**NEUROBIOLOGY**

**Biology 256**

## Fall 2019

Lecture Tuesday/Thursday 11-12:15 pm in RISC 262

Laboratory Wednesdays 8-10:50, 1:10-4pm in RISC 134

Professor Elaine Reynolds, she/her

office: 318 RISC lab: 310 RISC

phone: 330-5654

email: [reynolde@lafayette.edu](mailto:reynolde@lafayette.edu) (best way to reach me)

office hours: Tuesdays 9-11 am

I will be available to answer questions during lab or at office hours. I will also set up additional office hours as needed. Please let me know if you can’t stop by during office hours and we will set up an appointment. A *Moodle* web page will be used with this course. It contains some general information about the course as well as class outlines, readings, and practice tests for exams. The URL for the site is <http://moodle.lafayette.edu>

**Moodle privacy statement**:

Moodle contains student information that is protected by the Family Educational Right to Privacy Act (FERPA).  Disclosure to unauthorized parties violates federal privacy laws.  Courses using Moodle will make student information visible to other students in this class.  Please remember that this information is protected by these federal privacy laws and must not be shared with anyone outside the class.  Questions can be referred to the Registrar’s Office.

**Compliance statement:**

The student work in this course is in full compliance with the federal definition of a four credit hour course. Please see the Registrar’s Office web site (<http://registrar.lafayette.edu/additional-resources/cep-course-proposal/>) for the full policy and practice statement.

**Course Objectives and Outcomes**

This course examines the field of neurobiology from a cellular and molecular perspective with the neuron, the functional cellular unit, and the circuit, the informational unit, as the focus of discussion and experimentation. After a review of basic neuronal cell biology, the course will examine the means by which this highly differentiated cell mediates information flow through synaptic transmission and circuitry. Finally we examine the development of the nervous system and the interaction of genetics and environment that constantly fine-tunes the functioning of synaptic connections and circuits throughout life. These objectives will be meet through class discussions, readings and simulations: discussion of primary literature articles; and the application of our knowledge in the laboratory. Prerequisites for this course are Biology 101 and it is intended for intermediate science students. This course is a core requirement for the BS in Neuroscience major. This course also serves as a prerequisite for Neuroscience 410 Advanced Neuroscience.

**Students at the end of the course will be able to:**

Demonstrate an understanding of the following concepts:

The cell biology of neurons

The electrical properties of the neuron

Propagation of action potentials

Process of synaptic transmission between neurons

Roles of neuronal molecules such as ion channels, neurotransmitters and receptors

The role and organization of circuits.

The development of the nervous system

Postnatal modification of the nervous system with experience and its underlying mechanisms

The interaction of genetic and environmental factors that lead to the constant reorganization

of synaptic connections during postnatal developmental stages

Be able to argue that the diversity of life evolved over time by processes of genetic change in the context of neurobiology

Demonstrate that they can read, interpret and understand original research in neuroscience.

Develop a hypothesis, and then design, conduct, and analyze an experiment that utilizes the tools

of neurobiological research.

Understand how evidence supports our current knowledge of neuroscience

**Text**

There is no required textbook for the class. I will be posting readings, simulations, videos etc for the course on Moodle. We will be using a SimUText simulation of neurological processes as a text for the first part of the course. I have posted a link on Moodle for you to obtain this program for your personal computer ($6) and I will also have the program available for student use in the lab. Please let me know if you need access to the program outside of scheduled lab time. If you would like to read a textbook in conjunction with the material presented in class, I would suggest a used copy of Neuroscience: Exploring the Brain by Bear, Connor and Paradiso or any introductory textbook. These texts are designed for undergraduate coursework requiring only an elementary knowledge of biology. I will be using some figures from Bear et al during lecture. I will also place copies of this textbook at the library and share the pages that coincide with the classwork.

The readings, simulations etc associated with each week of class are indicated under Preparation or Discussion on the syllabus.

**Course Mechanics**

The course has been organized to include two components. Class/discussion sessions will convey the essential material required for an understanding of neurobiology. The laboratory component will enhance what you have learned in the lecture section of the course through computer simulation, electrophysiology, histological and behavioral techniques.

