# B 473/CPSC467: Plant Genomics
# Course Syllabus
## Fall 2018

INSTRUCTOR

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COURSE INFORMATION

**Place and time:** 2083 Natural History Building, 3:00 - 3:50 pm, Monday and Wednesday, Oct. 22 – Dec. 12, 2018
**Credit**: 1 hour
**Pre-requisites**: IB204 Genetics or MCB250 Molecular Genetics
**Requirements that course meets**: Optional course for IB undergraduate and graduate students to learn plant molecular biology.

**Course website**: https://compass2g.illinois.edu/

**Optional textbooks: A Primer of Genome Science** (paperback), 3rd ed. G. Gibson and S.V. Muse (2009), Sinauer Associates, ISBN 978-0-87893-236-8. Both of these are available (new and used at "reasonable" prices) at Amazon.com.

PDF files of recommended reading materials will be posted on the class web site.

**General information**: The availability of whole genome sequences for an increasing number of plant genomes is revolutionizing basic and applied plant biological research. This course provides a broad overview of structural and functional genomics with emphasis on structural genomics. It will cover genomic approaches leading to the sequencing of whole genomes, functional analysis of acquired sequences, and application of genomic resources for addressing specific biological questions. This course is aimed at developing students' abilities to read and interpret genomic literature, to analyze and evaluate genomic data, and to apply genomic approaches in their own research when suitable. Specific learning outcomes include:

1. Understand fundamental features of eukaryotic genomes.
2. Have full knowledge of plant genome size evolution.
3. Assess the structure and organization of plant genomes.
4. Evaluate various types of DNA markers.
5. Explain different strategies to sequence a plant genome.
6. Understand comparative genomics and its applications.
7. Explore the mechanisms of molecular evolution and sex chromosomes.
8. Apply geneomic techniques in research.

SUGGESTED LEARNING STRATEGIES FOR LECTURE

1. Read posted materials for the lecture.
2. Print lecture ppt file prior to each lecture.
3. Participate fully in all active learning exercises.
4. Learn definitions of all unfamiliar terms that appear in slides, and in the assigned reading.
5. Don't procrastinate on homework. Homework questions emphasize the most important concepts and skills that you will need to master in order to do well on exams.
6. Review figures in reading materials and on PPT slides to practice generating and interpreting figures. Pay particular attention to understanding how to interpret figures and tables.
7. Master all computational skills and data interpretation skills that are critical components of the scientific process; be able to apply these skills when confronting a new genetics problem.

GRADING AND ASSIGNMENTS

**Homework Assignments:** Two sets of homework problems consisting of short questions or calculations will be distributed on Nov. 12 and Dec. 3. You will have a week to prepare written answers to the questions (word-processed). The homework problems are expected to be worked out by each student alone since they account for 60% of the final grade. Homework assignments will be posted on the class web site.

**Short Paper:** A short review essay evaluating a research article on plant genomics will be submitted on Dec. 3. The essay should be prepared following the "News and Views" article style in *Nature* that summarizes and discusses the significance and places the work in a broader context.

**Class Participation:** Students are encouraged to participate in discussions in class, before or after class, or any time by e mail.

**Grading policy and breakdown of final grade**

40% Two sets of homework problems
40% Written essay (journal article evaluation); 'News & Views' style
15% Evaluation of three essays
5% Attendance

**Guidelines for evaluating the essay:**

- Importance of the topic to the field
- Substance and scope of the of research covered in the essay
- The degree of advancement or breakthrough that adds value to the existing knowledge
- The impact of the breakthrough to the field of research and society
- Clear and compelling conclusions
- Overall organization and clarity of writing

**Grading criteria for the written essay:**

- Summary of findings in the article – accuracy, completeness (10 points)
- Discussion – significance, context (20 points)
- Overall organization, clarity (5 points)
- Technical merit – spelling and grammar (3 points)
- Citation of key references (2 points)

COURSE POLICIES

**General:**
This course will follow all policies in the Student Code: http://studentcode.illinois.edu/.

**Academic Integrity:**
This course will follow Article 3 of the Student Code http://studentcode.illinois.edu/article3_part1_3-101.html. This rule defines infractions of academic integrity, which include but are not limited to cheating, fabrication, and plagiarism. You are responsible for being knowledgeable what these infractions are for not following these guidelines. Plagiarism while writing the scientific manuscripts will be carefully monitored. If you do not feel you fully understand what constitutes plagiarism, see your TA or Ray Ming.

