

**BRAIN, MIND, AND BEHAVIOR: FOUNDATIONAL CONCEPTS IN NEUROSCIENCE
MCB / PSYCH C61**

Department of Molecular and Cell Biology, and Department of Psychology

University of California, Berkeley - Winter-Spring Semester 2020

The human brain is the most complex structure in the known universe. The study of its structure and function and how it figures into our actions and mental experience is among the most exciting projects of modern science. This class begins with molecules and cells, builds up to brains and nervous systems, encompasses neural signaling, sensory perception, memory, language, and emotion, and culminates with the great mystery of how brain processes relate to consciousness and mental experience – that is, how mind is related to brain. This is a comprehensive introduction to the exciting subject of contemporary neuroscience, open to all interested students.

Two Required Lectures and one Required Discussion Section meeting each week.

Lecture times: Tuesday and Thursday at 2:00 to 3:30 PM - Wheeler Auditorium

Instructor: David Presti 249 Life Sciences Addition (LSA)
phone and voicemail: 510-643-2111 <presti@berkeley.edu>

Office hours: Tuesdays 3:45 to 4:30 PM; Wednesdays 2:30 to 3:15 PM
249 Life Sciences Addition (LSA)

Required text: *Foundational Concepts in Neuroscience: A Brain-Mind Odyssey*
by David E. Presti (W.W. Norton, 2016)

Other course readings: There will be additional readings (some required, some optional) posted throughout the semester on our class bCourses website.

Graduate student instructors (GSIs) and their email addresses:

Allen Louie	<allen.louie@berkeley.edu>
Bradley Heinz	<here@berkeley.edu>
Frederique Sauve	<frederique_sauve@berkeley.edu>
Madison Browne	<mbrowne.gsi@gmail.com>
Melissa Galinato	<melissa_galinato@berkeley.edu>
Melissa Newton	<mlnewton@berkeley.edu>
Nathaniel Sands	<nathaniel_sands@berkeley.edu>
Nema Lankarani	<nema@berkeley.edu>

The GSIs are here to help you get the most from this class. You are encouraged to get to know and talk with your GSI. Your GSI will see you in weekly Discussion Section and will also be available to meet with you during weekly office hours. Office hours are an outstanding opportunity to deepen your connection with the course material, as well as with teachers and fellow students. It is not necessary to have specific questions. Moreover, you may visit office hours for any of the GSIs. This is an opportunity to maximize your benefiting from our class. Visit, and visit often.
Don't be shy!

Discussion section times, locations, and GSIs:

101	Mon	9-10	205 Dwinelle	Frederique
102	Mon	10-11	200 Wheeler	Nathaniel
103	Mon	11-12	130 Wheeler	Allen
104	Mon	12-1	243 Dwinelle	Madison
105	Mon	1-2	174 Barrows	Nema
107	Mon	3-4	24 Wheeler	Melissa Newton
108	Mon	4-5	24 Wheeler	Melissa Galinato
110	Wed	9-10	2038 VLSB	Frederique
111	Wed	1-2	107 GPPB	Bradley
112	Wed	11-12	104 Wheeler	Allen
113	Wed	10-11	30 Wheeler	Allen
114	Wed	2-3	200 Wheeler	Melissa Newton
115	Wed	3-4	2038 VLSB	Bradley
116	Wed	4-5	251 Dwinelle	Nema
117	Wed	12-1	250 Dwinelle	Madison
118	Fri	12-1	4 Evans	Frederique
119	Fri	3-4	228 Dwinelle	Nathaniel
120	Fri	2-3	136 Barrows	Melissa Newton
121	Thu	4-5	2070 VLSB	Bradley
122	Fri	9-10	223 Dwinelle	Nathaniel
123	Fri	10-11	289 Cory	Melissa Galinato
124	Fri	11-12	175 Barrows	Madison

Prerequisites: A passion to learn! There are no University course prerequisites for this class. The subject matter is of interest to both non-science and science majors, and the course touches upon many aspects of history and philosophy, as well as a great deal of biological science.

