Abstract #523 | Invited

Engineered viscoelasticity in stem cell microenvironments

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The physical properties of the extracellular matrix (ECM) and the use of growth factors are powerful tools to control cell behaviour, including fundamental processes such as cell migration and (stem) cell differentiation. Integrins are mechanotransductors that feel and respond towards the mechanical properties of the ECM [1]. We have developed polymers that allow simultaneous stimulation of integrins and growth factors receptors [2]. We have engineered 3D hydrogels of controlled stiffness that incorporate proteins to allow exposure of the integrin and growth factor binding regions. For example, we show the use of BMP-2 in synergy with a5b1 integrins to promote osteogenesis and regeneration of critical-sized defects [3]. Yet, the ECM is viscoleastic and we are interested in engineering substrates that capture this property to build 2D and 3D environments for stem cells - we have pioneered the understanding of the role of viscosity in cell mechanotransduction [4]. We are interested in understanding the interplay between mechanics (viscoelasticity) of the ECM and growth factor signalling, and engineer hydrogels with independent control of elasticity and viscosity. We introduce Brillouin microscopy as a way to follow the evolution of the viscoelastic properties of cells and the engineered hydrogels in 3D in a non-invasive way and in real time.

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