EuroSciCon

# DAY 1

Special Session


13th Edition of International Conference on

## Advances in Tissue Engineering and Biomaterials Science

June 17-18, 2019 | London, UK

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Advances in Tissue Engineering and Biomaterials Science

Dimitrios A. Lamprou, J Biomedical Sci 2019, Volume 08

# 3D printing and electrospinning: Applications in drug delivery and tissue engineering

**Dimitrios A. Lamprou**
Queen's University Belfast, UK

**3D printing and electrospinning are example of technologies that have been widely used in other industries, however are new to Pharmaceutical Industries and for Tissue Engineering Applications. Therefore, the use of these techniques in drug delivery and tissue engineering, including the use of state-of-the-art characterisation methods (e.g. Bio-AFM, ToF-SIMS, nanoCT) will discussed in this talk. The first part will focus on the preparation of drug-loaded polymeric electrospun nanofibers. The purpose of this study is to examine any potential effects, chemical and mechanically, of drug-loaded electrospun nanofiber scaffolds. Biopolymers that used for biomedical applications was loaded with either antibacterial agents or broad-spectrum antibiotics. The electrospun fibres were characterised through various methods in order to measure the drug efficacy, antibacterial properties, and drug-polymer interactions. There are a number of different applications within medicine that require materials to be developed with the optimal characteristics, such as their strength, rate of degradation, and porosity, as well as their shapes and sizes. 3D printing process patented in 1986, however only recently have be utilised in the field of tissue Engineering using also bioprinters. Therefore, in the second part, 3D printed systems that have be formulated using advanced additive technologies and characterised using advanced characterisation techniques will be discussed.**

## Biography

Dimitrios Lamprou (Ph.D., MBA) is Reader in Pharmaceutical Engineering and MSc Programme Director at the School of Pharmacy in Queen's University Belfast (UK; a member of the Prestigious Russell Group) and Visiting Researcher at University of Strathclyde (Glasgow, UK) with experience of teaching in Higher Education, conducting research (60+ publications, 200+ conference abstracts, 60+ Invited Presentations) and securing national and international funding (£2M+). His Group Research Interests focused on five distinct areas: Biosurface Engineering, Electrospinning, Microfluidics, Nano-analysis, and Printing of Medicines

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# DAY 1

Scientific Tracks & Abstracts


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June 17, 2019

## Sessions

## Biomedical Engineering Techniques, Tissue Engineering, Immunomodulation, Regenerative Medicine, Biomaterials, Stem Cell Bioprocessing

**Session Chair**
**Alamelu Sundaresan**
Texas Southern University, USA

**Session Introduction**

Title: **Characterization of three-dimensional bone constructs derived from unloaded human fetal osteoblasts exposed to the random positioning machine and use of prebiotics for bone heath**

**Alamelu Sundaresan,** Texas Southern University, USA

Title: **Amniotic membrane mapping discloses novel promising features of amniotic membrane epithelial cells for regenerative medicine purposes**

**Roberta Di Pietro,** G. d'Annunzio University of Chieti-Pescara, Italy

Title: **Induction of hepatic regeneration in an experimental model using hepatocyte differentiated MSCs**

**Taghrid Gaafar,** Cairo University, Egypt

Title: **Ag-doped PCL nanofibers for tissue engineering**

**Permyakova Elizaveta,** National University of Science and Technology MISiS, Russian Federation

Title: **Stimuli responsive lipid coated mesoporous silica nanoparticles for drug delivery**

**Muhammad Umair Amin,** Philipps-Universität Marburg, Germany

Title: **Photosensitive tetraether lipid-based liposomes for temoporfin mediated photodynamic therapy to cancer cells**

**Sajid Ali,** University of Marburg, Germany

Title: **Evaluation of serum calcium levels in pre-eclampsia**

**Heera Lal Roy,** Khulna City Medical College, Bangladesh

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Alamelu Sundaresan et al., J Biomedical Sci 2019, Volume 08

# Characterization of three-dimensional bone constructs derived from unloaded human fetal osteoblasts exposed to the random positioning machine and use of prebiotics for bone heath.

