NRSC 588 - Principles of Cellular and Molecular Neurobiology
Syllabus, Fall 2018

https://d2l.arizona.edu/

Course content

The course offers a comprehensive introduction into the cellular and molecular biology of the nervous system. The covered material ranges from classical studies to the current state of knowledge. For many topics, research papers will be assigned for presentation and in-depth discussion. All parts of the course provide an overview of standard techniques and approaches analyzing neuronal gene function in vitro and in vivo. The following topics are considered in substantial detail: ***a)*** neuronal cell biology, ***b)*** electrical properties of neurons; ***c)*** function of voltage- & ligand-gated ion channels; ***d)*** structure & function of synapses; ***e)*** molecular mechanisms underlying synaptic plasticity & learning; ***f)*** cellular, molecular and genetic approaches & techniques in neuroscience; ***g)*** human diseases of the nervous system. The course assumes a well-founded standard background in molecular and cellular biology.

Course Objective

- To acquaint you with the cellular and molecular principles of neuronal communication.
- To acquaint you with the major methods (tools) of neurobiology and the knowledge to apply them.
- To foster your "critical thinking" skills.
- To leave you with understandings that will persist beyond the end of the semester.

Prerequisites

Course work that is ordinarily prerequisite to enrollment:
- General and organic chemistry (CHEM 103b, 104b, 241 a-b, 243b, 245b)
- Introductory physics (PHYS 102b)
- Cell biology (MCB 410a-b)
- Biochemistry (BIOC 462a-b)

For questions on course prerequisites, consult the neuroscience graduate program office (1548 E. Drachman St., phone: 520-621-8380) or Konrad Zinsmaier (kez4@email.arizona.edu) before enrolling.

Course listings

NRSC588 (cross-listed as: CBA588, MCB588, BIOC588, INSC588, PSIO588)

Semester offered

Fall

Number of units

4

Location and Time

RP Harvill Bldg, Rm 428; Monday and Wednesday, 4:00 - 5:50 p.m.

Course Coordinator

Konrad E. Zinsmaier, PhD, Neuroscience, Gould-Simpson 627, kez4@email.arizona.edu

Course Instructors

Lalitha Madhavan, MD PhD. Neurology, Life Sciences North 350, lmadhavan@neurology.arizona.edu
Andrew Fuglevand, PhD, Physiology, Ina E. Gittings Building 101, fuglevan@u.arizona.edu
Konrad E. Zinsmaier, PhD, Neuroscience, Gould-Simpson 627, kez4@email.arizona.edu

Office hours
"Electronic Open-Door" policy. Contact any of us by email, and we will try to answer promptly.

Organization of sessions
- Each session usually includes a lecture (45-60 minutes) followed by a presentation and discussion of a selected research publication (see schedule). Lectures will be posted on the course website in advance.
- Selected research publications for the discussion section will be assigned to 1-2 students for an oral power point presentation in class with the goal of critically discussing the presented study. To achieve this, it is critical that *every student is familiar with the study prior* to the presentation.
- Active participation in lectures and class discussion is required for all students.

Suggested Textbook
Principles of Neural Science (5th) by Kandel, Schwartz, Jessell, Siegelbaum, Hudspeth (2013)

Alternative Textbooks
From Neuron to Brain (5th) by Nicholls, Martin, Fuchs, Brown, Diamond, Weisblat (2011)
Fundamental Neuroscience (4th) by Squire, Berg, Bloom, du Lac, Ghosh, Spitzer (2012)
Neuroscience (5th) by Purves, Augustine, Fitzpatrick, Hall, LaMantia, White (2011)
Development of the Nervous System (3rd) by Sanes, Reh, Harris (2011)

Reading Material
All readings but will be posted on the "content" section of the course D2L website in advance of each session.
- ***"Required Readings"*** are critically important for the understanding of the presented lecture material. Required Readings typically include relevant sections from the suggested textbook and review articles providing in-depth and up-to-date information on the relevant topic; note that text textbooks typically have a "lag time" of about 5-7 years.
- ***"Additional Readings"*** provide additional information on the presented topic and are highly recommended for graduate students choosing neuroscience as a major or minor.

Lecture Schedule
See posting on course D2L website.

Grading & Assignments
Students must take 3 exams (ea. 100 points) and present at least one research paper for discussion during the course.
Readings: textbook and selected research articles provided on D2L
Written assignments: None.

The final course grade is determined as follows:

1) Written exams (3):	300 points	(83% of final grade)
2) Participation & performance in discussion:	60 points	(17% of final grade)

Regular grades are awarded for this course: A B C D E.

Make-up exams require approval and will only be allowed in cases of well-documented emergencies. Make up exams or quizzes will be modified from the original.

Regrading Policy
If there is reason to believe that there has been a grading error, immediately contact the instructor responsible for grading the respective exam. You must initiate a request for re-grading within 2 weeks of the date on which the grade was posted; otherwise, we will not consider the request.

Attendance Policy

Regular attendance of lectures *& active participation* is considered essential to reach a satisfactory understanding of the course material, although attendance will not be monitored.

All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion. Absences pre-approved by the UA Dean of Students (or Dean designee) will be honored.

Make-up exams require approval and will only be allowed in cases of well-documented emergencies. Make up exams will be modified from the original.

Student Code of Academic Integrity

Students must adhere to the UA Code of Academic Integrity. Graded work must be the product of an independent effort unless otherwise instructed. The policies related to issues like cheating and plagiarism will be strictly enforced.

