ICFO

INSIGHT SEMINAR: How to control intracellular transporters

ANNE STRAUBE

April 24, 2025
12:00 to 13:00
Elements Room

ABSTRACT:
Intracellular transport is essential to organise the inner contents of cells, including the delivery of lipids, RNAs and proteins to the cell periphery and the positioning of organelles. Long-distance transport occurs along microtubules, long polar polymers that span the entire cellular space. Molecular motors dynein and kinesins step along microtubules and haul cargoes, with dynein moving towards the minus end of microtubules that are usually pointing towards the cell centre and most kinesins moving towards the microtubule plus ends. My lab is focussing on the questions how the polar microtubule cytoskeleton is organised and how transport by molecular motors is regulated. To limit futile energy consumption and blocking of transport tracks, motors are switched off when they are not loaded onto cargoes. Furthermore, cargoes often recruit motors of opposite polarity to enable bidirectional

movement, avoid oncoming traffic and other obstacles.
We have recently made progress in understanding the phenomenon of co-dependence of opposite polarity motors, whereby the depletion or inhibition of one motor, results in a decrease in transport towards both ends of the microtubule. Using in vitro reconstitution of complexes that contain both the kinesin-3 KIF1C and cytoplasmic dynein, fast long-distance transporters with opposite polarity, we showed that the motors mutually activate each other via the shared cargo adapter Hook3. Furthermore, KIF1C engages weakly with the microtubule during minus end directed motility and acts as a processivity factor, extending dynein-driven transport. Because many cargo adapters bind both dynein and kinesins, this mechanism could be generalized to other bidirectional complexes.

BIO:

I am currently a Professor at Warwick Medical School and the Director of Warwick Bio-Medical Sciences. Research in my lab focusses on the organisation of microtubules and intracellular transport with a recent focus on the regulation of motor activity and coordination of opposite polarity motors.
I trained in Biochemistry and Molecular Biology at the University of Hamburg, Germany, and then joined the lab of Gero Steinberg at the Ludwig Maximilian University in Munich and later at the Max Planck Institute for Terrestrial Microbiology in Marburg, where I studied the microtubule cytoskeleton in the fungus Ustilago maydis, concentrating on the dynamic re-organisation of microtubules during the cell cycle and on intracellular transport by the molecular motors dynein and kinesin, which carry traffic along microtubules. I then moved as a Postdoctoral Fellow of the Emmy Noether programme of the German Science Foundation to the Wellcome Trust Centre for Cell Biology in Edinburgh, where I worked with Andreas Merdes on the microtubule cytoskeleton in differentiating muscle cells. In 2007, I started my own lab at the Marie Curie Research Institute (MCRI) in Oxted, Surrey. When the MCRI closed in 2010, I moved with my colleagues Rob Cross and Andrew McAinsh to the University of Warwick to found the Centre for Mechanochemical Cell Biology. I won a Lister Institute Research Prize in 2013 and received Wellcome Investigator Awards in Science in 2016 and 2022.

Hosted by: Prof. Dr. Maria Garcia-Parajo