ely of this work is (i) to develop a novel biomimetic HA/Col nanocomposite scaffold, and (ii) to use natural biologically-derived molecules as cross-linking agent instead of synthetic chemical agents, which has been long-term regarded with cytotoxicity concerns. In summary, enzymatic cross-linking HA/Col scaffolds possess more superior properties and potential compared to conventional collagen or HA matrices as a novel bone substitute for bone tissue regeneration.

31.P12
Effect of nanofiber scaffolds on organelle morphology in human bone marrow stromal cells
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It is widely acknowledged that stem cell fates can be controlled by biomolecules and recent work suggests that physical cues, such as scaffold architecture, can also influence stem cell functions. Scaffolds with a nanofibrous structure are effective in promoting stem cell differentiation because they provide a physiologically relevant 3D microenvironment that mimics native extracellular matrix (ECM). Recent work suggests that nanofiber scaffolds are effective because they drive stem cells into a morphology that induces differentiation. However, it is not known how changes in cell morphology can influence cell fate. We hypothesize that the shape and function of subcellular organelles are modulated by changes in cell shape. Herein, we cultured human bone marrow stromal cells (hBMSCs) on poly(-caprolactone (PCL) flat 2D films and in 3D PCL nanofiber scaffolds and then measured the shape of organelles. The shape of actin, nucleus, peroxisomes and mitochondria organelles were imaged by confocal microscopy and analyzed using ImageJ software. Multiple differences in the aspect ratio and sub-cellular locations of these organelles were observed between hBMSCs culture on 2D films versus 3D nanofiber scaffolds. These results support the hypothesis that material morphology guides stem cell function by driving cells into shapes that alter the structure and function of sub-cellular organelles such as the actin, peroxisomes and mitochondria.

31.P13
Platelet lysates scaffolds prepared by supercritical fluid technology as autologous templates for cartilage regeneration
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The tissue engineering strategy proposed in this work regards the development of a novel autologous scaffold based on platelet lysates (PLs) with the ultimate goal of promoting the regeneration of an orthopaedic osteochondral interface. PLs are a high concentration of platelets in a small volume of plasma that, when activated, release several growth factors (GFs). Most of current PLs-based hydrogels present several limitations, specifically the lack of stability, the constant shrinking in culture and the need of activation with animal-derived thrombin. This study represents a major breakthrough as it demonstrates that a stable scaffold can be prepared only from PLs, thus acting simultaneously as a template for cell colonization and as multiple GF release system. The PL scaffolds, crosslinked with genipin were prepared by supercritical fluid assisted phase inversion at 100 bar and 40 °C. The morphological properties of the scaffolds were assessed and in vitro GF release profile was studied by micro BCA and ELISA assays. Scaffolds were seeded with human adipose-derived stem cells (hASCs) and cultured in vitro up to 28 days. Cell viability and proliferation were assessed as well as histology and immunohistochemistry. Results showed the deposition of cartilage extracellular matrix and the expression of chondrogenic gene makers, demonstrating the feasibility of the constructs to simultaneously provide architectural support and biological cues to promote chondrogenic differentiation.

31.P14
Directing MSC fate in 3D through cell inert and adhesive block copolymer domains
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Novel materials design for the tissue engineering often requires both chemical and physical cues on the nano- and micro- scales. To date, physicochemical properties directing mesenchymal stem cell (MSC) fate have been well studied in 2D, however understanding MSC differentiation in 3D warrants investigation. Here, we report the synthesis of highly porous matrices that are surface functionalised in 3D, with cell adhesive and inert chemistries using amphiphilic block copolymers as surfactants in a high internal phase emulsion (HIPE) templating method. Foam morphology and surface functionality were characterised by SEM, XPS and contact angle measurements while the presence block copolymer surface domains were demonstrated by chemical force spectroscopy mapping. Protein adsorption and clustering was found to be composition dependent which in turn determined the adhesion and spreading of human embryonic derived- mesoderm progenitors (hES-MP) and human bone marrow derived mesenchymal stem cells (hBMSC) cultured on these 3D scaffolds. In the absence of soluble induction factors, stem cell fate was composition and cell source dependent with the hES-MP and hBMSCs exhibiting osteo- and adipogenic differentiation respectively. These data show the importance of mimicking the heterogeneities of native extracellular matrix to control MSC fate using the HIPE process, which provides a platform for 3D matrices in tissue engineering and regenerative medicine applications.

31.P15
3D culture of mesenchymal stem cells on nanofiber PCL and PS meshes
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In the field of tissue engineering, scaffolds should mimic the extra cellular matrix ( ECM) to provide cells with the best 3D environment for their attachment, growth and differentiation. We have developed the jet-spraying method to produce nanometer sized polymer meshes that mimic the structure of collagen fibers. Two types of polymers, polycaprolactone (PCL) and polyethylene (PS), were processed, characterized by using streaming electron microscopy and inserted into 12-well plates. After gamma sterilization, human bone marrow mesenchymal stem cells (hMSC, 1.106 per 2 cm²) were seeded and cultured onto the PCL and PS meshes. The high permeability of these scaffolds allowed the proliferation, migration and osteoblastic differentiation of hMSC. The growth of cells was corroborated by Alamar Blue assay while cell colonization inside the meshes was observed by confocal microscopy and histology of cryosections. Culturing of hMSC into these 3D microenvironments allowed more physiological conditions than conventional 2D cultures on standard dishes. This method can be applied to a variety of polymers producing complex structures for a wide range of tissue engineering applications.