SEMINAR

Biomaterials and Tissue Engineering Research Center

Shanghai Institute of Ceramics, Chinese Academy of Sciences

中国科学院上海硅酸盐研究所生物材料与组织工程研究中心

Soft but Tough! Engineering Protein Assemblies and Interfacial Mechanics for Stem Cell Technologies and the Design of Biomimetic Niches

Speaker：Prof. Julien Gautrot

(Queen Mary University of London)

报告时间：2024年11月11日（星期一）9:30

报告地点：4号楼14楼第一会议室

联系人：常江研究员（52412804）

Personal information:

Julien Gautrot is Professor of Biomaterials and Biointerfaces in the School of Engineering and Materials Science at Queen Mary, University of London. After a PhD at Manchester University and postdoctoral research, first at the Universite de Montreal, then at the University of Cambridge, he joined QMUL as a lecturer in 2011. His research focuses on the development of biointerfaces and engineered biomaterials for stem cell technologies and regenerative medicine. In particular, his group has been exploring cross-talks between the physico-chemistry and biochemistry of soft biointerfaces (polymer brushes, hydrogels and protein assemblies) and the mechanical properties and microstructure of the cell microenvironment, and their impact on the regulation of cell adhesion and stem cell phenotype. He has published many research papers in high impact journals such as Nature Materials, Nature Cell Biology, Nature Communications, Nano Letters, Chem. Rev., Angew. Chem. Int. Ed., ACS Nano, Biomaterials, Adv. Funct. Mater.

ABSTRACT

The ability of cells to sense the mechanical properties of their environment has been extensively reported and studied. The mechanisms via which cells are able to do so, and how in turn this enables to regulate a range of cell phenotypes have received significant attention in the last two decades. However, materials chemistry and mechanical properties in the bulk and at interfaces may significantly differ. We have recently uncovered mechanisms via which adherent cells can not only spread but also adhere at liquid-liquid interfaces, hence demonstrating that interface chemistry and mechanics can completely override bulk mechanical properties to not only direct cell adhesion and spreading, but also regulate stem cell phenotype. We identified some of the design parameters allowing polymer and protein assembly to control the mechanical properties of corresponding interfaces. In turn, this enables the design of bioactive microdroplets, or bioemulsions, supporting cell adhesion and proliferation, for the scale up of adherent cell culture and processing. We propose that bioemulsions will allow transforming the cell manufacturing and delivery pipeline. In addition, we show that microdroplet technologies can be used to recreate some of the structural, mechanical and biochemical properties of ultra-soft stem cell niches, for example in the bone marrow, for regenerative medicine and advanced in vitro models.