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Pattern Learning, Damage and Repair within Biological Neural Networks THEODORE SIU, KATE FITZGERALD O'NEILL, TROY SHINBROT, Rutgers Univ — Traumatic brain injury (TBI) causes damage to neural networks, potentially leading to disability or even death. Nearly one in ten of these patients die, and most of the remainder suffer from symptoms ranging from headaches and nausea to convulsions and paralysis. In vitro studies to develop treatments for TBI have limited in vivo applicability, and in vitro therapies have even proven to worsen the outcome of TBI patients. We propose that this disconnect between in vitro and in vivo outcomes may be associated with the fact that in vitro tests assess indirect measures of neuronal health, but do not investigate the actual function of neuronal networks. Therefore in this talk, we examine both in vitro and in silico neuronal networks that actually perform a function: pattern identification. We allow the networks to execute genetic, Hebbian, learning, and additionally, we examine the effects of damage and subsequent repair within our networks. We show that the length of repaired connections affects the overall pattern learning performance of the network and we propose therapies that may improve function following TBI in clinical settings.

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