

## **Computational Challenges beyond Circuits: Messages from Neurobiology**

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The goal of our presentation is to make people uncomfortable. Creating artificial intelligence is a huge undertaking, but it can be done without reference to a real brain. In coming to a meeting on "Computational Neuroscience" the title of this symposium, implies that we participants wish to use the evolutionary success of the animal brain as a model to guide our creation. The complexity of the 'wiring diagram' of even the simplest brain is daunting enough. But the architecture of the brain in real life is considerably more challenging, as it exists in additional dimensions that are not always included in our models. Fundamental principles of neurobiology will be discussed in the context of how they should inform our modeling.

Topics to be covered include:

- 1) The role of astrocytes in controlling the microenvironment of the synapse.
- 2) The role of myelin in controlling both conduction velocity and the microenvironment of the axon.
- 3) The role of the adrenergic neurons of the brainstem in controlling brain "set".
- 4) The role of the immune system in the tuning the function of all brain cells.
- 5) The role of age in altering the structural and functional parameters of all of the above.

The importance of each of these factors for brain function will be highlighted by one or more human neurological diseases.