

# BILD 12: Neurobiology and Behavior Syllabus

Summer Session I 2022

Lecture: MTuWTh 11:00a-12:20p [MOS 0204]

Discussions: MW 9:00-9:50a or 10:00-10:50a [SEQUO 148]

Instruction Team	Email	Office Hours
<b>Instructor:</b> Donghyung (KDan) Lee (he/him) PhD candidate in Biological Sciences	dol127@ucsd.edu	Thurs 1:00-2:00p in person @Art of Espresso Fri 11:00am-12:00pm over Zoom 7253604866
<b>Instructional Assistants:</b> Elizabeth Diaz (/)	hyl135@ucsd.edu	

## Course Description

This is an introductory course on how the nervous system processes information from the environment to output a behavior. This course is designed for non-science majors who are interested in learning more about the brain. Topics will include: biological substrate of information, mechanisms of synaptic integration, sensory perception, and neurobiological bases of behavior.

## Textbook

Not required, but recommended as supplemental reading:

*Neuroscience: Exploring the Brain*, 4<sup>th</sup> edition

Authors: Mark F. Bear, Barry W. Connors, Michael A. Paradiso ISBN: 9781284211283

## Canvas

The canvas site for this course is <https://canvas.ucsd.edu/courses/38118>. Lecture slides, announcements, quizzes, homework, class discussion forums, and grades will be communicated via Canvas.

## Course Learning Objectives

After this course, you will be able to:

1. Define the substrates of bioelectricity.
2. Analyze whether a neuron will fire or not based on its synaptic inputs.
3. Describe the organization of receptive fields in sensory systems.
4. Describe how features of sensory stimuli are extracted by neural circuits.
5. Compare and contrast different sensory systems.
6. Compare and contrast biological neural circuits to artificial neural networks.
7. Follow the trajectory of neural activity in reflex arcs.
8. Follow the progress of a reinforcement learning agent.

## Class Roadmap

Week	Date	Topic	To do
1	6/27	Introduction to course	Worksheet 1.1
	6/28	Cells and membranes Nernst Equation	Worksheet 1.2
	6/29	Action potential pt.I: voltage-gated sodium/potassium channels	Worksheet 1.3
	6/30	Action potential pt.II: perturbations	Worksheet 1.4 <b>Worksheets due by noon on Friday 7/1</b>
	Discussion	Brainstorm group project ideas	<b>Brainstorming notes due by midnight Friday 7/1</b>
2	7/4	Independence Day, no class	<b>Quiz #1 due by midnight Sunday 7/3</b>
	7/5	<i>Quiz 1 review</i> Neurotransmitter release Synaptic potentials Synaptic Integration	Worksheet 2.1
	7/6	Neuroplasticity Perceptrons	Worksheet 2.2
	7/7	Logic gates Design a XOR circuit Review	Worksheet 2.3 <b>Worksheets due by noon on Friday 7/8</b>
	Discussion	Scientific literacy	
3	7/11	Vision pt.I: light, the camera eye, phototransduction	<b>Quiz #2 due by midnight Sunday 7/10</b> Worksheet 3.1
	7/12	<i>Quiz 2 review</i> Vision pt.II: color vision, center-surround, beyond the retina	Worksheet 3.2
	7/13	Audition pt.I: soundwaves, acoustic transduction, cochlear amplifier	Worksheet 3.3
	7/14	Audition pt.II: tonotopy, sound localization, auditory illusions	Worksheet 3.4 <b>Worksheets due by noon on Friday 7/15</b>

## Class Roadmap

Week	Date	Topic	To do
	Discussion	Commit on final topic for group project, come up with list of 3 references	<b>Final topic and references due by midnight on Friday 7/15</b>
4	7/18	Gustatory system: chemotransduction, taste maps Labeled lines vs. Population code	<b>Quiz #3 due by midnight Sunday 7/17</b> Worksheet 4.1
	7/19	Olfactory system: olfactory receptors, odor maps, concentration invariant responses	Worksheet 4.2
	7/20	Hopfield networks Pattern completion and memory	Worksheet 4.3
	7/21	<i>Quiz 3 review</i> Common themes in sensory processing	Worksheet 4.4 <b>Worksheets due by noon on Friday 7/22</b>
	Discussion	Work on group project, get initial feedback	
5	7/25	Autonomic nervous system Muscle contraction	<b>Quiz #4 due by midnight Sunday 7/24</b> Worksheet 5.1
	7/26	<i>Quiz 4 review</i> Reflex arcs	Worksheet 5.2
	7/27	Central Pattern Generators Forward and Inverse models	Worksheet 5.3
	7/28	Reinforcement learning algorithms Dopamine as reward-prediction-error	Worksheet 5.4 <b>Worksheets due by noon on Friday 7/29</b>
	Discussion	Work on group project, get final feedback	
<b>Final</b>	7/29	Present group projects	<b>Quiz #5 due by midnight Sunday 7/31</b>

