BIOENGINEERING RESEARCH SEMINAR

ENGINEERING BRAIN CELL POLARITY: FROM MICROSYSTEMS TO NANOENGINEERING APPROACHES

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Cell polarity can be described by an asymmetry of structure and functionality within a biological cell body. Cells in the brain, in particular excitatory neurons, are well-known to generate distinct structural and functional asymmetry, which contributes to proper neurite network connections and brain functionality. During the formation of neuronal cell polarity, extracellular and intracellular signals play a crucial role and often act synergistically. In the event of misleading signals, malformation in cell polarity can occur, resulting in abnormalities in neurite networks, or degenerative diseases. In my talk, I will give an overview about intracellular protein polarity in neurons and how its distribution relates to neurodegenerative diseases. Within this context, I will introduce micro- and nanoengineered systems that allow us to engineer and image extracellular and intracellular signals and thus to control and guide neuronal cell polarity. I will present superparamagnetic nanoparticles on chip, which I call nanomagnets, to engineer protein polarity through parallel forces in an array of neuronal cells. Engineering cell polarity using nanomagnets is broadly applicable to a diverse range of brain cells and other cell phenotypes, and has a large potential to shape the development of novel therapeutics against neurodegenerative diseases.

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