
Plasticity and selection in synaptic populations

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Abstract

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How can collectives in the brain coordinate their activity to produce behavior appropriate to changing circumstances? Functional plasticity has traditionally been understood as an adaptive process operating at the level of *neurons*. But another way of seeing plasticity is as the consequence of *selection processes* acting on populations of *synapses*. In many cases, the function of a given collective – from aggregating sensory information to producing motor output or predicting rewards for the organism – is determined by the nature of the selection processes facing its members (as well as by gross anatomical constraints). How likely it is that a synapse will persist (and in what form) depends in part on its activity level, which in turn depends on modulatory influences in its vicinity. Modulation can serve as a mechanism to enforce cooperation between synapses. Prominent types of modulation include feedback effects responsible for phenomena such as gain control through synaptic homeostasis and feedforward effects responsible for pathway consolidation during development.

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