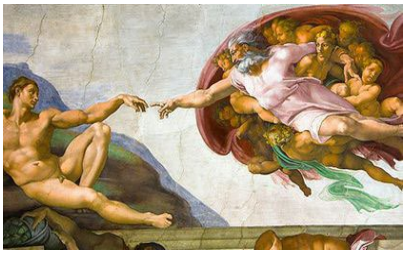
BIOLOGY 360 NEUROBIOLOGY SYLLABUS SPRING 2022



COURSE DESCRIPTION

Understanding the detailed workings of the brain is the goal of neuroscience. Neuroscience is a vast, rapidly evolving, and incredibly exciting subject ranging from elucidating neuronal function at the molecular and cellular levels to providing mechanistic explanations of higher-level cognitive function. The goals of this course are: 1) to provide an underpinning of basic neuroscience principles, and 2) to prepare students for 400 level neuroscience courses at the University of Oregon. The course is divided into two parts: the first part focuses on the cellular and molecular mechanisms and principles responsible for proper neuronal function at the level of a single nerve cell. The second half of the course surveys a variety of topics at the sensory and motor systems, cognitive and medical neuroscience levels.

INSTRUCTORS

Nathan Tublitz (tublitz@uoregon.edu; office hours by appointment)
Molly Shallow (mshallow@uoregon.edu; office hours: Tuesdays, 2-4pm, 258 Straub)
Rachael (Rocky) Penick (rpenick@uoregon.edu: office hours: Wednesdays, 11am-1pm, 258 Straub)

COURSE WEBSITE https://canvas.uoregon.edu/

COURSE STRUCTURE OVERVIEW

The course has numerous, diverse elements, all of which will assist you in understanding the course content and performing well. Details of each are described below (syllabus page #). and also found on CANVAS.

COURSE DETAILS

I. LECTURES

Lectures will be held on Tuesdays and Thursdays at 10:00 AM in 221 McKenzie Hall. Lectures will be 80 minutes long with PowerPoint slides. Please feel free to ask questions throughout the lecture.

II. LECTURE PDFs

To assist in your understanding of the course, PDFs of the PowerPoint slides for each lecture are posted here on Canvas.

III. LECTURE, ASSIGNMENTS & READINGS SCHEDULE

LECTURE # & DATE Papers & Exams Surveys	TOPIC	READINGS (K, Kandel; L, Liu; NO, Neuroscience Online; numbers refer to chapters)
WEEK 1		
1) 29 Mar Pre-Course Survey	**HOUSEKEEPING & INTRODUCTION**	K, 1-3; L, 1; NO, Intro & 1.1
2) 31 Mar	**RESTING POTENTIAL**	K, 9; L, 2; NO, Intro & 1.1
WEEK 2		
3) 05 Apr	**ACTION POTENTIALS**	K, 10; L, 2; NO, 1.1-3
4) 07 Apr	**CHANNELS**	K, 8; L, 2; NO, 1.1-2
WEEK 3		
5) 12 Apr	**PASSIVE PROPERTIES OF NEURONS**	K, 9; L, 2; NO, 1.3
6) 14 Apr **PAPER #1: due 10:00 AM**	**SYNAPSES I**	K, 11; L, 3; NO, 1.4
WEEK 4		
7) 19 Apr	**SYNAPSES II**	K, 12,13 & 15; L, 3; NO,1.5
8) 21 Apr	**SYNAPSES III**	K, 12, 13 & 15; L, 3; NO, 1.6
WEEK 5		
9) 26 Apr	**TRANSMITTERS**	K, 16; L, 3; NO, 1.11-14
10) 28 Apr **EXAM #1 (in class)**	**NO LECTURE – EXAM #1**	n/a
WEEK 6		
11) 03 May	**SENSORY SYSTEMS I**	K, 17 & 29; L, 6; NO, 2.9
12) 05 May	**SENSORY SYSTEMS II**	K, 17 & 29; L, 6; NO, 2.9
WEEK 7		
13) 10 May	**CONTROL OF MOTOR PATTERNS I**	K, 30-33; L, 8; NO, 3.1-3
14) 12 May	**CONTROL OF MOTOR PATTERNS II**	K, 30-33; L, 8; NO, 3:1-3
WEEK 8		
15) 17 May	**NEURONAL PLASTICITY I**	K, 52-54; L, 11; NO, 1.7 & 4.7
16) 19 May **PAPER #2: due 10:00 AM**	**NEURONAL PLASTICITY II**	K, 52-54; L, 11; NO, 1.7 & 4.7
WEEK 9		
17) 24 May	**DISEASES OF THE NERVOUS SYSTEM**	K, 54-60; L, 12; NO, 4.10
18) 26 May	**COGITIVE NEUROSCIENCE & LANGUAGE**	K, 55; L, n/a; NO, 4.8
WEEK 10		
19) 31 May	**DRUGS & THE DOPAMINE REWARD CENTER**	Article: Dopamine Reward System
20) 02 June **EXAM #2 (take home; due Sunday 05 June 12:00 PM)** Post-Course Survey	**THIS IS JUST THE BEGINNING**	Article: Right vs Left Brain Article: The Next 50 Years of Neuroscience

