

# BIOLOGY 360 NEUROBIOLOGY

## SYLLABUS - Fall 2020

**COURSE DESCRIPTION:** Understanding the details underlying the inner workings of the brain is the goal of neuroscience. Neuroscience is a vast, rapidly evolving and exciting area ranging from elucidating neuronal function at the molecular and cellular levels to providing mechanistic explanations of higher level cognition. 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 systems, cognitive and medical neuroscience levels.

**HINTS FOR SUCCESS:** This course is being offered **asynchronously**, which means lectures - called lessons - are taped. As a result, you must work predominantly on your own. This is far from an easy task as many of you learned firsthand last spring. To be successful in this course will require new levels of 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 particularly in online/remote courses. Set up an appropriate study schedule now and stick to it throughout the term. Also consider forming a study group with your fellow students. 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'll help you. You should also take full advantage of the course materials, including textbooks, discussion & thought questions, posted documents and course surveys. **The most important hint is to ask for help whenever necessary. Don't be shy or embarrassed. We are dedicated to assisting you in learning this fascinating subject, so please feel free to contact us for whatever reason.**

**INSTRUCTORS:** Nathan Tublitz ([tublitz@uoregon.edu](mailto:tublitz@uoregon.edu); please call me Nathan)  
Kris Chauvin ([kchauvin@uoregon.edu](mailto:kchauvin@uoregon.edu))  
Molly Shallow ([mshallow@uoregon.edu](mailto:mshallow@uoregon.edu))

**COURSE WEBSITE:** <https://canvas.uoregon.edu/>

**ZOOM MEETINGS INFO** (For the best connection, please load [Zoom](#) on your device)

**NATHAN:** [Nathan's Zoom address](#); Meeting ID: 952 843 6367; No passcode

**KRIS:** [Kris' Zoom address](#); Meeting ID: 835 550 0618; No passcode

**MOLLY:** [Molly's Zoom address](#); Meeting ID: 838 160 0116; No passcode

### **COURSE STRUCTURE**

**I. LESSONS:** Lessons comprise the major part of the course. Each is pre-recorded and ~10-20 min in length. Lessons are posted in the Canvas [MODULE](#) section and each week's lessons will be available on that Monday.

Each lesson contains:

- A. An oral presentation with a set of accompanying Powerpoint slides;
- B. A brief review of the previous lesson;
- C. An equally brief overview of the current lesson;
- D. At least one, short, topical video;
- E. An ungraded, thought question that must be answered to continue viewing the lesson; and,
- F. A discussion question(s) at the end of the lesson to be answered on the Canvas [DISCUSSION](#) page (see below for details).

**II. TEXTBOOKS.** There is no official textbook for the course. To understand the course material, it is essential however that you read a neuroscience textbook of your choice. All cover the basic material of this course and each has its particular strengths. Here are 3 of the best plus an excellent online text:

A. *Principles of Neural Science*, Kandel, Schwartz, Jessell, Siegelbaum and Hudspeth (K), 5th Edition, Elsevier (2014; 6<sup>th</sup> edition expected fall 2020). Lucidly written, extremely comprehensive and expensive neurobiology text with more clinical coverage than other texts. Recommended for those wanting a first-rate, wide-ranging neuroscience reference text.

B. *From Neuron to Brain*, Nicholls, Martin, Fuchs, Brown, Diamond & Weisblat (N), 5th edition, Sinauer (2012). Provides deeper coverage of fewer issues than Kandel and is an easier read. Experimental emphasis plus a more historical approach.

C. *Principles of Neurobiology*, Luo (L), 1st edition, Garland (2015; 2<sup>nd</sup> edition scheduled for fall 2020). Presents the major concepts of neuroscience with an emphasis on how we know what we know. The text is organized around a series of key experiments to illustrate how scientific progress is made. Concise and well written.

D. *Neuroscience Online*, <https://nba.uth.tmc.edu/neuroscience/>, U. Texas Health Sciences Center Neuroscience faculty. A excellent, clearly written of basic neuroscience topics. Online and free!

E. *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 organization 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.

