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The Effect of Sleep on Microglial Synaptic Elimination: Exploring Microglial Synaptic Engulfment as a Possible Mechanism through which Sleep Facilitates Learning

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Microglia are the resident immune cells in the central nervous system, responding to pathogens and injury in the brain. Recently it has been shown that microglia also play a role in synaptic plasticity, engulfing and eliminating synaptic connections in an activity dependent manner. It has also been well demonstrated that sleep is a period in which synaptic connections and networks are refined, sleep being correlated with reduction in synaptic densities. In this paper, I explore the possibility that this variation in neuronal spine and synaptic densities during sleep is a product of altered interactions between microglia and synapses. The first study uses an immunohistochemical approach to examine differences in number of engulfed synapses in the forebrains of waking and sleeping mice. The second study explores a possible molecular mechanism of this alteration in microglial synapse modification, investigating the amount and localization in microglia of the RNA binding protein, QK6, known for regulating peripheral translation. By comparing both extent of synaptic engulfment and levels of QK6 in microglial cells at different time points, we attempt to illuminate differences in microglial synaptic engulfment between sleep and wake, and further propose a possible model for dendritic spine density attenuation during periods of sleep. Differences in microglial synaptic engulfment between sleep and wake could have implications for models of synaptic plasticity, and help to advance microglia engulfment as a possible mechanism of learning.