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INTERNATIONAL CONFERENCE ON

TISSUE ENGINEERING AND REGENERATIVE MEDICINE

SEPTEMBER 20-21, 2021

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TERMC 2021

BOOK OF ABSTRACTS

INTERNATIONAL CONFERENCE ON

TISSUE ENGINEERING AND REGENERATIVE MEDICINE

SEPTEMBER 20-21, 2021

Theme:

Advancements in Tissue Engineering and Regenerative Medicine

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About MAGNUS GROUP

Magnus Group (MG) is initiated to meet a need and to pursue collective goals of the scientific community specifically focusing in the field of Sciences, Engineering and technology to endorse exchanging of the ideas & knowledge which facilitate the collaboration between the scientists, academicians and researchers of same field or interdisciplinary research. Magnus group is proficient in organizing conferences, meetings, seminars and workshops with the ingenious and peerless speakers throughout the world providing you and your organization with broad range of networking opportunities to globalize your research and create your own identity. Our conference and workshops can be well titled as 'ocean of knowledge' where you can sail your boat and pick the pearls, leading the way for innovative research and strategies empowering the strength by overwhelming the complications associated with in the respective fields.

Participation from 90 different countries and 1090 different Universities have contributed to the success of our conferences. Our first International Conference was organized on Oncology and Radiology (ICOR) in Dubai, UAE. Our conferences usually run for 2-3 days completely covering Keynote & Oral sessions along with workshops and poster presentations. Our organization runs promptly with dedicated and proficient employees' managing different conferences throughout the world, without compromising service and quality.

About TERMC 2021

Magnus Group stretches out its warm greetings to join us for Online Event "International Conference on Tissue Engineering and Regenerative Medicine" scheduled during September 20-21, 2021. Taking the Covid-19 Pandemic into consideration, TERMC 2021 is scheduled as Online Event. We believe that our decision will allow many more people to participate in the event.

TERMC 2021 will offer an unparalleled vision to get associated with leading Scientists, Academicians, and Specialists & Medical professionals coming from all over the world. It is also an immense platform to present and discuss the most significant advances and concerns in the field of Tissue Engineering and Regenerative Medicine. This two-day Conference will give the chance to promote knowledge exchange and network with a wide audience in the field of Tissue Engineering to share the latest research that will enable the best outcomes. Incredibly famous speakers, the latest advancements, improvements, and the most up to data in Tissue Engineering and Regenerative Medicine are signs of Conference.

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KEYNOTE FORUM

DAY 1

INTERNATIONAL CONFERENCE ON

TISSUE ENGINEERING AND REGENERATIVE MEDICINE

SEP 20-21, 2021

TERMC 2021

Pedro Morouco
ESECS, Polytechnic of Leiria, Leiria, Portugal

Challenges and Innovations in Osteochondral Regeneration

In the last years, the world has been witnessing the progressive increase in the prevalence of debilitating disorders affecting osteochondral tissues, leading to the functional impairment of synovial joints and severe pain [1]. In particular, osteoarthritis (OA) represents a significant health burden in developed and developing countries, mostly due to aging and to the increase of risk factors, including obesity and sedentary lifestyle, along with intervening joint injuries [2,3]. OA is a chronic and etiologically heterogeneous joint disorder, which represents the most prevalent musculoskeletal disorder worldwide. In OA, the progressive degeneration of the hyaline cartilage that lines the surfaces of bones articulating through synovial (i.e., moving) joints causes direct bone-to-bone attrition during movements throughout the body. Due to the extremely high incidence of lesions and diseases in aging population, it is critical to put all efforts into developing a successful implant for osteochondral tissue regeneration. Many of the patients undergoing surgery present osteochondral fissure extending until the subchondral. Therefore, strategies for functional tissue regeneration should also aim at healing the subchondral bone and joint interface, besides hyaline cartilage. With the ambition of contributing to solving this problem, several research groups have been working intensively on the development of tailored implants that could promote that complex osteochondral regeneration. These implants may be manufactured through a wide variety of processes and use a wide variety of (bio)materials. This talk will examine the state of the art regarding the challenges, advantages, and drawbacks of the current strategies for osteochondral regeneration. One of the most promising approaches relies on the principles of additive manufacturing, where technologies are used that allow for the production of complex 3D structures with a high level of control, intended and predefined geometry, size, and interconnected pores, in a reproducible way. However, not all materials are suitable for these processes, and their features should be examined, targeting a successful regeneration.

Audience Take Away:

- up-to-date overview of the challenges posed by osteochondral regeneration
- updated categorization of the tissue engineering strategies described in the extant scientific literature
- development of biomimetic and bioactive scaffolds or advanced strategies, which could replicate the native architecture completely and the function of the osteochondral tissue.

Biography:

Pedro Morouço, PhD, is currently the Dean of ESECS – Polytechnic of Leiria. His research focus on bridging the gap between the lab and in vivo applications, with a special interest on developing novel hybrid manufacturing processes for tissue engineering.

Federico Carpi

Department of Industrial Engineering, University of Florence, Via di S. Marta, 3 - 50139 Florence, Italy

Electroactive polymers as 'artificial muscle' materials: new opportunities for biomaterials and tissue engineering

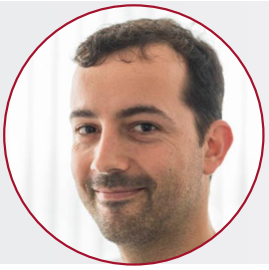
Electroactive polymers (EAPs) consist of synthetic materials capable of changing dimensions and/or shape in response to an electrical stimulus. They show useful actuation properties, such as sizable active strains and/or stresses, large compliance, low density, low power consumption and ease of processing. In this talk, EAPs will be introduced as a promising technology in order to provide biomaterials and tissue engineering scaffolds with intrinsic actuation capabilities. Ongoing research in our group will be described, showing soft and electromechanically activated bioreactors with inherent cell stretching functions. They are investigated to deliver controllable mechanical stimuli to cell cultures, in order to regulate their developmental processes. The greatest promise of the considered technology relies on its high versatility, compact size, low weight and scalability, as well as low cost.

Audience Take Away:

- Basic aspects of electroactive polymers
- New opportunities offered by electroactive polymers for biomaterials and tissue engineering
- Ongoing studies on electromechanically activated soft bioreactors

Biography:

Federico Carpi is an Associate Professor in Biomedical Engineering at the University of Florence, Department of Industrial Engineering, Florence, Italy. He received from the University of Pisa the Laurea degree in Electronic Engineering in 2001, the Ph.D. degree in Bioengineering in 2005 and a second Laurea degree in Biomedical Engineering in 2008. From 2012 to 2016 he has been an Associate Professor (Reader) in Biomedical Engineering and Biomaterials at Queen Mary University of London, School of Engineering and Materials Science, UK. Since 2016, he is with the University of Florence, where he leads the 'SMART – Soft Matter ARtificial muscles and Transducers' research group (www.smart.unifi.it). His research interests include smart material-based biomedical and bioinspired mechatronic devices, and polymer artificial muscles. His publications include some 70 articles in international journals, 3 edited books and several contributions to books and conferences.



Laurent Pieuchot
Universite de Haute-Alsace, CNRS, IS2M, UMR 7361, F-68100 Mulhouse, France

Curvature as a guidance cue for single cell migration and epithelium morphogenesis

Cells can migrate individually between tissues and organs or collectively in tightly or loosely associated groups. In both cases, cell migration is regulated by extracellular cues of very different natures. Here I will describe a cellular mechanism called curvotaxis that enables individual cells and growing epithelial monolayers to sense and respond to curvature variations from the substrate on which they adhere. Live imaging combined with functional analysis and in silico modeling shows that curvotaxis relies on a dynamic interplay between the nucleus and the cytoskeleton - the nucleus acting as a negative curvature magnet that leads the migrating cell towards concave curvatures. Curvature affects also focal adhesions organization and dynamics, nuclear shape and gene expression. Growing epithelial colonies can also respond to curvature by a process involving both curvotaxis in the leading edge where cells are loosely associated, and oriented cell divisions in the more mature parts of the colony. Altogether, this work identifies cell-scale curvature as an essential physical cue that can guide both single and collective cell migration processes. Potential applications in tissue engineering and biomaterial design will be discussed.

Audience Take Away:

- Curvature can impact cell migration trajectories
- Curvature can alter the expression profile of mesenchymal stem cells
- Cell nucleus is used as a negative curvature magnet by the cells
- Curvature can be used to tune the growth of epithelial molonalyers

Biography:

Dr. Laurent Pieuchot is permanent researcher (CRCN) at the CNRS. After a Ph.D. in cellular and molecular biology in 2009, Laurent moved to the National University of Singapore to study fundamental mechanisms that govern cell growth and differentiation. He worked on a variety of topics, ranging from organelle biogenesis in mammalian cells to the systems biology of multicellular fungi. He obtained a permanent CNRS position (CR1) in 2016 and joined the IS2M, Mulhouse to develop approaches combining cell biology and material sciences. He focuses his current research on the role of topographical curvature in various cell biology processes.

