Attention!

This is a *representative* syllabus.

The syllabus for the course when you enroll may be **different**.

Use the syllabus provided **by your instructor** for the most up-to-date information. Please refer to your instructor for more information for the specific requirements for a given quarter.

Fall Semester 7001

CELLULAR, MOLECULAR & PHYSIOLOGICAL NEUROSCIENCE

Fall 2012: 14 weeks with 4 holidays
750 minutes = 1 credit hour
5 credit hours = 3750 minutes
3 x 80 minute periods/week x 14 weeks = 3360 minutes (42 Class Periods Mon, Wed, Fri with Holidays)
3 IN CLASS exams and 39 lecture periods.

A separate course entitled "Current Topics in Cellular, Molecular, and Physiological Neuroscience (?)" could run concurrently and have paper discussions (1 credit hour/14 class periods). It will parallel this course with 1 instructor doing a paper review to illustrate the key concepts, provide "real-life" current examples, and give students more experience reading primary literature.

A. Introduction to Nervous Systems

1. Overview of core course sequence, introduction to Fall course/**History of neuroscience** –
2. Introduction to nervous systems (neurons: structure, morphology and functional diversity; glial overview, organization and functional principles)
3. BASIC structure & function of the mammalian nervous system (CNS/PNS, somatic/autonomic) -

B. Cell Biology of Neurons and Glia

4. Nucleus and gene expression (mechanisms of transcription)
5. Regulation of gene expression (transcriptional control)
6. Protein synthesis & translational control (including RNAi)
7. Protein sorting & trafficking (signal peptides, Golgi, secretory and endocytic pathways)
8. Cytoskeleton & transport (cytoskeleton, actin, microtubules, intermediate filaments, dendritic and axonal localization/transport, motors and adaptor)
9. Signaling Pathways I- signaling pathways important for Neuroscience
10. Signaling Pathways II- signaling pathways important for Neuroscience
11. The mitochondria, energy homeostasis and free radicals/energy metabolism in the neuron
12. Cellular and molecular techniques in neuroscience
13. Overview of glial cell biology & myelination (types of glia, morphology and function, myelination in CNS and PNS)
14. **EXAM 1**

C. Electrical Properties of Neurons

15. Overview of membrane structure & membrane transport
16. The membrane potential
17. Ion channels and Ion Channel activity (electrochemical gradient)
18. Action potentials
19. Propagation of action potentials along axons
20. Modulating action potentials
21. Electrophysiological techniques for studying action potentials and ion channels.

D. Synaptic Transmission

22. Overview of synaptic communication/structure of the synapse (details of the molecules/cell biology)
23. Mechanisms of neurotransmitter release
24. The postsynaptic response: Synaptic Potentials, electrotonic properties of dendrites, basic integration
25. Ionotropic versus metabotrobic receptors
26. Neurochemical transmission: Glutamate, GABA, Glycine, Acetylcholine (Synthesis, storage, release and inactivation)
27. Neurochemical transmission: Dopamine, Norepinephrine, epinephrine, serotonin, histamine
28. Neurochemical transmission: Neuropeptides & atypical neurotransmitters
29. Electrical synapses (gap junctions)
30. Mechanism of synaptic plasticity LTP/LTD in adult nervous system
31. **Exam 2 (this is a big exam with lots to cover)**

E. Development & Plasticity

32. Overview of nervous system development / comparative embryology
33. Neural induction
34. Regionalization
35. Neurogenesis & migration
36. Mechanisms of axon guidance & target cell recognition
37. Synapse formation & elimination
38. Neuronal Death
39. FREE
40. FREE
41. FREE
42. Exam 3

Ideas for the three spots:

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1. They could all go in this last section ensure an even distribution of material between exams.
    i. Potential Ideas:
    ii. iPS cells and stem cells (fits in development and plasticity)
    iii. Techniques lecture on the use of viral vectors, RNAi, and other similar methods (could go in first section or last-could be a filler lecture that moves as needed)
    iv. Techniques lecture on transgenic mice, or a lecture with more glia, or growth factors, or a basic neuroimmunology lecture. What are we missing?

2. Keep the three open class times as “floaters” (1 per module) to allow some flexibility in the schedule to accommodate lecturer availability. We could leave two spots “blank” for scheduling conflicts: those times when we can’t get the appropriate lecturer at the appropriate time. That way we have some buffer if an individual can’t make their lecture in their spot. This will be an issue with such a tight curriculum that builds on itself and lecturer’s schedules change each year. We can fill in the floater lectures (or not) with topics related to where they fall in the syllabus or ones that stand alone.