THE UNIVERSITY OF BRITISH COLUMBIA

Biology UBC
Vancouver, BC, CANADA

UBC's Point Grey Campus is located on the unceded, traditional and ancestral territory of the xʷməθkʷəy̓əm (Musqueam).

This syllabus is a general representation of the course and is subject to change.

BIOL/FNH 436 - Integrated Functional Genomics

General Course Syllabus (as of July 2024)

Course Description: In this course, we will explore how different types of 'omics data (genomics, epigenomics, transcriptomics, metabolomics…) can be integrated with approaches from different disciplines (molecular biology, genetics, evolutionary biology…) to identify the connections between DNA and phenotype. While the general techniques and approaches that we will cover can be applied to any living organism, the focus of the course will be on plants – how (integrated) genomics approaches can be used to study plant diversity and adaptation, and to improve our crops so that they are more sustainable and more productive.

Course Format: Lecture

Credits: 3 credits

Prerequisites: One of BIOL 335, BIOL 338. Equivalency: FNH 436

Course Goal: Understanding 'omics technologies and their application in research and agriculture.

Learning Outcomes: By the end of the course, students should be able to:

- List the various 'omics technologies (e.g. second- and third-generation sequencing, bisulfite sequencing, single cell RNAseq, etc.) and their relevance to functional genomics studies.
- Discuss different ways to identify links between genes and their function (mutant screens, quantitative trait loci and association mapping, scans for signatures of selection…)
- Propose the best suited omics strategies/technologies and their combination to answer a range of different fundamental research questions (e.g. how do genomes evolve; how do plants maintain complex adaptations) as well as applied problems (e.g. how can we make a crop more resistant to abiotic stress).
- Explain how genetic diversity arises and its importance for adaptation and agriculture.
- Critically read and analyze scientific papers related to functional genomics, by identifying hypothesis, evaluating methodologies, extracting key findings, and discussing implications.
- Explain these papers to their peers, engage in collaborative learning, and lead a discussion.

Resources:

- Course site: Canvas

Evaluation:

Assessments	Weight
Engagement with the course (participation, discussions)	15%
Paper presentation	20%
Pre- and post-class evaluations (quizzes, etc.)	20%
Midterm	20%
Final	25%

Details of Evaluation/Assessments: You will be assessed on your knowledge of the materials covered in the lectures and the papers discussed (with a Midterm and a Final written exam), and for your ability to understand and present to the class published research papers. A focus of the course is on fostering discussion on different genomic technologies and their applications – therefore participation to these discussions (during class and/or on discussion boards) will count toward the final grade as well. Finally, we will have pre- and post-lecture quizzes on topics covered in class and in weekly assignments; these are important to track which topics are clear and which ones need further explanation, but will also serve as an exercise for the type of questions that will be in the exams – and will contribute towards your final grade.

Possible Lecture Topics:

- Genome organization
- Sequencing technologies (w/ field trip to BC Cancer Genome Science Centre)
- Genome assembly and annotation
- Natural and artificial genetic diversity, and its roles in crop improvement
- Genetic mapping and QTL mapping
- Genome-Wide and Genotype-Environment Association Studies
- Population genomics and signatures of selection
- Candidate gene characterization
- Epigenomics
- Transcriptomics (single-cell, spatial)
- Proteomics
- Metabolomics
- Genomic data sharing and sovereignty

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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, spiritual and cultural observances.

UBC values academic honesty and students ae expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions.

Details of how to access support are available on the UBC Senate website.