

**Faculty mentors:** Justin Gardner & Anthony Norcia

**Project topic(s):** Using EEG to measure human visual cortical selectivity and invariance

**Brief description of scientific issues:**

Your friend's face looks like your friend's face whether you are outside in bright sunlight or sitting in a dimly lit lecture hall. This is a rather amazing feat of our visual systems because it means that the system is built to be invariant to many orders of magnitude of difference in strength of light. It is thought that part of this ability is due to neural circuits within the visual cortex that make neurons invariant to properties of visual stimuli like overall luminance or contrast. While this invariant property of visual cortex has been well-studied in invasive animal experiments, we do not know whether it also occurs in the human visual cortex because it has been hard to make these measurements non-invasively in humans. However, new technical advances in experimental design and analysis open up the possibility of being able to measure these effects non-invasively. In particular, a technique called frequency-tagging can be used with EEG measurements to measure responses specific to particular visual stimuli. We will use this technique to measure orientation selectivity of human visual cortex and ask whether orientation selectivity is invariant to the contrast of the stimulus.

**Skills required:**

- Some basic computer programming (e.g. Matlab, Python)
- Basic knowledge of statistics
- Ideally, having taken either Psych 30 (Perception) or Psych 50 (Cog Neuro) or both

**Skills to be learned:**

- Experience working with human subjects
- Running EEG experiments
- Analyzing EEG data
- Analysis of time series data (Fourier transform, frequency analysis)
- Understanding of basic visual neurophysiology