Shrikant L Kulkarni

Kulkarni Clinic, 175/1 Balwant Station Road, Near Post Office, Chinchwad Gaon Pune 411033, Maharashtra, India

Regeneration in CKD by Resolution of Renal fibrosis

Chronic kidney disease is characterized by progressive loss of the renal microvasculature, which leads to local areas of hypoxia and induction of profibrotic responses, scarring and deterioration of renal function. Revascularization alone might be sufficient to restore kidney function and regenerate the structure of the diseased kidney. For revascularization to be successful, however, the underlying disease process needs to be halted or alleviated and there must remain enough surviving nephron units that can serve as a scaffold for kidney regeneration. Chronic intrarenal hypoxia and microvascular obliteration play an important role in the pathogenesis of renal scarring and loss of function, in the proposed methodology restoration of kidney structure and function is being done by arresting microvascular drop-out and restoring the interstitial capillary network could be a feasible approach to regeneration of a diseased kidney The vasculature is the core for the survival and function of every organ In its early stages, symptoms of chronic kidney disease (CKD) are usually not apparent. Significant reduction of the kidney function is the first obvious sign of disease. CKD is a silent disease. Most CKD patients are unaware of their condition during the early stages of the disease which poses a challenge for healthcare professionals. The trouble with the diagnosis of CKD is that in most parts of the world, it is still diagnosed based on measurements of serum creatinine and corresponding calculations of eGFR. There are controversies with the current staging system, especially in the methodology to diagnose and prognosticate CKD. Fibrosis and hypoxia are major therapeutic targets for treating tubulointerstitial lesions in CKD. Protection of the tubulointerstitial vasculature theoretically should preserve blood supply and guarantee oxygenation to the corresponding compartment, which are central causes of hypoxia. Currently, no therapy exists to treat established kidney injuries. Strategies to augment human endogenous repair processes and retard associated profibrotic responses are urgently required. It would be deemed necessary to find a means to initiate an intervention well in advance of end-stage disease, when an adequate number of surviving nephrons are available. The self-renewal of damaged tissues is being done by the endogenous stem cells. This natural process of healing replaces young cells having strong stress tolerance for tissue survival which requires a functional vascular network at site. Self-renewal is self-organization which is the ability of a system to spontaneously arrange its element in a purposeful manner under a healthy environment without the help of external agency. because the system knows how to do its own thing. Although fibrosis was once thought to be irreversible, there is now growing evidence suggesting that fibrosis is reversible in human fibrotic diseases under some circumstances. Resolution can occur if the underlying etiology is eliminated. Human fibrotic diseases are often multifactorial, and eradication of the injurious stimuli may not be possible. Fibrosis is the common endpoint of chronic kidney diseases of multiple etiologies. Treating the cause of injury is perhaps the most efficacious approach to fibrosis resolution. Ideally, the rate of fibrosis resolution should be coordinated with parenchymal regeneration, since removal of the fibrotic scar without concomitant replacement with parenchyma may result in weakened tissue structure On resolving fibrosis, an improved blood supply recreates vivo healthy cellular microenvironment. Integrity of renal vasculature has a profound effect on renal regeneration after tissue injury mechanism that leads to new blood vessels formation, and microvascular capillaries are most important for tissue regeneration. An in-situ self-organ repair regeneration method utilizes the body's own biological resources by creating a supporting microenvironment for the endogenous stem cells to generate injured tissue structurally and functionally. The following steps are proposed in this method i) artificial hydronephrotic condition is created with help of pelvi–ureteric junction (PUJ) block ii) due to increased retrograde pressure the fibrosed renal parenchyma is dissolved iii) remove the artificial block at PUJ causing back pressure. When the fibrosis is dissolved it creates a supporting environment for endogenous stem cells to go for self-organ repair mechanisms. Theoretically

the prognosis is that the endogenous stem cells niches are naturally placed between the renal capsule and the cortex and will start regeneration of new normal renal tissue.

Audience Take Away:

- Prolonging kidney lifespan of a chronic renal failure patient in the present state is through dialysis treatment or the renal transplant with lifelong immunosuppressive drugs. Patient is alive with disease and with the side effects of drugs
- The human kidney possesses an enormous, astonishing, and persistent capacity to heal itself for which innovative techniques as proposed are required to regenerate damaged ischemic renal tissues
- Early detection of the disease is the key to treat or prevent the progress of the disease for which the proper method to assess the renal fibrosis is required

Biography:

Dr. Shrikant L. Kulkarni completed his M.S. (General Surgery) in 1975 from B.J.Medical College Pune, Maharashtra India. The bachelor's degree M.B.B.S. completed from Miraj Medical College. Since 1971 he has worked at several government hospitals like the Wanless Hospital Miraj, Sangli General Hospital Sangli, Sassoon Hospital Pune and multispecialty hospitals like Ruby Hall Clinic, Pune and Jahangir Nursing Home, Pune. For the last 40 plus years he has been working at his own hospital at Chinchwad, Pune Maharashtra India.

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SPEAKERS DAY 1

INTERNATIONAL CONFERENCE ON

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Riccardo Sacco[1*], Greta Chiaravalli[2] and Guglielmo Lanzani[2]

[1]Department or Mathematics, Politecnico di Milano, Milano, Italy,
[2]Center for Nanoscience and Technology, Istituto Italiano di Tecnologia, Milano, Italy, Department of Physics, Politecnico di Milano, Milano, Italy

Multiphysics/Multiscale Modeling and Simulation of Organic Retinal Prostheses

In this talk we propose a model for the simulation of retinal prostheses based on the use of organic polymer nanoparticles (NP). The model consists of a nonlinearly coupled system of partial differential equations accounting for: (1) light photoconversion into free charge carriers in the NP bulk; (2) charge transport in the NP bulk due to drift and diffusion forces; (3) net charge recombination in the NP bulk due to the balance between light absorption and particle-particle recombination; (4) electron-driven molecular oxygen reduction and capacitive coupling at the NP-solution interface; (5) ion electrodiffusion in the solution bulk; (6) capacitive and conductive coupling across the neuronal membrane. The proposed model is solved in stationary conditions and in one spatial dimension. System coupling is dealt with a modification of the Gummel Decoupled algorithm conventionally used in inorganic semiconductor simulation. System discretization is conducted using the Finite Element Method, with stabilization terms to prevent spurious unphysical oscillations in the electric potential and ensure positivity of carrier and ion concentrations. Model predictions suggest that the combined effect of NP polarization and resistivity of the NP-neuron interface results in neuron depolarization and supports the efficacy of organic NPs in retinal prosthesis development.

Audience Take Away:

- The model can be used as a virtual laboratory to assess conjectures, compare and validate different assumptions against experimental data, identify the most relevant physical mechanisms underlying system response to photostimulation
- The model can be used to quantitatively characterize physical parameters that are not available from experimental measurements, specifically: photogenerated electron mobility, ion permeability of the transition region between electrolyte solution and interstitial cleft
- Model predictions can be used to help optimize the design of the NP (for example, the radius of the NP and the interface redox reaction rate) for subsequent application to animal models and for human individual treatment

Biography:

Dr. Sacco received a MS in Electronic Engineering from Politecnico di Milano (PoliMi), Italy in 1989, and a PhD in Applied Mathematics from Universita' degli Studi di Milano, Italy in 1992. In 1995, Dr. Sacco obtained the position of Assistant Professor in Numerical Analysis (NA) at PoliMi, in 2001 the position of Associate Professor in NA at PoliMi and in 2017 the National Habilitation to the role of Full Professor in NA. Dr. Sacco has published 6 books and more than 80 research articles in SCI(E) journals.

Michael J. Ausserlechner
Medical University of Innsbruck, Austria

3D bioprinted, perfused tumor-environment on a chip

Additive 3D bio-manufacturing is a young, rapidly evolving research field that allows defined 3D architecture for artificial tissue equivalents. In contrast to other 3D culture techniques, 3D-bioprinted tissue can be designed to contain channel geometries for optimized perfusion or areas with specific cell types, such as immune cells, tumor cells or organoids. In a previous project we discovered that in neuroblastoma tumors the transcription factor FOXO3 promotes tumor-angiogenesis in chorion allantois membrane (CAM) assays and in xeno-graft transplantation mouse models. An ongoing study identified small compounds that bind to the FOXO3-DBD and inhibit the activity of this transcription factor. To study possible anti-tumor effects of these compounds and in parallel to replace above animal experiments we now developed a fully self-contained, mostly 3D-printed, microprocessor-controlled perfusion system, designed fluidic chips and bioprinted into these chips hydrogels that contain various cell types and channel geometries for optimized perfusion. Microfluidic devices are made of glass and laser engraved PMMA. Using our industry standard bioprinter we directly manufacture conduits-containing hydrogels in such custom-designed fluidic chips, which allows direct connection of hydrogel channel-geometries to engraved channels and perfusion circuits. Bioreactor-grown tumor spheroids are placed into the hydrogels during the printing process. In parallel, we also developed a bioink that shows excellent printability for extrusion- and microjet bioprinting. This bioink was optimized to support growth and adhesion of human fibroblasts, human umbilical vein endothelial cells (HUVEC) and adipocyte-derived stem cells and it promotes the formation of micro-vessel networks. The hydrogel between imprinted conduits can be therefore micro-vascularized with endothelial cell vessel networks below the resolution of the bioprinter. Perfusion controller, fluidic devices, and perfused 3D bioprinted hydrogel represent a novel system for developing in vitro tumor-microenvironment / tumor angiogenesis models to study the impact of tumor cells, immune cells, chemotherapeutics and anti-angiogenic drugs on (tumor) cell growth, tumor-microenvironment and micro-angiogenesis.

Biography:

Dr. Michael J. Ausserlechner received his MS in 1996 and his PhD in molecular biology in 2000 from University of Innsbruck. After a postdoctoral training (Albert Einstein College of Medicine, New York) he became lab director at the Dept. of Pediatrics at the Medical University Innsbruck where he established a research group with focus on cell death regulation in childhood malignancies. He received the venia docendi in 2006, served as group leader in drug discovery projects and founded the first 3D Bioprinting Laboratory in Austria in 2017 (together with Judith Hagenbuchner). He published more than 54 papers in peer-review journals

Ryakhovsky A.N., LLC Ryakhovsky S.A.