**Attendance:**
Your attendance at class is required and 1 point will be deducted for each missing lecture. The total deduction can exceed 5% of the final grade with no upper limit. The information covered in class will make up the majority of content on the homework assignments. Class starts promptly at 3:00 pm. "Things" happen, but please make every effort to be on time, and doctor's note is required for absence without deduction.

**Late work:**
Homework is due one week after the assignments are posted. A deduction of 10% of points is in effect for every 2 days the assignment is late. If you are ill, please get a note from your physician or the McKinley clinic and any missed deadlines will be changed by mutual agreement.

**Writing assignment:**
The final essay is due on Nov. 30. There is no grace period for this writing assignment. A deduction of 10% of points is in effect for every 2 days the assignment is late. Plagiarism will result in a grade of 0 for the written essay.

**Accommodation of disability:**
If you require special accommodations, please contact Ray Ming. All accommodations will follow the procedures as stated in Article 1-110 of the Student Code (http://studentcode.illinois.edu/article1_part1_1-110.html)

**Class schedule**

| Date | Day | Topic |
|---|---|---|
| Oct. 22 | Monday | **Course Introduction – Genome size evolution**<br>Definition of genomics<br>Genome size evolution |
| Oct. 25 | Wednesday | **The structure and organization of plant genomes (I)**<br>Organization of single-copy sequences<br>Repetitive sequences<br>Transposable elements<br>Genome duplication |
| Oct. 29 | Monday | **The structure and organization of plant genomes (II)**<br>Origin of plastid and mitochondria genomes<br>Plastid and mitochondria genome organization<br>Evolutionary changes of plastid and mitochondria genomes |
| Oct. 31 | Wednesday | **The basic toolbox – Building up genomic resources (I)**<br>DNA markers<br>Mapping population<br>Genetic mapping |
| Nov. 5 | Monday | **The basic toolbox – Building up genomic resources (II)**<br>Physical mapping using High Information Content Fingerprinting<br>Overgo (OVERlapping oliGOnucleotides) hybridization<br>FPC (FingerPrinted Contigs) software |
| Nov. 7 | Wednesday | **Genome sequencing strategies (I)**<br>BAC by BAC genome sequencing<br>Whole genome shotgun sequencing |
| Nov. 12 | Monday | **Guest lecture:** Floral dip<br>Effect of various sugars on transformation<br>Discovery of floral dip for transformation<br>Impact of floral dip on plant sciences |
| Nov. 14 | Wednesday | **UIUC Genomics Facility tour** |
| Nov. 19 | Monday | **Thanksgiving holiday** |
| Nov. 21 | Wednesday | **Thanksgiving holiday** |
| Nov. 26 | Monday | **Genome sequencing strategies (II)**<br>Cot-based sequencing<br>Methyl filtration<br>Homework 1 due at 11:59 pm |
| Nov. 28 | Wednesday | **Genome sequencing strategies (II)**<br>Cot-based sequencing<br>Methyl filtration |
| Dec. 3 | Monday | **Gene discovery**<br>ESTs<br>Full-length cDNAs<br>Identify genes by mutagenosis<br>Short essay due at 11:59 pm |

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| Nov. 5 | Wednesday | **Comparative genomics** |
| | | Homologs, patalogs, and orthologs |
| | | Macrosynteny, microsynteny, and colinearity |
| | | Implications of comparative genomics |
| Dec. 10 | Monday | **Molecular evolution** |
| | | Evolutionary changes in nucleotide sequences |
| | | Rates and patterns of nucleotide substitution |
| | | Molecular clock |
| | | Evolution of multigene families |
| | | Homework 2 due at 11:59 pm |
| Dec. 12 | Wednesday | **Genomics of sex chromosomes** |
| | | Evolution of sex chromosomes |
| | | Sequence features of the Y chromosome |