Shukry James Habib  
King’s College London, UK

How Do Stem Cells Find Their Niche

Friday 9th March 2018 1pm  
June Lloyd, ICH

Abstract

Localized niche Wnt signals orient asymmetric stem cell division (ACD) to produce one stem cell and another lineage restricted daughter cell, a process that is essential for tissue formation and repair. The detection mechanisms of niche signals by stem cells remain largely elusive. We found that stem cells detect and recruit localised Wnt proteins by specialized actin-based protrusions. To characterise further the interaction of the cells and localised Wnt, we apply the theory of simple liquids bridging the gap between living and dead matter. We quantify the biophysics and dynamics of this interaction in terms of effective potentials and pair correlation functions. Our results indicate that β-catenin controls the cellular affinity, location and duration of the interaction between localized Wnt and the plasma membrane. Consequently Wnt signals increase the membrane stiffness locally and recruit the ACD machinery. In this process, β-catenin is dispensable for polarizing the Wnt receptors but essential for polarizing the down stream effector APC, spindle orientation and ACD. This system provides a novel mechanism for the stem cell-niche recognition and can be extended to other stem cell types and niche signals.

Biosketch

Shukry James Habib: is a Principal Investigator at the Centre for Stem Cells and Regenerative Medicine at King’s College London. He leads a multidisciplinary research team at the intersection of stem cell biology, advanced imaging, biophysics and tissue engineering. Shukry has pioneered the technology of immobilising Wnt proteins to synthetic surfaces. He has shown that immobilised Wnts can maintain a variety of stem cell types and control asymmetric cell division. His lab studies how the stem cells recruit localised Wnts and the mechanism of breaking cellular symmetry. Using this knowledge they generate organised 3D tissues for applications in regenerative medicine.

Shukry pursued his undergraduate and Master degrees in Israel at the Technion and Tel-Aviv university, respectively. He obtained his PhD from the lab of Prof. Walter Neupert at the Ludwig Maximilian University (LMU) of Munich, Germany. He carried out postdoctoral research at Stanford University, California, USA in the lab of Prof. Roel Nusse. He was also a member of visiting programme at Janelia Farm of the Howard Hughes medical institute, USA (Hosted by Prof. Eric Betzig).

Shukry has received numerous awards and honours including the fellowships: Minerva (Max-Plank Society), EMBO, DFG and Siebel scholar. Currently, Shukry holds the Sir Henry Dale Fellowship (Wellcome Trust and Royal Society) and he is also a member of the UK regenerative Medicine platform, which is funded by the Medical Research Council.