THE VISUAL SYSTEM

(Psy 236, EECE 225, Psy 336, EECE 351, CellBio 347, Neurosci 347)
Spring 2004

This course offers an overview of the structure and function of the visual system, including optics, neural structure, neural mechanisms, and psychophysics. You will learn about the design problems that this system must solve and what is currently known about how the visual system works.

This course will differ from most others you have taken. It is an interdisciplinary course taught by more than a dozen faculty, from a half dozen different departments and four separate schools. Each instructor brings a different expertise and perspective to the study of vision. As you progress in the course, you are urged to seek out individual faculty members, who may provide more information about topics of interest, help in the course, and help in planning your term paper.

Faculty:	**Area of interest**	**Department**	**Office**	**Phone**
Bobby Bodenheimer	Computer graphics	EECS	368 Jacobs	2-3555
A. B. Bonds	Cortical processing	EECS, BME	328 FGH	2-2903
Vivien Casagrande	Pathways, brain imaging	Cell Biology	C2310 MCN	3-4538
Anne Corn	Low vision	Spec. Ed.	313 MRL	2-2249
Tom Palmeri	Object recognition	Psych	507 WH	3-7900
Joe Lappin	Spatial vision	Psych	510 WH	2-2398
Rene Marois	Attention, brain imaging	Psych	530 WH	2-1779
David Noelle	Computational neuroscience	EECS	366 Jacobs	2-3067
Alan Peters	Computer vision	EECS	332 FGH	2-7924
John Penn	Retina	Ophthalmology	8016 MCE	6-1456
Anna Roe	Cortical physiology	Psych	066 WH	3-0901
Andrew Rossi	Cortical physiology	Psych	008 WH	2-7466
Jeffrey Schall	Eye movements	Psych	004 WH	2-0868

Books:

1) Tovée, M.J. (1996). *An introduction to the visual system*. Cambridge U. Press. ISBN 0-521-48339-5.
2) McIlwain, J.T. (1996). *An introduction to the biology of vision*. Cambridge U. Press. ISBN 0-521-49890-2.

No currently available book is fully appropriate for this course, but these two cover most of the topics. These books are intended as supplementary background and reference. Additional readings will be made available in class or placed on reserve in the library. Lectures will constitute the main source of information. Exams will be based mainly on the lectures, but background reading is essential.

Course requirements and grading:

Grades will be based on (a) three exams (3 x 20%), (b) a research paper (30%), and (c) class participation (10%). Exam questions are short-answer essays. Approval of the paper topic must be *signed* by one of the listed faculty members prior to the Spring Break. Exams will be graded uniformly, but grading standards will be elevated for term papers from graduate students.

For undergraduates, the research papers should be about 10 pages with at least 10 references. For graduate students, the papers should be about 15 pages with at least 15 references. Web pages are not acceptable references, though the internet may be used to find references (e.g., Medline, Web of Science). References for the sources of information reported in these papers should be fully specified — in accord with the Vanderbilt Honor Code. (Plagiarism is a serious offense and will be reported to the Honor Council.) Term papers are due on the last day of class, 4/26. More information about the term papers will be distributed in class.

Schedule

We will try to adhere to the following schedule, but some changes may be needed to coordinate schedules of many different faculty members.

Date	Topic	Lecturer
1/14	Introductions, course description	Lappin et al.
1/16	Survey of basic design problems	Lappin
1/19	Methods for visual science	Lappin
1/21	Anatomical overview	Casagrande
1/23	Clinical deficits of the eye	Penn
1/26	Image formation — optics	Bonds
1/28	Image formation — linear systems	Bonds
1/30	Physiological primer	Bonds
2/2	Retinal anatomy	Casagrande
2/4	Retinal mosaic & visual fields	Lappin
2/6	Ganglion cells and linear systems	Bonds
2/9	Color vision: Wavelength sensitivities	Lappin
2/11	Color vision: Neural mechanisms	Lappin
2/13	Color vision: Deficiencies & perception	Lappin
2/16	**EXAM**	
2/18	Central projections, parallel paths & streams	Casagrande
2/20	LGN	Casagrande
2/23	Cortical architecture	Casagrande
2/25	Cortical receptive fields	Bonds
2/27	Extra-striate areas	Roe
3/1	Spatial and temporal filters	Bonds
3/3	Cortical representations of natural images	Noelle
3/5	Visual Development	Casagrande
	**** Research Paper Proposals Due Today ****	
3/6 - 14	**SPRING BREAK**	
3/15	Visual plasticity	Casagrande
3/17	Visual prosthetics	Bonds
3/19	Physiology of visual attention	Rossi
3/22	Eye movements — low level	Schall
3/24	Eye movements — high level	Schall
3/26	**EXAM**	
3/29	Motion mechanisms	Lappin
3/31	Space from motion	Lappin
4/2	Stereopsis & depth perception	Lappin
4/5	Computer graphics & human vision	Bodenheimer
4/7	Machine vision	Peters
4/9	Low vision	Corn
4/12	3D shape	Lappin
4/14	fMRI imaging of visual processes	Marois
4/16	Selective attention	Logan
4/19	Object recognition	Palmeri
4/21	Perception & action	Lappin
4/23	Clinical deficits — perception	Schall
4/26	WRAP-UP	STAFF
	**** Research Papers Due Today ****	
5/6, 9:00 a.m.	**FINAL EXAM**	