Read the full code at http://deanofstudents.arizona.edu/codeofacademicintegrity

Principle (from the above website)

Integrity is expected of every student in all academic work. The guiding principle of academic integrity is that a student's submitted work must be the student's own. This principle is furthered by the student Code of Conduct and disciplinary procedures established by ABOR Policies 5-308 - 5-403, all provisions of which apply to all University of Arizona students. This Code of Academic Integrity (hereinafter "the Code") is intended to fulfill the requirement imposed by ABOR Policy 5-403.A.4 and otherwise to supplement the student Code of Conduct as permitted by ABOR Policy 5-308.C.1. ***When you sign your name to your work, you are signing that it is solely your work!***

Classroom Behavior and Classroom Policies Regarding Effective Learning

Students are *highly encouraged* to share intellectual views and discuss freely the course material and the applications of this knowledge for society.

In addition, individuals in groups can learn best when all are considerate of each other. Therefore, we ask that you please make every effort to make the environment in the classroom conducive to effective learning. This includes such things as turning off your cell phone, only using your laptop for class related activities, refraining from conversation that is not geared toward the topic of the day, arriving on time, and leaving when class is finished.

Read the full code at http://deanofstudents.arizona.edu/studentcodeofconduct!

Policy against Threatening Behavior

The Arizona Board of Regents' Student Code of Conduct, ABOR Policy 5-308, prohibits threats of physical harm to any member of the University community, including to one's self.

University of Arizona policies apply and can be found at the following website: http://policy.web.arizona.edu/~policy/threaten.shtml.

Notification of Objectionable Materials

This may contain course material that may be deemed offensive by some students. Students are not automatically excused from interacting with such materials, but they are encouraged to speak with the instructor to voice concerns and to provide feedback. See also: http://gened.arizona.edu/content/course-syllabus-guidelines."

Accessibility and Accommodations

It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, please notify the course

director immediately so that your options can be discussed. You are also welcome to contact Disability Resources (520-621-3268, drc.arizona.edu) to establish reasonable accommodations.

Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Gender Pronoun

It is already UA policy that class rosters are provided to instructors with a student's preferred name. Students may share their preferred name and pronoun with members of the teaching staff and fellow students, as desired, and these gender identities and gender expressions will be honored in this course. As the course includes group work and in-class discussion, it is critical to create an educational environment of inclusion and mutual respect. In this class, to be inclusive of all gender identities and expressions, students will be referred to by their first or last names, the pronoun of their choice, or by default, the pronoun "they".

Confidentiality of Student Records

See http://www.registrar.arizona.edu/ferpa/default.htm

Notification of Objectionable Materials

Warning of course content that may be deemed offensive by some students.

Course Schedule

See listing on D2L website of the course

The information in this course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor. Any changes to the syllabus will be announced in class and posted on the D2L website

Date	***Topic***	***Instructor***
Aug. 20	Course Overview and a Perspective	Zinsmaier
Aug. 22	Nervous System Structure and Gross Development	Madhavan
Aug. 27	Induction and Patterning of the Nervous System	Madhavan
Aug. 29	Wiring the Brain: Genesis and Survival of Neurons	Madhavan
Sep. 3	***Labor Day (no class)***	
Sep. 5	Wiring the Brain: Genesis of Connections	Madhavan
Sep. 10	Wiring the Brain: Genesis and Pruning of Synapses	Madhavan
Sep. 12	Electrical Signaling – Resting Membrane Potential	Zinsmaier
Sep. 17	Electrical Signaling – Action Potential and Voltage-gated Ion Channels	Zinsmaier
Sep. 19	Structure, Function and Diversity of Ion Channels	Zinsmaier
Sep. 24	Ligand-gated Ion Channels and Metabotropic Receptors	Zinsmaier
Sep. 26	***Exam 1***	Madhavan/Zinsmaier
Oct. 1	Neurogenetics: Gene Knock-down, Knock-out, and Editing	Zinsmaier
Oct. 3	Principle of Synaptic Structure & Function	Zinsmaier

Oct. 8	Synaptic Vesicle Fusion	Zinsmaier
Oct. 10	Synaptic Vesicle Recycling & Pools	Zinsmaier
Oct. 15	Synaptic Plasticity & Non-Associative Learning	Zinsmaier
Oct. 17	Long-term Synaptic Plasticity & Memory	Zinsmaier
Oct. 22	Synaptic Integration in Dendrites	Fuglevand
Oct. 24	Active Properties of Dendritic Signaling	Fuglevand
Oct. 29	Generation of Rhythmic Neural Activity	Fuglevand
Oct. 31	***Exam 2***	Zinsmaier/Fuglevand
Nov. 5	Associative Learning & LTP	Zinsmaier
Nov. 7	Molecular Mechanisms inducing LTP	Zinsmaier
Nov. 12	***No class***	
Nov. 14	The Yin & Yang of Synaptic Plasticity (LTP/LTD)	Zinsmaier
Nov. 19	Optogenetics	Zinsmaier
Nov. 21	***No class***	
	Thanksgiving Holiday (Nov. 22 - Nov. 25)	
Nov. 26	Fragile X Syndrome	Zinsmaier
Nov. 28	Alzheimer Disease	Zinsmaier
Dec. 3	Parkinson Disease	Zinsmaier
Dec. 5	***Exam 3***	Zinsmaier

Instructors

Lalitha Madhavan, MD PhD, lmadhavan@neurology.arizona.edu
Andrew Fuglevand, PhD, fuglevan@u.arizona.edu
Konrad Zinsmaier, PhD, kez4@email.arizona.edu
SFN Meeting Nov 3-7