Abstract

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Thermofluidic heat exchangers for actuation of transcription in artificial tissues

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Abstract

Spatial patterns of gene expression in living organisms orchestrate cell decisions in development, homeostasis, and disease. However, most methods for reconstructing gene patterning in 3D cell culture and artificial tissues are restricted by patterning depth and scale. We introduce a depth- and scale-flexible method to direct volumetric gene expression patterning in 3D artificial tissues, which we call “heat exchangers for actuation of transcription” (HEAT). This approach leverages fluid-based heat transfer from printed networks in the tissues to activate heat-inducible transgenes expressed by embedded cells. We show that gene expression patterning can be tuned both spatially and dynamically by varying channel network architecture, fluid temperature, fluid flow direction, and stimulation timing in a user-defined manner and maintained in vivo. We apply this approach to activate the 3D positional expression of Wnt ligands and Wnt/β-catenin pathway regulators, which are major regulators of development, homeostasis, regeneration, and cancer throughout the animal kingdom.

Biography:

Daniel Corbett has completed his PhD at the age of 26 years from the University of Washington. He is now working as a sales representative for CellInk, The Bioink company, in the bioprinter division.