IV. SUPPLEMENTAL VIDEOS

Each lecture has two or more short videos associated with it. These videos, posted here, are optional, however you are urged to watch them as they will enhance your understanding of the lecture materials.

V. TEXTBOOKS

There is no official textbook for the course. To understand the course material, however, it is essential to read a neuroscience textbook of your choice. Nearly every neuroscience text covers the basic material in this course. Here are two of the best in print, an excellent online text, and a special book to read:

A. ***Principles of Neural Science***, Kandel, Koester, Mack & Siegelbaum (K), 6th Edition, Elsevier (2021). Lucidly written, very comprehensive and expensive neurobiology textbook with more clinical coverage than other texts. Recommended for those wanting a first-rate, wide-ranging neuroscience reference source.

B. ***Principles of Neurobiology***, Luo (L), 2nd edition, Garland (2021). Presents the major concepts of neuroscience. The text is organized around a series of key experiments to illustrate how scientific progress is made. Concise and well written.

C. ***Neuroscience Online*** (NO), https://nba.uth.tmc.edu/neuroscience, U. Texas Health Sciences Center Neuroscience faculty. An excellent, clearly written of basic neuroscience topics. Online and free!

D. ***The Man Who Mistook His Wife for A Hat***, Sacks, Harper and Row (1985). **REQUIRED READING.** This inexpensive paperback provides a very different view of neuroscience. The content of the Sacks book does not correlate with that of the lecture schedule; hence you are responsible for chapters 1-12 for Exam #1 and the rest for Exam #2.

VI. WEEKLY DISCUSSION SECTIONS & SCHEDULE

The purpose of these weekly meetings is two-fold: 1) to augment your understanding of the lecture material by discussing and answering a set of discussion questions derived from the week's lectures (posted online here); and, 2) to address whatever questions have arisen during lectures. Answers to the discussion section questions will be posted on CANVAS after the discussion sections. Discussion section attendance is voluntary but highly recommended. Feel free to drop in on one of the other discussion sections if you can't make yours.

DISCUSSION SCHEDULE (214 Friendly Hall at 12:00-12:50, 13:00-13:50 & 14:00-14:50)
Weeks 1-9: Discussion sections will be held
Week 10: No discussions (Take-home exam in progress)

VII. ASSESSMENTS: EXAMS & PAPERS

A. ASSESSMENTS. There are 4 assessments: 2 exams and 2 papers. Each assessment will be worth 25% of your final course grade. Grading scales and the course grading policy are found in Section XIII (p. 8) of this document.

B. EXAMS. There are two exams in this course, an in-class midterm and a take-home final. Exam answers and grade distributions as well as previous Bi 360 exams will be posted here. HINT: Try the old exams without answers first before viewing the answers. **There are no make-up exams. A missed exam will be graded an "F" unless arrangements are made in advance of the scheduled exam.**

1. **Exam #1 (midterm; Thursday April 28th)**. This closed book, closed notes exam will be held in class and will consist of 10-15 short answer questions.

2. Exam #2 (take-home final; available on CANVAS on Thursday June 2nd at 12 noon and must be uploaded onto the Exam #2 CANVAS web page no later than Sunday June 5th at 12 noon). **Late exams will not be graded**. The only acceptable formats are docx, doc, rtf, txt and pdf formats.

This exam is a 72 hr, open book, open notes exam. You may use the internet as a resource. The exam is cumulative, covering the entire course.

The exam consists of 12 questions of which you are allowed to answer only 10 of your choice. If you answer more than 10, we will grade the first 10 only.

Your **typed**, single spaced answers should be entered into the document using a typical font like Times New Roman and no smaller than 12 pt. Each answer should not exceed one page including the question. Each question should begin at the top of a new page. Any figures/graphs /charts must be inserted into the exam and be part of the page limit.

If you have questions about the exam, please contact Nathan by email, SLACK or WhatsApp. Your questions will be answered as quickly as possible. Please note that Nathan will not respond to messages between 11 PM and 8 AM.

