

Kubie Translational Summit Abstract

Title: Place Cells, Hippocampal Navigation and the Neuronal Basis of Cognition

In 1971 John O'Keefe discovered 'place cells' in recordings from the rat hippocampus; Largely based on the place cell discovery O'Keefe and Lynn Nadel published the book "The hippocampus as a cognitive map" (1978). Although outrageous at the time, book proved prescient, and remains a guiding hypothesis for current research, stimulating intense study of place cells and related hippocampal neurons.

In 1975 Jim Ranck moved to Downstate. Ranck led a group that initially tested the place cell hypothesis. Finding strong supporting evidence they fleshed out much of what's currently known. Among the advances and discoveries were 1. Demonstrating the validity of the place cell phenomenon; 2. The discovering of head direction cells; 3. Demonstrating 'remapping' and proposing remapping as the physiological basis of 'context'; Fitting 'place cells' into an anatomical and physiological context; and 5. Creating computational models suggesting how hippocampal neurons could compute efficient paths.

I will give a brief introduction to the remarkable phenomenon of 'place cells', and summarize a few of the advances.

A second remarkable hippocampal discovery is that hippocampal damage leads to a loss of episodic memory — amnesia. Although cognitive mapping and episodic memory appear to be disparate processes, recent hippocampal research suggests how these two functions may be based on a single hippocampal network process. Indeed, damage to hippocampal structures that occurs at early stages of Alzheimer's disease leads to both memory loss and spatial disorientation in familiar places.