hFOB. The fact that hFOB were more sensitive to the inhibitory effects of LPS suggests the need to choose differentiated cell model in vitro studies on the bone regeneration.

Founding

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THE EFFECTS OF SGLT2 INHIBITORS ON THE MICROVASCULAR FUNCTION IN PATIENTS WITH HEART FAILURE

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Introduction

Heart failure (HF) usually results from conditions like coronary artery disease or microvascular dysfunction. Sodium-glucose cotransporter 2 inhibitors (SGLT2i) provide cardiovascular benefits in HF patients regardless of ejection fraction and type 2 diabetes, but their effect on microvascular function is not fully elucidated.

This study aims to investigate the effects of SGLT2i on microvascular function in HF patients.

Materials and methods

The evaluation of microvascular function was performed using the flow-mediated skin fluorescence (FMSF) technique before and after one and three months of adding SGLT2i (dapagliflozin or empagliflozin at a dose of 10mg/day) in twenty-one outpatients with HF. Microvascular function was assessed using flow-mediated skin fluorescence (FMSF). The method analyzes the dynamic changes in cutaneous fluorescence intensity of reduced nicotinamide adenine dinucleotide (NADH) emitted from the skin in response to post-occlusive reactive hyperemia. In addition, FMSF provides information on mitochondrial metabolic status, microvascular function and intracellular oxygen delivery through the circulatory system.

Description

One of the FMSF parameters, Normoxia Oscillatory Index (NOI), showed significant improvement after one and three months of SGLT2i therapy versus the study before the drug was introduced (examination before SGLT2i therapy NOI = 71.37 ± 22.3, examination after three months of SGLT2i therapy NOI = 73.33 ± 28.1).The NOI parameter reflects microcirculatory oscillations at baseline conditions and its increase indicates improvement of microcirculatory function.

Other parameters related to ischemic and hyperemic responses did not show a statistically significant increase. This may be due to the short duration of treatment, which will be extended in subsequent studies.

Conclusions

FMSF can serve as a valuable tool for monitoring improvements in microvascular function during SGLT2i therapy. These findings may support guiding patient management and advancing endothelium-targeted strategies in HF treatment.

Founding

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PDGF- AND VEGF-DERIVED PEPTIDES AS PROMISING TOOLS FOR REGENERATIVE MEDICINE

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Chronic wounds affect millions of patients worldwide, particularly those with diabetes and cancer, resulting in impaired quality of life, frequent infections, and high healthcare costs. One promising therapeutic approach is the use of growth factors, which under physiological conditions regulate cell proliferation, migration, and angiogenesis. Among them, platelet-derived growth factor (PDGF) and vascular endothelial growth factor (VEGF) are of special interest, as their high structural homology within receptor-binding domains results not only in similar biological functions but also in partial cross-reactivity[1]. Previous studies have demonstrated that regenerative properties are not limited to full-length dimeric proteins but can also be retained by short peptides derived from receptor-binding loop sequences. Such peptides represent an attractive alternative to full-length proteins, enabling the design of stable and selective therapeutic compounds[2].

The aim of this study was to synthesize, characterize, and evaluate the biological activity of peptides based on the L1 and L3 loop sequences of human VEGF (isoforms A–D) and PDGF (A–D). Peptides were synthesized and purified using standard MW-SPPS protocols, and their biological activity was assessed through a combination of cell-based assays, receptor-binding studies, and structural analyses. Their cytotoxicity and proliferative effects were assessed in keratinocyte and fibroblast cell lines. Although the cross-reactive activity of full-length VEGF and PDGF proteins is well documented, their peptide-derived analogs have not been systematically investigated in this context. To address this gap, we examined the binding potential of loop-derived peptides to VEGFR1/2 and PDGFRα/β receptors using a modified ELISA assay. Structural features and potential receptor interactions were further analyzed by circular dichroism spectroscopy. The results revealed that L1-derived peptides strongly promoted keratinocyte proliferation, whereas L3-based sequences exhibited higher receptor-binding affinity. Selected PDGF- and VEGF-derived peptides showed particularly interesting activity profiles, displaying both strong pro-regenerative effects and broad receptor-binding capability.

These findings suggest that short peptides inspired by VEGF and PDGF sequences may serve as modulators of cell proliferation and receptor activity. Future studies will focus on elucidating their mechanisms of action using biochemical methods, including western blotting, to determine downstream signaling pathways. Our results provide a basis for the development of peptide-based therapeutics and bioactive materials, offering a promising avenue for advancing current strategies in chronic wound management.