Please read this syllabus carefully. We have worked to make it comprehensive and address most questions that might arise.

Attendance at lectures and in discussion section is required. While the factual content in the course can be learned by reading the book and obtaining notes from the lectures, we believe there are very important elements of the material that are best, if not exclusively, transmitted through in-person contact. True learning is more than memorizing facts, even though knowing facts is also an important part of the process. We will not be posting verbatim copies of lecture material from class, although summaries of detailed material not found in the textbook will be posted on the course website. We will also compile and post Key Concepts from lectures and the textbook that can be used as a basis for constructing your own personalized study guide.

Use of Electronics in Class: Use of laptop computers, tablets, or other screen devices, in class is not allowed, except in a designated area of the room. Research studies consistently demonstrate that use of screen devices during lectures (even for note-taking) detracts from learning on the part of the user and also, very importantly, has a negative impact on those in the vicinity of the user. We ask that cell phones be turned off or placed on silent mode at the start of class, and that there be no texting during class.

Grading: Your grade in the class is based on exam performance (~80-85% of your grade) and discussion-section assignments (~15-20% of your grade). There are two midterms and a final. The final exam will be longer and cover the entire semester, and will be worth more than a midterm exam (although less than both midterm exams combined). The discussion-section portion of your grade comes from the written homework assignments and participation in three oral-group debates. For one of the debates you are graded on your

participation as part of a debate team; for the other two debates you are graded on participation in the class discussion. The exact % contributions of the various exams and assignments will be determined at the end of the semester. We do not indicate the exact % contributions of the grade components at the beginning of the semester because we wish to discourage the running computation of points and accompanying preoccupation with how well one is numerically doing in the class. The GSIs and I do not wish to hear questions of the form: "How well do I need to do on the next exam in order to get an 'A' in the class?" Our answer to any questions of this sort will always be: "Do as well as you can on all exams and assignments!" Our hope is you will enjoy learning the material; the assignments and exams are meant to assist with this.

If you are taking this class for a letter grade, you cannot earn better than a "C-" grade without receiving credit for ALL of the homework assignments and participating on a debate team. If you are taking this class P/NP, you must turn in ALL of the homework and participate on a debate team in order to pass the class. The homework and debate assignments are required in this way because we believe them to be an important component of the learning in this class.

Your letter grade in the course will be determined according to absolute standards of performance. This hopefully relates to your acquisition of knowledge and understanding of the material. **Importantly, you will not be in competition with fellow students for grades. That is, we do not force letter grades to conform to a predetermined distribution - which is another way of saying that we do not "grade on a curve."** If everyone does extremely well, everyone could receive an "A" grade. If everyone does poorly (highly unlikely, as this has never happened), then everyone could get a low grade. Rather than devoting energy to worrying about letter-grade cut-offs, if you are truly interested in this subject and in getting the most from this class, we urge you to study seriously from the beginning, attend class meetings, do the readings, and truly make an effort to learn the material. You will be rewarded with knowledge and understanding of some really fascinating topics. Good grades will be a natural side effect.

In past years the percentage of students earning an "A" or a "B" in this class has generally been between 60 and 70%. Thus, the majority of students do well in this class. However, in order to do well in the class you do have to learn a bunch of material. Neuroscience is a big subject. It is also easy to get a "C" or even lower grade in the class if you don't put in sufficient effort.

Do not make the mistake of not keeping up with the material and then trying to negotiate a last-minute deal to improve your grade. On the bCourses website (in Files: Course Information) there are some examples (Emails to Avoid) of desperate emails I have received in past years. Please read this document. It is very sad. We recommend that you not get yourself into the position of needing to write such emails. We do not offer extra credit or make other arrangements to boost grades. If you want a good grade, you must learn the course material in a timely manner. It's as simple as that.