[1]Avantis 3D, Moscow, Russia,
[2]Center for Cranio-Maxillofacial Surgery, Central Research Institute of Dental and Maxillofacial Surgery, Moscow, Russia

From diagnostics to 3D printing in dentistry and maxillofacial surgery

1. Application of CAD / CAM technologies and materials for 3D printing in dental treatment clinical practice. Who wins the competition between milling and 3D printing? The main current requirements for materials used in dentistry.
2. Digital planning of dental treatment and 3D modeling tools used in the Avantis 3D software. A Concept of 4D dental treatment planning (simulation in virtual 3D space and time) –the ability to anticipate the final result and reduce treatment time by organizing simultaneous execution of different types of treatment. Review of the Instruments of diagnostics and measurements in the software
3. Implant planning, application of 3D printing for the navigation templates manufacturing. Disadvantages of existing implantation systems
4. Planning for bone augmentation. CAM technologies for milling bone-augmentation material, existing disadvantages and limitations
5. Orthognathic surgery planning. Application of 3D printing for fixing plates manufacturing
6. Planning of silicone implants for the maxillofacial region, disadvantages of the existing technology for manufacturing silicone implants
7. Review of the tools for preparing objects for 3D printing in the Avantis 3D software

Audience Take Away:

- Any 3D printing needs to design the objects first. Special tools for design will be presented and their application in dentistry will be shown
- Instruments of diagnostic craniofacial region and measurement tools presented in Avantis 3D software can be used in research and tutorials

Biography:

Dr. Ryakhovsky studied dentistry at the Ivano-Frankovsk state medical institute and graduated in 1983. Started a dental practice as a general practitioner and then prosthetic dentist in 1984. In 1988 he defended a scientific work and become a candidate of medical Sciences. In 1989 was invited to continue scientific work by Central Research Institute of Dental and Maxillofacial surgery. In 1992 became a doctor of medical science and in 1997 received the title of Professor. At 2015 he was awarded the title of honored doctor of Russia. From 2000 to 2019 was a Head of Prosthodontic Department of Central Research Institute of Dental and Maxillofacial Surgery (CRID). Nowadays he is a consultant of CRID and General Director of LCC "Avantis 3D" (Resident of Skolkovo Technopark). He has published more than 110 research articles in SCI(E) journals. He has more than 30 patents

Sergio Gonzalez-Itier*, Valentina Veloso, Miguel Miranda, Marianne Brenet, Tomas Egana

Institute for Biological and Medical Engineering, School of Engineering, Pontificia Universidad Católica de Chile, Santiago, Chile

Towards photosynthetic explants as local oxygen delivery systems for tissue regeneration

Oxygen is necessary for tissue regeneration as it plays a key role in metabolism, immune response, and protein synthesis. Thus, the delivery of oxygen to wounds is an active field of research. Among others, hyperbaric therapy has been evaluated for wound oxygenation and, more recently, in vitro, and in vivo studies have shown that photosynthetic biomaterials are a promising approach to deliver oxygen in a vascular independent manner. Due to its physical and chemical properties, plants have been historically used to improve tissue regeneration, but their capabilities to produce and deliver oxygen in situ have not yet been explored for wound healing. In this work, the influence of different environmental conditions in the oxygen releasing capacity of *Marchantia polymorpha* explants was characterized under human physiological conditions. Additionally, the biocompatibility of such explants as well as their capacity to fulfill the metabolic requirements of living vertebrate system was studied using a zebrafish larvae model. Here we found that the explants were able to produce oxygen under human physiological conditions under light/dark cycles of 15 mins. Moreover, co-incubation with zebrafish larvae demonstrates that *M. polymorpha* explants are not toxic, as viability of the larvae was not compromised. Finally, co-incubation assays also demonstrate that, under the appropriate illumination, the explants can exceed the oxygen demand of 96 hours post fecundation zebrafish larvae. Our proof of concept results suggest that photosynthetic explants could be used as biocompatible local oxygen delivery systems for wound healing and tissue regeneration. Nevertheless, further studies should be conducted in order to confirm the safety and efficacy of *M. polymorpha* to promote wound healing *in vivo.*

Audience Take Away:

- This is a proof of concept where photosynthetic explants derived from plants, could be used as biocompatible dressings for the local delivery of oxygen in wound healing and tissue regeneration.
- Zebrafish larvae can be used as a living metabolic sensor to test oxygen production by photosynthetic materials under different light and temperature conditions.
- Due to its chemical, physical, and photosynthetic capabilities, plants could be used as a novel material to treat wounds.

Biography:

Sergio González-Itier studied Molecular Biotechnology Engineer at Universidad de Chile, Chile, and graduated a MS in 2017. He then joined the research group of Dr. Tomás Egaña at Institute for Biological and Medical Engineering. Schools of Engineering, Biological Sciences and Medicine, P. Universidad Católica de Chile. Here he has been working on the development of a photosynthetic explants derived from plants as local oxygen delivery systems to improve tissue regeneration. During his undergrad and master's degree he published 2 articles in SCI journals.

A.E. Wiacek*, M. Jurak, A. Ladniak, K. Przykaza, K. Szafran
Department of Interfacial Phenomena, Maria Curie-Sklodowska University, 20-031 Lublin, Poland

Immunosuppressive cyclosporine CsA. The physicochemical characterization of liposomal and colloidal systems

These researches present an overview of the possibilities of testing various cyclosporine (CsA) formulations with an emphasis on parameters that may be key to improving the stability and biocompatibility. The feasibility of immunosuppressive cyclosporine CsA (Fig. 1) colloidal systems for oral (injection) administration was investigated using different techniques and compared with similar investigations of other researchers.

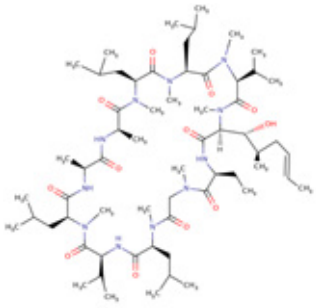

Fig. 1 Cyclosporine A structure

The chosen CsA systems were developed using dipalmitoylphosphocholine (DPPC) and/or cholesterol as a lipid matrix, stabilized with ethanol, with soybean oil or n-tetradecane as oil phase in emulsions, under natural pH, room and physiological temperature (Fig. 2).

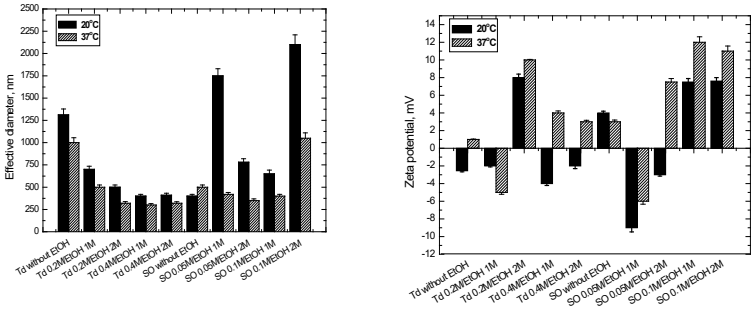

Fig. 2 a) Effective diameter and b) zeta potential of different CsA formulation at 20 and 37oC. Abbreviation: SO – soybean oil, Td n-tetradecane, EtOH ethanol solution (1M or 2M).

Their integrity was found to be strictly dependent on the stabilizers. The highest CsA penetrability with the system containing phospholipid in the context of its interactions with lipid membranes was shown. Also, the bioavailability of CsA can be enhanced with the biopolymer antibacterial chitosan. The obtained results showed the suitability of liposome/microemulsion

as promising vehicles for CsA delivery, the most hopeful to be formulation with the smaller particle size facilitating absorption. However, when safety is assessed, relying on just the particle size cannot be the only criteria. Reassumed, the CsA formulation stability known on the basis of the size and zeta potential measurements guarantees a decrease of the individual variations in the drug bioavailability, toxicity and minimizes rejection.

Audience Take Away:

- Colloidal and liposomal systems physico-chemical characterisation
- Static and dynamic light scattering method used for measure of drug systems stability
- Electrophoresis as a separative method and a tool for stability measurements

Biography:

Dr Hab. Agnieszka Ewa Wiacek studied chemistry in 1989-1994 at Maria Curie-Sklodowska University and in 1994 was employed as a research assistant in the Department of Physical Chemistry. She received D. Sc. degree in chemistry in September 2000 on the base of PhD. thesis including the effect of natural stabilizers on oil/water emulsion stability. In 2013 she received Dr. habilitation degree in physical chemistry writing dissertation titled "Effect of the selected biologically-active substances, mainly phospholipids and (phospho)lipases on the interfacial properties of dispersed systems". She has published more than 80 research articles which were cited according to Scopus more than 650 times. Additionally she is author or co-author of 100 conference' articles. She is promoter of about 27 master of science thesis (M. Sc) and 25 licentiate thesis (B. Sc.) and 2 doctoral thesis. She participated in 6 scientific projects. In 2018 she obtained the position of an Associate Professor at MCSU.

Eleonora Marsich[1]*, Ivan Donati[2], Chiara Pizzolitto[1], Pasquale Sacco[2]

[1]Department of Medicine Surgery and Health Sciences, University of Trieste, Trieste, Italy.

