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TEMASEK LIFESCIENCES LABORATORY

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The Auditorium (Level 1)

Hosted by: Dr Yu Fengwei

Creating neuron dendrite arbor shapes

Dr Adrian Walton Moore
RIKEN Brain Science Institute, Japan



Adrian Moore graduated with a B.A. in Natural Sciences (Genetics), from the University of Cambridge, UK in 1993. During this study he developed a strong interest in using genetic approaches to understand embryonic development. To follow up that interest he then moved to the laboratory of Nick Hastie at The MRC Human Genetics Unit in Edinburgh, UK. In Professor Hastie's laboratory he studied the regulation and function of the Wilms' Tumor 1 gene. In partnership with Andreas Schedl he used YAC transgenic mice to demonstrate a new function for Wilms' Tumor 1 in regulating epicardial formation. As understanding the brain represents one of the great modern frontiers in science, he decided focus solely on the control neural formation and took a post-doctoral fellow position in the laboratory of Yuh-Nung Jan at the University of California, San Francisco, USA. In this work with Professor Jan he first learnt to use Drosophila genetics to study neuron development and function. Following this, Adrian Moore joined the RIKEN Brain Science Institute (BSI), in Wako (Tokyo Metropolitan Area), Japan. He is head of the BSI Laboratory for the Genetic Control of Neuronal Architecture.

Neurons require highly branched dendrite arbors that underlie circuit organization. Yet the intricate cell biological mechanisms by which complex dendrite arbor architectures are established remain largely unidentified, and we do not understand how these processes are modified in order to create the large diversity of different arbor morphologies necessary to build the nervous system. To address these questions, my laboratory identifies closely related neuron types that nonetheless show clear morphological differences and then we elucidate the mechanisms that promote the differences between these neuron types. Our early research uncovered a combinatorial control mechanism to define nociceptive neuron specification and morphology through a combination of neuron type- and body region-specific transcription factors. Now, downstream of these transcription factors we show how differential control of dendrite microtubule organization underlies neuron diversification. The microtubule cytoskeleton is critical to provide structure and exert force during dendrite branching. We show how balancing the activities of distinct nucleation machineries within the growing dendrite can alter microtubule polymerization polarity and dendrite branching, and how regulating this balance can generate the wide diversity of different neuron shapes found within the nervous system. In addition, we are now using in vivo time-lapse imaging of dendrite elaboration, and customized algorithms for the automated quantification of these events, in order to reveal key processes in dendrite patterning. These imaging studies have revealed how the local action of myosin motor proteins directs the direction of microtubule polymerization in order to generate new dendrite branches.

Recent Publications:

1. Delandre C., Amikura R., **Moore AW**. "Microtubule nucleation and organization in dendrites." Cell Cycle 2016
2. Yalgin C., Ebrahimi S., Delandre C., Yoong LF., Akimoto S., Tran H., Amikura R., Spokony R., Torben-Nielsen B., White KP., **Moore AW**. "Centrosomin represses dendrite branching by orienting microtubule nucleation." Nat Neurosci 2015
3. Endo K., Karim MR., Taniguchi H., Krejci A., Kinameri E., Siebert M., Ito K., Bray S., **Moore AW**. "Chromatin modification of Notch targets in olfactory receptor neuron diversification". Nat Neurosci 2012