Exams will consist of multiple-choice and short-answer questions. Each midterm exam covers the preceding portion of the course and draws from material in lectures, discussion sections, and required readings. The final exam is comprehensive and covers material from the entire semester. Key-Concept study guides will be provided and review sessions will be conducted prior to each of the exams. A sampling of questions from past exams is on bCourses (in Files: Course Information). There will be no surprises or trick questions. Our desire is for you to learn the material and do well on the exams.

You are responsible for knowing material presented in lectures, all material from the textbook (whether or not it is covered in lecture), and other required material posted on bCourses. Key-Concept study guides will be posted on bCourses to assist in identifying material from the lectures and textbook that we feel is most important to know.

- Midterm Exam I is **Tuesday February 25** at 2:00 PM in Wheeler Auditorium
 - covers Lectures of Jan 22 through Feb 21 and corresponding material from the textbook (approximately chapters 1-8) and any supplementary readings
- Midterm Exam II is **Tuesday April 14** at 2:00 PM in Wheeler Auditorium
 - covers Lectures of Feb 28 through April 11 and corresponding material from the textbook (approximately chapters 9-17) and any supplementary readings
- Final Exam is **Monday, May 11** at 11:30 AM (location to be determined)
 - comprehensive, covering the entire semester, including all Lectures, all 22 chapters of the textbook, and all supplementary readings
- exams dates will not be changed; mark your calendars now
- there will be no make-up exams; if you miss an exam, you will receive zero points for that exam
- if you miss a midterm exam with a credible excuse (e.g., significant medical problem documented with verifiable documentation), your final exam score will count proportionally more in determining your course grade. **Written documentation must be presented in-person to me (David Presti) and to your GSI. The material must also be presented in a timely manner, within a week of the missed exam.**
- if you miss the final exam with a credible excuse, you **may qualify** to receive an incomplete (I) grade for the course (provided you have passing status in the class prior to the exam, otherwise grade = F); it may be necessary to wait until the next time the class is given to resolve the incomplete grade. An Incomplete grade will only be given in extreme circumstances, and again written documentation presented in-person to me (David Presti) in a timely manner is essential. In general, Incomplete grades are not recommended, as our experience is that students have a great deal of difficulty in completing them and they tend to only contribute to increased stress going into the future.

Homework:

- homework assignment 1 - analysis of an article you find from the recent news media
 - due in discussion section the week of **February 3-7**
- homework assignment 2 - writing about consciousness and experience in non-humans
 - due in discussion section the week of **February 10-14**
- homework assignment 3 - reflection essay on mind-body expectation/belief in your own life
 - due in discussion section the week of **March 16-20**
- homework assignment 4 - haiku poetry composition about brain, mind, and behavior
 - due in discussion section the week of **April 27 to May 1**
- detailed instructions for the homework will be provided in class and on bCourses in Files: Homework
- homework assignments are to be turned in to your GSI as paper copy, **not e-mailed**
- Assignments turned in up to one week after the due date will receive half-credit. Assignments turned in more than 1 week after the due date will receive zero points, but will still be credited as having been completed. Note that you have to turn in (complete) all four homework assignments in order to receive better than a C- grade (for a letter grade) or a passing grade (for a P/NP grade) in the class. No late homework assignments will be accepted after the last date of instruction.
- Homework due dates are not arbitrary, but are created to encourage completion of the homework in the way we believe to be most useful, informative, and enjoyable.

Debates: for each of the three debates, teams will be drawn from one-third of the class

- **Debate One:** week of **March 2-6**
- **Debate Two:** week of **March 30 - April 3**
- **Debate Three:** week of **April 20-24**
- debate guidelines and topics (when announced) are posted on bCourses in Files: Debates
- for one of the debates you are graded on your participation as part of a debate team; for the other two debates you are graded on participation in the class discussion.
- if you have an idea for an interesting debate topic, please let us know!

