Bioengineering mechanically actuated organoids

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Tissues and organs are sculpted by mechanical forces during embryonic development. In particular, neural tube morphogenesis, the first step in neural development, occurs through the action of mechanical forces, which shape a flat epithelial sheet through bending and folding into a closed tube. However, the underlying mechanisms driving these mechanical forces are poorly understood. In this talk I will discuss our ongoing efforts in developing bioengineered models of neural tube development to study force-mediated neural patterning and morphogenesis. I will discuss how we have used these models to uncover a novel mechanism underlying human neural tube closure and neural tube defects, where multi-cellular calcium waves drive local tissue displacements. Our work with organoid-based models of morphogenesis provides a novel paradigm for understanding how mechanical forces are activated in development and how disruption of these forces may underlie morphology-driven neurodevelopmental pathologies.