*This syllabus is a general representation of the course as previously offered and is subject to change.*

# BIOL 440 / APBI 440 – Plant Genomics

General Course Syllabus (as of March 2023)

## About the Course:

**Course Description:** This course covers concepts, principles, applications, and recent discoveries in genome structure, genetics, and comparative genomics in plants with a focus on economically important plants.

Plant genomes are being sequenced at an ever-increasing rate. All major crops and most minor crops now have genome projects associated with them. The availability of genomic resources is driving an exciting phase of discovery in the plant sciences and this is consequently a very exciting and dynamic research field. Genomics-led discoveries are being made in many fields including stress physiology, speciation and agricultural yield. Course material will focus heavily on crop plant genomics. We will concentrate on discoveries in fundamental plant science aided by plant genomics, and also on "translational research" (i.e. how fundamental scientific research can be translated into applied benefits). Emphasis will be on recent discoveries and on reading, comprehending, digesting and presenting primary literature.

**Course Format:** Lectures: The course will be taught using a hybrid of lectures, group presentations, class discussions, seminars, in-class research project analysis, and quizzes. Some computer exercises will also be included.

**Credits:** 3
**Pre-requisites:** (a) BIOL 233 or BIOL 234, and (b) one of BIOL 335, BIOL 338

## Course Learning Objectives:

- Achieve a good working knowledge of concepts, principles, and recent discoveries in genomics and molecular genetics of agricultural and other economically important plants.
- Learn to describe and critically evaluate genomic data presented in Circos plots, Manhattan plots, volcano plots, heatmaps, and genome browsers etc, and apply your knowledge to crop plant improvement, evolution, and ecology.
- Discuss and present assigned topics in crop genomics, domestication, cultivar variation, polyploidy, and genome editing while enjoying a modern learn-unlearn-relearn educational process.

## Textbook and Additional Resources:

No textbook. Readings will be literature review articles from scientific journals and primary research papers mentioned in class. They can be found and downloaded from PubMed.

For group presentations, students are encouraged to borrow and read related parts of the textbooks (e.g. “Economic Botany: Plants in our World”). Students are responsible for self-learning and researching into the assigned topic and research papers.

Course website: www.canvas.ubc.ca

## Evaluation:

| Assessments | Weight |
|---|---|
| Exam | 30% |
| Quizzes | 20% |
| Group research and presentation | 32% |
| Class participation | 18% |

## Details on Assessments:

**Plant genomics group presentations**
You will be asked to sign up for three group presentations. Your group will design and deliver three oral lectures (**in which all group members will participate**) on crop genomics. As part of your presentation you should explain the importance of the crop, the domestication history, define current challenges, summarize the recent genomics advances that include the primary research papers, and provide a critical analysis of the current status of the crop. Your classmates will be learning on the topic from your group, and the ideal presentation will engage the whole class in an interactive manner in the classroom.

Your presentation will be evaluated by the instructor, your teammates, and peer students in the audience. You will be evaluated as a group on the quality of your presentation and individually by your own presentation. For the scientific presentations, each student will also need to submit a one- to two-paragraph written summary on the assigned topic one week after the presentation. The presentation file (in ppt or pdf format) of each group will be posted on the course website.

**In-class research projects**
Plant genomics datasets will be studied and dissected to learn how to solve real-world plant genomics problems. You will utilize the skills in exam(s) and quizzes.

## Course Policies:

- Final exams will be written only on the scheduled date.
- You are expected to attend both the lectures and student-led group presentations. Should there be a need to miss a class due to a valid reason, please inform the instructor by email in advance to the class.

## Schedule of Topics:

Sixteen lectures will be dedicated to covering state-of-the-art topics for plant genomics and preparing students for their group presentation:

| Lecture | Topic |
|---|---|
| Lecture 01 | Plant Evolution |
| Lecture 02 | Plant Domestication |
| Lecture 03 | The Green Revolution and Crop Improvement |
| Lecture 04 | Genomes and Sequencing Techniques |
| Lecture 05 | Sequencing Techniques and Functional Genomics |
| Lecture 06 | Genomic Attributes and Visualization |
| Lecture 07 | Transcriptional Regulation of Gene Expression |
| Lecture 08 | Cultivar Diversity, SNPs, and Translational Regulation |
| Lecture 09 | Genomic Tools to Link Genotype and Phenotype |
| Lecture 10 | Polyploidy |
| Lecture 11 | Data Analysis and Communication |
| Lecture 12 | Presentation Workshop |
| Lecture 13 | Epigenetic Regulation and Histone Modifications |
| Lecture 14 | Small RNA and DNA methylation |
| Lecture 15 | Plant Transformation and Epitranscriptomics |
| Lecture 16 | Genome Editing |

***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 the policies and how to access support are available on the UBC Senate website.*