[2]Department of Life Sciences, University of Trieste, Trieste, Italy

Mechanotransduction -towards a bioinspired design of responsive biomaterials

Mechanotransduction refers to the phenomenon that external mechanical stresses acting on cells are translated into intracellular biochemical signals, which in turn trigger adaptive responses [Martino 2018]. Extensive research has shown that the biomechanics of the extracellular matrix influence crucial cellular processes, including adhesion, spreading, proliferation, migration, and differentiation. Cells interact dynamically with the ECM by being pulled through the actomyosin-integrin machinery and pushed through the polymerization of actin and microtubules [Sun 2016]. The mechanical nature of the ECM is therefore of paramount importance in guiding cell status decisions. Evidence suggests that energy dissipation through the viscoelastic ECM may play a crucial role in controlling cell fate decisions, and therefore the "energy dissipative" contribution should not be neglected in the development of biomimetic materials. Moreover, it is still unclear whether and how it correlates with the specific cell response. To address this open question, we have fabricated joint viscoelastic and plastic substrates and subsequently investigated the cell response. Using dynamic hydrogels based on natural polysaccharides, we introduced the notion of "substrate dissipation energy", i.e. the molar energy required to deviate from the linear stress-strain regime and enter the plastic region [P. Sacco et al., Advanced Functional Materials. 2020, 30, 2001997]. Dissipation energy appears to be an important control variable for cell fate. Strikingly, we found an inverse relationship between substrate energy dissipation and cell response, with high adhesion/high spreading and low adhesion/no spreading for substrates with low and high dissipation energy, respectively. Our recent results show that viscoelastic and plastic polysaccharide-based substrates endowed with different dissipation energies can modulate cell behavior in terms of adhesion, spreading, migration, and differentiation. We concluded that cells make their response dependent on the effective energy they can use for their functions, and that the ability of substrates to store or dissipate cellular forces is therefore a powerful tool for modulating intracellular signals.

Audience Take Away:

- What is the role of dissipation energy in regulating the biology of different cell types, and what biological mechanisms are involved?
- How could we use this knowledge to design innovative viscoelastic materials that would enhance tissue regeneration and help cells recover injured tissues more efficiently?
- Could viscoelasticity be a suitable tool to modulate cell ECM crosstalk to reprogram biological processes such as cell differentiation and senescence? This research could have a major impact on several sectors including the tissue engineering product market, the research-based biomaterials industry, and healthcare/wellness, to name a few
- How can we create material models that help identify and understand the factors that drive cellular processes in vitro by breaking down the complex cellular microenvironment into simpler systems to analyze the role of various chemical, mechanical, and/or physical factors. In order to successfully study how mechanotransduction affects the functions of cells in vitro, cell culture platforms need to be developed that mimic the extracellular environment in which cells reside

Biography:

Prof. Eleonora Marsich is Associate Professor at the University of Trieste, Italy. She holds a M.Sc degree in Biology and a PhD in Biochemistry obtained in the same institution. She is founding member of the spin-off Biopolife Srl involved in development of materials for biomedical use.Her research is focused on the design of polymeric biomaterials for regenerative medicine, tissue engineering and drug delivery. Current studies are aimed at the production of hydrogels with viscoelastic properties that mimic those of the ECM. She authored 85 papers in peer-reviewed journals, 9 book chapters and is co-inventor in 6 international patents

Patrycja Sitek[1,2*], Matera-Witkiewicz A[1,2], Zagorska K[1,2], Laskowski M[1,2], Witoń M[1,2] and Gleńska-Olender J[1,2]

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[2]BBMRI.pl Consortium

Adapting to new COVID-19 reality in Polish Biobanking Network BBMRI.pl - QMS system implementation, audits and trainings

1. COVID-19 pandemic has a strong impact for functioning of biobanks across the world. Severe restrictions implemented by national and international administrative organs and changes in policies of human biological material in biobanking entities, influenced the way of auditing, training and implementing the Quality Management Systems (QMS) in Polish Biobanking Network.

2. The BBMRI.pl QMS team has made a risk analysis and suggested actions to stay active in the pandemic. In the field of auditing, the BBMRI.pl QMS experts team have developed and implemented a set of procedures for effective remote audits conducting. Technological solutions such as software-based platforms and personal cloud storage enable exchanging documents or data and offer communication in real time. It results to perform audits completely or partially remotely. The exchange of information took place objectively and was correctly received.

3. The new COVID-19 reality also influenced the implementation of QMS in biobanks as well as training and improvement. BBMRI.pl QMS experts managed with the situation by developing a proprietary training system in the form of online webinars and offering to the members and observers of the Polish Biobanking Network, the possibility of continuous consulting as a part of the creation and implementation of QMS SOPs. Each biobank has also received a dedicated QMS consultant responsible for Biobank improvement.

4. All of the actions and tools, used during pandemic, allowed for the continuation of the development process of the Polish Biobanking Network, including audits for compliance with Quality Standards for Polish Biobanks as well as training and consultations. Thanks to this, the continuation of biobank`s improvement , as well as BBMRI.pl project, is possible. Also the expectations both side were fulfilled.

Audience Take Away:

- The audience will learn that COVID-19 reality didn't affect the opportunity for effective implementation of strong QMS system in Biobank as well as the possibility of conducting the online audits
- The audience will obtain a strong practical solution for conducting audits within their local biobanking network as well as learn how to train biobank personnel to implement ISO 20387 standard as well as ISO 9001. They will learn that online reality is also a proper way for good functioning of the Biobank

Biography:

Patrycja Sitek QMS Coordinator and Lead ISO 9001:2015 auditor in BBMRI.pl project, MSC in biotechnology and chemistry, ongoing PhD in Chemistry, 3 years' experience in bio banking, 12 years' experience in pharmacy and medical devices, CRK owner, TUV Nord trainer

A.A. Mieloch[1,2*], J. Semba[1,3], J.D. Rybka[1]

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Carbon nanotube-reinforced polycaprolactone for 3D bioprinting and tissue engineering

3D bioprinting is a rapidly growing field of tissue engineering. Currently, one of the main obstacles is the scarcity of biomaterials tailored for particular use cases. This study is focused on exploring thermoplastic material – polycaprolactone, reinforced with multiwalled (MWCNT) and bamboo (BCNT) type of carbon nanotubes, for use in tissue engineering. Toxicity of various nanomaterials, including carbon nanotubes is still a subject of ongoing debate. The added complexity of hybrid biomaterials necessitates further studies, extending beyond properties of a single constituent, taking into account various interactions between given materials. In the study, mechanical, structural, optical and biological evaluations of the materials were performed, including: nanoindentation, rheology studies, differential scanning calorimetry, scanning electron microscopy, confocal microscopy, proliferation, and cytotoxicity assays. Human normal chondrocytes were utilized for biological studies. Carbon nanotubes were added in concentrations ranging from 0.005% to 0.2% w/w. Cellink BioX printer with thermoplastic printhead was utilized. Preliminary results indicate that both the concentration and type of carbon nanotubes used significantly affect the mechanical properties and biocompatibility of the scaffold 3D bioprinted with PCL/CNT composite. The study aims to find a link between material`s crystallinity, surface topography, mechanical properties, and biocompatibility, necessary for furthering our understanding of thermoplastic biomaterials in tissue engineering, and 3D bioprinting. This work tries to navigate through the issues inherent for composite bionanomaterials, proposing analytical techniques helpful in evaluation of the materials` properties, crucial from the standpoint of 3D bioprinting and tissue engineering.

Acknowledgements: The work was supported by grant no. POWR.03.02.00-00-I026/16 co-financed by the European Union through the European Social Fund under the Operational Program Knowledge Education Development.

Audience Take Away:

- How to prepare PCL blends with CNTs for 3D printing
- Presented data will provide valuable insights into biological effects of PCL/CNT scaffolds driven by its various properties
- It will highlight the complexity of issues related to 3D printing of thermoplastic materials for tissue engineering, while presenting ways to approach solving those issues

Biography:

Adam Mieloch is a PhD student at the Adam Mickiewicz University in Poznan, Poland, at the Faculty of Chemistry. He graduated as Ms in 2015 in Biotechnology He currently works as a researcher at the Laboratory of Applied Biotechnology, chaired by prof. Jakub Rybka. Adam Mieloch is currently employed as researcher in three projects, two of which are focused on 3D bioprinting, tissue engineering and biomaterials in meniscus regeneration. The third one aims at the development of a novel immunodiagnostic tool for COVID-19. He co-authored several research papers in international journals and a patent application.

Oscar Dario Garcia-Garcia*[1.2.3], Jesús Chato-Astrain[1.2.3], Víctor Carriel[1.2.3]

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Fibrin/agarose-based strategies and natural matrices for peripheral nerve repair

Peripheral nerve (PN) are essential organs that communicate the central nervous system to distal target organs at the motor, sensory and autonomic level. PN can be affected by different pathological conditions and their continuity is frequently affected by a wide range of traumatic injuries or cancer removal. These injuries can occur at any anatomic location with severe consequences for these patients worldwide. Nowadays, incomplete or complete PN defects are managed by well-known surgical procedures. Short nerve gaps are repaired directly with acceptable success. However, in case of critical PN defects, the re-establishment of the nerve trunk continuity can be achieved by using graft materials, being the nerve autograft the current gold standard technique to treat these patients. Nerve autograft promotes an acceptable regeneration and functional recovery in nerve gap repairs with a maximum length of 5 cm being inefficient in the treatment of defects beyond this distance. In this context, our aim during the last few years was to develop novel nerve substitutes for peripheral nerve repair. On one hand, we designed and characterized novel strategies based on the use of fibrin-agarose hydrogels (FAH) containing or not adipose-derived mesenchymal stem cells (ADMSCs). On the other hand, we developed new decellularized nerve allografts. These strategies were characterized ex vivo and then used to repair a 1 cm gap in the sciatic nerve of Wistar rats. Firstly, we evaluated the use of acellular and cellular FAH as intraluminal fillers of collagen conduits. From the clinical and functional point of view, filled conduits were significantly superior to the use of hollow collagen conduits used as control. In addition, superior sensory, motor and neurophysiological profile was achieved with the use of FAH containing ADMSCs. Histology revealed an active nerve tissue regeneration characterized by the presence of abundant Schwann cells, regenerating axons and tissue organization with the use of cellular FAH. Secondly and based on the positive results obtained with FAH and ADMSCs, we developed a novel nanostructured FAH bioartificial nerve substitutes (NFABNS). Ex vivo studies confirmed that, by subjecting FAH containing ADMSCs to plastic compression technique, it is possible to generate biomimetic constructs in a controlled manner with acceptable biomechanical properties and preserving the cell viability and functionality. The in vivo analysis of the NFABNS revealed acceptable degree of nerve tissue regeneration, sensory and motor function recovery and neurophysiological profile. Overall results were comparable, and in some cases superior than autograft technique used as control. Finally, concerning our acellular nerve grafts, ex vivo studies confirmed an efficient decellularization and acceptable preservation of the structure and chemical composition of the ECM. The in vivo evaluation revealed that all acellular grafts were able to promote an efficient peripheral nerve regeneration, being these results closely comparable to the autograft technique, which still remains as the gold standard technique for the treatment of sever nerve defects. In conclusion, our studies confirmed that engineered substitutes are promising alternatives for peripheral nerve repair. Furthermore, clear differences can be obtained depending on the molecular composition of the scaffolds used, the 3D configuration and the presence or not of viable and active cells. However, more research is still needed to generate more efficient alternatives for peripheral nerve repair.

