Week #1 (Jan. 28 & Feb. 2), Receptive fields and neural codes
Rick Born (rborn[at]hms.harvard.edu) and Rachel Wilson (rachel_wilson[at]hms.harvard.edu)

In Wednesday's lecture, we will begin by exploring the idea of a neural "receptive field", with a brief historical introduction and overview of methodology. We will review the origin of unexplained variability (or "noise") in neural responses and its implications for neural coding. Next, we will discuss the idea that information is generally represented by populations of neurons rather than single neurons, and we will introduce the concept of a "decoder" (or observer) of neural signals. Finally, we will briefly discuss the idea that neural circuits implement varied types of computations, and we will consider a few of these computations and their potential functions.

On Monday we will discuss the following paper in class:

M. Meister, L. Lagnado, D.A. Baylor (1995) "Concerted signaling by retinal ganglion cells", *Science*, 270:1207-1210.

As you are reading, please consider the following questions. You do not necessarily need to directly address these questions in your written assignment—they are mainly intended to guide your reading.

- At one point, the authors write, "This strong tendency to fire in near-synchrony shows that the two neurons did not respond to light independently." What exactly is meant here by the term "independent"? Generically, what can we say about the relationship between the "independence" of a pair of neurons and the relationship between the receptive fields of those two neurons?
- Why are the authors interested in the relationship between the correlation index and distance (Fig. 2)?
- How were the receptive field maps (Fig. 3) obtained? What is the significance of this figure?
- Why are the authors interested in the temporal profile of spike-timing correlations (Fig. 4)?
- Why might discovering the mechanisms underlying correlated spiking influence our interpretation of the function of these correlations?
- The authors propose an interpretation of their results whereby the retina "muliplexes" many signals onto the same axon. What exactly do they mean by this? What are alternative interpretations of their results? How might we (in principle) discriminate between these alternatives?

Your assignment this week is to write a referee's report on this paper. Please see the course website for detailed guidelines and a sample referee's report (www.hms.harvard.edu/bss/neuro/bornlab/nb204/).

The written assignment (as always) must be submitted via email before 10:00am Monday. See the course website for instructions.