Getting the most from the class AND preparing to do well on the exams: Keep up with the lecture material, readings, homework, and debate preparation. As a guide to studying for exams, we provide a regularly updated list of Key Concepts from lectures. On bCourses there is also a comprehensive list of Key Concepts for the textbook. Review these Key Concepts and use them as a framework for creating your own expanded study outline / study guide. If you know all the Key Concepts, you will do well on the exams. Review the Key Concepts, look up what you don't understand - in your notes, in the readings, in the book, and on the internet (e.g., Wikipedia is often pretty good for these topics). Talk with your classmates. Come to discussion section and office hours with any questions on things needing clarification. Repeat throughout the semester. It's really a pretty simple recipe for success.

Honor Code: The students at UC Berkeley have adopted the following Honor Code:
"As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others."
The hope and expectation is that you will adhere to this code.

Collaboration and Independence: Reviewing lecture and reading materials and studying for exams can be enjoyable and enriching things to do with fellow students. This is recommended. However, unless otherwise instructed, homework assignments are to be completed independently and materials submitted as homework should be the result of one's own independent work.

Cheating: Anyone caught cheating on an assignment or exam in this course will receive a failing grade in the course and will also be reported to the University Center for Student Conduct. A good lifetime strategy is always to act in such a way that no one would ever imagine that you would even consider cheating. For example, in order to guarantee that you are not suspected of cheating, please keep your eyes on your own materials and do not converse with others during exams.

Plagiarism: Your homework essays must be original writing composed by you. To copy text or ideas from another source without appropriate reference is plagiarism and will result in a failing grade for your assignment and usually further disciplinary action. Additional information on plagiarism and how to avoid it: <http://gsi.berkeley.edu/gsi-guide-contents/academic-misconduct-intro/plagiarism/>

Academic Integrity and Ethics: Cheating on exams and plagiarism are two common examples of dishonest, unethical behavior. Honesty and integrity are of great importance in all facets of life. They help to build a sense of self-confidence, and are key to building trust within relationships, whether personal or professional. There is no tolerance for dishonesty in the academic world, for it undermines what we are dedicated to doing - furthering knowledge for the benefit of humanity.

Your experience as a student at UC Berkeley is hopefully fueled by passion for learning and replete with fulfilling activities. And we also appreciate that being a student can be stressful. There may be times when there is temptation to engage in some kind of cheating in order to improve a grade or otherwise advance your career. This could be as blatant as having someone else sit for you in an exam, or submitting a written assignment that has been copied from another source. And it could be as subtle as glancing at a fellow student's exam when you are unsure of an answer to a question and are looking for some confirmation. One might do any of these things and potentially not get caught. However, if you cheat, no matter how much you may have learned in this class, you have failed to learn the most important lesson of all.

Mental Health and Wellness: All students - regardless of background or identity - may experience a range of issues that can become barriers to learning. These issues include, but are not limited to, strained relationships, anxiety, depression, alcohol and other drug problems, difficulties with concentration, sleep, and eating, and/or lack of motivation. Such mental health concerns can diminish both academic performance and the capacity to participate in daily activities. In the event that you need mental health support, or are concerned about a friend, UC Berkeley offers many services, such as free short-term

counseling at University Health Services. An excellent campus website having links to many resources is: <http://recalibrate.berkeley.edu/>

Remember that seeking help is a good and courageous thing to do – both for yourself and for those who care about you.

Safe, Supportive, and Inclusive Environment: Whenever a faculty member, staff member, postdoc, or GSI is responsible for the supervision of a student, a personal relationship between them of a romantic or sexual nature, even if consensual, is against university policy. Any such relationship jeopardizes the integrity of the educational process. Although faculty and staff can act as excellent resources for students, you should be aware that they are required to report any violations of this campus policy. If you wish to have a confidential discussion on matters related to this policy, you may contact the Path to CARE Center on campus for support related to counseling or sensitive issues: 510-642-1988.

