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Creating 3D chemical gradients with self-folding microfluidic networks MUSTAPHA JAMAL, YEVGENIY KALININ, AASIYEH ZARAFSHAR, DAVID GRACIAS, Chemical and Biomolecular Engineering, Johns Hopkins University — We describe the reversible self-folding of polymeric films into intricate three-dimensional (3D) microfluidic networks and investigate their utility as bio-inspired synthetic vasculature for in vitro tissue culture models. Our fabrication methodology relies on patterning of channels inside the films at the planar microfabrication stage followed by programmable self-folding of the two-dimensional patterned structures. Here self-folding action is enabled by stress gradients which develop in the films due to differential ultraviolet cross-linking and subsequent solvent conditioning. We achieved wafer-scale assembly of micropatterned geometries including helices, polyhedra and corrugated sheets. To demonstrate utility of such self-folded microfluidic devices we present localized chemical delivery of biochemicals in 3D to discrete regions of cells cultured on the curved self-assembled surfaces and in a thick, surrounding hydrogel. We believe that the devices can be used to mimic such natural self-assembled systems as leaves and tissues. Reference: M. Jamal et al., Nature Communications (2011; in press).

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