

The diversity and complexity of hippocampal neurons

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Models of artificial neural networks are usually constructed using simplified representations of neurons and memory mechanisms are often explored in these networks by using simple rules for manipulating the strength of the connections between the neural elements. Although this approach can be informative, there is a risk that we will not uncover the actual mechanisms of memory storage and recall until we are willing to include more realistic neurons and synapses into neural network models. In my talk, I will provide several examples of functions performed by real neurons that are often absent from simplified neural models. Similarly, I will describe plasticity mechanisms that depart from the rules most frequently used in network models of memory storage. Finally, I will highlight the tremendous diversity of neuronal properties, even among a group of neurons traditionally regarded as a monolithic cell type. The hope is that an understanding of the biological complexity and diversity of real neurons will inspire future work examining how these properties can enrich the function of neural networks, leading to dynamics and information storage mechanisms that may differ from those observed in simpler, artificial networks.