**Neurophysiology**

**Neuroscience NROSCI 1012**

**Spring Term, 2018 (2184)**

**Instructor**:

Meredyth Wegener, Ph.D.

Department of Neuroscience

Office: 447 Crawford Hall (Enter via 446 Crawford Hall, office is the 1st on the right)

E-mail: maw201@pitt.edu

Office hours: Monday, 2– 3 PM; Thursday 11AM – 12:30 PM or by appointment. If you are unavailable during regular office hours, please feel free to email me and make an appointment.

**Undergraduate Teaching Assistants**

Haadi Ali ([Haadi.Ali@pitt.edu](mailto:Haadi.Ali@pitt.edu) )

**Lecture**

Tuesday and Thursday, 4 – 5:15PM, 241 Crawford Hall

**Recitation**:

Monday, 1:00 – 1:50 PM, Langley Hall A214, begins 1/22/18

Recitation is not strictly required. There will not be quizzes administered during recitation, and new material will not be presented during this time. However, I strongly recommend regular attendance at recitation. Neurophysiology is a subject that is learned by ‘doing’ not just reading, and practice problems are essential to success on exams and problem sets. Recitation worksheets and/or practice problems will be provided prior to each recitation and solutions posted after recitation. Recitation is a great time to work in small groups, get advice and feedback, test your understanding of concepts and problem solving strategies and to gague your readiness for exams.

**Textbooks (not required):**

There is no comprehensive textbook (that is not exhoribant!) The following textbooks are suggested if you would like supplemental reading or find it easier to take in information via reading. Both can be found on reserve in the Langley Hall library.

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 (CellP)

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 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, 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:**

Academic Integrity Policy

*Cheating/plagiarism will not be tolerated. Students suspected of violating the University of Pittsburgh Policy on Academic Integrity, noted below, will be required to participate in the outlined procedural process as initiated by the instructor. A minimum sanction of a zero score for the quiz, exam or paper will be imposed. (For the full Academic Integrity policy, go to* [*www.provost.pitt.edu/info/ai1.html*](http://www.provost.pitt.edu/info/ai1.html)*.)*

Please note that I will follow the School of Arts and Sciences policy of academic integrity. Any violations will be documented and reported to the dean’s office.

**E-mail Communication Policy**

*Each student is issued a University e-mail address (username@pitt.edu) upon admittance. This e-mail address may be used by the University for official communication with students. Students are expected to read e-mail sent to this account on a regular basis. Failure to read and react to University communications in a timely manner does not absolve the student from knowing and complying with the content of the communications. The University provides an e-mail forwarding service that allows students to read their e-mail via other service providers (e.g., Gmail, Hotmail, Yahoo). Students that choose to forward their e-mail from their pitt.edu address to another address do so at their own risk. If e-mail is lost as a result of forwarding, it does not absolve the student from responding to official communications sent to their University e-mail address. To forward e-mail sent to your University account, go to* [*http://accounts.pitt.edu*](http://accounts.pitt.edu)*, log into your account, click on* ***Edit Forwarding Addresses****, and follow the instructions on the page. Be sure to log out of your account when you have finished. (For the full E-mail Communication Policy, go to* [*www.bc.pitt.edu/policies/policy/09/09-10-01.html*](http://www.bc.pitt.edu/policies/policy/09/09-10-01.html)*.)*

**Disabilities and Special Needs:**

Disability Resource Services

*If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Office of Disability Resources and Services, 140 William Pitt Union, 412-648-7890, as early as possible in the term. Disability Resources and Services will verify your disability and determine reasonable accommodations for this course.*

**Statement on Classroom Recording:** If you would like to record lectures for your own personal use and review, please contact me to attain permission. 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**

5% for class participation

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

18% for Exam 1

18% for Exam 2

18% for Exam 3

26% for Final exam

**Exams:**

There will be 3 unit exams covering the first 3 ‘blocks’ of material. Exams will focus on material presented in class and assigned problem sets. These exams are not explicitly cumulative, although much of the later course material will depend on understanding the information and concepts 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 multiple choice, short answer / essay and problem solving.

