With its approximately 100 billion neurons and 200 trillion connections, the human central nervous system is astoundingly complex. Nevertheless, experimental advances are rapidly revealing new insights about the workings of neurons and the networks in which they are connected. Simultaneously, computational models of neurons have grown swiftly in terms of both their capability and utility. When constrained by experimental data, such models greatly enhance the observations and provide tools to construct new experimentally testable predictions.

In this talk I will describe how this two-pronged approach has helped explain some of the function of hippocampal CA1 pyramidal neurons, a group of principal cells in a region of the brain that is important for the formation of new memories. The models and experiments indicate that these relatively large neurons integrate and process their inputs in a two-stage manner, in that they first combine inputs in localized parts of the dendritic tree before making an ultimate determination whether or not to signal downstream neurons with an action potential.

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