BIOLOGY 360 NEUROBIOLOGY  
Autumn 2009 - SYLLABUS

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TEXTS (copies of all texts are on 2 hr reserve in the Science Library)

   Lucidly written, extremely comprehensive neurobiology text with more clinical coverage  
   than other texts, but significantly more expensive. Recommended for those want a  
   first-rate, wide-ranging neuroscience reference text.

   Provides deeper coverage of fewer issues than Kandel.  Experimental emphasis plus  
   a more historical approach.

   READING. This inexpensive paperback provides a very different view of neuroscience.  
   The organization of the Sacks book does not correlate with that of the lecture schedule;  
   hence it is impossible to associate specific lectures with individual chapters in  
   his book. You are responsible for the material in the first half (chapters 1-12)  
   of the book by the midterm, and for the second half of the text by the final.

LECTURE #, DATE, & SUBJECT (READING ASSIGNMENT)

1) 29 Sept COURSE OVERVIEW & INTRODUCTION: history of neuroscience; structure of  
    neurons; signaling in CNS; recording techniques; stretch reflex (KSJ, Ch. 1 & 2;  
    NMWF Ch. 1; Appendix A in KSJ and NMWF).

2) 01 Oct IONIC BASIS OF RESTING POTENTIAL: ionic distribution in neurons; Nernst  
    equation (KSJ, Ch. 7; NMWF, Ch. 5).

3) 06 Oct CONTROL OF IONIC PERMEABILITY: action potentials; voltage clamp; Na-K pump  
    (KSJ, Ch. 9; NMWF, Ch. 6).

4) 08 Oct CHANNELS: calcium action potentials; distribution of excitability (KSJ, Ch. 6;  
    NMWF, Ch. 3).

5) 13 Oct PASSIVE PROPERTIES OF NEURONS: cable theory; time & length constants;  
    action potential propagation (KSJ, Ch. 8; NMWF, Ch. 7).

6) 15 Oct SYNAPSES I: electrical synaptic transmission; intro to chemical synaptic  
    transmission; synaptic potentials (KSJ, Ch. 10 & 11; NMWF, Ch. 9).

7) 20 Oct SYNAPSES II: reversal potentials; transmitter-dependent channels; IPSPs;  
    post-synaptic inhibition (KSJ, Ch. 12; NMWF, Ch. 10 & 11).
8) 22 Oct  SYNAPSES III: control of transmitter release; quantal & vesicle hypotheses; MEPPs & role of calcium (KSJ, Ch. 14; NMWF, Ch. 10 & 11).

9) 27 Oct  TRANSMITTERS: neurotransmitter criteria; acetylcholine, biogenic amines; amino acid transmitters; peptides (KSJ, Ch. 15; NMWF, Ch. 14).

10) 29 Oct  MIDTERM EXAM

11) 03 Nov  SENSORY SYSTEMS I: General properties of sensory systems; chemical senses overview; olfaction (KSJ, Ch. 21, 22 & 32; NMWF, Ch. 17).

12) 05 Nov  SENSORY SYSTEMS II: central processing of olfactory information; gustation (KSJ, Ch. 32; Ch.13; NMWF, Ch. 17).

13) 10 Nov  FILM: To be announced.

14) 12 Nov  CONTROL OF MOTOR PATTERNS I: reflexes; fixed action patterns; central pattern generators; simple neural networks (KSJ, Ch. 33-34 & 36; NMWF, Ch. 22).

15) 17 Nov  CONTROL OF MOTOR PATTERNS II: Complex motor patterns; fish swimming; hatching in chicks; human infant behavior (KSJ, Ch. 36-37 & 42; NMWF, Ch. 22).

16) 19 Nov  NEURONAL PLASTICITY: Memory systems; associative & non-associative learning; mechanisms underlying habituation, sensitization and dishabituation; long-term potentiation; other types of neural plasticity (KSJ, Ch. 13, 62-63; NMWF, Ch. 12).

17) 24 Nov  CNS DISORDERS: Alzheimer's and Parkinson's (KSJ Ch. 35, 46, 60 & 65; NMWF, Ch. 19).

18) 26 Nov  NO LECTURE (Thanksgiving).

19) 01 Dec  COGNITIVE NEUROSCIENCE AND BRAIN IMAGING METHODS (KSJ, CH. 59-61)

20) 03 Dec  COURSE WRAP-UP: Discussion of Sacks book and movie; Brief overview of other areas of neuroscience; Discussion on the future direction of brain research. Is there a continuing need for animal research?

DISCUSSION SCHEDULE

Week 1: No discussion

Weeks 2-8: Discussion sections at usual times.

Week 9: No discussion (Thanksgiving week)

Week 10: Discussion sections at usual times.
ASSIGNMENTS (due dates & maximum possible points)

Grading of each paper will be based on the insightfulness and depth of your discussion and the clarity and quality of your writing. PAPERS ARE DUE AT THE BEGINNING OF CLASS.

ASSIGNMENT #1: Report on a primary scientific paper (DUE DATE: 15 Oct; 50 points maximum). A prerequisite to being a Biologist of any sort (even a physician) is the ability to read and critically evaluate the primary scientific literature. The goal of this assignment is to help you develop these essential skills.

Your assignment is to read and write a short report (3 page maximum) on a primary scientific neuroscience paper. The key word here is "primary": you must read and report on an experimental paper written by those who performed the work rather than a review of that work. A good rule of thumb is that if the paper has a materials and methods section, then it is a primary scientific paper. Papers can be on any neurobiological topic from any primary journal. I suggest choosing a paper from a recent neuroscience journal such as Journal of Neuroscience, Journal of Neurobiology, Neuron, Journal of Neurophysiology, and Neuron. Other journals with neuroscience papers may also be used (e.g., Journal of Experimental Biology). Nature and Science are also good sources of interesting neurobiology papers. Review articles are not appropriate. If you are unsure about the paper, check with me first. You may also find it useful to read other papers related to the one you are reading. The most useful related papers are generally those cited in the references.

You must specifically and fully answer the following questions in order. Please number each answer.

1. What is the title of the paper, who are the author(s), and where was it published (journal, volume, page numbers, year)? Please attach a copy of the title page and abstract.

2. What is the major scientific issue addressed by the paper? What is (are) the specific experimental question(s) asked by the paper?

3. What were the results for each experiment?

4. What did the author(s) conclude from the results? Are their conclusions justified?

5. Based on these results, what experiments should the researchers do next?

ASSIGNMENT #2: Discuss an unsolved neuroscience question (DUE DATE: 24 Nov; 50 points maximum). There are literally hundreds of intriguing neuroscience questions not yet understood. Choose one and write a short paper (3 page maximum) describing it, its importance and possible approaches to its solution. At least 3 references are required; wikipedia is not allowed.
**GRADING POLICY**

The course grade is based on the results from the two exams and the two papers.

**EXAMS:** Each exam will count 50% towards your final grade. **There are no make-up exams.** The class will choose whether these will be open or closed book exams. Exams are graded on a modified curve; everyone can receive an "A" if earned. Improvement between the midterm and final will be taken into account when assigning the course grade. You also have the option of not taking the final exam and receiving your midterm grade for the course grade if you submit a 5 page paper on a neurobiological topic of your own choosing.

**ASSIGNMENTS:** There are 2 papers (100 points total) in this course that contribute to your final grade. If you earn 90 points or better (≥ 90%), your final course grade will be raised by 1/3 of a letter grade. If you earn less than 70 points (< 70%), your final course grade will lowered by 1/3 of a letter grade. **Assignments submitted late will have 5 points deducted from the final score.**