**Class/discussion sessions**

Please be on time for the class sessions as I will make announcements regarding course material changes, test review sessions, etc. at the beginning of the lecture period. You will need to prepare for class by reading or viewing the assigned material. An outline, Powerpoint and other materials for each class will be available online well before the start of each class. In particular the class outline will serve as a guide to the material you will need to master.We will be reading review and journal articles in this class and a **quiz** will be given online starting 24 hrs before the class to gauge your understanding of what you have read in the paper. We will also have in-class activities that will contribute to your grade**.**

**Laboratory**

A handout will detail the procedures to be performed. To **prepare** for your lab you should carefully read before the lab, and bring with you the laboratory exercise printed out or on a laptop. To complete the laboratory exercises within the scheduled 3 hours, it is imperative that you arrive at the lab having previously reviewed the laboratory instructions. Upon arrival at the lab you should understand what is going to be accomplished that day and what is required of you as a follow-up to each exercise. In the lab handout you will be directed as to which lab exercises you are required to wear your lab coat, and in some cases UV protective goggles and latex gloves (which will be provided). I will make general announcements and briefly outline the day’s events at the beginning of class. Each lab will then proceed in a manner consistent with the observations and experiments to be performed. These may include working with living and prepared material; discussions of upcoming projects; videos or computer simulations; demonstrations by the TA or instructor, etc**. Some time outside of the scheduled class time may be required, although every effort is made to keep to the scheduled interval. The time required does depend on your preparation.**

Most of the time you will work with other students and I expect students to cooperate and share observations. Science is often a collaborative effort. **All collaboration in the lab should be documented in the lab notebook. However, I expect each student to record individually their observations and prepare their notebooks independently.** **Any questions about this policy should be directed to me at the beginning of the semester.**

**General Policies**

**Attendance**

Attendance in class is essential since I will be covering important material, and quizzes and activities cannot be made up (although you will be able to drop the lowest score from 1 of these quizzes/activities). Frequent class absences will be taken into consideration in my evaluation of your performance in this class.

Attendance at labs is mandatory. The theories, techniques and protocols presented during the laboratory period are a vital component of your learning experience. **Students will be penalized 10% of the final lab grade for each laboratory missed (see below).** Please note that the laboratory session run 3 hours and students generally will not be excused from laboratory before that time.

**If you must miss a class, laboratory or an exam because of a reasonable conflict, you must make arrangements in advance with me. I am the sole arbitrator of what is reasonable.** If you miss an exam because of sickness or emergency, please notify me as soon as possible. A Dean’s excuse will be required if an exam or laboratory is missed without prior arrangement because of sickness or any other conflict.If because of athletic or other commitments you anticipate missing any laboratory session, it is your responsibility at the beginning of the semester to enroll in a different lab section (or different course).

**Cell Phone/Computer policy**

Cell phones and computers should be silenced during class/discussion sessions. Many students find it useful to print out the presentation for that day or other materials and to take notes on the printout during class. A computer is helpful, but not necessary for making graphs and for doing internet searches during lab. There will be computers available for these purposes in the classrooms we are using.

Computers and cell phones should be silenced and put away during exams. Use of either during an exam will be considered a violation of our academic honesty code and will be pursued with the Dean’s office

**Diversity, Inclusion and Equity Statement**

In this class we will respect and appreciate the background and perspective of every student regardless of their race, ethnicity, gender, social class, sexual orientation, religion, political affiliation, ability, and learning style. I am committed to providing an atmosphere for learning that respects diversity and inclusion, as well as promotes equality by removing educational barriers in our classroom. Please feel free to engage with me on how we might create an inclusive classroom together.

In compliance with Lafayette College policy and equal access laws, I am available to discuss appropriate academic accommodations that you may require as a student. Requests for academic accommodations need to be made during the first two weeks of the semester, except for unusual circumstances, so arrangements can be made. Students must register with the Office of the Dean of the College for verification and for determination of reasonable academic accommodations.

