

Cellular and Molecular Neuroscience

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Department of Chemistry and Biochemistry
Murie 113E

Lecture: MWF 11:45 am – 12:45 pm
REIC 203

Office Hours: 1-3 M Murie 113E or arrange via email

Textbooks: I will be following Purves for assigned readings and course organization but either one of the three text books will be adequate for the course.

- Neuroscience (6th Edition); Sinauer Associates
Dale Purves et al., **ISBN:** 9781605353807
- From Neuron to Brain (5th Edition); Sinauer Associates
John G. Nicholls et al, **ISBN-13:** 978-0878936090 or **ISBN-10:** 0878936092
- From Molecules to Networks: An Introduction to Cellular and Molecular Neuroscience (3rd Edition, 2014); Academic Press John H. Byrne, Ruth Heidelberger, M. Neal Waxham, **ISBN-13:** 978-0123971791 or **ISBN-10:** 0123971799

Additional Reading: Scientific research articles and review articles (PDF via Blackboard)
Handouts provided in class

Course Description (modified from catalogue)

Neuroscience is a complex discipline integrating concepts of chemistry, physics, biochemistry, cell biology, pharmacology, physiology, anatomy, and psychology. The goal of this course is to provide both undergraduate and graduate students a comprehensive foundation of the cellular and molecular concepts governing the function and communication of the developing and adult nervous system ultimately forming complex behaviors such as learning and memory. Topics addressed will include membrane excitability, ion channel function, G-protein signaling, synaptic transmission, development of the nervous system and innervation patterns. Fundamentals of the functional properties of neurons will provide the background for discussions of small neuronal circuits that regulate behavior, the cellular/molecular basis of learning and memory, and pharmacological approaches for the treatment of neuronal pathologies.

Course Goals:

- Acquire the foundation of the cellular and molecular concepts governing neuronal communication
- Understand how cellular and molecular concepts integrate into complex behaviors
- Appreciate parallels between development and plasticity of neuronal interconnectivity
- Acquire the ability to critically evaluate scientific research articles in cellular, molecular, and developmental neuroscience

Learning Outcomes:

- To understand membrane potential and excitability
- To understand neuronal action potentials
- To understand synaptic transmission
- To understand structure/function aspects of voltage and ligand-gated ion channels
- To understand G-protein signaling
- To understand early brain development (gastrulation, neurulation)
- To understand cellular adhesion and neuronal process outgrowth
- To understand basic techniques and experimental approaches in cellular and molecular neuroscience.

Course Structure:

The teaching methods employed in this course will consist of lectures (70%), groupwork (10%), and class discussions (20%). The suggested textbooks serve as a basic reference. Being prepared for discussion is essential, hence preparation and reading of material is critical. **Canvas** (<https://canvas.alaska.edu>) will be utilized as a central communication platform for announcements, posting of lectures and reading material. It is assumed that every student is frequently visiting Canvas to check for announcements as well as email notifications. Please verify your email address is correct and current.

Course Policies:**Attendance and Participation**

Regular attendance is expected to ensure consistency in discussions and presentations. Active student participation is essential and will be accounted for in the final grade (40 pts). If you are unable to attend class, you should contact the instructor in advance.

Exams

Two exams will be given including one midterm and one final exam (see grading for details). These exams may have take-home question and consist primarily of short essay questions. Importantly, **makeup exams** will only be allowed with pre-approval of the instructor or with an acceptable, documented reason such as unexpected illness, family emergencies, or other unavoidable events. The format of a make-up exam could vary from the original. Alternatively, an oral exam may also substitute if acceptable with student.

Paper Discussions

Research paper(s) pertinent to topics addressed in lectures will be discussed with respect to rationale, hypothesis, research data, and analysis. Papers will be distributed **one week prior** to discussion. Student pairs will be assigned a section and figure(s), and will be asked to explain the material to their classmates. These discussions are important to translate science knowledge into understanding (i.e. the application of science). **Six paper** discussions over the term of the semester account for 100 points (20 points each paper, 5 out of 6 papers will be accounted for). Students are expected to contribute to these discussions with explanations and arguments. Actively participating by providing constructive contribution is sufficient to receive full points.

Clinical Discussions

We will do two discussions on the clinical aspects of what can happen when brain systems go rogue or how pharmacological manipulation can alter brain states. These are supposed to be interesting, fun and will hopefully inspire you to learn more. Reading materials will be provided (2 discussions, 20 pts each).

Portfolio (HW)

Written assignments will be used to generate summaries of key topics discussed. Summaries will be guided by questions given by the instructor (100 points). There will be one midterm evaluation due prior to taking the midterm exam, and one final evaluation due before taking the final exam. There will be one midterm evaluation and one final evaluation (see course schedule).

Group project

There will be a group project with due dates spread throughout the semester (80 points). Each group will develop an interactive activity for the class to do that helps to teach the material. Instructions will be posted on Canvas.

Late assignments are not accepted. Students are given up to a week to complete assignments, which are scheduled to coordinate with lectures and exams.

