Speaker  Garrett B. Stanley, Division of Engineering & Applied Sciences, Harvard University
Time      4 pm, followed immediately by Departmental Tea
Date      Friday, 9 February
Place     BCS Auditorium, 46-3002
Title     Reading the Neural Code in the Natural Visual World

Abstract

The external world is represented in the brain as spatiotemporal patterns of electrical activity. Sensory signals, such as light, sound, and touch, are transduced at the periphery and subsequently transformed by various stages of neural circuitry, resulting in increasingly abstract representations through the sensory pathways of the brain. It is these representations that ultimately give rise to sensory perception. Deciphering the messages conveyed in the representations is often referred to as reading the “neural code”. True understanding of the neural code requires knowledge of not only the representation of the external world at a particular stage of the neural pathway, but also knowledge of how this representation is ultimately communicated to downstream brain structures. Our laboratory has focused on various challenges posed by this problem, two of which will be discussed in the context of the mammalian visual pathway. First, a ubiquitous property of neurons throughout the various sensory pathways of the brain is the ability to adapt their response properties to changes in the external environment. Adaptation therefore poses a unique challenge in reading the neural code, as it is unknown to what extent the “words” to be conveyed downstream change meaning in the non-stationary natural environment. Secondly, in interpreting neural representations, it is necessary to define the relevant temporal and spatial scales. Temporal precision of neural activity exists at the millisecond time scale, even in situations where the natural sensory world is changing over much slower time scales. This level of precision is not absolute, but instead relative to the time scale of the sensory input, and serves a critical role in the synaptic relay to downstream targets. Taken together, an understanding of these complexities and others is critical for understanding how these representations are communicated to downstream brain structures, and ultimately in relating spatiotemporal patterns of neural activity to sensory perception.