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The promotion of neuronal maturation on soft substrates.

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Microenvironmental mechanical properties of stem cell niches vary across tissues and developmental stages. Accumulating evidence suggests that matching substrate elasticity with in vivo tissue elasticity facilitates stem cell differentiation. However, it has not been established whether substrate elasticity can control the maturation stage of cells generated by stem cell differentiation. Here we show that soft substrates with elasticities commensurable to the elasticity of the brain promote the maturation of neural stem cell-derived neurons. In the absence of added growth factors, neurons differentiated on soft substrates displayed long neurites and presynaptic terminals, contrasting with the bipolar immature morphology of neurons differentiated on stiff substrates. Further, soft substrates supported an increase in astrocytic differentiation. However, stiffness cues could not override the dependency of astrocytic differentiation on Notch signaling. These results demonstrate that substrate elasticity per se can drive neuronal maturation thus defining a crucial parameter in neuronal differentiation of stem cells.

PMID: 19500834 [PubMed - in process]

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