BIOLOGY 404 Sensory Biology Course Outline

Fall 2025 A01 CRN 10406

Department of Biology, University of Victoria

Course instructor:

Dr. Gautam Awatramani

Contact information: gautam@uvic.ca Please include “BIOL 404” in the subject line

Time and Place:

Sept 3 – Dec 3, 2025

Tues, Wed, Fri

11:30am – 12:20 pm;

Cunningham Building (CUN) room 149

Office hours: by appointment

Course Description:

Sensory neurobiology explores how organisms perceive and interpret the world through specialized sensory systems. This course provides a comparative and mechanistic understanding of how external stimuli—light, sound, chemicals, touch, and temperature—are detected, transduced, and processed by the nervous system. Emphasis will be placed on the cellular, molecular, and systems-level principles that underlie sensory function, as well as how these computations give rise to perception and behavior. Both vertebrate and invertebrate models will be discussed, highlighting evolutionary conservation and diversity in sensory strategies.

Learning Outcomes:

By the end of the course, students will be able to:

1. Critically evaluate the primary literature

2. Describe the anatomical and molecular organization of major sensory systems (vision, audition, olfaction, gustation, somatosensation, vestibular).

3. Explain the biophysical principles underlying sensory transduction (e.g., phototransduction, mechanotransduction, chemoreception).

4. Evaluate how neural circuits process sensory input to extract relevant features.

5. Understand how sensory information is integrated across modalities to guide perception and behavior.

6. Analyze classical and modern experimental approaches in sensory neurobiology, including electrophysiology, imaging, genetics, and behavioral assays.

7. Discuss clinical and translational aspects of sensory neuroscience, including sensory disorders, prosthetics, and therapies.

Major Topics Covered

Introduction to Sensory Neurobiology, general principles of transduction and neural coding

· Audition and Vestibular Systems

Hair cell mechanotransduction

Tonotopy and auditory coding (sound localization)

Balance, orientation, and vestibular reflexes

· Olfaction and Gustation

Odorant receptors and olfactory coding

Taste receptor mechanisms and pathways

Neural representation of flavor and chemical cues

· Somatosensation and Pain

Mechanoreceptors and touch coding

Proprioception

Thermoreception and nociception

Plasticity and chronic pain mechanisms

· Vision

Photoreceptor physiology and phototransduction

Retinal circuits and feature detection

Central visual pathways and cortical processing

Textbook (suggested but not required):

Purves et al., (2015) Neuroscience. 6th edition.

Note: Previous editions would also be helpful

Course material:

Material such as course outline, class schedule, exam results and presentation lecture notes will be available on Brightspace (http://bright.uvic.ca/ with your Netlink ID and password). Note that there will be no recorded lectures available.

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Prerequisites: Complete 1 of:

BIOL365 - Animal Physiology (1.5)

BIOL367 - Neurobiology: Molecules to Behaviour (1.5)

BIOL409A - Neurobiology: Molecules to Behaviour (1.5)

Course Format:

Lectures with integrated primary literature discussions. Friday lectures will focus on a single "discussion paper", following the weekly quiz (see below)

The last two weeks will be dedicated to Student presentations aimed at synthesizing concepts across sensory modalities

Assessment:

Quizzes (30%): Every Friday

Midterm exam (25%): October, 17

Research article presentation (10%): Last two weeks

End-term exam (35%): scheduled by Records

Quizzes:

· Each quiz will consist of ~5 multiple choice (M/C) questions

· Lecture material directly related to the paper to be discussed that day will be emphasized.

· The questions are designed to encourage a critical and thorough examination of the discussion paper

· The quizzes will be handed at the start of class (most Fridays) and students will be given 5-10 minutes to complete the quiz.

· Total of 9 quizzes

Midterm exam & Final Exams

· Mid-term test material will be presented up till Oct 14th

· Questions will be taken from both the lectures and discussion papers.

· The exams will be mostly short answer questions with some matching, M/C and labeling of diagrams

· The Final exam will be comprehensive

Quizzes, Midterms and Final Exams will be done face-to face for all students.

Student presentations

· Groups of ~2-3 students/ group will be assigned in class

· Presentations of a chosen paper should include the following sections: background/introduction, methods, results, discussion.

· Grade assigned based on individual and group presentation. A detailed rubric for grading will be posted on brightspaces

· Papers must be chosen from one of three journals: Neuron, Cell Reports, and Nature Neuroscience.

· The article needs to be approved by the instructor. Presentation due NOV 7th

· Presentation material may be included in the final exam

Required course components:

· Students must receive 50% on the Quiz section to attempt the Final Exam

· Students must receive 50% on the Final Exam to pass the course

Academic concessions

• In agreement with UVic policy, an exam missed for a legitimate reason (illness, accident, family affliction; does not include weddings etc.) may be rescheduled provided supporting documentation from a physician, UHS or UVic Counselling Services is presented

• In the case of a missed quiz, a 2-page written report summarizing the discussion paper (including an

· Introduction, Methods, Results and Discussion section) submitted within two weeks of dates of absence (as per doctor's note), will be evaluated and marked by the instructor

· The final exam can be deferred in cases of illness, accident, family affliction, or sporting commitments as a UVic athlete. If you miss or expect to miss the final exam for any of these reasons, please notify the instructor. You must also fill out a Request for Academic Concession form, available from the Records office, as soon as possible in order to have your request for deferral consideration.

· Travel plans are not a valid reason for missing the midterm test or the final exam.

· No supplemental final exam will be given on this course as per Biology Dept. policy.

Grading

• The final grade for the course will be submitted as a percentage grade (rounded to the nearest whole percent by our spreadsheet program).

• Please do not request raises in your grade, or extra-credit work to raise your grade. This would be unfair to you fellow students

Note: Last day for 100% reduction of tuition fees for standard first term and full year courses: Tuesday, September 16th

Last day for 50% reduction of tuition fees for standard courses: Tuesday, October 7th

100% of tuition fees will be assessed for courses dropped after this date.

Last day for 50% reduction of tuition fees for October 31 (without penalty of failure)

Academic regulations and policies:

Please read the appropriate section of the current UVic Academic Calendar regarding your rights

and obligations. Students are to take note of the ADD/DROP dates published in the

Calendar and posted on the Undergraduate Records website. Students must not assume they

will be dropped automatically from any course they do not attend.

Academic Integrity

Students are required to abide by all academic regulations set as set out in the University calendar, including standards of academic integrity. Violations of academic integrity (e.g. cheating and plagiarism) are considered serious and may result in significant penalties.

Student conduct:

The University of Victoria is committed to promoting critical academic discourse while providing a respectful and supportive learning environment. All members of the university community have the right to this experience and the responsibility to help create such an environment. The University will not tolerate racism, sexualized violence, or any form of discrimination, bullying or harassment. Please be advised that, by logging into UVic's learning systems or interacting with online resources, and course-related communication platforms, you are engaging in a university activity. All interactions within this environment are subject to the university expectations and policies.