Founding

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IMMUNOMODULATORY AND ANTIBACTERIAL ACTIVITIES OF USNIC ACID: POTENTIAL APPLICATIONS IN WOUND HEALING

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Introduction

Usnic acid (UA), a secondary metabolite derived from lichens, has attracted considerable attention due to its diverse biological activities. The aim of this study was to examine the impact of UA on the production of pro-inflammatory (IL-1β, IL-6, TNF-α) and anti-inflammatory (IL-10) cytokines, as well as the effect of this metabolite on pathogenic bacteria, including MRSA strains.

Materials and methods

Peripheral blood mononuclear cells (PBMCs) were isolated from four healthy donors. The cytotoxicity of PBMCs after 24-hour exposure to UA was assessed by the trypan blue exclusion assay. PBMCs were pretreated with 2.5 μg/mL UA and then stimulated with LPS and levels of IL-1β, IL-6, TNF-α, and IL-10 were measured in culture supernatants using ELISA. The antibacterial activity of UA was evaluated by determining the minimum inhibitory concentration (MIC).

Results

UA decreased the levels of the pro-inflammatory cytokines IL-1β and TNF-α, but not IL-6, while the anti-inflammatory cytokine IL-10 was increased after 24-hour exposure. Moreover, UA effectively inhibited the growth of Gram-positive bacteria, including mupirocin-resistant Staphylococcus aureus.

Conclusions

UA exhibited both immunomodulatory and antibacterial properties, indicating its potential as a dual-action therapeutic agent. These findings suggest that UA may serve as a promising natural compound for the management of infectious and inflammatory diseases, including wound-healing applications.

MOLYBDENUM(VI) COORDINATION COMPOUNDS AS PROSPECTIVE AGENTS PROTECTING NEURAL CELLS FROM THE OXIDATIVE INJURY

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Introduction

Use of coordinative compounds of metals allows to change significantly these metals pharmacodynamics. Among coordinative compounds there are cytoprotective agents, and molybdenum complexes bearing less risk of toxicity are promising in this field. Screening studies have shown the protective activity for the certain compounds within the previously synthetized molybdenum complexes.

Materials and methods

The choice of the studied compounds was based on the data of the preliminary screening. HT-22 and SH-SY5Ycells were used, and cellular injury was induced by hydrogen peroxide or glutamate.

Description

The results allowed to identify the most active compound protecting the cells from hydrogen peroxide-induced injury in HT-22 cells. The range of the active concentrations and the temporal characteristics of the effect were also studied as well as the effect modulation by the different level of glucose in the medium. The safety of compounds was analysed. Further search was aimed at the verification of the protective effect in the other cell line and for identification of the possible mechanism of the cytoprotective activity, among which the influence on the oxidative stress is of great importance.

Conclusions

The results indicate cytoprotective activity of the certain molybdenum(VI) coordination compounds. According the data in the literature, among such complexes there are "superoxide dismutase/catalase biomimetic compounds," able not only to mitigate oxidative stress, but even to prolong the life span. Molybdenum complexes also can target β-amyloid formation or arrangement as well as realize the effects associated with xanthine oxidase and sulfite oxidase activity changes.

PRF ENRICHED WITH PECTINS AS A NEW BIOMATERIAL SUPPORTING BONE REGENERATION

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Introduction

Medicationrelated osteonecrosis of the jaw (MRONJ) represents a growing clinical challenge requiring effective therapeutic strategies. MRONJ is a side effect of bisphosphonates used for cancer treatment to prevent skeletal metastases, that leads to progressive jawbone destruction, accompanied by chronic pain, recurrent infections, and impaired oral function. Autologous plateletrich fibrin (PRF) membranes were proposed to prevent MRONJ as it supports soft tissue regeneration after tooth removal. However there is a reduce evidence if PRF can stimulate bone regeneration. Therefore the aim of this study is to functionalized PRF with plant-derived nanoparticles, pectins with osteogenic properties to enhance bone repair.

Methods

We used plantderived pectins isolated from potato, specifically unmodified Rhamnogalacturonan-I (RG-I), called PU. PU was incorporated in PRF, that was obtained from patient blood in multiple steps using standard preparation protocol with different blood collection tubes. The functionalised PRF with PU was tested in vitro using human primary osteoblasts. The biological cell response was analysed using real time PCR with selected bone related genes.

