

NRO C69F The Synaptic Organization of the Brain

Fall, 2002; Room B-382; F 1-3 p.m.

Instructor: Professor Gwen O. Ivy

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Office Hours: T 5-6, TH 5-6, F 3-4 or by appointment

NOTE: T and TH, I teach in S143 and S-128 until 5:00 p.m. and may be detained there by students asking questions.

COURSE DESCRIPTION

Synaptic organization may be defined as the study of principles underlying the organization of neurons and synapses into circuits that mediate the functional operations of different brain regions. It is a multidisciplinary subject, requiring the integration of results from studies in molecular neurobiology, neuroanatomy, neurophysiology, neurochemistry, neuropharmacology, development and behavior, as well as theoretical studies of computational neural models and neuronal networks. It is also a multilevel subject, beginning with the properties of the individual synapse and building up through microcircuits and neurons to the local circuits characteristic of a given region and finally, to the interactions between various circuits that form a given system, and even to system-system interactions. Such multi-system interactions must surely underlie complex thought processes such as art, music and science appreciation, analytical thinking, creativity and self-awareness!

TEXT

The Synaptic Organization of the Brain. Fourth Edition. Gordon M. Shepherd (ed.), Oxford University Press, New York, 1998.

ORGANIZATION

The course will meet weekly for two hours and will consist of lectures by the instructor and extensive class discussions. The textbook will be the major source of information, supplemented by illustrations and concepts provided by the instructor in class.

EVALUATION

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| *Midterm Exam - Week of Oct. 21, TBA by Registrar, 2hrs
(multiple choice, short answer, label diagrams, draw circuits) | 30% |
| *Final Exam - Final exam period, TBA by Registrar, 3hrs.
(same format as midterm; emphasis placed on material after midterm) | 40% |
| Term Paper - Due Dec. 2 (Last day of class)
Fifteen pages, topic of your choice approved by instructor
Possible topics will be provided. Format will be provided | 30% |

*Exam questions will be taken from both the book and the lectures.

2002 NRO C69F Schedule of Topics

DATE :	TOPIC :
F Sept. 13	Introduction to the course Begin Chapter 1: Introduction to synaptic circuits
F 20	Chapter 1
F 27	Chapter 2: Membrane properties and
F Oct 4	Chapter 2: (cont'd.)
F 11	Chapter 2 : (cont'd.)
F 18	Chapter 5: Olfactory Bulb
MIDTERM: week of Oct. 21, TBA by Registrar, 2hrs	
F 25	Chapter 5 : (cont'd.)
F Nov 01	Chapter 7: Cerebellum
F 08	Chapter 7: (cont'd.)
F 15	Chapter 11: Hippocampus
F 22	Chapter 11: (cont'd.)
F 29	Chapter 11: (cont'd.)
M Dec. 02	Last day of class, Term paper due
F Dec 9 - 19	Final exam period, date TBA 40% of grade

Topics for term papers in NRO C69F

Other topics are welcome for approval!

Detailed structure and functions of different regions in the:

- frontal cortex
- parietal cortex
- temporal cortex
- occipital cortex
- cerebellum
- olfactory bulb
- hippocampus

Structure, projections and functions of the:

- locus coeruleus
- raphe nuclei
- substantia nigra
- endopiriform nucleus
- amygdala
- other?

Pain: various pathways, fiber types, neurotransmitters, etc.

Different locations of classes (and subtypes) of receptors and their functions:

- DA (about 5 subtypes now)
- several peptides (CCK, SS, leu-enk, met-enk, etc.) (endorphins)
- 5HT
- NE
- glutamate
- aspartate
- adenosine

Cellular/molecular mechanisms of:

- color perception
- smell
- taste
- audition
- learning
- neuromodulation

- new neuron channels - subtypes and functions:
Survey SCIENCE for the last couple of years - there are lots to choose from; try to pick a theme, not just 1 paper!
- various drug actions - again, pick a theme: drugs for epilepsy/depression/pain/hallucinations/other ...

Evolution of the:

- neocortex - when it first appears evolutionarily, how its structure, size and functions change (note: neocortex is first found in mammals)
- hippocampus - as above; this structure has homologues as far back as reptiles!
- corpus callosum and anterior commissure, also include or focus on mechanisms of development
- anterior commissure - same as with cc - were our brains ever not connected from side to side?

DISEASES

Almost anything goes here: the more cell/molecular, the better. What is the latest scoop on your favourite disease of the nervous system? Or simply the most insidious one?

Please - run your chosen topics by me. I'm sure I will be interested. And, I'll do you the favour of helping you to narrow your topic down.