**Alamelu Sundaresan[1], Vivek Mann[2], Sundar Devakottai[3], Ria Devakottai[4],** and **Daniella Grimm[5]**

[1]Texas Southern University, USA

[2]University of Incarnate Word School of Medicine, USA

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**Human cells exposed to microgravity form large 3D tissue constructs mirroring the *in vivo* architecture (e.g. cartilage, intima constructs, cancer spheroids and others). In this study, we exposed human fetal osteoblasts (hFOB 1.19) cells to the Random Positioning Machine (RPM) for 7 and 14 days with the purpose to engineer 3D bone constructs. RPM-exposure of hFOB 1.19 cells induces alterations in the cytoskeleton, cell adhesion, ECM and 3D multicellular spheroid (MCS) formation. In addition, it also influences the morphologic appearance of these cells after 7 days as it forces adherent cells to detach from the surface and assemble in 3D structures. The RPM-exposed hFOB 1.19 cells exhibited a differential gene expression of the following genes: transforming growth factor beta 1 (TGFB1), bone morphogenetic protein 2 (BMP2), SRY-Box 9 (SOX9), actin beta (ACTB), beta tubulin (TUBB), vimentin (VIM), laminin subunit alpha 1 (LAMA1), collagen type 1 alpha 1 (COL1A1), phosphoprotein 1 (SPP1) and fibronectin 1(FN1). RPM-exposure also induced significantly altered release of the cytokines and bone biomarkers sclerostin (SOST), osteocalcin (OC), osteoprotegerin (OPG), osteopontin (OPN), interleukin 1 beta (IL-1 ) and tumor necrosis factor 1 alpha (TNF-1 ). After two weeks of incubation, the spheroids presented a bone-specific morphology. Of late unloading conditions and use of prebiotics are known to augment 3D tissue engineering of immune cells and bone. Preliminary results from the use of a prebiotic AHCC on lymphocytes and hFOB cells in unloaded conditions will also be presented.**

**Recent Publications**

1. A. Sundaresan, S.Devakottai, J. E. Reseland: Effects of load on normal human osteoblast function. European Cells and Materials,. Volume No 26 - Supplement 2,pages 32-33 – 2013.

2. Claudia Ulbrich,1 Markus Wehland,2 Jessica Pietsch,2 Ganna Aleshcheva,2 Petra Wise,3 Jack van Loon,4,5,6 Nils Magnusson,7 Manfred Infanger,2 Jirka Grosse,8 Christoph Eilles,8 Alamelu Sundaresan,9 and Daniela Grimm10. Review Article. The Impact of Simulated and Real Microgravity on Bone Cells and Mesenchymal Stem Cells. BioMed Research International.Volume

2014 (2014), Article ID 928507, 15pages. http://dx.doi.org/10.1155/2014/928507http://dx.doi.org/10.1155/2014/928507

3. Clarke, M.S.F*., Sundaresan, A*.,Vanderberg, C.,and Pellis, N.R., A three-dimensional tissue culture model of bone formation utilizing rotational co-culture of human adult osteoblasts and osteoclasts Acta Biomaterialia, Volume 9, Issue 8, August 2013, Pages 7908–7916.

4. Change in Bioavailability and Functional Response of Human Lymphocytes to AHCC via altering pH during preparation of AHCC and Responsive Assessment of Cell Proliferation

5. Devakottai, Ria , Sundaresan, Alamelu and Wilson, Bobby Wilson. Change in Bioavailability and Functional Response of Human Lymphocytes to AHCC in 3D culture via altering pH during preparation of AHCC and Responsive Assessment of Cell Proliferation.STEM ready internship symposium, August 2016.

## Biography

Dr.Sundaresan is a Professor of Biology at Texas Southern University and the director of the Osteoimmunology and Integrative Physiology Laboratory. Her laboratory focusses on research in Immune suppression, mathematical modeling, bone biology, tissue engineering, cardiovascular biomarkers and nutritional immunomodulation.The specific areas we investigate are upstream targets in lymphocyte signaling in microgravity, adaptive genetic response gene suites, hyper gravity and high altitude stress, lymphocyte locomotion and signal transduction in microgravity,bone tissue engineering and resorption models and human radiation/cancer /toxicity models. We also have ongoing projects in nanoformulation, nanotechnology and mathematical tissue modeling of heavy ion effects.

