QBiC SEMINAR

Speaker

Adrian W. Moore, Ph.D.

RIKEN Brain Science Institute

Date & Location

Tuesday, August 8, 2017, 14:00 - 15:00

Osaka, QBiC Bldg. A 1F lounge

(6-2-3, Furuedai, Suita, Osaka)

There will be a TV broadcast at Kobe CDB bldg.A 7F seminar room.

Title

Important things have small beginnings: Major branches in the dendrite arbor arise by stabilization of single actin bundles at the dendrite tip

Abstract

Dendrite arbor branching patterns determine the number, distribution and integration of neuron inputs; neuron firing properties; and ultimately the activity of a neuron within a circuit. Not all dendrite branches are equal. As mature dendrite arbor pattern is the compound outcome of a series of branching events, specific branches created early in dendrite outgrowth delineate the arbor into its distinct main subtrees and underlie its targeting into correct innervation fields. Nevertheless, while extensive analyses have revealed key processes that pattern terminal dendrites and spines, mechanisms constructing the critical major branches within the tree remain fundamentally unknown. In part, this is because in order to identify these mechanisms requires the association of individual subcellular molecular events occurring early in outgrowth with later mature arbor-wide pattern—an integrated approach spanning different spatiotemporal levels. Here, we reveal how highly localized stabilization of single F-actin bundles at the growing dendrite tip is the key precipitating event that generates major branches. By a genetic screen utilizing in vivo imaging coupled with automated dendrite feature detection and quantification, we identify the atypical myosin (MyoVI) as a principal player in this process. We show that underlying major branch formation is a transient local upregulation of anterograde-directed microtubule nucleation at the dendrite tip, a process spatially separable from continuous background dendrite microtubule nucleation. MyoVI drives localized stabilization of single F-actin bundles at the tip and these bundles in turn capture and target anterograde-directed microtubule polymerization events into discrete filopodia, driving tip-splitting for major branch creation. Moreover, differential use of MyoVI generates the diverse arbor complexities of different neuron types. Our findings establish how early individual cell biological events feed-forward to subdivide the mature dendrite arbor and create diversity in neuron form and function, thus defining critical neuronal features underlying circuit wiring and computation.

Host

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