

VIGRE Undergraduate Colloquium

Winter 2005

1360 East Hall

April 7, 4:10-5:00pm

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How neurons compute integrals to control the eyes

Abstract

Despite making several twists and turns in its path while foraging for food in a featureless landscape, a desert ant can somehow return to its nest in a straight line and even know how far away the nest is. In response to head movements, a goldfish (or human) can maintain a stable direction of gaze by appropriately counter-rotating its eyes and holding them in a new position, even in total darkness. These seemingly unrelated activities in ants, fish, and humans share a key mathematical element: the brain takes sensory inputs and somehow explicitly integrates them, in the sense of calculus, to generate outputs that are used for future behavior. In this talk, I will describe neural integrators in nature, and discuss some biologically detailed yet elegant models that seek to explain, in the context of oculomotor (eye muscle) control, how relatively memory-less neurons may collude to perform the task of memory-requiring neural integration.