**Academic Honesty**

I expect that you will perform this work independently and honestly as laid out in the student handbook, this syllabus, and departmental statement on academic honesty that is attached to this syllabus. The handbook states:

“To maintain the scholarly standards of the College and, equally important, the personal ethical standards of our students, it is essential that written assignments be a student’s own work, just as is expected in examinations and class participation. A student who commits academic dishonesty is subject to a range of penalties, including suspension or expulsion. Finally, the underlying principle is one of intellectual honesty. If a person is to have self-respect and the respect of others, all work must be his/her own.”

**Evaluation**

Three examinations will be given, two during the semester and one during the final period covering material from **both** the lecture sessions and the laboratory.

In summary, grades will follow these guidelines:

Exam I 20%

Exam II 20%

Exam III 20%

Quizzes/Classroom activities 5%

Infographic Project and Presentation 10%

Laboratory Notebook 15%

Research Project and Presentation 10%

**Important Dates**

Exam I 10/1

Exam II 11/5

Exam III Scheduled during final’s week

Lab Presentation Last week of classes

Lab Notebook Turn in Wednesday before last day of class

**Bio 256 Fall 2017 Syllabus**

**Listed here are lecture topics for specific classes. Please check the moodle site for the reading assignments and posts that go with each class.**

**Week dates Class and Lab Topics**

1 8/27, 29 Class 1/2 Intro, organization of the nervous system

anatomy and cell biology

Preparation: YouTube videos: Anatomy Zone-“Divisions of the Nervous

System – Neuroanatomy Basics” and “Neuron Structure” posted on

Moodle

2 9/3,5 Class 3/4 Basic electrical properties of cells/neurons

Preparation: SimUText Section 1 & 2, Links: Slideshow and tutorial on

Resting Membrane Potential posted on Moodle

3 9/10,12 Class 5/6 Action potential, mechanism and measurement

Preparation: SimUText Section 3 and Tutorials on action potential and

voltage clamp posted on Moodle

4 9/17, 19 Class 7/8 AP propagation/Molecular basis of the action potential

Preparation: Tutorial on action potential propagation,

Armstrong and Hille (1998) Voltage-Gated Ion Channels and Electrical

Excitability. Neuron 20: 371–380 posted on Moodle

5 9/24, 26 Class 9/10 Evolution of ion channels/Action potential in context

Preparation: “Avoidance and the single cell” and “Coordination to fit the occasion” from *An Introduction to Nervous Systems*

Evolution of ion channels link on Moodle

Keirstead, Hans S. (2005) Stem cells for the treatment of myelin loss

*Trends in Neurosciences* 28: 677 – 683

Kohama et al (2001) Transplantation of Cryopreserved Adult Human Schwann Cells Enhances Axonal Conduction in Demyelinated Spinal Cord*. J Neurosci* 21:944–950 all posted on Moodle

6 10/1 **Exam I**

10/3 Class 11 Synaptic transmission-presynaptic processes

Preparation: “Synaptic vesicles-message in a bottle” from Betarhythm

Blog posted on Moodle, Infographics handout/discussion in class

7 10/8,10 Class 12/13 Post-synaptic processes, Neurotransmitters

Preparation: “Neurotransmitters” from Betarhythm Blog posted on

Moodle.

Bear et al Chap 6 and 7 (useful for infographics and preparation)

8 10/15 **Fall break**

10/17 Class 14Neurotransmitters receptors

Preparation: Changeux, Jean-Pierre (2012) The nicotinic acetylcholine

receptor: the founding father of the pentameric ligand-gated ion channel

superfamily. JBC 287:40207-15

9 10/22, 24 **No class Tuesday Society for Neuroscience Meetings**

Class 15 **Infographic Presentations**

10 10/29, 11/1 Class 16/17 Fast/slow neurotransmission interactions/Circuits

Preparation and discussion: Greengard, P. (2001)  The Neurobiology of

Slow Synaptic Transmission.  Science 294: 1024-1030.