Results

Uniform distribution of PU within the PRF membrane was confirmed using a fluorescent labelling (Alexa Fluor 633 nm), visualized with fluorescence and confocal microscopy. Confocal imaging revealed that PU was internalized by osteoblasts without cytotoxic effects. PU functionalised PRF showed increased bone profile response compare to control PRF without PU.

Conclusions

In conclusion, PRF functionalised with PU shows significant potential as a regenerative therapy for prevention of MRONJ, providing a promising strategy for clinical translation.

Founding

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A NEW CONCEPT OF A URINARY BLADDER WALL SUBSTITUTE MADE OF A MULTILAYER SCAFFOLD ENRICHED WITH A PROANGIOGENIC PEPTIDE

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Introduction

Tissue engineering presents significant opportunities for regenerative medicine, including the construction of a urinary bladder. Despite these advances, clinical translation combining biomaterials with cells to generate substitutes for urinary tract wall remains limited due to challenges such as urine permeability through scaffolds, adhesion formation at implantation sites, and the difficulty of reproducing the bladder's complex structure and physiological function in vivo. Our approach aims to develop a universal regenerative bladder scaffold designed to support cell migration, proliferation, angiogenesis, and controlled biodegradation. The construct will integrate essential mechanical properties - elasticity, urine impermeability, and multilayer organization-together with biological features such as vascularization, urothelial cell integration, and protection against Gram-negative bacteria.

Materials and methods

Peptides will be synthesized via solid-phase chemical methods. After confirming their bioactivity, peptides will be conjugated with chitosan through a bifunctional linker derived from the NHS ester of maleimidoglycine, obtained on two steps chemical synthesis.

Description

The proposed design yields a scaffold that functions as a temporary extracellular matrix (ECM), capable of sustaining cell growth and differentiation until host tissue regeneration occurs. The combination of angiogenic peptides, antimicrobial properties, and multilayer mechanical design addresses critical barriers to clinical application - urine impermeability, scaffold biocompatibility, and functional tissue organization.

Conclusions

The proposed regenerative bladder scaffold by combining structural, biological, and antimicrobial properties within a single engineered construct, could enable the development of personalized, functional bladder models for both therapeutic applications and drug testing.

Founding

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NEUROPROTECTIVE STRATEGIES ASSOCIATED WITH THE MODULATION OF URIC ACID METABOLISM AND TRANSPORT

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Introduction

Uric acid remains to be an ambigious metabolite possessing the neuroprotective effect and being the detrimental factor within cardiorenal continuum and metabolic syndrome (in hyperuricemia).

Materials and method

The search of data in the literature was done in order to indentify the possible ways of uric acid metabolism modulation which enable protective effects and are safe.

Description

Among the targets of uric acid neuroprotective effects there are TFEB-related signaling pathways, Nrf2 signaling pathway in the astrocytes, in addition to its well known ability of peroxynitrite scavenging. Given that the increase in uric acid blood level is not feasible, the influence on uric acid compartmentalization within the CNS and other systems seems to be ezpedient. The data on the processes of transport of uric acid into the CNS evidence that such modulation could be realized at the level of choroid plexus, and/or ependymal cells but not at the level of BBB (where efflux is mostly supposed). Regulation of GLUT9-mediated urate transport has shown to be a promising way of neuroprotection. The ambiguity of purine metabolism also lies in the fact that xanthine oxidase inhibitors can favourably influence the brain function, thus the further investigation of such compounds (while avoiding hypouricemia) is feasible. Finally, the problem of uric acid solubility should be considered very carefully in preclinical research since the effects of soluble molecule reverse to detrimental ones in microcrystallization.

Conclusions

Mechanisms, associated with uric acid metabolism modulation, represent challenging albeit promising field for the futther development of neuroprotective strategies.

EVALUATION OF THE EFFECT OF AUTOLOGOUS PLATELET-RICH PLASMA ON STEM CELL ACTIVITY IN VITRO

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Adipose tissue is a very promising material for use in tissue engineering and regenerative medicine. It is a rich source of stem cells and a good experimental model for tissue regeneration research. It has therapeutic potential due to the secretion of growth factors and adipokines that stimulate tissue regeneration. During surgical procedures, it is an important material in the reconstruction or regeneration of other patient tissues.

Transplanted fat fragments do not always fully integrate with the surrounding tissues, contributing to necrosis, necrosis, or apoptosis. Poor blood supply, elevated inflammatory parameters, or infection can contribute to poor healing. Therefore, efforts are being made to maximize the adaptation of the tissue fragment to the filling site by using various substitutes and compounds that facilitate complete healing. In our research, we focused on the effect of platelet-rich plasma (PRP) derived from whole peripheral blood as an autologous medium that enhances the regenerative potential of adipose tissue stem cells in the wound healing process.