Acknowledgements: This study was supported by the Spanish "Plan Nacional de Investigación Científica, Desarrollo e Innovación Tecnológica, Ministerio de Economía y Competitividad (Instituto de Salud Carlos III), and co-financed by "Fondo Europeo de Desarrollo Regional (FEDER) Unión Europea", Grant No FIS PI17-0393

Audience Take Away:

- Basic information related to peripheral nerve regeneration will be provided to understand the biological bases behind the clinical problem.
- Audience will learn about the recent advances in nerve tissue engineering.
- The lecture will provide information concerning to the biofabrication process of the 3 different engineered strategies to generate functional and biologically active bioartificial substitutes for peripheral nerve repair.
- Through the presentation of three different engineered strategies the audience will be able to understand the multifactorial problems related to the complex process of peripheral nerve repair.

Biography:

Prof. Óscar Darío García is graduated in Biochemistry with mention in Biotechnology at the University of Malaga, Spain. He performed Postgraduate Master Program in Tissue Engineering and Advanced Therapies, and is currently enrolled in a Ph.D. in Biomedicine at the University of Granada, Spain. Currently, he is Professor of Histological Techniques and Tissue Engineering for postgraduate student Master´s Programs in Tissue Engineering and Advanced Therapies and Manufacturing of Advanced Medical Products at the University of Granada, Granada, Spain. He has published more than 10 research articles, specialized chapter books in the field of Tissue Engineering and Histology and has participated in 5 research projects, co-directing 1 of them. His research activities are focused on peripheral nerve tissue engineering, novel biomaterials, cartilage tissue engineering and skin substitutes.

Suruchi Garg
Director &Chief consultant, Aura Skin Institute, Chandigarh, India

Myriad uses of platelet rich plasma in intervention dermatology and trichology

Platelet rich plasma(PRP) therapy is one of the fast pacing branch of regenerative medicine in intervention dermatology and trichology. This has significantly changed the out of difficult to treat difficult disorders in addition to contributing immensely in the field of cosmetic-intervention dermatology and trichology. PRP therapy can be used as an adjuvant in various cocktail treatments of scarring alopecia, androgenetic alopecia, alopecia areata in trichology with promising results. It has also proved its mettle as an add on therapy in hair transplant and randomized controlled trials are published to prove its efficacy in reducing the catagen fall, preserving the transplanted hair and giving faster results as early as 6 months against 9 months in control group. It also helps in activating native dormant hair thus adding on to existing density. It can be used in difficult conditions like surgical treatment of vitiligo with LAPEEST (laser ablation of recipient area with PRP enriched epidermal suspension) and yielding impressive pigmentation as early as 3 to 6 months. The triple combination of ablative laser, PRP therapy and epidermal fragment suspension works in multipronged way to give fast and cosmetically acceptable pigmentation. Other indications are burn scars, post acne and post traumatic scars where it is an excellent adjuvant to ablative lasers and microneedling radiofrequency to resurface not only skin, but underlying appendages as well, thus restoring near normal looking skin. PRP therapy when utilized to aid in the healing process can yield unparalleled results in various difficult areas in intervention dermatology and trichology.

Audience Take Away:

- Uses of PRP in dermatology to reduce scars, wrinkles and for rejuvenation
- Use in treatment of different types of scarring and non-scarring alopecia
- Use in vitiligo and burn scars

Biography:

Dr Suruchi Garg has done her graduation from IGMC, Shimla and post-graduation in MD, Dermatology from prestigious Post Graduate Institute of Medical Sciences and Research, Chandigarh. She is currently director and chief consultant at Aura Skin Institute, Chandigarh, India. Her special areas of research are regenerative medicine, innovative anti-aging techniques, vitiligo surgery(LAPEEST) and difficult to treat scar revisions. She has filed a patent in non- surgical face lift and proposed a drooping and wrinkle global classification for aging face. She was bestowed with young dermatologist award (Dermacon,2008) for her publication in cutaneous vasculitis and Distinguished scholar award, 2020 by European Journal of scientific research for her work in scarring alopecia with hair transplant and PRP therapy. She has more than 20 publications in international and national journals of high repute, many of these are original articles. She is a part of editorial board of Cosmoderma journal and Indian Dermatology Online Journal and reviewer for various prestigious journals.

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KEYNOTE FORUM

DAY 2

INTERNATIONAL CONFERENCE ON

TISSUE ENGINEERING AND REGENERATIVE MEDICINE

SEP 20-21, 2021

TERMC 2021

Ruben F Pereira

ICBAS – Instituto de Ciencias Biomedicas Abel Salazar, Universidade do Porto, Porto, Portugal

Bioprinting bioinspired microenvironments to study cell-matrix interactions

Bioprinting is assuming a central role in tissue engineering and regenerative medicine, enabling the fabrication of 3D constructs and in vitro tissue models with biological function. The biophysical and biochemical cues of the cell microenvironment are recognized as key variables determining cell fate and how cells respond to the surrounding niche. We have designed a toolbox of double crosslinked bioinks with tuneable and controllable cues to study the regulatory role of microenvironmental cues on cell behaviour and biological function of bioprinted constructs. Our approach involves the bioprinting of cell niches in which biophysical and biochemical cues can be independently modulated and presented to the cells in a precise manner. Our findings reveal the importance of matrix cues on cell response and their implication on the biological properties of bioprinted constructs.

Audience Take Away:

- Design principles of bioinstructive bioinks for 3D bioprinting
- Bioprinting 3D cell niches with user-defined properties
- Impact of microenvironmental cues on cell response

Biography:

Dr. Ruben Pereira is an Assistant Professor of Biomaterials at ICBAS/University of Porto and researcher at the Biofabrication Group (i3S). He holds a PhD in Biomedical Sciences with specialization in the development of cell-instructive bioinks for 3D bioprinting. He has been collaborating with the pharmaceutical industry in the design of biomaterials for skin repair and has been involved in research projects supported by the industry, national and international agencies in the fields of bioengineering and tissue engineering. His research focuses on the development of dynamic hydrogels for bioprinting cell microenvironments and in vitro tissue models for regenerative medicine applications.

Pavla Jendelova

Department of Neuroregeneration, Institute of Experimental Medicine, Prague, Czech Republic

Cell or cell-less therapy for treatment of neurological disorders, what is the option?

Various types of stem cells have been proposed to be an effective, safe and feasible alternative method for the treatment of neurological disorders. Stem cell transplantation can reduce oxidative stress, prevent apoptosis, promote the function of spared axons, induce new axon growth or replace lost cells, which all leads to functional improvement or reduced neuronal degeneration. Transplantation of stem cells directly into nervous tissue have some limitations, including additional damage due to invasive application, and risk of immune response, therefore intrathecal application of stem cells or their secretome as cell-less therapy might be an option. We studied the paracrine effect of stem cells from different sources – mesenchymal stem cells (MSCs), derived either from bone marrow or Wharton Jelly or human induced pluripotent stem cell-derived neural precursors (iPS-NPs) – for the treatment of a spinal cord injury (SCI) or Amyotrophic lateral sclerosis (ALS). Cells were applied intrathecally, or we used their secretome. In SCI model, we observed the effect of cell grafting on reduced glial scar, spared tissue and levels of secreted cytokines. Cell transplantation resulted in significant downregulation of TNF-α production. To assess the effectivity of the MSC treatment, different dosages and repeated applications were compared. Histochemical analyses revealed a gradually increasing effect of grafted cells, resulting in a significant increase in axonal sprouting, spared gray matter and reduced astrogliosis. MSC-secretome was compared with cell grafting and had similar effect as cell application. In ALS model of SOD1 rats, intrathecal application of MSCs reduced motoneuron death and increased life span of the animals. Our results demonstrate that the transplantation of stem cells or their secretome can trigger long lasting improvement of functional outcome even without robust cell survival. The effect of MSCs on neural tissue regeneration is dose-dependent and is potentiated by repeated application.

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Audience Take Away:

- Cell therapy will be discussed from the point of importance of cell survival and way of application
- Cell therapy will be compared with cell secretome treatment in terms of effectiveness
- Two animal models will be discussed (spinal cord injury and amyotrophic lateral sclerosis)

Biography:

Pavla Jendelova obtained her master degree in Science in 1988 at the Charles University in Prague; she received her PhD degree in the field of neurophysiology at the Institute of Experimental Medicine in 1999. She was subsequently appointed as a head of the Laboratory 2002 and later as a head of the Department (2016). The main research topic is the axonal regeneration and plasticity in spinal cord model using gene therapy, stem cells and/or biomaterials and how to reduce secondary injury after spinal cord injury using anti-inflammatory treatment. In total, she published over 100 peer-reviewed publications (H index 33).

