Proseminar in vision science – the brain

**Brief course description**
This seminar gives a basic introduction to post-retinal visual processes and perception. The emphasis will be to provide a background to the functional neurobiology of the cortex. The seminar is aimed at students in the Ph.D. program. Lecturers will impart basic information and ideas, stress current foci of research interest, and introduce research methods and their pitfalls. These topics will then be further pursued in the tutorial program.

**Learning goals**
The main goal of the proseminar is didactic. Students from varied backgrounds should be able to learn basic facts about the visual system. However, the goal is to achieve this in a thoughtful manner so that important issues in current research are brought to the fore. Additional goals are to inculcate a way of looking at experimental data in a critical manner so as to be able to assess the strength of results and conclusions. To this end, some sessions are devoted to experimental and computational methods.

**Prerequisites:**
Admission to the Ph.D. program. Other students may audit the course with approval of the IOR. Contact hours: 2-3 hrs per week, dates are provisional and times to be announced.

**Student requirements**
Background readings will be assigned for each lecture. On occasion selected students will be required to discuss topics assigned by the lecturer. Grades will be based on student participation and performance on a midterm and a final examination, which will consist of essay-style questions, requiring students to think critically and integrate materials.
INTRODUCTION TO VISION SCIENCE II

Lectures (and lecturers) for Spring 2011. Two 1.5 hour sessions/week, Monday & Wednesday 3-5 pm (or by arrangement with instructor).

Since this is the only course requirement for 1st year PhD students, a considerable amount of effort is expected. It is very important that the students know the readings beforehand and come prepared to discuss the material and ask questions. Exams will test students on all the material, so they should engage with faculty in understanding the material in every lecture.

This syllabus is provisional: lecture and exam dates, lecturers and lecture titles, and readings will change when considered appropriate by the faculty.

Jan 3: Psychophysical techniques (including photometry) (Schwartz)

Jan 5 & 10: Structure and function in striate cortex (Alonso)

Jan 12: Color perception (Zaidi)

Jan 19: Visual adaptation (Zaidi)

Jan 24 & 26: Linear systems and Fourier analysis (Pola)
Handouts.

Jan 31 & Feb 3: Bayesian statistical models (and reasoning) (Backus)
A. Required reading:

1. Economist1.pdf (basic background)
2. Yudkowsky web intro (basic theory)
3. Attached selection from Chapter 2 of "Spikes" (an application of Bayesian inference to neural coding)

B. Highly recommended:


C. We will also touch on Bayes Nets. Prepare by reading as far as you can into:

D. Additional links and info (optional for now):

1. The attached paper by Kersten et al. gives an account of one aspect of perception, under the assumption that the visual system uses sense data to do Bayesian inference.
2. Netica tutorial to Bayes Nets is here, may help understand them:
   http://www.norsys.com/tutorials/netica/nt_toc_A.htm

Feb 7 & 9: Signal detection (Backus)


   Required: pp 165-180.
   Recommended: pp 193-201.

Feb 16: 3-D Shape perception (Zaidi)


Feb 21: Motion perception (Zaidi & Jain)

Feb 23: 3-D Shape from motion cues (Zaidi & Jain)
Jain, A and Zaidi, Q. Discerning non-rigid 3-D shapes from motion cues PNAS (In press).

Feb 28: Mid-term Exam

March 14 & 16: Binocular vision (Backus)

March 21 & 23: Space and scene perception (Sedgwick)


March 28 & 30: Control and consequences of eye-movements (Pola)
Eye Movements Basics for the Clinician, Kenneth Ciuffreda & Barry Tannen
Chap. 1: p. 1 - 9
Chap. 2: p. 10 -19
Chap. 3: p. 36 - 44, p. 53 - 60
Chap. 4: p. 72 - 78, p. 91 - 92
Chap. 5: p. 102 - 108
Chap. 6: p. 127 - 129

April 4 & 6: Extra-striate cortex and perception (Alonso)

April 11 & 13: Disorders of central vision (Ciuffreda)

April 18 & 20: Perceptual learning (Backus)

April 25 & 27: Attention and the control of neural processing (Alonso)

**May 3 & 5: Higher level control of saccades and attention (McPeek)**

**May 10: Final written examination**