Grading: Grades will be posted to Canvas, which can be accessed from the UAF homepage. Class grades may be adjusted (curved) from the following schedule only in the students' favor.

Evaluation Type	Undergraduates	Graduates
Midterm Exam	100	100
Final Exam	100	100
Participation/Discussion	40	40
Clinical discussions (2, 20 pts each)	40	40
Portfolio (10pts per EoC, 10 HWs)	100	100
Paper Discussion (20pts each, 5 papers- one freebie for undergrads)	100	100 (will be leading discussion for 1 paper)
Leading paper discussions (1, 40 pts)	----	40
Group activity	80	80
Grad student: Neuro disease activity or case study	----	100
Total	560	700

Grade:	Percentage:
A+	97-100
A	90-96
A-	88-89
B+	86-87
B	80-85
B-	78-79
C+	76-77
C	70-75
C-	68-69
D+	66-67
D	60-65
D-	58-59
F	0-57

The instructor reserves the right to drop any student from class if that student has missed an exam without an excused absence, has missed more than two labs, appears to be failing as of Friday, March 31, 2023. Students will be notified once via email before the drop; if the student corrects the deficiency, the student may remain in this class. Progress reports for freshman students are due to the

Registrar's Office by Friday, March 31, 2023. The last day for instructor-initiated withdrawal is Friday, March 31, 2023 (W grade appears on academic record). An incomplete grade will only be assigned if a student misses the final exam for an outstanding reason, such as a medical problem, a death in the family, etc.

Student success

There are a large number of resources to help students who would like to perform at their best. The student may make an appointment to see the instructor for help. (The instructor will attempt to reply to email questions within 48 hours during the school week.)

Disabilities

Students with a physical or learning disability are required to identify themselves to the Disability Services office, 474-7043, located in the Center for Health and Counseling. The student must provide documentation of the disability. Disability Services will then notify the instructor of special arrangements for taking tests, working homework assignments, and doing lab work.

Computer Access: Currently Department of Computing and Communications (DCC) maintains two open labs on campus: the Bunnell Lab, and the Node (Rasmussen library). The Node has 24-hour access.

Support Services: Support can be obtained through the University of Alaska Library system, online resources, and the instructor. Additional services are available through Student Support Services (<http://www.uaf.edu/sssp/>) at UAF.

Classroom Etiquette:

Cell phones are turned off silenced answering in emergencies only via permission of instructor authorized use by instructor NO texting/calling.

The purpose of this information is to assist students in understanding proper classroom behavior. The classroom should be a learning centered environment in which faculty and students are unhindered by disruptive behavior. Students are expected to maintain proper decorum in the online classroom including during lab and when responding on the discussion board. Students are expected to be honest, professional, and courteous at all times. The University of Alaska Fairbanks is an institution of higher education that promotes the free exchange of ideas. However, students must adhere to the rules set forth by the University and the instructor. Failure to comply with classroom rules may result in dismissal from the class and/or the University. Faculty have the authority to manage their classrooms to ensure an environment conducive to learning. The University of Alaska Student Code of Conduct (the Code), part of the Board of Regents Policy 09.02, is available at <https://www.alaska.edu/bor/policy/09-02.pdf>. You should be familiar with the Code as you will be held accountable to maintain the standards stated within. The Code includes the following statements:

P09.02.020.A As with all members of the university community, the university requires students to conduct themselves honestly and responsibly and to respect the rights of others. Students may not engage in behavior that disrupts the learning environment, violates the rights of others or otherwise violates the Student Code of Conduct (Code), university rules, regulations, or procedures. Students and student organizations will be responsible for ensuring that they and their guests comply with the Code while on property owned or controlled by the university or at activities authorized or sponsored by the university.

P09.02.030.B Behavior that occurs on property owned or controlled by the university, in university online environments and classes, or at activities sponsored by or authorized by the university, is subject to

university student conduct review and disciplinary action by the university. The Student Code of Conduct may also apply to behavior that occurs off campus when it may present a potential danger or threat to the health and safety of others or may reasonably lead to a hostile environment on campus. The Student Code of Conduct may also apply to behavior exhibited online or electronically via email, social media, text messaging, or other electronic means.

Student protections and services statement: Every qualified student is welcome in my classroom. As needed, I am happy to work with you, disability services, veterans' services, rural student services, etc. to find reasonable accommodations. Students at this university are protected against sexual harassment and discrimination (Title IX), and minors have additional protections. As required, if I notice or am informed of certain types of misconduct, then I am required to report it to the appropriate authorities. For more information on your rights as a student and the resources available to you to resolve problems, please go the following site: www.uaf.edu/handbook/.

COVID-19 Awareness: Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this website:

<https://sites.google.com/alaska.edu/coronavirus/uaf/uaf-students?authuser=0>

Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.

Amending this Syllabus: The instructor may make changes to this syllabus. Any changes will be clearly communicated via email sent to your UAF e-mail account and posted on Canvas.