You are not allowed to work with or discuss the exam questions or answers with anyone and you must adhere to the University Student Conduct code (https://policies.uoregon.edu/vol-3-administration-student-affairs/ch-1-conduct/student-conduct-code). Violations will be subject to sanctions.

This test will be graded only if the following statement is electronically signed (typing in your full name is sufficient and demonstrates affirmation of the statement):

> *"On my honor, I did not collaborate with any other person, including a fellow student, during this exam. I also declare I did not plagiarize from any source and that I did not violate the University Student Conduct code."*

After you finish the 2nd exam, please complete the very short (5 min) post-course survey. Your answers will help improve the next iteration of the course. Thanks!

C. PAPERS. There are two written papers. Details are found below. **Due dates: Paper #1: Thurs 14 April 10:00 AM; Paper #2: Thursday 19 May 10:00 AM.**

Grading of each paper will be based on the insightfulness, quality and depth of your discussion and the clarity of your writing (100 points maximum). Points will be taken off for superficial analyses and/or poor/imprecise writing. **A late paper or one longer than the 3 page maximum will have 10 points deduced from its score.**

1. PAPER #1: REPORT ON A PRIMARY SCIENTIFIC PAPER (DUE IN CLASS Thursday 14 April at 10:00 AM; 3 double spaced pages maximum excluding optional references and title pages; typed; 12 pt font;100 pts maximum). A prerequisite to be a biologist of any sort, even a physician, is the ability to read and critically evaluate the primary scientific literature. The goal of this paper is to help develop these essential skills.

Your assignment is to read and write a short report on a **primary** scientific neuroscience paper published in the past **5 years *(N.B.*, 5 points will be deducted if older)**. The key word here is **"primary"**; you must read and report on an experimental paper written by those who performed the work rather than a review of that work. A good rule of thumb is that if the paper has a Materials and Methods section, then it almost certainly is a primary scientific paper. Papers can

be on any neurobiological topic from any primary journal. You may choose a paper from a recent neuroscience journal such as *Journal of Neuroscience, Journal of Neurobiology, Neuron, Journal of Neurophysiology,* and *Neuron.* Other journals with neuroscience papers may also be used (*e.g.*, *Journal of Experimental Biology*). *Nature* and *Science* are also excellent sources of interesting neurobiology papers. Review articles are not appropriate. If you are unsure about the paper you have chosen, check with Nathan or the GEs first. You may also find it useful to read other papers related to the one you are reading. The most useful related papers are generally those cited in the references. Here are some notes to assist you in writing Paper #1.

You must specifically and fully answer the following questions in order**.** Please number each answer.

1. What is the paper's citation (use the format in the reference section of your paper; e.g., author, year, title, journal, volume, page numbers)? Please attach a copy of the title page and abstract (not included in the page limit). (10 points)

2. What is (are) the major scientific issue(s) addressed by the paper? What is (are) the specific experimental hypothesis (hypotheses) posed in the paper? (15 points)

3. What experiments were performed and what methods were used? (please be brief: 10 points)

4. What were the results for each experiment? (20 points)

5. What did the author(s) conclude from the results? Are their conclusions justified? Do you agree with their conclusions? Why or why not? (25 points)

6. Based on these results, what **two** experiments should the researchers do next? (20 points)

2. PAPER #2: REPORT ON AN UNSOLVED NEUROSCIENCE QUESTION (DUE IN CLASS Thursday 19 May at 10:00 AM; 3 double spaced pages maximum excluding references and title pages; typed; 12 pt font; 100 points maximum). There are literally hundreds of intriguing neuroscience questions not yet understood. Your goal in this assignment is to identify one unsolved question, explain its importance and propose an experimental test that addresses the question. At least 3 scientific references are required; Wikipedia is not allowed. Some helpful hints for writing this paper are found here.

Your paper must follow the following format (please organize your paper with the following subheadings):

1. Background and Significance (10 points): Be organized – use subheadings when possible. Make sure the significance of the topic is explicitly stated. Clearly state the gaps in current knowledge.

2. Main Hypothesis, Experimental Design & Rationale (20 points): Clearly state the hypothesis you are testing. Briefly describe the experimental design of the experiments and explain how the experimental design tests your hypothesis. (*N.B.,* experimental design differs from the methods section. The former describes the approach for testing the hypothesis, not the technical procedural details of the experiment).

3. Methods (15 points): List general approaches first, explaining why the methods you propose are the best available for your questions. Explain what statistical methods you will use and why.

4. Anticipated Results (30 points): Explain how you will analyze the data collected from your experiment. Describe the potential outcomes of your experiments and their likelihood. Explain your interpretation of the different possible results and how they relate to your hypotheses.

