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Constructing and deconstructing the human nervous system to study development and disease

A critical challenge in understanding the programs underlying the development, assembly and dysfunction of the human brain is the lack of direct access to intact, functioning human brain tissue for direct investigation and manipulation. In this talk, I will describe efforts in my laboratory to build functional cellular models and to capture previously inaccessible aspects of human brain development and dysfunction. To achieve this, we have pioneered the use of instructive signals to derive, from pluripotent stem cells, self-organizing 3D tissue structures called regionalized neural organoids that resembles domains of the developing central nervous system. We have shown that these cultures, such as the ones resembling the cerebral cortex, recapitulate many features of neural development, can be derived with high reliability across dozens of cell lines and experiments, and can be maintained for years in vitro to capture advanced stages of neural and glial maturation and function. To model complex cell-cell interactions, we developed assembloids and demonstrated their use in modeling cell migration, formation of neural circuits and disease processes. To advance maturation and circuit integration of organoids, we introduced a transplantation paradigm and demonstrated that engrafted human neurons can respond to sensory stimulation in the animal and can drive reward-seeking behavior therefore enabling behavioral readouts from patient-derived cells. Lastly, I will illustrate how these methods can be combined with modern neuroscience tools to study neuropsychiatric disorders and develop therapeutics.

Thursday, 24.04.2025, 11:00 am

Host: Melina Schuh



Large Seminar room
Fassberg Campus

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