The classroom, lab, and work place should be safe and inclusive environments for everyone. The Office for the Prevention of Harassment and Discrimination (OPHD) is responsible for ensuring the University provides an environment for faculty, staff and students that is free from discrimination and harassment on the basis of categories including race, color, national origin, age, sex, gender, gender identity, and sexual orientation. Questions or concerns: call 510-643-7985, email ask_ophd@berkeley.edu, or go to <http://survivorsupport.berkeley.edu/>

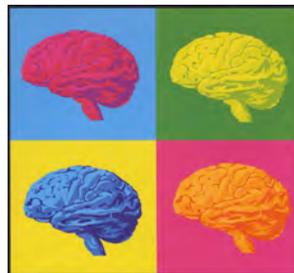
Communication and Emails: We like teaching this class! The material is fascinating and, we believe, useful and important to know about. I enjoy being available during office hours and after lectures to answer questions and further discuss the material. I strongly prefer in-person contact to email. **Questions of importance or ones that require detailed answers must be addressed in person.** In most circumstances, I am unlikely to respond to emailed questions. **Always make sure to see me in person about any important matter.** It will never be an acceptable excuse to say something like: "Well, I sent you an email and never heard back." **As stated: Always make sure to see me in person about any important matter.** Email is a wonderful tool and very convenient. However, it is not a substitute for direct personal contact, especially when such contact is easy, as it is with me.

Thanks again for your interest in this subject. The GSIs and I are excited about being together with you this semester, for what we hope to be an enjoyable and fulfilling adventure in learning!

- University holidays: no discussion sections or lectures on these days
 - Monday, February 17: Honor U.S. presidents, may they be up to the enormous tasks at hand.
 - March 23-27: Spring Break – Enjoy a well-deserved rest.

- Important astronomical dates and days of ancient ritual

New Moons:	January 24, February 23, March 24, April 22, May 22
Full Moons:	January 10, February 8, March 9, April 7, May 7
Vernal (Spring) Equinox:	March 19
Beltane:	May 1
Summer Solstice:	June 20



**Approximate timeline of topics, with corresponding chapter readings from the textbook.
Additional readings and lecture supplements will be posted on bCourses.**

Week 1:	Jan 21-24	course logistics; hominin evolution, mind-body problem, nervous systems, brains, neurons (1, 2)
Week 2:	Jan 27-31	molecules, water, polarity, hydrophilic, hydrophobic, phospholipids, membranes, proteins, chemistry and life (3)
Week 3:	Feb 3-7	DNA backstory, Darwin, Bohr, Delbrück, gene, genetic code, ion channels and pumps, membrane potential, neural signaling (4, 5) Homework One in Discussion Section.
Week 4:	Feb 10-14	synapses, neurotransmitters, ionotropic and GPCR receptors, autonomic nervous system, seizures (6, 7); Homework Two in Discussion Section.
Week 5:	Feb 18-21	<i>pharmakon</i> , Na-channel pharmacology, psychoactive drugs (8)
Week 6:	Feb 24-28	Midterm Exam One on Tuesday Feb 25. psychoactive drugs, psychiatric medications (9)
Week 7:	Mar 2-6	neural wiring and guidance, neuroplasticity (10) sensory perception, chemotaxis (11); Debate One in Discussion Section.
Week 8:	Mar 9-13	olfaction, taste, flavor (12, 13) vision, retina, photoreceptors, receptive fields, cortical visual areas (14)
Week 9:	Mar 16-20	hearing, Fourier analysis, hair cell, vestibular system (15) Homework Three in Discussion Section.
---	Mar 23-27	Spring Break
Week 10:	Mar 30-Apr 3	somatosensation, motor, cerebellum (16); Debate Two in Discussion Section.
Week 11:	Apr 6-10	lesions, brain imaging: x-ray, MRI, EEG, ECoG, MEG, PET, fMRI (17)
Week 12:	Apr 13-17	connectivity, language, meaning, memory (18, 19) Midterm Exam Two on Tuesday April 14
Week 13:	Apr 20-24	rhythms, sleep, dreams (20); emotion (21) Debate Three in Discussion Section.
Week 14:	Apr 27-May 1	consciousness, mind-body problem (22) Homework Four in Discussion Section.

This timeline is approximate, and the exact correspondence between topic and date may not be maintained. The order of topics will be preserved, and all topics in the Textbook will be covered.
Best wishes for an enjoyable semester together!