### III. LESSON SCHEDULE

<b>WEEK</b> <b>Assignments &amp; Exams</b> <b>Surveys</b>	<b><u>LESSON</u></b>	<b>TOPIC</b>	<b>READINGS</b> (K, Kandel; N, Nicholls; L, Liu; NO, Neuroscience Online; numbers refer to chapters)
<b>WEEK 1:</b> 28 Sept-04 Oct <b>Pre-Course Survey</b>	<b>LESSONS 0.1-0.2</b>	<b>COURSE OVERVIEW &amp; HOUSEKEEPING</b>	None
	<b>LESSONS 1.1-1.2</b>	<b>INTRODUCTION</b>	K,1&2; N,1; L,1; NO, Section 1:Intro
	<b>LESSONS 2.1-2.3</b>	<b>RESTING POTENTIAL</b>	K, 6; N, 6; L, 2; NO, 1:1
<b>WEEK 2:</b> 05-11 Oct	<b>LESSONS 3.1-3.3</b>	<b>ACTION POTENTIALS</b>	K, 7; N, 7; L, 2; NO, 1:2
	<b>LESSONS 4.1-4.3</b>	<b>CHANNELS</b>	K,6; N,5; L,2; NO, 1:1&2
<b>WEEK 3:</b> 12-18 Oct <b>ASSIGNMENT #1: DUE THURS 15 OCT 10:00 AM</b>	<b>LESSONS 5.1-5.2</b>	<b>PASSIVE PROPERTIES OF NEURONS</b>	K, 6; N, 8; L, 2; NO, 1:3
	<b>LESSONS 6.1-6.2</b>	<b>SYNAPSES I</b>	K, 8&9; N, 11&12; L, 3; NO, 1:4

WEEK 4: 19-25 Oct	LESSONS 7.1-7.2	SYNAPSES II	K,10;N,12&13;L,3;NO,1:5
	LESSONS 8.1-8.3	SYNAPSES III	K,12;N, 13; L, 3; NO, 1;6
WEEK 5: 26 Oct-01 Nov EXAM #1: AVAILABLE THURS 29 OCT 10:00 AM DUE FRI 30 OCT 10:00AM	LESSONS 9.1-9.4	TRANSMITTERS	K, 12; N, 13; L, 3; NO, 1;11-14
	LESSON 10	GLIA CELLS	<a href="#">Article: Glial Cells</a>
WEEK 6: 02-08 Nov	LESSONS 11.1-11.4	SENSORY SYSTEMS	K,21&32;N,19;L,6;NO,2:9
WEEK 7: 09-15 Nov	LESSONS 12.1-12.4	CONTROL OF MOTOR PATTERNS	K,33,34&36;N,18; L,8; NO,3:1-3
WEEK 8: 16-22 Nov ASSIGNMENT #2: DUE THURS 19 NOV 10:00 AM	LESSONS 13.1-13.5	NEURONAL PLASTICITY	K, 65-67; N, 16; L, 10; NO, 1:7 & 4:7
WEEK 9: 23-29 Nov	LESSONS 14.1-14.4	CNS DISORDERS	K,14&44; L,11;NO,4:10
	LESSON 15	NOVA: SECRETS OF THE MIND	<a href="#">Article: Phantom Limb</a> <a href="#">Article: Blindsight</a>
WEEK 10: 30 Nov-04 Dec EXAM #2: AVAILABLE THURS 03 DEC 10:00 AM DUE FRI 04 DEC 10:00AM	LESSONS 16.1-16.4	DRUGS & THE DOPAMINE REWARD CENTER	<a href="#">Article: Dopamine Reward System</a>
Post-Course Survey	LESSON 17	THIS IS JUST THE BEGINNING	<a href="#">Article: The Next 50 Years of Neuroscience</a> <a href="#">Article: Right vs Left Brain</a>

#### IV. ASSESSMENTS: Exams & Assignments

A. **ASSESSMENTS.** There are 4 assessments: 2 take-home exams and 2 written assignments. Each assessment will be worth 25% of your final course grade. Grading scales and the course grading policy are found towards the end of the syllabus.

