Leveraging biomaterials to understand melanoma progression and aggressiveness

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Metastatic disease is the leading cause of death in cancer where motile cells undergo dynamic morphogenetic changes to escape the primary site and disseminate to distant tissues. During this process, the cells display adaptive nature where they adopt different modes of migration such as amoeboid or mesenchymal single cell invasion, multicellular streaming and collective invasion. Recent evidence suggests that invasive processes are accompanied by dynamic changes in cell state, which poises the invading cells to adopt functional activities for proliferation, dissemination, survival and ultimate colonization. Some of these events arise from the different environmental cues from the extracellular matrix. Melanoma represents one of the deadliest and most aggressive metastatic disease. It has been reported to be highly heterogeneous comprising different subpopulations of cells with stem-like properties. However, the connection between melanoma heterogeneity, migratory behavior, aggressiveness, stem-like properties and therapeutic resistance remains elusive. Engineered biomaterials with tunable materials properties have been instrumental in deconstructing how cells sense, probe, integrate and respond to external stimuli in the tumor microenvironment. In this work, we use biomaterials with tunable matrix degradability to probe melanoma migration, phenotypic changes and heterogeneity.