M-CELS Virtual Seminar Series
Friday June 24, 2022 at 3 PM CT

Seminar Link: https://illinois.zoom.us/j/84940821290?pwd=b0pBUitNVy9FeTVFYWi4Z0dVRzZmUT09

Dr. Hyunjoon Kong
Professor, Department of Chemical and Biomolecular Engineering, University of Illinois at Urbana-Champaign
3:00 - 3:20 PM CT: "Cell Secretome Regulators for Neovascularization and Homeostasis"
3:20 - 3:30 PM CT: Q&A/Discussion

Vasiliki “Aliki” Kolliopoulou
Graduate Student, Department of Chemical and Biomolecular Engineering, University of Illinois at Urbana-Champaign (Advisor: Dr. Brendan Harley)
3:30 - 3:50 PM CT: "Uncovering the immunomodulatory potential of hMSCs on mineralized collagen scaffolds"
3:50 - 4:00 PM CT: Q&A/Discussion
**Dr. Hyunjoon Kong**

**Title:** Cell Secretome Regulators for Neovascularization and Homeostasis

**Abstract:** Biological cells have the unique functionality to synthesize and secrete various paracrine factors and exosomes. These bioactive molecules and exosomes bind to or enter neighboring cells and regulate gene expression and phenotypic activities. Therefore, extensive efforts to leverage these cell-secreting factors in restoring homeostasis of diseased tissue and recreating new tissues in tissue defects and wounds. It is common to administer cell-secreting factors collected in a bioreactor or transplant cells into the target tissue. Success in both approaches relies on controlling the cellular secretion level and spatial distribution of cell-secreting factors. To assist these efforts, we have been designing bioactive materials that can stimulate cellular secretome and modulate their concentration gradients in target tissues, particularly for neovascularization and homeostasis of the diseased tissue. This talk will discuss assembly strategy, efficacy, and challenges of cell secretome regulators, such as nanostimulators that can elevate and support cellular secretion levels and 3D printed devices that can control the spacing of cell-secreting factors in the target tissue and, in turn, regulate microvascular growth direction and spacing. In addition, this talk will also discuss an approach to regulating organoid physiology with cell-secreting factors.

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**Vasiliki “Aliki” Kolliopoulos**

**Title:** Uncovering the immunomodulatory potential of hMSCs on mineralized collagen scaffolds

**Abstract:** Critical-sized craniomaxillofacial (CMF) defects require surgical intervention to promote healing. Our lab has developed a class of mineralized collagen scaffolds to promote mesenchymal stem cell (MSC) osteogenic differentiation and subsequent bone regeneration in the absence of exogenous growth factors. MSCs can also endogenously secrete immunomodulatory factors to alter macrophage (MΦ) recruitment and phenotype towards more pro-inflammatory M1 or anti-inflammatory M2. Others suggest that the inflammatory status of MSCs may lead to the production of disparate combinations of biomolecules that influence macrophage polarization. We describe the immunosuppressive behavior of MSCs cultured in mineralized collagen scaffolds based on their initial inflammatory status: licensed MSCs vs. MSCs in basal media. We report the combined effect of MSC inflammatory status as well as the structural and compositional properties of the scaffold on MΦ polarization via analysis of MSC secretome and co-culture experiments over 7 days of culture. MSCs exhibited increased metabolic activity in anisotropic scaffolds while licensed MSCs in all scaffold groups secreted more immunomodulatory cytokines compared to basal MSCs, though scaffold anisotropy induced the greatest production. We then examined MSC-MΦ interactions using indirect and direct co-cultures with and without inflammatory stimulation. While the MΦ secretome directly influences MSC metabolic activity, MΦ-MSC co-cultures increase MSC production of OPG and immunomodulatory factors. These results show that MSC fate is directly influenced by their initial inflammatory status and their interactions with surrounding cellular cues. Future direction will focus on further understanding multi-cellular system influences and how to better design biomaterials to modulate these for improved bone repair.