

CAPS 431 Course Syllabus

CAPS 431. Laboratory in Human Health and Disease (3 Credits)

Academic Calendar Description:

Techniques relevant to human genetics and physiology in the assessment of human health and disease. This course is restricted to CAPS students. [1-4-0]

Prerequisites:

CAPS 303.

Corequisites:

None

Student Expectations

Students are required to read all online modules and attend all sessions. Students are expected to complete all lab reports and quizzes and achieve an overall grade of 50% to pass the course.

Learning Activities

Prior to each lab, students will have a minimum of one week to review lab materials. They will then take a pre-lab quiz, administered through CANVAS, to test their comprehension of the material. Expected time for review, comprehension and taking the pre-lab quiz is 2 hours total.

Students will then attend in person a 1-hour lecture and then a 4-hour lab under the guidance of the instructor, TA and lab technician.

After every module, students will write a lab report that includes introductory background and context, a methods section and fully analyzed dataset, as well as conclusions. These will be handed in no later than one week after the last lab of the module. Expected time to write the report will be 4 hours.

Students will engage in a small group activity to perform an original research project with assistance from the Instructor and TA. This will involve choosing any of the techniques learned in class to test novel hypotheses that each student group generates themselves. Students will then learn how to put together a research poster that they will present at the Annual CPS Department Presentation Day.

Learning Materials

All learning and reading material will be provided in PDF format on Canvas prior to the start of term. This will include the lab manual and the lecture material, as well as either short videos or documents that add additional pertinent information.

Course Structure

Each session comprises one pre-lab quiz, one 1-hour lecture and then a 4-hour n person lab session. One lab report is expected at the end of each module. Students will review the lab materials in the week prior to each lab and take a pre-lab quiz to assess comprehension. Instructors will start each session with a lecture to provide background and an outline of lab objectives and background. Students will then perform the laboratory, guided by the instructor and TA, with assistance from a laboratory technician. Lab reports at the end of each module will be written up in the form of a 4-page lab report.

Course Director

Dr. Douglas Allan doug.allan@ubc.ca

Course Instructors

TBD

Land Acknowledgements

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xwməθkwəy̓əm (Musqueam) people. The land it is situated on has always been a place of learning for the Musqueam people, who for millennia have passed on in their culture, history, and traditions from one generation to the next on this site.

Learning Outcomes

Students will be able to:

- Perform techniques of next generation sequencing of human genes, as well as PCR and RFLP, as used in forensics fingerprinting and disease variant identification and interpretation. All samples are simulated, to avoid ethical concerns.
- Perform an array of electrophysiological techniques in different models to assess nervous system function. This includes testing the impact of human disease variants in model systems, and also performing electroencephalogram analysis of the brain of human participants.
- Test multiple parameters of cardiovascular and pulmonary responses to a variety of evoked stimuli, including by combined analysis of electrocardiogram, blood pressure and breathing volume data from human participants.
- Identify potential tumors within a variety of human biopsy samples. Combined with bioinformatics analysis, students will then be able to recommend a cancer panel for exome sequencing. Samples will comprise images stripped of all identifiers and accessible in the public domain, to avoid ethical concerns.
- Design and execute an original research project based on one of the lab methodologies learned in this course.
- Present their research project in academic poster format.

Schedule of Topics :

MODULE 1. HUMAN GENETICS

1. Human next generation sequencing for human variant identification
 - Next generation sequencing on (simulated) human samples to identify variants that may lead to specific disease states.
2. Human disease variant interpretation
 - Bioinformatics analysis of identified human gene variants to identify which may contribute to disease.
3. Human forensics
 - Perform PCR and RFLP analyses on simulated human DNA to produce DNA fingerprints of individuals as used in forensics.

MODULE 2. NERVOUS SYSTEM

4. Electrophysiological properties of sensory neurons in the medicinal leech
 - Perform intracellular recordings from the neurons of the medicinal leech and investigate the neurological properties of various sensory neurons.
 5. Human disease variant ion channel recordings by two electrode voltage clamp
 - Tests for altered electrophysiological properties of human disease variants in ion
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channels, using transfected *Xenopus* oocytes. Students will also utilize online bioinformatics tools to determine how each variant in the gene alters protein function to cause these aberrant properties.

6. Human neurological disease gene variant recordings by *Drosophila* electroretinogram
 - Perform tests using sharp electrode extracellular recordings in the *Drosophila* eye to test the impact of human disease gene variants on neuronal function. Students will also utilize online bioinformatics tools to determine how each variant in the gene alters protein function to cause these aberrant properties.
7. Analysis of human attention by electroencephalogram (EEG)
 - Collect and interpret electroencephalogram recordings from participants and determine alterations in event-related potential in response various stimuli.

MODULE 3. CARDIOPULMONARY

8. Assessment of human pulmonary function
 - Perform pulmonary function assessments on participants and will investigate the impact of constricted airways on pulmonary function.
9. Assessment of human cardiovascular autonomic responses.
 - Perform cardiovascular function assessments, using electrocardiogram recordings and blood pressure measurements, and will explore the cardiovascular component of the autonomic response to various physiological conditions.

MODULE 4. RESEARCH PROJECT.

- 10-12. Active learning, student-led project work.
 - Student groups will develop their own research project based on any of the lab methodologies learned in the previous labs.

13: RESEARCH PROJECT PRESENTATION.

Poster Presentation at the Annual 4th Year CAPS Majors student presentation day.

- Students will present a poster of their Project work at this event.

Assessments of Learning

- 1) Lab participation will be based on each individual student's engagement and contributions during each lab and will be assessed by the instructor.
 - 2) Every lab will include a pre-lab quiz testing comprehension of the lab materials of each individual student.
 - 3) A lab report for every module will be completed. This will be assessed for comprehension, quality of data acquisition and analysis, as well as quality of conclusions. While the lab work will be performed in small groups, each student will write their own lab report and it will be assessed individually.
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4) Students will perform small group original research projects, which will be presented in poster format. Each poster will include background, methodology and data, as well as conclusions. Each student will be assessed on their individual contribution to the overall design, originality and presentation of the project, as well as their performance of the experiments, and the quality of the content of the poster.

Grading scheme:

| | |
|-----------------------------------|-----|
| Lab participation | 5% |
| Pre-lab quiz | 10% |
| Lab reports | 65% |
| Research project and presentation | 20% |

University Policies

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all their actions. Details of the policies and how to access support are available at the Policies and Resources section of the UBC Senate website.

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Careful records are kept in order to monitor and prevent recurrences.

A more detailed description of academic integrity, including the University's policies and procedures, may be found in the Discipline for Academic Misconduct section of the UBC Academic Calendar.

- No assignment may be submitted to any other instructor of any course for a grade.
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- The minimum penalty for plagiarism in any assignment is a zero for the paper; the maximum penalty is a zero for the course.

UBC Grading Standards

Undergraduate Grading Scale

| Percentage (%) | Letter Grade |
|----------------|--------------|
| 90-100 | A+ |
| 85-89 | A |
| 80-84 | A- |
| 76-79 | B+ |
| 72-75 | B |
| 68-71 | B- |
| 64-67 | C+ |
| 60-63 | C |
| 55-59 | C- |
| 50-54 | D |
| 0-49 | F |

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