Dynamics and augmentation patterns in adaptive networks

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In many cases interacting networks are adaptive system themselves, that undergo constant reorganization. The brain is a prime example of such a system. In this case the network reorganization not only consists of reorganization of network connectivity but may also include addition of new network nodes and deletion of existing ones. In hippocampal formation, new neurons are generated throughout life and integrate into the network via the process of adult neurogenesis. This process is thought to have an important functional role in healthy networks, but also may lead to pathological structural changes in epileptic brain. What controls this neural augmentation remains unknown. We use computational simulations to investigate the effect of network environment on structural and functional outcomes of neurogenesis. We find that small-world networks with external stimulus are able to be augmented by activity-seeking neurons in a manner that enhances activity at the stimulated sites without altering the network properties as a whole. However, when inhibition is decreased or connectivity patterns are changed, new cells are both less responsive to stimulus and the new cells are more likely to drive the network into bursting dynamics. These patterns are being compared with the experimental ones observed in a culture system.