“Modulation: The spice of neural life” from *An Introduction to Nervous*

*Systems*

Neural Circuits link on Moodle

Laughlin and Sejnowski (2003) Communication in Neuronal

Networks. Science 301: 1870-1874

11 11/5 **Exam II**

11/7 Class 18 Neural Development

Preparation: YouTube videos Development of the Nervous System

Bear et al. Early Neural Development Chap 7 pp.192-204

12 11/12, 14 Class 19/20 Neural Development

Bear et al. Genesis of neurons/connections/circuits Chap 23 pp. 783-800

Preparation: Axonal pathfinding neurowiki

13 11/19, 21 Class 21/22 Postnatal development-interaction of experience and genetics

Preparation: Toga et al. (2006) Mapping Brain Maturation. TINS

:148–159 Gogtay et al., (2004) Dynamic mapping of human cortical

development during childhood through early adulthood. PNAS

101:  8174–8179

14 11/26 Class 23 Epigenetics-Impact of experience

Preparation: Miller (2010) The Seductive Allure of Behavioral

Epigenetics” Science 329: 24-27, TBA

11/28  **Thanksgiving Break**

15 12/3, 5 Class 24/25 Impact of experience

Discussion: Caspi et al (2002) Role of Genotype in the Cycle of Violence

in Maltreated Children Science 297:851-854 and another paper TBA

**Exam III** will be given during final’s week

**Lab Schedule Fall 2019**

8/28(1) Lab 1 Cell biology and anatomy-prepared slides of neuron cell

types and tissues

9/4 (2) Finish Lab 1, start Lab 2 SimBio Modeling,

9/11 (3) Finish Lab 2

9/18 (4) Lab 3 Physiology of the Cockroach

9/25 (5) Lab 3 Physiology of the Cockroach

10/2 (6) Lab 4 Molecules to Behavior in Flies

10/9 (7) Lab 5 Leech Serotonergic Neurons

10/16 (8)  **Fall break** Infographics work week

10/23 (9) Lab 6 Circuitry Simulation

10/30 (10) Lab 7 Research project-Design

11/6 (11) Lab 7 Research project-Setup and/or data collection

11/13 (12) Lab 7 Research project-Data collection

11/20 (13) Lab 7 Research project-Data analysis/presentation work

11/27 (14) No lab-Thanksgiving

12/4 (15) Lab 7 Research presentations

Lab notebook due by Friday



**Biology Department Statement on Academic Honesty and Plagiarism**

We expect our students to conduct themselves with honor and integrity at all times. This includes, but is not limited to, respecting your instructors and fellow students in your comportment and behavior, as well as respecting their intellectual accomplishments and contributions to your own academic work. We define academic dishonesty as any act or intention to deceive any member of the Department as to the source of your ideas when submitting any work for a grade. During tests or exams this includes failure to abide by any test-taking condition (written, audiovisual or verbal) established by the course instructor. Unless explicitly stated otherwise, it will be understood that the use of "crib sheets", copying from other students, and any use of notes, books, electronic aids or other reference materials is prohibited while taking any quiz or test in any Department course. The Lafayette Student Handbook offers a more detailed discussion of academic honesty, including the procedures followed in cases of academic dishonesty and the possible penalties arising from it.

Our insistence on academic honesty extends from traditional writing (including laboratory reports) through artwork, electronic projects, or oral presentations that you submit for a grade. Students are cautioned to be particularly vigilant against plagiarism, which is a frequent form of academic dishonesty. The Lafayette Student Handbook includes an extensive section on plagiarism and we encourage you to become familiar with this material. Among the most common, but no less serious, forms of plagiarism is re-writing someone else's work without crediting the original author. Rewording a passage from another source and failing to cite that source is a form of plagiarism and will be treated as a breach of academic honesty. In crediting the work of others, all sources are treated as equal: you must cite material produced by other students, material found in the primary or secondary literature, course handouts, and any material obtained from the Internet. Individual instructors may establish more comprehensive guidelines within their respective courses; you are responsible for knowing and understanding any such rules for courses in which you are enrolled.

If you have any questions about what constitutes academic dishonesty in general or in a specific situation, it is your responsibility to discuss the matter with your instructor.

Issued by the Biology Department, January 2011

***Department of Biology***

**Easton, Pennsylvania 18042-1778 \* TEL 610-330-5456 \* FAX 610-330-5705 \* www.lafayette.edu**