

BDR SEMINAR via Zoom

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Tuesday, September 30, 2025

9:30-10:30

Meeting URL will be announced on the event day by e-mail.

※This seminar is open only for BDR Members

Programming Morphogenesis: Engineering Synthetic Organizer Cells to Guide Development

Summary

Stem cell models often lack the native-like spatial information essential for complex morphogenesis. To address this, I engineered morphogen-secreting organizer cells programmed to self-assemble around mouse embryonic stem (ES) cells via cell adhesion. These "synthetic" organizers form defined architectures, such as localized "nodes" or enclosing "shells", and secrete the morphogen WNT3A and its antagonist DKK1.

By combining WNT3A- and DKK1-producing organizers, I generated diverse morphogen gradients that systematically guided developmental outcomes. A steep gradient from opposing nodes induced a comprehensive range of anterior-to-posterior (A-P) cell lineages. Strikingly, shallower WNT gradients, while yielding truncated A-P lineages, resulted in higher-resolution cardiac morphologies, including a spontaneously beating, chambered cardiac-like structure integrated with an endothelial network. Thus, synthetic organizer cells provide a powerful and flexible way to systematically direct the development of progenitor cells by integrating spatial, temporal, and biochemical information.



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