**Neurophysiology**

**Neuroscience NROSCI 1012 - 1030**

**(20406)**

**Fall Term, 2015 (2161)**

**Instructor**:

Debra Artim, Ph.D.

Department of Neuroscience

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Office hours: Monday 3:00 – 4:00 PM; Wednesday 1:00 – 2:30 PM, or by appointment. If you are unavailable during regular office hours, please feel free to make an appointment. The best way to make an appointment is via e-mail.

**Lecture**

Tuesday and Thursday, 2:30 – 3:45 PM, A221 Langley Hall

**Recitation**:

Monday, 4:30 – 5:20 PM, A224 Langley Hall, begins 9/14/15

**Textbooks (recommended and encouraged):**

Main textbook: From Neuron to Brain, 5th ed., Nicholls, Martin, Fuchs, Brown, Diamond, Weisblat (NtoB)

Supplemental textbook: Cellular Physiology of Nerve and Muscle, 4th ed., Matthews

Both of the above textbooks are available in the book center.

**Course website:** [courseweb.pitt.edu](https://courseweb.pitt.edu/) Check here for announcements, handouts, grades, practice problems, and useful links. Lecture handouts will generally be posted on the class CourseWeb site the day prior to lecture. There is also an online discussion board for the course. Please feel free to post (or answer!) questions or comments regarding the material.

**Course Description:**

In this course we will examine the functioning of neurons and synapses, the basic units responsible for fast communication within the nervous system. The course will focus on the elegant use of electrical mechanisms by the nervous system, and on the powerful quantitative approach to scientific investigation that is fundamental to neurophysiology. Topics that will be addressed include: principles of electric current flow exploited by the nervous system; the basis of the resting potential of neurons; the structure and function of voltage-gated and neurotransmitter-gated ion channels; generation and propagation of action potentials; the physiology of fast synaptic communication

**Academic Integrity:**

Please refer to the School of Arts and Sciences web page for details on academic integrity: <http://www.as.pitt.edu/faculty/policy/integrity.html>

**Disabilities and Special Needs:**

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services, 216 William Pitt Union, 412-648-7890 or 412-383-7355 (TTY) as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course. Please go to the Student Affairs website at <http://www.drs.pitt.edu/> for more information.

**Statement on Classroom Recording:** To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student’s own private use.

**Assignments and Grading:**

**Final grade Determination**

 15% for graded problem sets (3 sets of equal weight)

 20% for Exam 1

 20% for Exam 2

 20% for Exam 3

 25% for Exam 4

**Exams:**

There will be 3 unit exams covering the first 3 ‘blocks’ of material. Exams will focus on material presented in class and assigned readings. These exams are not explicitly cumulative, although much of the later course material will depend on the information presented earlier in the course. The 4th exam will occur during final exam week, it will focus on the last block of material presented in class and will also include questions that are more comprehensive in nature.

 Exams will focus on material presented in class and on lecture notes and will be a combination of short answer / essay and problem solving. (no multiple choice in neurophysiology!)

**Lectures**: As described above, all exams will focus on material presented in class and on the lecture notes. All power point slides / figures used in class will be available on courseweb. Additionally, I will post lecture outlines / summaries online before / after class. These outlines are NOT intended to be comprehensive and will not include every word spoken in class! While much of the course material is covered in the textbook readings, a good amount of content will come from other sources in order to bring the best resources to the classroom. Additionally, I will solve example problems in class, and students will work alone or in small groups to solve some practice problems. For all of these reasons, I strongly encourage class attendance, and be sure to bring your calculator! It’s also a great idea to form study groups to get notes from a colleague in the event you do miss class.

**Make-up exams:**

 Make-up exams will only be given for extreme circumstances and must be documented. Any student with acceptable exam conflicts (e.g. University-related competitions, research conference, scheduled surgery) must discuss with Dr. Artim AT LEAST ONE WEEK BEFORE the exam and proper documentation must be provided. Students MUST contact Dr. Artim before the exam in order to be eligible for a make-up examination. Otherwise, any student missing an examination will receive 0 points for that exam.

**Materials permitted during examinations**

 (1) ONE page of notes (double-sided) is permitted for each exam. No textbook or photocopied pages are allowed. The pages must be either hand-written or typed (at least 11 point font) and printed by the student. This policy is to encourage understanding or the material and problem solving rather than rote memorization of formulae.

 (2) A calculator is required for solving some exam problems. Devices with capabilities beyond calculators, such as computers, tablets or PDAs or not permitted during exams.

**Graded Problem Sets**

 There will be 3 Graded Problem Sets (GPS) designed to provide students with experience in solving problems. These problem sets are essential to the learning and application of class material. You are encouraged to work in study groups to discuss approaches to solving problem sets. However, you must complete the solutions to the graded problem sets independently.

 The dates when problems sets will be given out and due dates are listed below. Problem sets will **NOT** be accepted late. Problem sets can be submitted in class on the date due, or to the **Department of Neuroscience Main Office (A210 Langley Hall) by 4:00 PM** on the due date.

**\*\*No points will be awarded for problem sets received after 4:00 PM on the due date\*\***

Problem set #Date Given Out Date Due

1 Sept. 10 Sept. 22

2 Oct. 8  **\*\***Oct. 20

3 Nov. 5 Nov. 17

**\*\*Please note that even though there is no class on Tuesday, Oct. 20th, GPS #2 is still due that day. You can turn it in at my office (A451 Langley Hall), or at the main neuroscience office (A210 Langley Hall)**

**Neurophysiology 1012 – Spring 2015**

**Course Schedule**

**Date Topic Reading Assignment**

Block 1

Sept. 1 Introduction to neurophysiology NtoB 1 & pp. 159-172

Sept. 3 Properties and functions of glial cells CellP 1

Sept. 8 Recording from neurons NtoB Appendix A

Sept. 10 Electrical principles of neuronal function

Sept. 15 Electrical principles II

Sept. 17 Structure of biological membranes NtoB 4. CellP 2

Sept. 22 Ion channels NtoB 5

 **GPS1 due**

Sept. 24 Patch-clamp recording techniques

**Sept. 29** **Exam 1**

Block 2

Oct. 1Ionic basis of resting potential NtoB 6, CellP 3,4,5 Oct. 6 Model of neuron and current-voltage relations

Oct. 8 Sodium/potassium pump

Oct. 13 Ion transport: pumps and exchangers NtoB 9

Oct. 15 Action potential properties NtoB 7, CellP 6,7

Oct. 20 **No Class – fall break (Monday classes meet)**

 **GPS2 due**

Oct. 22 Voltage clamp techniques

**Oct. 27 Exam 2**

Block 3

Oct. 29 Action potential currents

Nov. 3 Ionic basis of action potential properties

Nov. 5 Single-channel basis of action potential currents

Nov. 10 Cable properties of neurites

Nov. 12 Action potential propagation NtoB 8

Nov. 17 Introduction to synapses/electrical synapses- NtoB 11, CellP 8

 and the neuromuscular junction

 **GPS3 due**

Nov. 19 AChR IV plot

**Nov. 24** **Exam 3**

Block 4

**Nov. 26 No Class – Thanksgiving!**

Dec. 1Fast excitatory neurotransmission NtoB p 279-80 CellP9

Dec. 3 Fast inhibitory neurotransmission, summation

Dec. 8 Integrative mechanisms

Dec. 10 Synaptic plasticity

December 14 **Final exam – Monday, 12/14, 12:00 – 1:50 PM**