CELLULAR & SYSTEMS NEUROSCIENCE SEMINAR SERIES

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Next Speaker:
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3PM | BioE 1001

Engineering biomaterials and matrix signals to prevent infection, inflammation, and promote repair of large-scale bone defects

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Biomaterial strategies to repair craniomaxillofacial (CMF) defects, or large-scale bone defects, require materials which can provide structural support, resist infection, and provide cellular signals to promote bone formation. Mineralized collagen scaffolds are biomaterials capable of regenerating bone in small animal models; however, like many biomaterials, struggle to repair large-scale defects in clinically-relevant models (porcine). Due to the large size of CMF defects, these are easily infected and prone to chronic inflammation. To improve repair of CMF defects using mineralized collagen scaffolds, we altered material composition by adding manuka honey to prevent infection and the amniotic membrane derived from placentas to prevent inflammation. Furthermore, one of the primary principles of tissue engineering is incorporating signaling elements within biomaterials to guide cell behavior. Extracellular vesicles (EV), nano-scale lipid vesicles secreted by all cells, represent a source of cell-signaling cargo which can influence cell behavior. We examine the role of EV in bone repair and regenerative medicine applications, including the role of a new class of extracellular vesicle, matrix-bound nanovesicles (MBV), located within the extracellular matrix. Future work aims to combine biomaterials with a diverse population of EV to guide cell behavior and bone repair in CMF defects, as well as other skeletal repair problems such as implant infection and bone cancer.