## Class Roadmap

Week	Date	Topic	To do
			Optional final due by midnight Wednesday 8/3

## How this class will work

### Lectures

- Lectures will be held in person- because **class will be mostly based on group work**, lectures will not be recorded. Lecture slides will be posted on canvas.
- During class, there will be a worksheet that you will work on in groups. Worksheets for the week are due every Friday at midnight. If you miss a class, you are still responsible for completing the worksheets. You can resubmit them as many times as you want.

### Discussion sections

- Some of the discussion sections will be used to review lecture materials and go over questions from the previous week's quiz
- The rest of the sections will be time for the final group project: to brainstorm, get feedback, and learn about scientific literacy.

### Weekly quizzes

- Will open on Canvas Friday at noon. ***They are due by 11am the following Monday.***
- Open book/open note/open internet but *you must work alone.*
- Will have a mix of multiple choice and short answer questions.
- You will have 60 minutes to finish from the time you open it, so plan accordingly!
- Overall, quizzes are worth 50% of your final grade. Your highest quiz score will be weighted most heavily and your lowest quiz score will be dropped:

Highest Quiz Score	175
2nd Highest Quiz Score	125
3rd Highest Quiz Score	100
4th Highest Quiz Score	100
Lowest Quiz Score	0
<b>SUBTOTAL</b>	<b>500</b>

### Final group project

- This will be an opportunity to show off what you've learned in a creative way!
- You will pick a neurobiology topic that interests your group, research into the topic, and summarize your findings in a 3-minute video.
- You'll also submit a short, written component in the form of an abstract with 3 references (no more than 500 words).
- We will work on this throughout the course with plenty of opportunities for peer feedback and instructor feedback. See separate handout for more information.

### Optional Final

- You may choose to take a cumulative final at the end of the course.
- If your score on the final is higher than the weighted average of your quizzes, the final will replace your quiz scores (500). Your score on the final will not be counted towards your letter grade if it's lower than the weighted average of your quizzes.
- You must notify me by the end of Week 4 if you plan to take the final. If no one contacts me by the end of Week 4, I will not write a final.

### Grades and Distribution:

Class Attendance	50	<b>5%</b>
Section Attendance	50	<b>5%</b>
Worksheets (10 total)	200	<b>20%</b>
Group Project	200	<b>20%</b>
Quizzes (5 total)	500	<b>50%</b>
<b>TOTAL</b>	<b>1000</b>	<b>100%</b>
<i>Bonus Points</i>		
Pre-Class Survey	10	
Exit Ticket	10	
>90% CAPE Response	30	

950-1030	A+	800-849	B+	670-699	C+	570-599	D+
900-949	A	750-799	B	630-669	C	530-569	D
850-899	A-	700-749	B-	600-629	C-	500-529	D-

## General Policies

- If you think you deserve a regrade, please submit a written argument to your IA over email within 48 hours of receiving the grade.
- Late homework and quizzes will be deducted by 10% for each day they are late. However, I understand that life happens and we're still in a pandemic. If you need an extension for any reason, please let your IA know and we'll do our best to accommodate you.
- Students requesting accommodations and services due to a disability for this course need to provide a current Authorization for Accommodation (AFA) letter through the Office for Students with Disabilities (OSD) prior to eligibility for requests. For more information, contact OSD at 858-534-4382, [osd@ucsd.edu](mailto:osd@ucsd.edu), or visit: [osd.ucsd.edu](http://osd.ucsd.edu)

## Academic Integrity

- Please do your own work and do not cheat. All of the quizzes are open book/note/internet, so use the resources at your disposal but *do not work with others on the quizzes*. For the homework assignments and group project project, students may discuss with each other, but may not plagiarize or copy work from another student or another author. More information on the Academic Integrity Office can be found here: <https://students.ucsd.edu/academics/academic-integrity/index.html>

## Diversity and Inclusion

I acknowledge that learning does not occur in a vacuum. In order to reach our maximal learning potential, I believe it's important to feel comfortable bringing all of our identities to the table. I will strive to create a learning environment that supports a diversity of thoughts, perspectives, and experiences and honors all identities (race, ethnicity, gender identity, sexual orientation, immigration status, religion, or disabilities). I ask that you help me in showing respect to your fellow students and instructors, and giving me feedback at any point in the course.

