Engineered colloidal bio-scaffolds: Unlocking in vivo-Like developmental pathways in gastruloids and bile duct organoids.

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Positional information is crucial for controlling tissue patterning and the timing of differentiation events during development. The variability in developmental pathways observed in organoids, leading to heterogeneity in shape and states, largely stems from the lack of spatial control over differentiation patterns. In this talk, I will present how we used biofunctionalized colloidal particles to create controllable paracrine signaling centers within organoids. I will demonstrate how this approach can be applied to Gastruloids and Liver organoids to replicate in vivo-like developmental pathways, such as heart formation and bile duct elongation.

I will illustrate how we can control the developmental pathways of these organoids through 3D spatial patterning of cell differentiation. Additionally, I will discuss how our approach opens new possibilities for understanding the interactions between cell differentiation, cell migration, and tissue patterning at the scale of entire organoids, particularly within specific geometrical constraints.