**Top Hat**

We will be using the Top Hat ([www.tophat.com](http://www.tophat.com/)) classroom response system in class.  You will be able to submit answers to in-class  questions using Apple or Android smartphones and tablets, laptops, or through text message. Top Hat will require a paid subscription, and the standard pricing for the cheapest option is $24 for 4-months of unlimited access. If you are in other classes using TopHat this semester, you only need one subscription to cover all your courses for the semester. For a full breakdown of all subscription options available please visit [www.tophat.com/pricing.](http://www.tophat.com/pricing)

You can visit [tinyurl.com/TopHatStudentGuide](http://tinyurl.com/TopHatStudentGuide) for the Student Quick Start Guide which outlines how you will register for a Top Hat account, as well as providing a brief overview to get you up and running on the system.  An email invitation will also be sent to your school email account (if you don't receive this email, you can register by visiting our course website: tophat.com/e/994925).

**\*\*In class response questions will begin on Tuesday, Jan. 16th, and will start to count towards your participation grade on Tuesday, Jan. 23th. Each question will be worth 1 point; you will get credit for participation and your answer will not be \*graded\* for correctness (i.e., no point deductions for incorrect answers).**

Class participation is worth 5% of your overall grade. This will include participation in tophat questions, and any in-class activites such as practice problems or surveys.

**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 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, 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. Wegener AT LEAST ONE WEEK BEFORE the exam and proper documentation must be provided. Students MUST contact Dr. Wegener before the exam in order to be eligible for a make-up examination. Otherwise, any student who cannot provide documentation of a legitimate emergency and misses 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 the concepts behind the problem and/or approaches to solving problem sets. However, you must complete the solutions to the graded problem sets independently. Identical / copied problem sets will be investigated.

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 put in Dr. Wegener’s mailbox in **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 Jan. 16 Jan. 25

2 Feb. 13 Feb. 22

3 Mar. 13 Mar. 22

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| **Grading Scale**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Letter Grade | Percentage Range |  | Letter Grade | Percentage Range | | A+ | 98.0 - 100 |  | C+ | 78.0 - 79.9 | | A | 93.0 - 97.9 |  | C | 73.0 - 77.9 | | A- | 90.0 - 92.9 |  | C- | 70.0 - 72.9 | | B+ | 88.0 - 89.9 |  | D | 60.0 - 69.9 | | B | 83.0 - 87.9 |  | F | 59.9 or Less | | B- | 80.0 - 82.9 |  |  |  | |

**OMET evaluations:** Towards the end of the semester, you will receive an e-mail asking you to complete an evaluation of the course and of the instructor. I take these seriously as they are instrumental in organizing and improving the course and in learning how best to present the material. **\*If\*** on the last day of classes (Friday, April 20th) at least 90% of students in the course have completed the OMET evaluation, I will add 0.5% to each student’s overall grade.

**Neurophysiology 1012 – Spring 2018**

**Course Schedule**

**Date Topic Reading Assignment**

Block 1

Jan. 9 Introduction to neurophysiology NtoB 1 & pp. 159-172

Jan. 11 Recording from neurons NtoB Appendix A

Jan. 16 Review of RC circuits

Jan. 18 Electrical principles of neuronal function

Jan. 23 Circuit model of the resting cell

Jan. 25 Structure of biological membranes NtoB 4. CellP 2

**GPS1 due**

Jan. 30 Ion channels: structure and function NtoB 5

**Feb. 1** **Exam 1**

Block 2

Feb. 6 Patch-clamp recording techniques

Feb. 8Ionic basis of resting potential NtoB 6, CellP 3,4,5 Feb. 13 Model of neuron and current-voltage relations

Feb. 15 Ion transport: pumps and exchangers NtoB 9

Feb. 20 Action potential properties / currents NtoB 7, CellP 6,7

Feb. 22Ionic basis of action potential properties

**GPS 2 due**

Feb. 27 Voltage clamp techniques

**Mar. 1 Exam 2**

Mar 4-11 ***No Class – Spring Recess***

Block 3

Mar. 13 Single-channel basis of action potential currents CellP 1

Mar. 15 Cable properties of neurites

Mar. 20 Action potential propagation NtoB 8

Mar. 22 Introduction to synapses/electrical synapses- NtoB 11, CellP 8

and the neuromuscular junction

**GPS3 due**

Mar. 27 AChR IV plot

**Mar. 29** **Exam 3**

Block 4

Apr. 3 Firing patterns of neurons – ’other’ ion channels

Apr. 5Fast excitatory neurotransmission NtoB p 279-80 CellP9

Apr. 10 Fast inhibitory neurotransmission, summation

Apr.12 Integrative mechanisms / summation

Apr. 17 Synaptic plasticity

Apr. 19 Exam Review

**April 25 Final exam – Wednesday, 4/25, 8:00 – 9:50 AM**