

GEORGE MASON UNIVERSITY
COLLEGE OF SCIENCE
DEPARTMENT OF BIOLOGY SEMINAR

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“Removal of area CA3 from hippocampal slices induces rapid postsynaptic homeostatic plasticity at Schaffer collateral synapses that normalizes CA1 pyramidal cell discharge”

One compensatory mechanism that accommodates lasting increases or decreases in input activity in neuronal networks is homeostatic synaptic plasticity, which is a global up- or down-regulation of synaptic strength. Previously, homeostatic increases in the strength of mossy fiber to CA3 pyramidal cell synapses and Schaffer collateral to CA1 pyramidal cell synapses were observed after long-term inactivation of organotypic slices with tetrodotoxin. Here we show that, upon acute preparation of hippocampal slices and surgical removal of area CA3, input to area CA1 is reduced and Schaffer collateral synapses undergo functional strengthening. This compensatory increase in synaptic strength acts to normalize the level of postsynaptic discharge elicited by excitatory synapse activation. The increase in synaptic strength was limited to Schaffer collateral inputs (no alteration to temporoammonic synapses) and was not associated with alterations in short-term plasticity, but was accompanied by an increase in GluA1 labeling in the stratum radiatum, suggesting increased numbers of α -amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid receptors (AMPA) and a site-specific postsynaptic locus of expression. Combined, these data support the idea that, in response to the reduction in presynaptic activity caused by removal of area CA3, Schaffer collateral synapses undergo a relatively rapid increase in efficacy supported by insertion of more AMPARs, which maintains postsynaptic excitability in CA1 pyramidal neurons. This novel fast homeostatic plasticity exhibits properties that would allow it to maintain optimal network activity levels in the hippocampus, a brain structure lauded for its ongoing experience-dependent malleability.

TUESDAY October 31, 2017
3:00-4:15 PM
Innovation Hall Room 207