

2025-2026 Seminar Series



ENVIRONMENTAL PHYSICAL CUES REGULATE CELL BEHAVIORS



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ABSTRACT

Biophysical properties of cell environment direct the structural adaptation and functional coupling of the cells to their environment. Cells perceive their microenvironment not only through chemical signals, but also through physical cues which are largely originated from extracellular matrix (ECM) and body fluids. ECM stiffness potently regulates cellular behaviors in various biological events. For example, interpenetrating network with different stiffness affects the micro-extrusions, motility, and adhesiveness of breast cancer cells, without changing cell proliferation and survival. These changes are likely to be attributed to more microtubules assembled inside the cells and more extracellular vesicles released into microenvironment.

Biophysical cues can initiate or strengthen the biochemical signaling for the fate determination and differentiation of stem cells. Multilineage differentiation of adipose-derived stem cells is closely regulated by biochemical and/or biophysical cues in extracellular microenvironment. For example, certain types of integrins alter the adipogenesis of adipose-derived stem cells, likely, by alleviating cytoskeletal tension, which is manifested by the presence of specific cell stage with reduce cytoskeletal tension. Our observations not only open a simple avenue to engineer cell fate in vitro but also start to reveal the physical elements that regulate and determine cell fate.

BIO

Dr. Xin A. Zhang is a Professor at the Department of Biochemistry & Physiology of the University of Oklahoma Health Science Center. He has more than 30 years' research experience in integrin, cell adhesion, and cell movement and more than 25 years' expertise in the studies of tetraspanins and tetraspanin-enriched membrane domain (TEM), angiogenesis and vascular stability, endosomal and lysosomal trafficking, and tumor metastasis. His lab has recently expanded their research scope by using the knockout, knock-in, lineage tracing, and transgenic animal models to study vascular morphogenesis, vascular inflammatory responses, and other vascular pathophysiological functions. Lately, his laboratory has become proficient in handling various cutting-edge imaging techniques, performing organoid culture, and generating and analyzing various pathological angiogenesis, inflammation, and vascular disease models derived from genetically engineered mice. One of the lab's long-term goals is to understand the regulatory roles of tetraspanins and endolysosomal trafficking in vascular functions and the mechanisms by which tetraspanins regulate vascular morphogenesis, permeability, and inflammatory responses.