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Roberta Di Pietro, J Biomedical Sci 2019, Volume 08

# Amniotic membrane mapping discloses novel promising features of amniotic membrane epithelial cells for regenerative medicine purposes

**Roberta Di Pietro**

G. d'Annunzio University of Chieti-Pescara, Italy

**The amniotic membrane (AM) is the innermost part of the placenta, in direct contact with the amniotic fluid. In recent years the interest toward placenta stem cells has been increasingly growing, due in part to the absence of any ethical issues concerning their isolation. At present, two main stem cells populations have been identified in AM: amniotic epithelial cells (AECs) and amniotic mesenchymal stromal cells (AMSCs). Although AM is an excellent source of cells for regenerative medicine, also due to its immune-modulatory properties and low immunogenicity, only a few papers have studied its sub-regions. Thus, our focus was to map the human AM under physiological conditions to identify possible differences in morpho-functional features and regenerative capacity of its components. Human term placentas were collected from healthy women after vaginal delivery or caesarean section at Fondazione Poliambulanza-Istituto Ospedaliero of Brescia, University Hospital of Cagliari and SS. Annunziata Hospital of Chieti. Samples of AM were isolated from four different regions according to their position relative to umbilical cord (central, intermediate, peripheral, reflected). By means of immunohistochemistry, morphometry, flow cytometry, electron microscopy, CFU assays, RT-PCR and AECs in vitro differentiation we demonstrated the existence of different morpho-functional features in the different regions of AM, highlighting that AECs are a heterogeneous cell population. This should be considered to increase efficiency of amniotic membrane application within a therapeutic context.**

## Biography

Roberta Di Pietro got the degree in Medicine cum Laude in 1985 and the Specialization in Sports Medicine cum Laude in 1988, University of Chieti, Italy. She worked as a Visiting Scientist at the Biochemistry Department, AFRC, Cambridge, UK; at the Pathology Department, USUHS, Bethesda, USA, and at the Institute of Human Virology, University of Maryland, Baltimore, USA. She got the position of Full Professor of Histology and Embryology at the University of Chieti since 2005. She joined the Editorial Board of Current Pharmaceutical Design as an Executive Guest Editor and, recently, the Editorial Academy of the International Journal of Oncology as an Honorary Member. She was recognized as a Registered Referee for Archives of Ophthalmological Reviews and Reproductive Biology and Endocrinology. She is now author of 200 scientific publications plus international e-book chapters, editorials, Italian textbooks and 1 Italian patent.

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Taghrid Gaafar, J Biomedical Sci 2019, Volume 08

# Induction of hepatic regeneration in an experimental model using hepatocyte differentiated MSCs

## Taghrid Gaafar

Cairo University, Egypt

**Background and Objectives:** Scaffolds are three-dimensional (3D) matrices that provide support for cells to attach, proliferate, and differentiate, facilitating extracellular matrix formation. The study aimed to examine the differentiation potential of Mesenchymal stem cells (MSCs) into hepatocytes in 2D and 3D culture systems to improve their in vitro differentiation, and test their functionality in vivo.

**Methods:** MSCs were generated from umbilical cord blood. Hepatogenic differentiation was induced on 2D and 3D cultures and characterized by morphology, scanning electron microscopy, immunocytochemistry and Gene expression. Albumin and α-1 antitrypsin (AAT) in culture supernatants were measured. Differentiated Cells were administered IV into a murine model of carbon tetra (CCL4) induced liver cirrhosis which were divided into 3 groups, a) Pathological control group, b) and c) Groups treated with hepatogenic differentiated MSCs cultured on 2D and 3D culture system respectively. After 12 weeks of injection, liver pathology was examined.

**Results:** The hepatogenic differentiated MSCs stained positively for albumin, alpha fetoprotein (AFP), Heppar1, cytokeratin7, 18, and OV6 with more mature cells, hexagonal in shape with central nuclei forming large sheets in groups in 3D culture system. AAT secretion and Indocyanine green uptake were significantly increased in 3D system. In experimental model, MSC-3D treated group exhibited maximal restoration of liver architecture with absent septal fibrosis and marked improvement of ALT, AST.

**Conclusions:** Both 3D and 2D culture system are effective in functional hepatogenic differentiation from MSCs. In vivo hepatogenic differentiation is more effective on 3D scaffold, with better functional recovery.

### Biography

Roberta Di Pietro got the degree in Medicine cum Laude in 1985 and the Specialization in Sports Medicine cum Laude in 1988, University of Chieti, Italy. She worked as a Visiting Scientist at the Biochemistry Department, AFRC, Cambridge, UK; at the Pathology Department, USUHS, Bethesda, USA, and at the Institute of Human Virology, University of Maryland, Baltimore, USA. She got the position of Full Professor of Histology and Embryology at the University of Chieti since 2005. She joined the Editorial Board of Current Pharmaceutical Design as an Executive Guest Editor and, recently, the Editorial Academy of the International Journal of Oncology as an Honorary Member. She was recognized as a Registered Referee for Archives of Ophthalmological Reviews and Reproductive Biology and Endocrinology. She is now author of 200 scientific publications plus international e-book chapters, editorials, Italian textbooks and 1 Italian patent.