Elevated levels of extracellular matrix components such as collagen, as well as increased chemotaxis and high viability of ADMSCs, may be indicators of enhanced therapeutic properties that ensure cell integration with the patient's tissues.

This study has contributed to a better understanding of the use of PRP in autologous adipose tissue transplantation.

Founding

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SCARLESS WOUND HEALING IN FETUSES: MECHANISMS AND THERAPEUTIC POTENTIAL

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Wound healing in fetuses up to around 22nd week of prenatal development is characterized by the ability to regenerate skin without scar formation, in contrast to wound healing in adults. This phenomenon is associated with reduced inflammation, a unique extracellular matrix composition, and different cellular interactions. Understanding the molecular and cellular mechanisms underlying scarless skin regeneration in the fetus may help develop new therapeutic strategies that improve wound healing in adults and minimise fibrosis. This is particularly important for extensive or chronic wounds, where scar formation may impair skin functionality and lead to aesthetic or psychological complications for patients. This study reviews current literature on the roles of cytokines, growth factors, immune mechanisms, epigenetic regulation, and stem cell activity in fetal wound healing. Furthermore, it highlights potential translational approaches aimed at mimicking fetal scarless healing processes for future clinical applications in regenerative medicine.

$SGLT_2$ INHIBITION IMPROVES BIOENERGETIC STATUS IN MICROVASCULAR ENDOTHELIAL CELLS

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Introduction

Heart failure (HF) impairs endothelial function, leading to oxidative stress, inflammation, and disrupted vascular homeostasis. Flozins (SGLT2 inhibitors) improve cardiovascular outcomes in HF patients, independently of diabetes, and may modulate hemodynamics and cellular metabolism. However, their effects on endothelial cell function remain largely unknown.

Materials and methods

Primary endothelial cells (ECs) were isolated from the left ventricular myocardium of human hearts from both healthy donors excluded from use for transplantation surgery (n = 5) and heart failure patients with reduced ejection fraction (HFrEF, n = 5). Mouse cardiac microvascular endothelial cells (H5V) were subjected to 24h treatment with dapagliflozin (DAPA). Endothelial bioenergetics were assessed by measuring mitochondrial respiration and glycolytic parameters using the Seahorse XFp metabolic analyzer. High-performance liquid chromatography (HPLC) was used to determine the concentration of intracellular nucleotides. Nitric oxide (NO) production in live cells was assessed using DAF-FM fluorescence staining.

Furthermore, the influence of DAPA on coronary artery real-time NO production was evaluated in vivo using C57Bl/6J mice.

Description

In vitro, primary cells showed impaired mitochondrial respiration and reduced energy status – lower ATP/ADP ratio (6.4 vs. 5.0). In murine cell cultures, DAPA improved mitochondrial function by modulating ATP/ADP balance and enhancing NO production, while in vivo in coronary arteries, it further promoted NO synthesis.

Conclusions

This study shows that flozins enhance cardiac endothelial metabolism via mitochondrial and NO-dependent pathways, suggesting endothelial energy regulation as a key mechanism in slowing HF progression. These findings may step up the development of endothelial-targeted therapeutic strategies for heart failure treatment.

BREAST CANCER RESPONSES TO DONOR-SPECIFIC AD-MSC SUPERNATANTS: A CASE STUDY

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Breast cancer progression is profoundly influenced by the tumor microenvironment, wherein Adipose-Derived Mesenchymal Stromal Cells (AD-MSCs) constitute a key stromal component due to their secretory activity and anatomical proximity to mammary tissue. In this case study, we examined conditioned media from the AD-MSCs *in vitro* cell culture of two young donors undergoing breast reduction surgery and their effects on breast cancer cell lines (MCF-7, MDA-MB-231, SKBR-3) in 2D and 3D cultures.

In the 2D model, tumor cells and AD-MSCs were cultured in co-culture (tumor cells on a plate and AD-MSCs in inserts). In the 3D model, breast cancer cells formed spheroids that were treated with a medium conditioned by AD-MSCs. We assessed the viability and morphology of spheroids, as well as the viability of 2D cultured cells, both with and without stimulation by AD-MSC supernatant. Patient 1's conditioned medium from AD-MSCs cells increased MCF-7 viability in 2D and promoted MCF-7 organoid growth in 3D, while reducing SKBR-3 organoids. Patient 2's conditioned medium enhanced SKBR-3 viability in 2D but decreased SKBR-3 organoid size in 3D. These donor-specific and model-dependent responses suggest that individual clinical backgrounds may modulate the AD-MSCs secretome and underscore the critical role of 3D culture systems in modeling the breast cancer tumor microenvironment.