Sandeep Shrivastava*, Priyal Shrivastava, Pooja Vyas

Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra, India

Emerging Trends for Regenerative Care of Complex Wounds

The management of complex wounds is a huge challenge. It is associated with necrosis, infections and tissue losses. It need intense care and substantial cost. These cares include surgical and pharmaceutical interventions associated with risks, side effects and morbidity. The emergence of a Regenerative Care is predicted to change the managements of health problems. Inclusions of Stem cells, Mesenchymal Stem cells or Platelet rich plasma in treatment protocol are bringing the much-desired changes. Platelet Rich plasma is leading this change. The problem of complex wound healing can be overcome by this shift in knowledge, developed and based on regenerative Properties of Platelets. The STARS (Sandeep's Technique for assisted regeneration of skin) technique is a very simple protocol, developed scientifically step by step, through animal studies, standardisations of laboratory preparations, clinical case based observations and needful adoptions, till desirable results were obtained. Through this study, the regenerative care takes a leading stride in establishing the clinical practices, bridging and building solution for complex wound management.

Audience Take Away:

- Role of Regenerating Care in Wound Healing with PRP
- The audience will learn how to use PRP for Wound Care
- It would show them how a bench work can be converted to bed side problems, they can take further research in the same field
- It offers a very simple Technique of imparting regenerative Care , which can easily be replicated & reproduced by others health care providers such as Nurses , general Doctors and Experts

Biography:

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

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SPEAKERS DAY 2

INTERNATIONAL CONFERENCE ON

TISSUE ENGINEERING AND REGENERATIVE MEDICINE

SEP 20-21, 2021

TERMC 2021

Vasiliki E. Kalodimou
Director Flow Cytometry-Research & Regenerative Medicine Department, Athens Greece

Characterization of Mesenchymal Stem Cells (MSCs) and their use in the treatment of COVID-19

1. Discuss the history and properties of MSCs
2. Discuss rationale for use of uMSC in COVID-19
3. Present institutional Protocol for use of uMSC in COVID-19 pneumonia
4. Present local experience and outcome of patients treated with uMSC with COVID-19

Audience Take Away:

- Clinical
- Directors
- Medical Directors
- Physicians
- Scientists

Biography:

Vasiliki E. Kalodimou is the Collaborative partner for training and research for Regenerative Medicine Program at the Institute of Personalized Molecular Medicine at the Medical City Hospital, Philippines, the Board/Committee on Research Ethics at the National Hellenic Research Foundation, the Vice-Chair of the UEL Alumni Advisory Board, previously was the Director at the Flow Cytometry-Research and Regenerative Medicine Department of IASO in Greece, as well as the CBB & Processing Facility Director at MedStem-Cryobanks. In addition to collaboration with state universities and pharmaceutical companies on research projects (17), frequently publishes (46 & 9 books) her findings. She has 2 patents.

Elvan BAKAR
Department of Basic Pharmaceutical Science, Trakya University Faculty of Pharmacy, Edirne, Turkey

Regenerative effect of mesenchymal stem cell in covid-19

The novel COVID-19 disease caused by severe acute respiratory syndrome Coronavirus-2 (SARS-CoV-2), which emerged in China in late 2019, spread rapidly across the world in a short time. The disease has been declared as a pandemic by the World Health Organization (WHO). The patient's immune system plays an important role in the course of the disease. The virus causes pneumonia in infected patients and overabundant levels of cytokines are produced by immune modulator cells due to excessive triggering of the immune system in individuals with severe disease. This condition is defined as cytokine storm, causing acute respiratory distress syndrome (ARDS) and consequently multiple organ failure. Against the COVID-19 disease, the treatment protocols and drug development studies of scientists around the world continue intensively. However, there is currently no proven form of direct treatment against SARS-CoV-2. Today, the application treatment protocols include anti-viral drugs and the administration of Human Immunodeficiency Virus (HIV) protease inhibitors and ACE-2 receptor inhibitors, passive antibody transfer applications, in addition to all mesenchymal stem cell (MSC) treatments. In recent years, stem cell-based cellular therapy methods in regenerative medicine offer advantages in many areas and become increasingly important. MSCs are fibroblast-like precursor cells found in most adult and neonatal tissues. They are described by their capacity to differentiate into cells of mesodermal origin such as adipocytes, chondroblasts, and osteoblasts. However, MSCs have the potential to regulate adaptive and innate immune responses with their immunoregulatory properties. They regulate immune reactions by triggering the function and proliferation of immune system cells. MSCs can exhibit both anti-inflammatory and pro-inflammatory effects by interacting with components of the innate immune system. In this sense, MSCs stand out with their strong immunomodulatory effects. MSCs are cells with strong immunomodulatory properties thanks to their anti-inflammatory cytokines, chemokines secretion, anti-microbial, anti-apoptotic, pro-angiogenic potential and regeneration abilities. These cells perform their immunomodulatory effects either directly by interacting with the host immune cells or paracrine through the various cytokines they secrete. The paracrine effects of MSCs are mediated through growth factors such as vascular growth factor (VEGF), fibroblast growth factor (FGF), hepatocyte growth factor (HGF), MCP-1 and regulatory cytokines such as IFN-α, indolamine 2,3-dioxygenase, TGFα, IL-10 and PGE2. Paracrine secretion products of MSCs are therapeutically important. Their effectiveness in the regulation of immune reactions suggests that MSCs may be effective in suppressing the cytokine storm that occurs in patients infected with SARS-CoV-2. It is assumed that they contribute to tissue repair in the lungs by their ability to migrate towards damaged lung tissue, secretion of paracrine factors that repair and protect alveolar cells, and their effects on regulating the lung microenvironment. Thus, in the treatment of COVID-19, it is assumed that they may be a potential alternative strategy to treat ARDS. However, the limited applications and the effects that may develop depending on the application are important points that should consider in this sense. Larger randomized trials are needed to ensure the efficacy and safety of MSC treatment.

Audience Take Away:

- Participants will learn about the therapeutic importance of Mesenchymal stem cells (MSCs) and the factors they secrete in regenerative medicine
- Considering that CoVID-19 causes the development of the inflammatory reaction called a cytokine storm, they will have information about the effective use of MSCs in the treatment of CoVID-19

- By drawing attention to a new strategy in the treatment of CoVID-19, it will contribute to the acceleration of studies on this subject

Biography:

Dr. Bakar, graduated from the Faculty of Science, Department of Biology in 1994 University of Trakya in Turkey. She graduated as MS in1998 from Trakya University, Institute of Science and received her PhD degree in 2008 at the same institution. She worked as a research assistant between 1998-2012 in Trakya University, Department of Molecular Biology. She obtained the position of an Associate Professor at Trakya University Faculty of Pharmacy in 2012. She received the title of Associate Professor in 2017 and continues her studies in the same Faculty.

Shaila Kothiwale
KLE Academy of Higher Education and Research V.K Institute of Dental Sciences, Karnataka, India

Tissue engineering in periodontal therapy – a case Series

Periodontitis is a globally prevalent inflammatory disease characterized by periodontal tissue destruction. The main purpose of periodontal treatment is to arrest the progression of the disease and to regenerate the lost periodontal structures. Periodontal regenerative therapy is aimed at reconstruction of lost or injured tissues through tissue engineering with the application of barrier membrane (guided tissue regeneration), osseous defects and growth factors. One of the oldest biomaterial used as a scaffold is foetal membrane. The foetal membrane which consists of aminion (AM) and chorion membrane as a bilayer are used individually with novel technique in periodontics. Growth factors play critical roles in periodontal repair through the regulation of cell behavior such as cell adhesion, migration, proliferation and differentiation. Different growth factors have specific functions and target cells in wound healing, and their delicate balance is required for optimal tissue repair. Human bone allografts are predominantly used in clinical practice for the treatment of periodontal defects as they give predictable results and eliminate an additional donor site surgery. The presentation includes the studies which involves the clinical application of allografts, ACM membranes (as barrier membrane in guided tissue regeneration) and PRP-PRF (growth factors) in periodontal therapy.

Audience Take Away:

- The presentation includes the clinical application of bone grafts and the membranes (ACM) in the patients which will give the awareness to the audience, the above information can be implemented in the clinical research and clinical practice

Biography:

Dr. Shaila Kothiwale is a periodontist who received her PhD degree in 2006 at the KAHER University. She completed her Diploma in Tissue Banking in 2015 from National University of Singapore. She is currently employed as Professor, Dept of Periodontics at KLE V.K Institute of Dental Sciences, Karnataka, India. She has published more than 70 research articles in SCOPUS and PUBMED journals.

Fajar Shodiq Permata[1]*, Herawati[1], Dyah Ayu Oktavianie Ardhiana Pratama[1], Ahmad Fauzi[1], Dhita Evi Aryani[2], Alvinda Ayu Kartikasari[3], Clara Widya Pithaloka[3], David Christian[3], Ike Aurorah Afifah[3], William Putra Utomo[3], Immanuel Kavisson J[3], Luica Leony Allo L[3], Mark Robert Duncan[4]

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Comparative effects of allograft and xenograft blood to induce hemolytic anaemia in mice

Hemolytic anemia (HA) often attacks dogs and is challenging to treat. HA could be an autoimmune disorder. Therefore it needs an animal model of hemolytic anaemia. For making HA condition, mimicry materials such as blood from allograft or xenograft are used to induce autoimmune to against the blood. The purpose of the research was to examine the comparative effects of allograft and xenograft blood to induce HA in mice. The results were considered based on complete blood count (RBC, WBC, Hb, PCV), blood chemistry (TPP, bilirubin, globulin, BUN, and creatinine), blood smear description, CD4+ and CD8+ of the spleen, and liver, spleen, kidney histopathology. There were three groups, namely negative control, allograft blood induction, xenograft blood induction. Allograft blood was obtained from other mice from a different source. Xenograft blood was obtained from cat blood. The blood was injected intraperitoneally (i.p) 0.2 ml 5 times per week until seven weeks. The results showed that both types of blood induced hemolytic anaemia with a different type and impacted liver, spleen and kidney tissue. Xenograft blood group has a higher ($p<0.05$) WBC, bilirubin, BUN level, number of CD4+ and CD8+ cells of spleen and lower ($p<0.05$), albumin and creatinine level than that of allograft blood group than of allograft. Both allograft and xenograft blood induce the tissue destruction of the spleen, liver and kidney. Conclusions of the research were the allograft blood caused fast hemolytic anemia and the xenograft blood induced the delayed hemolytic anaemia.

