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Geometrically induced polarization and alignment of cells on nanopillar arrays YOLANDA VASQUEZ, MICHAEL BUCARO, BENJAMIN HATTON, JOANNA AIZENBERG, Harvard University — Topological features at the nano and microscale can trigger mammalian cell growth and differentiation. In this work, we describe geometrical tuning of ordered arrays of nanopillars and micropillars that elicit specialized morphologies in adherent cells. Systematic analysis of the effects of the pillar radius, height, and spacing reveals that stem cells assume either flattened, polarized, or stellate morphologies in direct response to interpillar spacing. Notably, on patterns of pitch near a critical spacing (dcrit = 2 ?m for C3H10T1/2 cells), cells exhibit rounding of the cell body, pronounced polarization, and extension of narrow axon-like cell projections aligned with the square or hexagonal lattice of the NP array. This morphology persists for various stem cell lines and primary mesenchymal stem cells. The neuron-like morphological characteristics suggest that NP arrays can be utilized in tissue engineering applications that require directed axon growth. The ability of nano and micropillars to support various morphogenetic trends will allow rational design of scaffolds that may be useful for stem cell lineage specification, formation of patterned neural networks, and enhancement of implant integration with adjoining tissue.

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