1. **EXAMS.** Each exam will be a 24 hr, open book, open notes, take-home exam. You may use the internet as a resource. The exams are written to be completed in 3-4 hours. Each exam will consist of 12 short-to-medium length questions (no multiple choice) of which you will answer 10 of your choice. If you answer more than 10, we will only grade the first 10. Figures/graphs/charts are allowed. The exam will be available online at 10:00 AM Thursday and will be due at 10:00 AM the next day (Friday). You are not allowed to work with or discuss the exam questions or answers with anyone and you will be required to attest to that by signing an honors principle statement. No exam will be accepted without your signature. **There are no make-up exams. A missed exam will be graded an "F" unless arrangements are made in advance of the scheduled exam.** Exam answers and grade distributions will be posted [here](#). Last year's Bi 360 final exam is also [here](#) with and without answers HINT: Try the old exam without answers first before viewing the answers. **Due dates: Exam #1: Friday 30 Oct 10:00 AM & Exam #2: Friday 04 Dec 10:00 AM.** Please note: the 2<sup>nd</sup> exam will be comprehensive, i.e., it will cover the entire course.

**2. ASSIGNMENTS.** There are two written assignments. Their details are located below. **Due dates: Assignment #1: Thurs 15 Oct 10:00 AM & Assignment #2: Thursday 19 Nov 10:00 AM.**

**B. ASSESSMENT SUBMISSION PROCEDURE.** Exams and written assignments must be uploaded to the appropriate **ASSIGNMENT** page on the CANVAS website by the due date and time. The only acceptable formats are docx, doc, rtf, txt and pdf formats.

**C. PLAGIARISM & CHEATING.** All submitted exams and written assignments will undergo a plagiarism review through the CANVAS SIMCHECK program. Any Student Conduct Code violations, including plagiarism, cheating and collaboration on assessments, will not be tolerated. These behaviors are patently unfair to your fellow classmates who work very hard for their grades. A Conduct Code violation 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.

**V. WRITTEN ASSIGNMENTS.** Grading of each paper will be based on the insightfulness, quality and depth of your discussion and the clarity of your writing (100 pts 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 pts deducted from its score.**

**A. ASSIGNMENT #1: Report on a primary scientific paper (DUE: 15 October at 10:00 AM; 3 double spaced pages maximum excluding optional references and title pages; 100 points maximum).** A prerequisite to being a biologist of any sort, even a physician, is the ability to read and critically evaluate the primary scientific literature. The goal of this assignment 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. 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 good sources of interesting neurobiology papers. Review articles are not appropriate. If you are unsure about the paper you have chosen, check with Nathan, Kris or Molly 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.

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

1. What is the title of the paper, who are the author(s), and where was it published (journal, volume, page numbers, year)? Please attach a copy of the title page and abstract. (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 methods were used (VERY BRIEFLY: 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? (25 points)
6. Based on these results, what two experiments should the researchers do next? (20 points)

**B. ASSIGNMENT #2: Report on an unsolved neuroscience question (DUE: 19 November at 10:00 AM; 3 double spaced pages maximum excluding optional references and title pages; 100 points maximum).** There are literally hundreds of intriguing neuroscience questions not yet understood. Choose one and write a short paper describing it, its importance and possible approaches to its solution. At least 3 scientific references are required; Wikipedia is not allowed.

Your paper must have 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 knowledge.
- 2. Main Hypothesis** (6 points): Clearly state your hypothesis. Briefly explain the experimental design to test the 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. Rationale** (10 points): How does the experimental design test your hypothesis? What is your reasoning?
- 4. Methods** (15 points): List general approaches first, explaining why the methods you propose are the best available for your questions. Be as specific as space allows. Include your approaches to statistical analyses.
- 5. Anticipated Results** (30 points): Explain how your data will be analyzed and all potential outcomes of your experiments and their likelihood. Explain your interpretation of the different possible results and how they relate to your hypotheses.
- 6. Problems and Pitfalls** (24 points): This section serves as a reality test of your proposed experiment. Be honest and explain pitfalls and problems with your experiments and how alternative approaches will be used if they occur. All experiments have potential problems so not including these indicates you have not thought carefully about your experiment. If this section feels uncomfortable, it is because you are probably proposing an experiment that is not feasible.
- 7. References** (5 points). List all references. Please use full references following the style from any scientific journal.

