BP 32: Closing Plenary Talk (joint session BP/CPP)

Time: Friday 12:15–13:00 Location: HSZ 03

Invited Talk BP 32.1 Fri 12:15 HSZ 03

The physical regulation of brain development — •Kristian Franze — IMP, FAU Erlangen-Nürnberg — Max-Planck-Zentrum für Physik und Medizin, Erlangen — PDN, University of Cambridge

The brain is our most complex organ system. Billions of neurons form an intricate network that regulates all major body functions including thought and emotions. However, the brain is not always that complex. It originally starts off as a simple epithelium, i.e., a single layer of cuboid cells. Axons, which transmit information to other cells over large distances, are only formed during embryonic development. Their immense length - up to several meters in some large animals - comes with severe logistic challenges. For example, how is transport of proteins and genetic information achieved from the nucleus, where the DNA is located, to the axon's distant end? And how does an axon growing through a crowded and dynamic environment know where to turn and where to connect? These questions have captured the imagination of neuroscientists for more than a century. However, despite tremendous progress in molecular biology and imaging technologies, many problems remain unresolved. Combining theory and experiments, we here identified how microtubules, which are polar polymers along which molecular motors transport cargo, orient uniformly along the axon to enable long-range transport, and how mechanical tissue properties regulate axon growth through the developing brain. Our results suggest that chemical and physical signals are integrated by neurons, and that their interaction is crucial for proper brain development and function.