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Permyakova Elizaveta, J Biomedical Sci 2019, Volume 08

# Ag-doped PCL nanofibers for tissue engineering

**Permyakova Elizaveta[1], Manakhov Anton[1], Sheveyko Alexander[1] Polčak Josef [2,3], Zajíčková Lenka[4], Kovalskii Andrey[1], Ignatov Sergey[5] Shtansky Dmitry[1]**

[1]National University of Science and Technology "MISiS", Russia

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[5]State Research Center for Applied Microbiology and Biotechnology, Russia

**Poly-ε-caprolactone (PCL) is a biocompatible and biodegradable polymer that is attracting great interest as the promising materials for various applications is in medicine and, in particular, in tissue engineering. Here, we produced PCL nanofibers by electrospinning technique that allows one to obtain the nanofiber structure similar to that of extracellular matrix. The PCL scaffolds can be used as bone fillers and skin bandages. To improve bioactivity and to endow the PCL nanofibers with antibacterial properties, the material was first coated with multifunctional bioactive nanostructured films and then implanted with Ag ions. To select Ag ion energy, SRIM (The Stopping and Range of Ions in Matter) calculations were carried out. Microstructure and phase composition of modified fibers were studied by means of scanning electron microscopy and X-ray photoelectron spectroscopy. The adhesion and proliferation of the MC3T3-E1 cells cultivated on the surface of TiCaPCON-coated PCL nanofibers were significantly improved in comparison with the uncoated nanofibers. The antimicrobial effect of the Ag-doped samples was evaluated against clinically isolated Escherichia coli U20 (E. coli), Staphylococcus aureus 839 (S. aureus) bacteria and different strains of Neurospora crassa (N. crassa) Wt987, Nit-6 and Nit 20. In all cases surface Ag-doped nanofibers had strong antibacterial effect, however Ag ions didn't release from the scaffold that means they don't be accumulated in the liver. Inductively coupled plasma mass spectrometry (ICP-MS) which was utilized to determine the amount of Ag ions leached from the scaffolds indicated less than 5 ppb/cm$^2$ released Ag ions for 7 days.**

## Biography

Permyakova Elizaveta is a PhD student of Material Technology in National University of Science and Technolgy "MISiS". The main topic of her research is related to the deposition of bioactive multicomponent thin films, immobilization of biomolecules and surface analysis. Her work is absolutely essential for the development of novel bioactive materials used in regenerative medicine. Permyakova has already published eleven articles indexed in Scopus and she is first author of four articles. Permyakova has demonstrated very good expertise in biochemistry, cell biology and material characterization.

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Muhammad Umair Amin et al., J Biomedical Sci 2019, Volume 08

# Stimuli responsive lipid coated mesoporous silica nanoparticles for drug delivery

**Muhammad Umair Amin, Sajid Ali, Imran Tariq, Muhammad Yasir Ali, Shashank Reddy Pinnapreddy, Jana Brüßler** and **Udo Bakowsky**

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**Immediate release of the drug from the drug delivery carrier after cellular uptake is a big challenge. Premature leakage of the chemotherapeutics during circulation, causing side effects to healthy tissue, is even more relevant. Stimuli responsive drug delivery systems have addressed these issues and have become more attractive in last few years. Physical stimuli including ultrasound (US) due to its non- invasive nature are considered very safe and effective. Mesoporous silica nanoparticles due to their salient features are very suitable for drug delivery to tumor cells. These features include larger surface area, hydrophilic and hydrophobic nature, tailorable pore size and pore volume, inner and outer surface for attachment, mechanical strength and non-toxic nature. By combining distinguishing features of liposomes to mesoporous silica nanoparticles very satisfactory results can be achieved. We have developed an US responsive drug delivery system where we have used mesoporous silica nanoparticles as a drug carrier, doxorubicin as a model drug, perfluoropentane (PFP) as an US responsive material and liposomes as gatekeeper. The release of the drug was successfully triggered by US due to the disruption of low boiling point PFP inside pores, building up pressure and causing the immediate release. This immediate release was also observed in cell culture experiments where our system has produced more cytotoxic effects to tumor cells as compared to non-US carriers. Lipid coating to MSNPs not only provided the gate keeping effects but also enhanced the cellular uptake of the carrier.**

## Biography

Muhammad Umair Amin is Pharmacist by profession and has done his Master in Pharmaceutics. Currently he is doing PhD under DAAD/HEC Pakistan Scholarship program, in the supervision of Prof. Dr. Udo. Bakowsky at Department of Pharmaceutics and Biopharmaceutics, Philipps-Universität Marburg, Marburg, Germany. The major area of interest is development of drug carrier systems and characterization. Primary research goals are directed toward the fabrication of mesoporous silica nanoparticles and targeting of nanoparticles loaded with anti-cancer drugs to resistant hypoxic tumor cells. He has an experience in research, teaching and administration in education institutions.

