Computation in the brain: neuron, synapse, astrocyte interactions in small networks

Project summary: Networks of a very small number of McCormick neurons, synapses and astrocytes would be simulated taking into account as much detail as possible. Three compartment neuron model (dendritic tree, soma, axon) will be followed. Attempt will be made to incorporate directional aspects of dendritic computation. Information will be assumed to flow through bursts rather than through isolated action potentials. Only one network from a graphical isomorphic class would be studied for information processing, particularly how by modulating synaptic plasticity, the astrocytes control the temporal coding of the network neurons. Since synaptic plasticity is central to learning and memory, astrocytes may have some role in modulating short term or working memory, which has remained unexplored, because physiological studies of astrocytes is much more difficult than the neurons. Computational modeling may offer some novel insight. We may try to improve the only computational model of astrocytes so far, if we can acquire calcium imaging data.