5. Potential Problems and Pitfalls (20 points): This section serves as a reality test of your proposed experiment. Be honest; explain pitfalls and problems with your experiments and how alternative approaches will be used if problems occur. All experiments have potential problems and not including these indicates you have not thought carefully about your experiment.

6. References (5 points; not include in the page limit). List all references. Please use full references following the style from any scientific journal.

D. PLAGIARISM & CHEATING ON ASSESSMENTS. Plagiarism, cheating, and collaboration on assessments are unacceptable and will not be tolerated. These behaviors are patently unfair to your fellow classmates who work very hard and honestly for their grades. All Student Conduct Code violations will result in an "F" for that assessment and the student will be reported to the Director of Student Conduct and Community Standards for sanctions.

VIII. COMMUNICATION WITH YOUR INSTRUCTORS

A. IMMEDIATELY AFTER LECTURE. One of the most effective methods of interactions is to talk with Nathan or the GEs immediately after lecture. This is especially useful when there is a pressing question from lecture that was not already answered. Don't be shy or bashful – come talk to us!

B. OFFICE HOURS. If you don't have time to meet after class, then drop into our office hours. Each GE has scheduled office hours (click on INSTRUCTORS button on CANVAS home page for an up-to-date schedule). Nathan's office hours are by appointment only.

C. PRIVATE MEETINGS WITH NATHAN OR THE GEs. Our goal is to support your learning experience throughout the term. Towards that goal, we are available to meet with you privately any time during the term to address your issues and/or provide advice and encouragement. These meetings are by appointment only, so please message us to schedule a meeting.

D. EMAIL. If you prefer the written word, then email remains an excellent mode of communication particularly for personal issues. Feel free to communicate with us anytime. We will respond within 24 hours and usually sooner. Please send emails directly rather than using the cumbersome and unreliable CANVAS email system.

E. SLACK. Slack is a slick and effective way to communicate; it is perfect for text and video messaging as well as audio and video calls. We have set up a Slack channel called "Uoregonbi360s22". One advantage of Slack is that it allows you to communicate quickly and efficiently with individuals such as your instructors or groups of classmates (think study groups). We encourage you to sign up for and utilize SLACK this term. SLACK download instructions and channel invite are here. Please take advantage of this powerful communication tool.

F. WHATSAPP WITH NATHAN. This is the most used communication app worldwide and is perfect for voice and video messaging, calls and video chats. Best of all, it is completely free if you are using wifi (it will utilize your data allotment if not connected to wifi). If this type of communication suits you best, download and set up WhatsApp if you haven't already and use it to text or call Nathan with questions. His WhatsApp number is 1-541-913-4510. Here's an easy-to-follow WhatsApp set up guide. One request: the first time you WhatsApp with Nathan, please mention you are a Bi 360 student.

IX. COMMUNICATION WITH YOUR PEERS

A. SLACK. A simple, effective method to communicate with your fellow classmates. Much easier than sending them emails on Canvas. See Section VIII above for SLACK information.

B. STUDY GROUPS. If you want to be part of a Bi 360 study group this term, use this google document to identify fellow students interested in forming a study group:

https://docs.google.com/document/d/1GCzc10Vsq_ZXvAFipWfic-NEnV3g1FSId73j9ppGuSs/edit?usp=sharing

X. TIPS ON SCIENTIFIC WRITING

Success on the four assessments in the course (2 exams & 2 papers) will depend in large part on the quality of your writing. Strong writing skills are essential in nearly every modern career, and one should always strive to improve one's written expression ability regardless of your current level. To help you strengthen these skills, several excellent and diverse videos have been posted on the course website. The suggestions in these videos, if implemented, will almost certainly have a positive impact on your university career and beyond.

A. ***My Step by Step Guide to Writing a Research Paper***. An excellent, professorial-like review of the steps involved in writing a generic research paper from initial organization to the final product.

B. ***Papers & Essays Crash Course Study Skills*.** A zippy, well-produced video on writing a strong paper quickly and efficiently.

C. ***Sainani SciWrite 1.1.*** This is the first in a series of videos from a Stanford online scientific writing course. It's an academic presentation to be sure however it does covers all the major points. If a science career is in your future, you would be well advised to view the entire course (all on youtube).

D. ***Tips on Scientific Writing*.** If you don't have time to view all the Stanford science writing course, try this one from the same presenter. Will immediately improve your editing skills.

E. ***How I Got a First Class in Every Essay at University***. How to write a research paper from student's point of view. Covers all the bases. My personal favorite. ("First class" is the equivalent of an "A" in England)

XI. ADDITIONAL RESOURCES

A. BASIC ELECTRICITY CONCEPTS. This document reviews the major concepts in electricity. Worth a look during the first week of class, particularly for those who have forgotten or never took the electricity part of physics. All major neurobiology textbooks have a section, usually as an appendix, on basic electricity. We also suggest reading or re-reading the electricity chapter in a physics textbook.