#### **Assignment #2 Common Mistakes**

**Background and Significance:** Neither significant nor interesting; Lack of compelling rationale; Incremental and low impact research; Lack of new or original ideas.

**Main Hypothesis:** Too ambitious, too much work proposed; Unfocused aim, unclear goal.

**Experimental Design:** Not enough detail; Lack of appropriate controls; Not directly testing hypothesis; Correlative or descriptive data; Experiments descriptive and not directed towards mechanisms.

**Methods:** Not enough detail however don't include too much to conserve space for the other sections.

**Anticipated Results:** Insufficient discussion of proper data analysis and interpretation of data.

**Problems and Pitfalls:** No discussion of potential pitfalls and alternative models or hypotheses.

**Formatting/Writing Issues:** Exceeds 3 pages; Grammatical and/or spelling errors; Writing is unclear.

**VI. DISCUSSION SECTIONS.** These will be run as live, Zoom meetings (all times are Pacific time). The purpose of these meetings is two-fold: 1) to go over a few of the week's discussion questions; and, 2) to answer whatever questions have arisen during the lessons. These meetings will be held every Friday during the term except for Weeks 9 (27 Nov) and 10 (04 Dec). You will be placed in a waiting room before being admitted. Attendance is voluntary however strongly encouraged. Please make every effort to join the meeting on time.

Here is the discussion schedule:

MOLLY: Fridays 12:00-12:50 PM and 1:00-1:50 PM ([Molly's Zoom address](#))

KRIS: Fridays 2:00-2:50 PM and 3:00-3:50 PM ([Kris' Zoom address](#))

**VII. CANVAS [DISCUSSION PAGES](#).** Discussion questions are an integral part of the course. Answering them will be very useful in understanding the course materials and studying for the exams. Each lesson's discussion question(s) has its own, individual page in the Canvas [DISCUSSION](#) section and you are strongly encouraged to post an answer, either signed or anonymous. Discussion answers are ungraded. We recommend you post your responses as soon as possible, and preferably before Friday's discussion class. Discussion questions for each lesson will be open for postings for one week only, starting on Monday when its lesson is available for viewing. Discussion pages will be moderated by your instructors.

### **VIII. MODES OF INTERACTION WITH YOUR INSTRUCTORS**

**A. Q&A WITH NATHAN.** Nathan will hold two, class-wide [Q&A sessions](#) each week on Zoom during scheduled class time (Tuesdays & Thursdays at 10:15-11:15 am; starts Week 2). Here you will be able to ask anything arising from the lessons, so bring on your questions. Please do not be shy or embarrassed; there truly are no stupid questions and remember it is almost certain that your classmates also have the same question. Please note you will be in a waiting room before being admitted and remember that once admitted, your classmates will be listening to your comments and questions.

**B. CANVAS [CHAT PAGE](#).** If you prefer to communicate via the written word, then the Canvas [CHAT](#) page is for you! It is the place to post your questions, thoughts, suggestions and general comments concerning all aspects of the course. We will respond within 24 hr and usually sooner. And of course, if anyone else has an answer, we encourage you to reply. Remember this is a public forum.

**C. EMAIL.** Email remains an excellent mode of communication particularly for personal issues. Feel free to communicate with us anytime. We will endeavor to respond within 24 hr or sooner.

**D. PERSONAL MEETINGS WITH NATHAN.** You must meet with Nathan during WEEK 1 (28 Sept-03 Oct) and WEEK 6 (02-07 Nov) to discuss your goals, progress and any other issues. These meetings will be held on Zoom at [Nathan's Zoom location](#). To schedule a meeting, please click the CALENDAR link on the left column of the course home page, click on FIND APPOINTMENT on the right side of the calendar, select BI 360 from your course list, click on SUBMIT and the available appointment dates and times will appear.

**E. PRIVATE ZOOM MEETINGS WITH NATHAN, KRIS OR MOLLY.** Our goal is to support your learning experience throughout the term. Towards that goal, we are available to meet with you privately via Zoom at any time during the term to address your issues and/or provide advice and encouragement. These meetings are by appointment only so please email to schedule a meeting.