Keywords: allograft, anaemia, xenograft

Audience Take Away:

- The presentation includes the clinical application of bone grafts and the membranes (ACM) in the patients which will give the awareness to the audience, the above information can be implemented in the clinical research and clinical practice

Biography:

Fajar, DVM, M.Biotech studied Biomedical Engineering from Biotechnology Master Program at Universitas Gadjah Mada, Indonesia and graduated as MBiotech in 2013. He is a veterinarian (DVM) since 2009. His master thesis was about nerve xenograft from sheep using decellularization techniques. He is a lecturer in the Faculty of Veterinary Medicine, Universitas Brawijaya started in 2013. He has an active researcher, and he achieved research grant Medical ministry of Indonesia in 2015, which developed xeno-cardiac tissue engineering. He got as the best presenter in Nichi-in Regenerative Medicine event in Tokyo, Japan, in 2019. He is one of the panelist in SYIS TERMIS AP in 2021. Now he has 16 Scopus articles.

Bhardwaj Payal*, Athira Raj, S Srikantaswamy
Department of M. Tech. in Materials Science, University of Mysore, Karnataka, India

Electrical impedance spectroscopy: tool for bone health diagnosis?

There is currently only one technique that has been used routinely to screen for osteoporosis, the Dual Energy x ray absorptiometry (DEXA) test. DEXA test attempts to predict bone risk fracture based on bone mineral density. Bone density is not the best predictor of future fracture. Micro architecture is another important fracture risk parameter which if analyzed along with the DEXA scanning can predict more accurately. Few of the findings of our lab showed correlation between dielectric parameters and bone microarchitecture. We report here that the results from the initial studies are promising but significant barriers would have to be overcome, before electric impedance analyzer could become a part of routine osteoporosis screening.

Audience Take Away:

- They might get a better understanding of how the changes in material composition or architecture would cause a change in the electrical properties
- Societal intervention of this particular technique if established, would enable us to diagnose the bone porosity with much ease and in a very economical manner. Of primary importance is understanding the changes in dielectric parameters with the bone porosity

Biography:

Dr Payal Bhardwaj has completed her PhD from the Department of Biophysics, Panjab University, Chandigarh, India. Currently, she is working as a Women Scientist/Department of Science and Technology in University of Mysore, Department of Materials Science, Mysore, Karnataka. She has almost twelve years of research and over five years of experience in teaching undergraduate and graduate students at the department of Biophysics.

Majid Abedi[1], Samira Tajvar[2], Hossein Rezvandoust[3], Narjes Mohamad Esmaeili[4], Fatemeh Taati[5], Majid Hajihosseinali[6]*

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Restoration of Craniomaxillofacial Bone Deficiencies by Patient-Specific 3D Bioprinted Bone Scaffolds

Guided bone regeneration (GBR) is a reconstructive procedure for craniomaxillofacial bone defects. Common GBR methods using barrier membranes combined with bone graft could be limited due to the complicated structure of craniomaxillofacial bone, large area bone resorption and the uniqueness of individual defects. Three dimensional (3D) bioprinting technology facilitates the fabrication of complex patient-specific meshes and scaffolds. To date, the application of 3D bioprinting to reconstruct the craniomaxillofacial bone defects is very limited. In the present study, 3D bioprinted patient-specific scaffolds were prepared and applied for three patients. The present study consists of 5 stages: developing an appropriate bioink, determining the physicochemical characteristics of scaffolds, performing in vivo animal experiments, designing and fabrication of patient-specific scaffolds and in-human implantation of scaffolds. The developed bioink was a composite of PCL/β-TCP. The presence of β-TCP as a bioactive element in the composite enhanced the cell behavior and scaffold integration with surrounded bone to prevent any localized necrosis or implant failure. The scaffold pore size set to 400 µm which is desirable for bone tissue regeneration. By means of SEM-EDS technique (Scanning Electron Microscopy with Energy Dispersive Spectroscopy), Ca/P molar ratio of deposited layer was measured 1.71 which is similar to human bones (1.63). Subsequently MTT assay confirmed the biocompatibility of scaffolds. In vivo evaluation of scaffolds was performed on the calvarial bone of eight-week-old male Sprague-Dawley rats (n=4, Pasture institute). Histological analysis showed that after one-month, collagen fibers were deposited and after three months, the created defect filled with new bone tissue. Large populations of osteoblasts and osteocytes were present at the defect site and the shape of repaired tissue was similar to the natural bone. Then, three subjects with different periodontal defects were selected for scaffold implantation. The first one was a 69 years old female with intense bone resorption in the bone surrounding the missing upper left molar and pre-molar teeth. The second subject was a 62 years old female with severely bone lose around two implants in her left posterior maxilla four years after insertion. And the third one was a 73 years old female with an edentulous maxilla. In all cases, bone augmentation was proposed due to the patients' inadequate bone volume for stable dental implants. So, personalized scaffolds were designed, 3D bioprinted and implanted in patients. In all cases, the implantation of developed PCL/β-TCP composite scaffolds as an artificial bone substitute revealed promising results after continues follow ups. In conclusion, we have successfully 3D bioprinted PCL/β-TCP scaffolds and sheets, evaluated their bioactivity and biocompatibility, and investigated their performance during in-vivo experiments. According to the results, 3D bioprinting technique is thought to be very helpful for patients with craniomaxillofacial bone disease.

Keywords: Guided Bone Regeneration, Bone Scaffolds, 3D Bioprinting, Bone Tissue Engineering, Craniomaxofacial Bone Deficiency

Audience Take Away:

- 3D bioprinting technique will be introduced as a growing and practical technique to heal craniomaxillofacial bone defects
- A systematic method of design and fabricating of patient-specific scaffolds will be explained
- Using absorbable scaffolds and sheets proposed in this work, dentists can reduce the treatment time and cost due to prevention of secondary surgery (in comparison with unabsorbable mesh removal)

Biography:

Majid Hajihosseinali received his PhD in biomedical engineering at Sharif University of Technology with a minor in industrial engineering from Amirkabir University. As a researcher in bioengineering turned entrepreneur with cross-disciplinary experience in engineering, medicine, health, and biology. With a rich academic background in biomedical, mechanical and industrial engineering, he is the founder and CEO of OmidAfarinan, the first bioprinting company in Iran. He is leveraging his passion for health to improve health and medicine. He has been awarded numerous awards such and Djawad Mowafaghian Fellowship, the founder of the best startup of Sharif University in 2018 and the top student at Sharif University.

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2-Deoxycytidine Differentiates Cord MSCs into cardiomyocytes in vitro and Improves Cardiac Function *in vivo*

Introduction: Small molecules are wisely used to induce differentiation in stem cell. 2'-deoxycytidine (DC), belong to cytidine family is used as demethylating agent. It stimulates the cardiac specific genes and proteins expression and directs Mesenchymal Stem Cells differentiation towards cardiomyogenic lineage.

Aims: Our aim was to analyze 2'-deoxycytidine activated rat umbilical cord derived mesenchymal stem cells (UC-MSCs) for their potential role in adhesion and cardiac differentiation.

Methods: Myocardial infarction (MI) was produced in Wistar rats by occlusion of the left anterior descending coronary artery. MSCs were treated with 2'-deoxycytidine to activate cardiac specific genes. Normal (untreated) and DC-treated MSCs were transplanted through intramyocardial injection in respective groups. Cardiac function was assessed by echocardiography at 2 and 4 weeks after cell transplantation. Histological analysis was performed to observe changes at tissue level.

Results: Homing of DC-treated MSCs was significantly (***P<.001) higher as compared to normal MSCs in the infarcted hearts. This may be due to increase in the gene expression of some of the cell adhesion molecules as evident by qRT-PCR analysis. Significant (***P<.001) improvement in the restoration of heart function in terms of left ventricular diastolic and systolic internal diameters (LVIDd, LVIDs), % ejection fraction, % fraction shortening and end-systolic and end-diastolic volumes were observed in DC-treated MSCs as compared to the MI model. Histological analyses showed significant (***P<.001) reduction in scar formation in the DC-treated group. Differentiation of treated MSCs into functional cardiomyocytes was evident through immunohistochemical staining. LV wall thickness was also preserved significantly (***P<.001). Blood vessel formation was more pronounced in DC-treated group although both cell therapy groups showed significant increase as compared to MI model.

Conclusion: Our findings showed that activation of cardiac specific genes through DC improves cardiac function through better survival, adhesion and differentiation of transplanted cells. Transplantation of these MSCs in the infarct area restored functional myocardium.