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Sajid Ali et al., J Biomedical Sci 2019, Volume 08

# Photosensitive tetraether lipid-based liposomes for temoporfin mediated photodynamic therapy to cancer cells

**Sajid Ali, Umair Amin, Jens Schäfer, Jarmila Jedelská** and **Udo Bakowsky**

University of Marburg, Germany

Photodynamic therapy (PDT) is a minimally-invasive therapeutic approach that is being widely used for the treatment of large number of medical conditions. The principal of PDT is based on the combination of a light sensitive molecule (a photosensitizing agent) and light. After being administered, the photosensitizer compound can be illuminated by specific wavelength of light to activate the drug molecule (photosensitization). After absorption of light energy of particular wavelength, the photoactivated sensitizer interacts with molecular oxygen to generate free radicals and singlet oxygen species. These highly reactive oxygen species (ROS) then induce cellular apoptosis or necrosis leading to tumor destruction. These species are very short lived; therefore, the resultant tissue damage occurs very close to production site. Temoporfin loaded liposomes are prepared by thin film hydration and filter extrusion technique using stable tetraether lipid combinations. These liposomes were extruded to get uni-dispersed liposomal population. These processed liposomes were characterized for size distribution parameters, encapsulation efficiency and morphological studies using dynamic light scattering, laser doppler velocimetry, ultracentrifugation and atomic force microscopy. These liposomes were further evaluated for in-vitro photo-cytotoxicity and intracellular localization with CLSM in SK-OV-3 cell line. The safety profile of these formulations was also tested using haemocompatibility assay and in-vitro CAM model. All liposomal formulations ranged from 109 nm to 140 nm in size with a PDI less than 0.2 and surface charge from -6 to +35mV. Photodynamic studies showed a dose dependent effect with no cytotoxicity in unirradiated formulations. Intracellular uptake studies confirmed the temoporfin localization into the nuclear region. In vivo CAM model showed a strong occlusion of blood vessel while haemocompatibility studies showed no toxicity to the blood cells. Present study concludes that stable liposomes containing temoporfin can be formulated using different lipid combinations. These formulations are superior to free temoporfin in terms of safety and efficacy as well as very effective against different cancer and bacterial strains.

**Recent Publications**

1. Mahmoud, G., et al., Stabilized tetraether lipids-based particles guided porphyrins photodynamic therapy. Drug delivery, 2018. 25(1): p. 1526-1536.
2. Duse, L., et al., Low level LED photodynamic therapy using curcumin loaded tetraether liposomes. European Journal of Pharmaceutics and Biopharmaceutics, 2018. 126: p. 233-241.
3. Plenagl, N., et al., Hypericin Loaded Liposomes for Anti Microbial Photodynamic Therapy of Gram Positive Bacteria. physica status solidi (a), 2018. 215(15): p. 1700837.

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Heera Lal Roy et al., J Biomedical Sci 2019, Volume 08

# Evaluation of serum calcium levels in pre-eclampsia

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**Background:** Pre-eclampsia is the most common medical complication of pregnancy associated with increased maternal and infant mortality and morbidity. Reduced serum calcium level are found associated with elevated blood pressure in preeclampsia.

**Objectives:** To evaluate serum calcium level in pre-eclamptic women.

**Methods:** This cross sectional study was carried out in among 50 pre-eclamptic patients, aged 20 to 40 years, and gestational age ranges from 20 to 40 weeks and 50 age and gestational age matched normotensive pregnant women having no proteinuria. Serum calcium was measured by Colorimetric method.

**Results:** The mean age and mean gestational age of pre-eclampsia was not significantly different from those of normotensive pregnant women (p=0.203 and p=0.251 respectively). The mean body mass indexes of the test patients were significantly different from those of normotensive pregnant women (p<0.001). The mean serum calcium level was 7.27 ± 3.01 mg/dl in pre–eclampsia and 7.25 ± 2.59 mg/dl in normal pregnant women; did not differ significantly between the subjects of pre–eclampsia and normal pregnant women (p=0.963).

**Conclusion:** Serum calcium has no association in occurrence of pre–eclampsia.

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