Lecture: EGR1108 TuTh 9:30-10:45AM

Target Audience: Graduate students with some mathematical background [single-variable calculus, differential equations] and an interest in cell electrophysiology.

Summary: Students will be introduced to neuromuscular electrophysiology. Topics will include theoretical modeling of electrical properties of the cell, experimental approaches to cell electrophysiology, and the biological basis for cell electrical function. Finally, students will engage in the presentation, critical analysis, and discussion of journal articles to examine current research in these areas of study.

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Course Plan:
Week 1 (A30)      Introduction to the Neuron (Anatomy, Architecture)
Week 2 (S4,S6)    The Resting Cell Membrane (Structure, Proteins, Gradients, Potentials)
Week 3 (S11,S13)  Electrical Properties of the Nerve Axon (Cable Equation, Circuit Theory)
Week 4 (S18,S20)  Introduction to Synapses and Neurotransmitters (Neuromuscular, CNS)
Week 5 (S25,S27)  Neurotransmitters (Receptors, Selectivity, Packaging, Recycling)
Week 6 (O2,O4)   Presentations 1, 2
Week 7 (O9,O11)  Ionic Basis for Conduction (Ion channels, Electrophysiological Methods)
Week 8 (O16,O18) Midterm review; Midterm (covers weeks 1-7)
Week 9 (O23,O25) Hodgkin-Huxley Model (Physiological basis, Modeling)
Week 10 (O30,N1) Presentations 3, 4
Week 11 (N6,N8)  Introduction to Skeletal Muscle (Anatomy, Architecture), Lit review due
Week 12 (N13,N15) Presentations 5, 6
Week 13 (N20)    Muscle Mechanics (Crossbridge cycle)
Week 14 (N25, N27) Presentations 7, 8
Week 15 (D4,D6)  Muscle Mechanics (Contractile Measurements), E-C Coupling
Week 16 (D11)   Final exam review, Proposal due
Week 17 (Final)  Final exam (covers weeks 9-16)

Reading:
Optional textbook: Fain, Molecular and Cellular Physiology of Neurons. Harvard Press.
Additional journal readings will be given out 1-2 weeks preceding lectures.

Academic Integrity: Please write the following signed statement on each presentation, exam, or assignment: I pledge on my honor that I have not given or received any unauthorized assistance on this examination (or assignment).
**Attendance policy:** Attendance is required. Please let the instructor know at least two weeks in advance if you will miss class for religious observances. For University emergencies (e.g., inclement weather), class will be rescheduled for a mutually convenient time.

**Grading:**

**Graduate Students:** Group Paper Presentation (15%), Paper Summaries (20%), Homework (10%), Exams (25%), Literature Review (15%), Research Proposal (15%)

**Group Paper Presentation:** Groups of 2-3 students will present a research paper from a peer-reviewed journal once during the semester. PowerPoint presentation should be informal, but must include: Brief introduction/background, key experimental approaches, figures from the paper (scanned or screen-grabbed are OK), interpretation (what the paper says, and your own criticism), and what follow-up studies you would suggest. During the presentation, you will also answer questions about the paper posed by your classmates and/or the instructor. Papers should be relevant to course material and should be selected following consultation with instructor at least 2 weeks before presentation.

**Paper summaries:** For each presented research paper (except your own), complete a short (1-2 paragraphs) summary. Include: Brief summary of problem statement and major results, questions that the authors answered convincingly, questions that the authors failed to answer convincingly, and one question for the person presenting the paper. You are required to complete only 5 summaries over the course of the semester, but are expected to read all papers and participate in discussion. (If you complete more than 5 summaries, your 5 highest grades will be counted.)

**Homework:** Homework will be assigned periodically, based on reading and lecture.

**Exams:** A mid-term and a final exam will be given. Both will be weighted equally. The final exam will not be comprehensive.

**Literature Review:** Write a three-page (1-1.5 spaced) summary of 4-6 research articles on a focused topic relevant to course content (discuss topic with the instructor at least three weeks before you start). Define why your audience should care about the summarized topic, major advances in the field, and unanswered questions in the field. Summary should include 2-3 relevant figures (your own or from cited literature are OK) and appropriately formatted references. At least two references should be from journals published in the last two years.

**Research Proposal:** Write a three-page (1-1.5 spaced) research proposal based on your literature review. In the proposal, include: background, specific aims (your assessment of unanswered questions identified in your literature review should help define these aims), and proposed experiments that will address each aim. You may include up to three figures if they help your proposal’s clarity. References may be on an additional page, but all figures, tables, etc. must be included within the three pages.