Group 5: Project 3

1) Implement the BCM plasticity rule (Bienenstock et al., 1982); see the Scholarpedia page on BCM for a succinct summary. Show how this model can account for the effects of dark rearing (see Figure 5 in Cooper & Bear, 2012). For simplicity, you can simulate this phenomenon using a single synapse.

2) The BCM theory assumes that the modification threshold is set on a cell-wide basis by the history postsynaptic activity, such that all synapses sharing the same postsynaptic neuron have the same modification threshold. However, experiments manipulating presynaptic glutamate release have shown that each synapse can have its own modification threshold. How might the BCM theory be modified to account for this phenomenon?

3) Compare Hebbian and BCM learning in terms of the theoretical predictions and empirical support for these predictions (see the Scholarpedia page).

References:

Bienenstock, E. L., Cooper, L. N, & Munro, P. W. (1982). Theory for the development of neuron selectivity: orientation specificity and binocular interaction in visual cortex. *Journal of Neuroscience, 2*, 32–48.

Cooper, L. N., & Bear, M. F. (2012). The BCM theory of synapse modification at 30: interaction of theory with experiment. *Nature Review Neuroscience, 13*, 798–810.

Lee, M. C., Yasuda, R. & Ehlers, M. D. (2010). Metaplasticity at single glutamatergic synapses. *Neuron, 66*, 859–870.