B. NEUROBIOLOGY EQUATIONS. A useful list of the major neurobiology equations covered in the course, each with a brief explanation. Useful throughout the course.

XII. PRE- & POST-COURSE SURVEYS

There are two short, ungraded surveys we ask you to complete. Both are available on the CANVAS quizzes page. The pre-course survey, available the first week of class, will help us optimize your learning experience. The post-course survey, open on December 2nd for a week, will ask you to provide constructive feedback to improve future iterations of this course. Both surveys are anonymous.

XIII. COURSE GRADING POLICY

A. EXAM GRADING. Each exam will receive a numerical score, which will be converted to a letter grade. Letter grades will be determined using a modified curve, in which the mean score of the class will be assigned a "B-" and the rest of the grades determined using standard deviation statistics. The curve will be posted.

B. WRITTEN ASSIGNMENTS GRADING. The two written assignments will be graded out of a maximum of 100 points and converted to a letter grade using the following conversion scale:

97-100	A+
94-96	A
90-93	A-
87-89	B+
84-86	B
80-83	B-
77-79	C+
74-76	C
70-73	C-
67-69	D+
64-66	D
60-63	D-
<60	F

C. COURSE GRADE CALCULATIONS

1. BASIC CALCULATION. Your course grade will be based on your performance on the four assessments, two exams and two written assignments. Each assessment will count as 25% of your course grade. Your course grade will be the mean of the mean of the exam letter grades and the mean of the assignment letter grades. If a mean is in between two letter grades, the higher grade will be used.

2. EXAM WEIGHTING. If your performance on Exam #2 is better than that of Exam #1, then Exam #2 may weigh more when calculating the average of the two exam grades, depending on the amount of improvement. If your Exam #2 grade is lower than that of Exam #1, your exam grade will be the simple average of the two exam grades.

3. ALTERNATIVE GRADING METHOD. If you wish, you may skip Exam #2 and instead write a 5 page paper on any topic in neuroscience (double spaced excluding title and reference pages). The goal is to learn about a new neurobiological topic we did not cover this term. **That paper will be due when Exam #2 is due** (June 5th at 12 noon; submit to the Exam #2 page) and will be graded pass/fail. If you choose this method and receive a passing grade (99.9% pass), your first exam will count for 50% of your course grade with the average of the two written assignments counting for the other 50%.

D. IMPORTANT GRADING NOTES

1. There are no make-up exams. A missed exam will be graded an "F" unless arrangements are made in advance of the scheduled exam.

2. A late paper or one longer than the 3 page maximum will have 10 pts deducted from its score.

HINTS FOR SUCCESS

Although this course is an in-person lecture course, much of the learning of the course information takes place outside of lecture. To be successful in this course will require self-motivation, focus, time management, determination, and autonomy (suggestion: watch this excellent study skills video). If you work hard and stay on top of the material, this course will help you develop these essential skills and you will do well. One pitfall to avoid is procrastination, an almost certain guarantee of poor performance. Set up an appropriate study schedule now and stick to it throughout the term. Also consider forming small study groups with your fellow students (see STUDY GROUPS, Section IX. COMMUNICATION WITH YOUR PEERS, P. 7 this document). This will not only assist you in learning the course principles and concepts, it will also greatly enhance your overall course experience. If you need assistance finding a study group, we will help you.

We deeply value your thoughts, suggestions, and advice regarding course improvements throughout the term. Most importantly, your instructors are dedicated to assisting you in learning this fascinating subject. Feel free to contact us for whatever reason.

LEARNING OUTCOMES

By the end of the course, Bi 360 students should be able to:

1. Describe the known cellular and molecular mechanisms responsible for neuronal function at the single neuron level;
2. Explain the basic principles of sensory transduction and processing;
3. Articulate the general concepts underlying motor control;
4. Know the basic cellular and molecular mechanisms underpinning associative and non-associative learning;
5. Understand the symptoms, etiology, and treatment alternatives of several nervous system disorders;
6. Read and comprehend primary and review papers in neuroscience;
7. Develop an understanding of living with a neurological disorder;
8. Identify an unanswered question in neuroscience, develop a testable scientific hypothesis to explore the question, design an experiment to test the hypothesis, and critically evaluate potential outcomes of the experiment;
9. Improve critical thinking and oral and written expression skills, and,
10. Enroll and perform well in 400 level neuroscience courses at the University of Oregon.