

**Week #4** (Feb. 18 & 23), Adaptation and efficient coding  
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In Wednesday's lecture, we will begin with some examples of adaptive processes and we will develop a general definition of the term "adaptation". Next, we will cover "the efficient coding hypothesis", and we will explore the idea that adaptation can be viewed as a feature of efficient neural codes. Then, we will discuss the notion that adaptation occurs on many different timescales, and that this in itself may be useful. We will define terms like "gain", "sensitivity", and "tuning", and we will look at examples of how all of these can change during adaptation. Finally, we will briefly discuss cellular and circuit mechanisms of adaptation.

On Monday we will discuss the following paper in class:

K.I. Nagel and A.J. Doupe (2006) "Temporal processing and adaptation in the songbird auditory forebrain", *Neuron*, 51:845-859.

Your assignment this week is to write a referee's report on this paper.

This week's "lunch lecture" (Thursday Feb. 19, 12:30-1:30pm) is designed to help you understand the major analytical technique of this paper – specifically, the "linear-nonlinear" model of receptive fields. Attendance is optional, but it's recommended if you aren't already familiar with this technique.

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.

- What do the authors mean when they call a neuron either an "integrator" or a "differentiator"? When might it be useful to integrate versus differentiate sensory stimuli?
- What do the authors mean by the "gain" of a neuron? Why might it be useful for a neuron to have a flexible gain?
- What do the authors mean when they talk about the "threshold or set-point" of a neuron? Why might it be useful for a neuron to have a flexible threshold/set-point?
- How does any of this fit with the idea of "efficient coding"?