Founding

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THE PRO-REGENERATIVE ACTIVITY OF THE EPIGENETIC INHIBITORS ML324 AND GSK126 IN ADIPOSE-DERIVED MESENCHYMAL STROMAL CELLS AND FIBROBLASTS FROM DIABETIC AND HEALTHY PATIENTS

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Diabetes mellitus (DM) is a metabolic disease, classified as a civilization disorder. The progression of the disease affects several organs and can lead to many complications, such as retinopathy, nephropathy, or diabetic foot ulcers (DFU). Chronic wounds, including DFU, are developed in 15-25% of DM patients. Treatment of these wounds requires a personalized, novel approach. We proposed the use of epigenetic modulators as pro-regenerative compounds in wound healing in diabetic patients.

Therefore, we tested the in vitro activity of two epigenetic compounds, ML324 (JMJD2 histone demethylase inhibitor) and GSK126 (inhibitor of EZH2 methyltransferase), using proliferation, migration, cytotoxicity, and senescence tests in fibroblasts and adipose-derived mesenchymal stromal cells (AD-MSCs). Skin and fat tissue samples constituted medical waste. Cells obtained from healthy patients represented a control group, while cells derived from diabetic donors constituted a study group. Cell proliferation and senescence were analyzed with flow cytometry assays. Migration was performed using inserts, and cytotoxicity was assessed using the LDH test. Moreover, cytokine secretion was studied using the Luminex method.

An increase in proliferation was observed in fibroblasts obtained from healthy patients after the application of both epigenetic modulators. ML324 induced a pro-migratory effect in all studied groups. The compounds were non-cytotoxic and had no effect on cellular senescence. Additionally, differential secretory profiles in AD-MSCs and fibroblasts were observed between the control and study groups for IL-6, IL-8, GM-CSF and TNF-α cytokines.

ML324 and GSK126 were shown to stimulate essential wound healing processes, which warrants further exploration of these compounds as potential drug candidates for chronic wound treatment.

Founding

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THE ROLE OF 5-HT$_2$A AND SIGMA-1 RECEPTORS IN PSYCHEDELIC-MEDIATED MYELIN PROTECTION AND REGENERATION

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Introduction

Psychedelics are increasingly studied for their psychoactive properties, yet their direct cellular effects on neuroinflammation and neuroprotection remain poorly understood. These compounds activate serotonin 5-HT$_2$A and/or Sigma-1 receptors, which play key roles in regulating neuronal survival, neuroplasticity and inflammatory signaling pathways. However, their potential involvement in promoting myelination or protecting against inflammation-induced demyelination has not been explored. Similarly, their effects on modulating blood-brain barrier (BBB) under normal and inflammatory conditions have yet to be investigated. This project aims to determine whether psychedelics can protect against demyelination and neuron damage by activating anti-inflammatory signaling via 5-HT$_2$A and Sigma-1 receptors. We will also assess BBB integrity and permeability.

Materials and Methods

Organotypic cerebellar slices were subjected to chemical demyelination and co-treated with 'classic' serotonergic psychedelics including DMT, LSD, 5-MeO-DMT and ketamine, the 'non-classic' psychedelic with glutamatergic activity, either alone or with selective antagonists: ketanserin (5-HT$_2$A receptor antagonist) and BD-1063 (Sigma-1 receptor antagonist). The release of pro-inflammatory cytokines and changes in gene expression were assessed by ELISAs and RT-qPCR. Human tri-cell BBB model was treated with selected psychedelics with or without IL17/TNFα and antagonists. Gene expression (inflammatory transcription factors, BBB components, 5-HT2A and Sigma-1) was assessed by RT-qPCR.

Description

Treatment with psychedelics attenuated pro-inflammatory signaling in our ex vivo and in vitro models. Psychedelics-mediated anti-inflammatory effects were inhibited with receptor antagonists indicating 5-HT$_2$A and Sigma-1 receptors mediated effects.

Conclusions

This project may offer a cellular basis for exploring psychedelics immunomodulatory properties as therapeutic approach in neuroimmune and neurodegenerative disorders.

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