2019 FALL MEETING SYMPOSIA

PROGRAM IS CURRENT AS OF: NOVEMBER 12, 2019

▶ TUTORIAL SESSION AVAILABLE WITH AFFILIATED SYMPOSIUM of PEGDA samples were immersed into the water and both weight and dimension measurements were also done in every hour for four hours. At the end, the third PEGDA samples were immersed into the 99% ethyl alcohol and their weight and dimensions were measured in every hour. Our results indicate that, as the PEGDA percentage increases, its degradation rate decreases. Also, PEGDA degrades away the most in the 99% ethyl alcohol more than limonene and water. Our research to study the degradation rate of PEGDA will extend to the use of hot-stir plate to study investigate the temperature affect.

SB04.08.22

Designing of Three-Dimensional Hybrid Scaffolds for Tissue Regeneration Olga Urbanek-Swiderska and Dorota Kolbuk; Institute of Fundamental Technological Research PAS, Poland

Application of electrospun nonwovens is limited due to its two-dimensional (2D) architecture. Hybrid scaffolds consisting of electrospun fibres and other 3D techniques are formed to overcome this problem. Those scaffolds are able to combine advantages of both materials' forms [1]. Electrospun nanofibers mimic the biopolymer network of native tissue very well and provide significant surface area for attaching bioactive components for local stimulation of cellular activity. On the other hand, hydrogels and its freeze-dried forms provide 3D architecture. An example of 3D tissue are bones cavities, occurring in the result of disease or injuries. For this purpose fibres may be coated with hydroxyapatite, in order to stimulate osteoblasts proliferation and activity [2]. The aim of this research was to develop 3D hybrid scaffold from the electrospun fibres and hydrogel. Poly(lacide-*co*-glicolide)(PLGA) fibres were formed via electrospinning technique and subjected to ultrasounds in order to increase the nonwoven dimensions. Additionally, this procedure was used to cover one group of the nonwovens with hydroxyapatite (nHAp). Finally, fibres were immersed in gelatine solution, crosslinked and subjected to both, materials characteristic and *in vitro* biological tests.
The contribution of fibres to hydrogel mass after lyophilisation was 50/50 w/w. SEM imaging confirmed presence and homogenously distributed PLGA and PLGA-nHAp coated fibres in the pore walls. FTIR, EDS analysis as well as WAXS measurement confirmed presence of nHAp crystal in the scaffolds, its distribution and structure. DSC analysis revealed no significant changes in glass transition temperature nor melting temperature of PLGA. The weight loss of 3D scaffolds was conducted per one month. During the first week of incubation the weight loss was ca. 5%. Moreover, the mechanical tests and *in vitro* tests were conducted. The biological tests confirmed constant proliferation of cells in the analysed time points, as well as proper cell morphology and spreading on the scaffold surface.
Summarizing, presented technique is an effective method of 3D hybrid scaffolds preparation, based on ECM mimicking electrospun fibres.

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References: [1] Bosworth, L. A. et. al. *Nanomedicine: Nanotechnology, Biology and Medicine* 2013, *9*(3), 322-335. [2] Kolbuk, D. et al. *Journal of Biomedical Materials Research Part A* 2019.

SB04.08.23

3D Printed Cochlea Models for Cochlear Implant Studies Iek Man Lei, Chen Jiang, Manohar Bance and Yan Yan Shery Huang; University of Cambridge, United Kingdom

Since the mid-1980s, cochlear implants have been used to treat severe hearing loss, remarkably improving patients' quality of life. Despite its successful clinical translation, several issues of the current cochlear implants remain. These are such as the frequency distortion problem caused by the current spread within cochlea, and the enormous individual differences in the treatment outcomes. Animal models have been extensively used in the pre-clinical research, however these models fail to demonstrate the anatomical features and the individual variability of human cochlea. In an effort to reduce *in vivo* approaches and to develop a personalised model for cochlear implant testing, this work aims to develop a 3D printed cochlea model for cochlear implant research. Here, we demonstrate a novel strategy to fabricate a cochlea model by embedded 3D printing. Our 3D model was designed to replicate the key anatomical features of the human cochlea; the composition of the gel matrix was tuned to match the impedance properties of temporal bone. We showed that the Electric Field Imaging (EFI) profiles obtained from the 3D printed models are highly similar to the clinical patients' profiles. These 3D cochlear models see the potential to be used as a tool to understanding the clinical outcome of existing cochlear implantation; or as a pre-clinical model for testing new cochlear implants.

SB04.08.24

Scaffold Pattern Optimization for Esophageal Tissue Repair Kai Ren, Bin Wu and Yinghsi Jerry Fuh; National University of Singapore, Singapore

Esophageal tissue engineering is an emerging solution to treat esophageal carcinoma. It utilizes a combination of cells, materials, suitable biochemical and physio-chemical factors to repair or replace biological tissue or organ functions. Scaffold pattern is critical in the tissue engineering as it influences the scaffold's ultimate tensile strength and tissue's cellular infiltration, while existing scaffold pattern design relies on empirical experience. This paper proposed a scaffold pattern optimization frame to design the scaffold structure. In the frame, a finite element (FE) model was developed to describe the physical constitution of the scaffold, together with an optimization algorithm to adjust scaffold structure. A hydrophilic additive, Pluronic F127 (F127), blended with polycaprolactone (PCL) was used as the scaffold with satisfying wettability and cell adhesion. The optimized pattern was tested to mechanically and biologically mimic the native esophageal tissue structure, facilitating the tissue regeneration.

SB04.08.25

White Light Emitting Graphene Quantum Dot Hydrogels for Bioimaging and Biosensing Applications Ankarao Kalluri[1], Bilal Cakir[2,2], Prabir Patra[3,3], In-Hyun Park[2] and Challa V. Kumar[1,1]; [1]University of Connecticut, United States; [2]Yale University, United States; [3]University of Bridgeport, United States

A new facile synthesis of white light-emitting, multifunctional, water-soluble, metal-free, non-toxic, highly photostable, bio-active Protein Quantum dot (ProQDot) hydrogels is reported here. These advanced functional nanoparticles consist of cross-linked bovine serum albumin (BSA) and graphene quantum dots (GQDs). The ProQDots contain blue, green and red dye conjugated GQDs, which are intern crosslinked with BSA to form white emitting hydrogels. These are bio-degradable and highly photostable when compared to organic and inorganic dyes. This bio-hydrogels are further characterized by XRD, CD, FT-IR, DLS, Raman, UV-Visible, TEM, SEM, confocal laser microscopy, photoluminescence spectroscopy, and gel electrophoresis techniques. This robust ProQDots with a variety of surface-functionalities with unique optical properties has led to promising applications in bioimaging, cellular biology, and drug delivery studies. Furthermore, as prepared ProQDot hydrogels can be used to study neuronal intracellular processes for *in vivo* observation of cell trafficking, tumor targeting, bio-sensing, CRISPR-Cas, and immunohistochemistry (IHC) applications.

SB04.08.26

Biorprinting Autologous Dermal Equivalent Organotypics Juyi Li[1], Michael Cottone[1], Philip Cottone[1], Olias Christie[1], Vivian Su[1], Zahin Huq[1], Michael Gozelski[1], Sampson Berlinski[1], Kimberly Lu[1], Adeel Azim[1], Christopher Chan[2], Teresa Duong[3], Saba Gulzar[4], Clara Dokyung Lee[5], Stella