**F. SLACK.** [Slack](#) is perfect for text and video messaging as well as audio and video calls. We have set up a Slack channel called "Uoregonbi360"; the URL is <https://uoregonbi360.slack.com/>. One advantage of Slack is that it allows you to communicate with individuals such as your instructors or groups of classmates (think study groups). Please take advantage of this powerful communication tool.

## SLACK INSTRUCTIONS

1. Download [Slack](#)
2. Click on this Bi 360 Slack invite link or paste it into your browser:  
[https://join.slack.com/t/uoregonbi360/shared\\_invite/zt-hjwbwha7n-prIX\\_90adp2DShmq~Ox48w](https://join.slack.com/t/uoregonbi360/shared_invite/zt-hjwbwha7n-prIX_90adp2DShmq~Ox48w)
3. Create an account with email & password.
4. After this, you will be directed to the Slack Bi 360 home page ([uoregonbi360.slack.com](http://uoregonbi360.slack.com)).
5. Direct messages are on the left-bottom of the home page screen. You can start a direct message with anyone else in the Bi 360 slack group, including Kris, Molly and Nathan.
6. Right above that is “channels”. These are for specific topics/uses. To join a channel, click on “more”, then “channel browser” and then on the specific channel you wish to join. If you think a new Slack channel should exist, please email Kris or Nathan and we’ll set one up.
7. Note that with Slack, not only can you post texts, but you can link to any web address and upload nearly any type of file directly into the chats/channels. If you prefer to ask questions orally rather than by text, you can easily take a video of yourself asking the question on your phone and upload it directly into the Slack channel of your choosing.

**G. 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 as long as 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](#). Please remember that Nathan is in Italy which is 9 hrs ahead of Pacific Time. Best time to voice or video call is between 8 AM and 1 PM Pacific time. Also, the first time you WhatsApp with Nathan, please mention you are a Bi 360 student.

**IX. TIPS ON SCIENTIFIC WRITING.** Success on the four assessments in the course (2 exams & 2 written assignments) 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 no matter 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.

## X. 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 the 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 and brief explanation of the major neurobiology equations covered in the course. Useful throughout the course but particularly prior to the exams.

**XI. PRE- & POST-COURSE SURVEYS**. The short, pre-course survey will help us improve the course and optimize your learning experience. The survey is in the [Week 1 Module](#) or [here](#) and is due by 01 Oct 2020 at 11:59 PM. The post-course survey, whose aim is to provide constructive feedback about the course, is in the [Week 10 module](#) and will be available from Friday 04 Dec at 10 AM to Monday 07 Dec at 11:59 PM. Both surveys are anonymous.

## XII. COURSE GRADING POLICY

A. **EXAM GRADING**. The numerical score you earned on your exams 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 subsequent grades determined using standard deviation statistics. A grade distribution histogram and grading curve for each exam will be posted [here](#).

B. **WRITTEN ASSIGNMENTS GRADING**. The two written assignments will be graded out of a 100 pts maximum 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 average 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 the 2<sup>nd</sup> exam is better than that of the 1<sup>st</sup>, that will be taken into account and the 2<sup>nd</sup> exam may weigh more when calculating the average of the two exam grades, depending on the amount of improvement. If your 2<sup>nd</sup> exam grade is less than the 1<sup>st</sup>, your exam total 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 (Friday 04 Dec at 10:00 AM)** 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%.

**XIII. LEARNING OUTCOMES.** By the end of the course, students should be able to:

- A. Describe the known cellular and molecular mechanisms responsible for neuronal function at the single neuron level;
- B. Explain the basic principles of sensory transduction and processing;
- C. Articulate the general concepts underlying motor control;
- D. Know the basic cellular and molecular mechanisms underpinning associative and non-associative learning;
- E. Understand the symptoms, etiology and treatment alternatives of several nervous system disorders;
- F. Read and comprehend primary and review papers in neuroscience;
- G. Develop an understanding of living with a neurological disorder;
- H. 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;
- I. Improve critical thinking and oral and written expression skills, and,
- J. Enroll and perform well in 400 level neuroscience courses at the University of Oregon.