

Granular niches: new frontiers for engineered tissue models

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Advances in the fields of tissue engineering and regenerative medicine require biomaterials that instruct, rather than simply permit, a desired cellular response. A major challenge to progress in our field is the complex organization of the tissues in our bodies, which are hierarchical, vary in space and time, and can differ person-to person. A major effort in biomaterials engineering has been to develop systems that replicate the complex cellular and extracellular microenvironment found in the tissues and organs of our body. These include porous, hydrogel/granular, and composite biomaterials for musculoskeletal tissue regeneration, hematopoietic stem cell biomanufacturing, and as model systems to investigate endometrial pathologies and invasive brain cancer. Granular hydrogel models offer new advantages to create engineered tissue models that replicate the mosaic nature of the tissue microenvironment. This talk will describe granular hydrogel models to study niche regulation of hematopoietic stem cells and patient-derived glioblastoma specimens. These tools enable study of dynamic processes such as remodelling and multicellular signalling that inform stem cell quiescence as well as brain cancer invasion and drug resistance. This talk will also explore emergent topics needed to create hierarchical models of the endometrial tissue microenvironment to investigate endometriosis. These new paradigms are essential for accelerating translation of scientific discoveries into innovations that improve our collective quality of life.