Key Words: Mesenchymal stem cells, 2-Deoxycytidine, Cardiomyocytes, Myocardial Infarction, Regeneration

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The impact of decellularization methods on human muscle extracellular matrix

Extracellular matrix (ECM) obtained after cell depletion (decellularization process) has been recently appointed as the best system to recapitulate fundamental aspects of the native tissue structure and soluble factors. In this work we propose the decellularization method as tool to study ECM composition of human skeletal muscle tissue. In order to balance both cell removal and the maintenance of the tissue structure and biochemical composition, we compared the efficiency of two decellularization methods. The detergent-enzymatic protocol involved cycles of sodium deoxycholate (SDC), the enzyme DNaseI and water. The non-detergent protocol expected the use of the chemical latrunculin B and water. DNA and ECM components quantification, electron microscopy imaging, immunohistochemistry and immunofluorescence analysis were performed. The use of SDC ensured the desired cell removal, the maintenance of the extracellular matrix (ECM) structural proteins such as laminin and fibronectin, but the sulfated glycosaminoglycans (GAGs) strongly decreased. On the contrary, Latrunculin B treatment allows a much better maintenance of GAGs in respect to the shape of the muscle fibers. GAGs interact with ECM constituents, adhesion molecules and growth factors that play a crucial role in muscle development and maintenance. These results demonstrated that SDC and Latruculin B treatment can provide a good tridimensional mold for ex vivo modeling of healthy and pathological muscle. Duchenne muscular dystrophy is an example of muscle pathology in which GAGs are dysregulated and they could represent a new therapeutic target.

Audience Take Away:

- Different tissue characteristics can be enhanced according to different decellularization methods
- The tissue characteristics selected after decellularization are useful for specific applications
- Different decellularization methods provide model of specific aspects of a disease
- The decellularization processes provide tissue-like model that well mimic the cell-ECM interaction

Biography:

Dr Stefania D'Agostino graduated in Industrial Biotechnologies at the University of Padova in 2017 (MSc) under the supervision of Dr Michela Pozzobon, Stem Cells and Regenerative Medicine Lab. In the same laboratory she started her PhD in 2017 and after 6 months of experience at the ZHAW Institute of Zurich under the supervision of prof Michal Raghunath, she received her PhD in Developmental Medicine and Health Planning Science, in march 2020. She is now junior post doc with a research fellow in the same laboratory, studying muscle extracellular matrix of healthy and pathological muscle.

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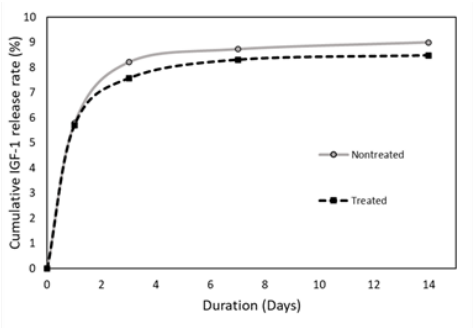
Igf-1 release from electrospunned pcl scaffold: ozone treatment effect on release kinetics

Introduction: Polycaprolactone scaffolds are commonly used for tissue engineering due to tunable fabrication properties, biodegradability, and biocompatibility. Although, the problem related to its wettability and the lack of functional groups that are essential for growth factor incorporation, remains. In this research ozone treatment in water environmental was used to enhance PCL scaffold wettability and the number of functional groups. Since IGF-1 is positively charged it can be incorporated to the PCL scaffold through functional groups occurred after treatment.

Materials and methods: The present study investigated the effect of ozone treatment to IGF-1 release kinetics. IGF-1 release was analysed using ELISA method and further investigation of release profile kinetics was performed using four mathematical models: the zero-order, first-order, Hixson–Crowell, and Higuchi. Coefficient of determination (R2) value was generated using simple linear regression. According to R2 best fitted mathematical model was used to calculate the release constants (k) for different treatment duration IGF-1 release profiles. The rate of IGF-1 release from scaffold was then compared according to k values.

Results: The IGF-1 release profile had two distinct stages: an initial burst and slow sustained release. The majority of IGF-1 was not released, demonstrating that there was a strong interaction between IGF-1 and the scaffold. Such release kinetics was approximated by Higuchi model, which suggested that the release constant (k) decreased with increasing treatment duration indicating slower release of IGF-1.

Conclusion: The release profiles of IGF-1 in all samples achieved the best fit with the Higuchi model, as indicated by the highest value of R2. Higuchi model shows that release of growth factor is time dependent and diffusion-controlled process. All observations suggest that O3 treatment could be used to release IGF-1 in a controllable and sustained manner.



Treatment time, min		Kinetic model			
	Release, %	Zero order	First order	Hixson Crowell model	Higuchi model
Nontreated	8.99	$R^2 = 0.47$	$R^2 = 0.48$	$R^2 = 0.47$	$R^2 = 0.75$; k = 5.63
Treated	8.47	$R^2 = 0.46$	$R^2 = 0.47$	$R^2 = 0.47$	$R^2 = 0.75$; k = 5.48

Biography:

Lauryna Dabasinskaite is PhD student from Kaunas University of Technology, Lithuania. Science field – chemistry, research topic: "Encapsulation and release kinetics of bioactive materials in biliar polymer fibers". Also working as junior researcher on "Innovative advanced therapy construct for articular cartilage regeneration (ICAR) project". This research project is funded by the European Regional Development Fund according to the 2014–2020 Operational Programme for the European Union Funds' Investments, under activity "Research Projects Implemented by World-class Researcher Groups".

Judith Hagenbuchner[1,2]*, Heidi Fiegl[3], Alain Zeimet[3], Michael J. Ausserlechner[1,4]

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Electrical impedance spectroscopy: tool for bone health diagnosis?

The reduction and replacement of animal experiments requires novel strategies for 3D cell culture that better reflect the complex 3D interaction of different cell types in living tissue. Compared to static 3D methods e.g. hanging drops, v-bottom plates or magnetic levitation *in vitro* cultivation using agitation-mediating devices significantly improves many physiological parameters such as oxygen supply and nutrient uptake. Devices such as orbital shakers or stirrer-tank bioreactors do not support parallelization and occupy significant incubator space, so only minimal condition testing is possible. To overcome these limitations we developed a microprocessor-controlled, fully 3D-printed mini-bioreactor system that allows stirred agitation of human cell spheroids and tissue aggregates in 12 or 24 well plates in a highly parallelized manner – i.e. simultaneous cultivation of up to 384 (16x 24 well plates) wells per bioreactor. The system is successfully used for growing brain-organoids and tumor cell / fibroblast spheroids. With these mini-bioreactors we now also developed a protocol to culture and expand tumor spheroids isolated from the ascites of ovarian cancer patients, which allows us parallel testing of multiple anti-cancer drugs. These free-floating tumor spheroids might be responsible for the spreading of ovarian cancer throughout the abdomen and the poor prognosis of patients with this malignancy. Interestingly, tumor-spheroids frequently show significant resistance to standard drugs used for ovarian cancer therapy (e.g. cisplatin), suggesting that these spheroids either represent a drug-resistant subpopulation of cancer cells that is shed off from the primary tumor or that these spheroids have an entirely different metabolism making them resistant to therapeutic drugs, which in both cases is detrimental for the patient. Parallelized testing with the mini-bioreactor system now provides an option to identify those chemotherapeutics that eradicate also ascites-derived tumor-spheroids and to study the underlying drug resistance mechanism. We believe that the depletion of freely-floating, metastasis-inducing tumor spheroids in the ascites of ovarian cancer patients is critical to improve the long term survival of these cancer patients and the use of mini-bioreactors for parallelized drug screening provides an option to identify effective chemotherapeutic drugs.

Audience Take Away:

Here we present a fully 3D printed, custom developed bioreactor for 12 and 24 well plates allowing efficient parallelization of agitated 3D cell growth also for small labs. The audience will learn that this microprocessor-controlled system can be used for complex 3D spheroids composed of multiple cell types, for growing organoids, and for primary, tumor spheroids isolated from the ascites of ovarian cancer patients. The rotation speed is strictly controlled and the system provides specific programs for preventing spheroid adhesion to the bottom of culture plates. This allows us to perform patient-specific drug testing on tumor avatars and to directly identify those therapeutics that selectively target spheroid metastases in ovarian cancer. In future, this novel system and cultivation technique might feed back into selection of therapeutic form precision medicine cancer therapy.

Biography:

Dr. Judith Hagenbuchner studied biotechnology at the University of Applied Sciences in Upper Austria and graduated as engineer (Dipl. Ing) in 2006. She received her PhD in molecular biology at the University of Innsbruck in 2009 and the venia docendi (Habilitation) in experimental pathology from Medical University of Innsbruck in 2016. She is senior researcher at the Childrens Hospital Innsbruck and co-founder of Austria's first 3D Bioprinting Laboratory (2017). Her main research interests are mitochondrial metabolism and fusion fission dynamics, organoid growth and building smart in vitro models by 3D bioprinting. She has published more than 23 papers in peer-reviewed journals.

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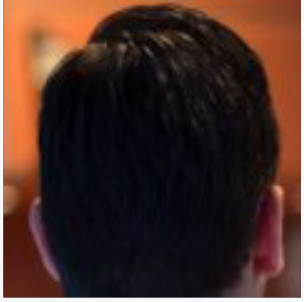
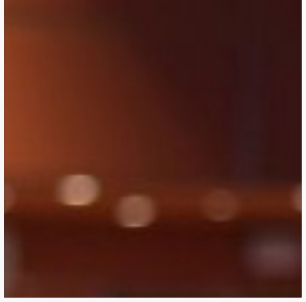
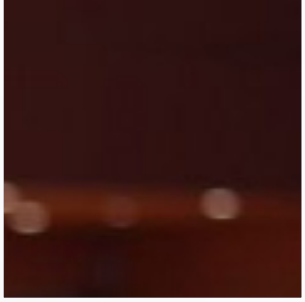
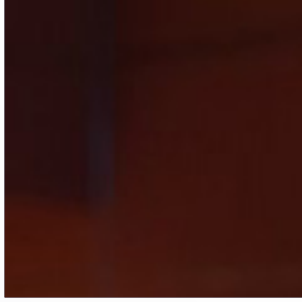





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