## No Tolerance Policy

Harassment and discrimination of any kind will not be tolerated. It is federal law that UCSD students have the right to an educational environment free from harassment and discrimination. The Office for the Prevention of Harassment & Discrimination (OPHD) provides assistance to students, faculty, and staff regarding reports of bias, harassment, and discrimination. Students have options for reporting incidents of sexual violence and sexual harassment. Sexual violence includes sexual assault, dating violence, domestic violence, and stalking. Information about reporting options may be obtained at OPHD at (858) 534-8298, [ophd@ucsd.edu](mailto:ophd@ucsd.edu) or <http://ophd.ucsd.edu>. Students may receive confidential assistance at CARE at the Sexual Assault Resource Center at (858) 534- 5793, [sarc@ucsd.edu](mailto:sarc@ucsd.edu) or <http://care.ucsd.edu> or Counseling and Psychological Services (CAPS) at (858) 534-3755 or <http://caps.ucsd.edu>. Students may feel more comfortable discussing their particular concern with a trusted employee (a student affairs staff member, a department Chair, a faculty member or other University official). These individuals have an obligation to report incidents of sexual

violence and sexual harassment to OPHD. This does not necessarily mean that a formal complaint will be filed. If you find yourself in an uncomfortable situation, ask for help.

<b>Resources for Students</b>	
<b>Learning and Academic Support</b>	
<p><b><a href="#">Ask a Librarian: Library Support</a></b>  <i>Chat or make an appointment with a librarian to focus on your research needs</i></p> <p><b><a href="#">Course Reserves, Connecting from Off-Campus and Research Support</a></b>  <i>Find supplemental course materials</i></p> <p><b><a href="#">First Gen Student Success Coaching Program</a></b>  <i>Peer mentor program that provides students with information, resources, and support in meeting their goals</i></p> <p><b><a href="#">Office of Academic Support &amp; Instructional Services (OASIS)</a></b>  <i>Intellectual and personal development support</i></p>	<p><b><a href="#">Writing Hub Services in the Teaching + Learning Commons</a></b>  <i>One-on-one online writing tutoring and workshops on key writing topics</i></p> <p><b><a href="#">Supplemental Instruction</a></b>  <i>Peer-assisted study sessions through the Academic Achievement Hub to improve success in historically challenging courses</i></p> <p><b><a href="#">Tutoring – Content</a></b>  <i>Drop-in and online tutoring through the Academic Achievement Hub</i></p> <p><b><a href="#">Tutoring – Learning Strategies</a></b>  <i>Address learning challenges with a metacognitive approach</i></p>
<b>Support for Well-being and Inclusion</b>	
<p><b><a href="#">Basic Needs at UCSD</a></b>  <i>Any student who has difficulty accessing sufficient food to eat every day, or who lacks a safe and stable place to live is encouraged to contact: <a href="mailto:foodpantry@ucsd.edu">foodpantry@ucsd.edu</a>   <a href="mailto:basicneeds@ucsd.edu">basicneeds@ucsd.edu</a>   (858) 246-2632</i></p> <p><b><a href="#">Counseling and Psychological Services</a></b>  <i>Confidential counseling and consultations for psychiatric service and mental health programming</i></p> <p><b><a href="#">Triton Concern Line</a></b>  <i>Report students of concern: (858) 246-1111</i></p> <p><b><a href="#">Office for Students with Disabilities (OSD)</a></b>  <i>Supports students with disabilities and accessibility across campus</i></p>	<p><b><a href="#">Community and Resource Centers Office of Equity, Diversity, and Inclusion</a></b>  <i>As part of the <a href="#">Office of Equity, Diversity, and Inclusion</a> the campus community centers provide programs and resources for students and contribute toward the evolution of a socially just campus            (858).822-.3542   <a href="mailto:diversity@ucsd.edu">diversity@ucsd.edu</a></i></p> <p><b><a href="#">Get Involved</a></b>  <i>Student organizations, clubs, service opportunities, and many other ways to connect with others on campus</i></p> <p><b><a href="#">Undocumented Student Services</a></b>  <i>Programs and services are designed to help students overcome obstacles that arise from their immigration status and support them through personal and academic excellence</i></p>