



*GENETICS 631: Plant Genetics and Development*

**\*Credits: 3**

**Canvas Course URL:**

<https://canvas.wisc.edu/courses/364803>

**Level:** Advanced

**Breadth:** Biological Science

**Meeting Time and Location**

**Time:** TuTh 11:00 - 12:15 PM

**Location:** BIOTECH CT 1441.

**Instructional Mode**

Classroom Instruction. However, we would like to emphasize that everyone's safety is very important to us, so we will ask you to keep safe distances during class. We also ask you to not come to class if you are not feeling well or have been exposed to someone with a respiratory disease. To accommodate such situations, we will stream the class on zoom and post class recordings on Canvas. If you have any concerns or comments about these accommodations, please feel free to contact us ASAP.

Zoom-streaming and class recording:

<https://uwmadison.zoom.us/j/95545982861?pwd=L0p1djQza3ptclBqK3d0WGNpdk5Cdz09>

**Credit Hours Policy and Regular and Substantive Student-Instructor Interactions**

This course uses the *Traditional Carnegie Definition* of credit hours: One hour (i.e., 50 minutes) of classroom or direct faculty/instructor instruction and a minimum of two hours of out of class student work each week over approximately 15 weeks. Hence, the three credit hours assigned to this class include two 75-minute sessions of direct

faculty/instructor instruction per week. Each session includes approximately 50 min of lecture and 25 min of discussion on assigned readings facilitated by the instructor. A minimum of six hours of out-of-class student work (mostly reading assigned papers and preparing homework assignments) is expected each week over approximately 15 weeks.

Regular and substantive student-instructor interaction will occur through:

1. Direct instruction through lectures (50 min per session)
2. Instructor-facilitated discussions on assigned reading (25 min per session)
3. Instructors providing information and responding to student questions about the content of the course
4. Instructors providing substantive feedback, information, explanation and/or corrections on students' answers to the homework assignment questions (see below) in the 'Comment' section of Canvas as a part of the grading process.

## **INSTRUCTORS**

**1) Jake Brunkard**, Assistant Professor of Genetics, University of Wisconsin-Madison, room 3106 Genetics/Biotech building, 425 Henry Mall, Madison WI 53706

Tel: 608-890-4874

E-mail: [brunkard@wisc.edu](mailto:brunkard@wisc.edu)

**2) Patrick H. Masson**, Professor of Genetics, University of Wisconsin-Madison, room 3262 Genetics/Biotech building, 425 Henry Mall, Madison WI 53706

Tel: 608-265-2312

E-mail: [phmasson@wisc.edu](mailto:phmasson@wisc.edu)

**3) Instructors Availability:** Students are strongly encouraged to meet with the instructors to discuss any of the materials covered in this class. The instructors will be happy to meet individually with interested students. Such one-on-one meetings should be scheduled ahead of time via e-mail, phone or direct request after class. We love interacting with our students, so please do not hesitate to contact us with any questions or discussions.

## **OFFICIAL COURSE DESCRIPTION**

### **\*Course Description**

Covers the basic concepts of genetics and genomics as applied to plants and their development, including discussions on breeding systems (modes of reproduction, sex determination, self incompatibility and crossing barriers), linkage analysis, genome structure and function (structure, function and evolution of nuclear and organellar

chromosomes; haploidy and polyploidy; expression regulation and epigenetics), along with a description of current methodologies used in the analysis of these processes within the context of plant development. The objective is to instigate a broader knowledge and understanding of the principles and methodologies used in plant genetics and their applications in investigations of the molecular mechanisms that modulate plant development.

**\*Requisites**

*GENETICS 466 or GENETICS 467/468 or Graduate Standing.*

**LEARNING OUTCOMES**

***Undergraduate and graduate students:***

1. Describe the plant life cycles and learn key concepts in plant development
2. Explore experimental approaches to study breeding systems, recombination, and modes of trait segregation in plants, including quantitative traits
3. Adopt genetic, epigenetic and genomic approaches to study plant growth, development and responses to the environment
4. Analyze and interpret data in plant genetics and development
5. Critically evaluate papers from the primary literature.

***Graduate students only:***

6. Compare and contrast published experimental data that address specific biological questions in plants, use the corresponding information to develop novel hypotheses, and design experiments that test these hypotheses.

**GRADING**

**Assigned Readings**

A paper from the primary literature will be assigned to each lecture, starting at lecture 2. Students will be expected to read the assigned paper and answer 5 Pre-Discussion questions posted under the Assignments section of Canvas, before each lecture. The assigned paper will then be discussed during lecture. Answers to the Pre-Discussion questions will be graded on a complete/incomplete basis:

- 5 answers submitted: 5 pts
- 1 answer missing: 4 pts
- 2 answers missing: 3 pts
- 3 answers missing: 2 pt
- 4 answers missing: 1pt
- 0 answers submitted: 0 pts

The maximal total score for Pre-Discussion assignments will be 130 pts.

## **Homework Assignments**

Four homework assignments will measure student learning in this class. No additional exams will be required. Each homework assignment will include five questions that focus on either resolving assigned problems and/or answering questions related to assigned papers (posted on Canvas at the time of the assignment). A sixth question will also be included in each homework assignment, testing students' ability to take the project discussed in the assigned paper one step further, developing new hypotheses and designing experimental approaches to test them. This question is targeted to graduate students in the class and covers Learning Objective 6. However, we also encourage undergraduate students to offer an answer.

### ***Undergraduate Evaluation***

The undergraduate students will be graded on their answers to the five first questions. They are also encouraged to answer the sixth question, which is optional for them. They will not be penalized for mistakes in their answers to the 6th question, but will be credited extra points for correct answers. Each Homework assignment will be worth 130 points.

### ***Graduate Student Evaluation***

Graduate students will have to answer all six questions. Each Homework assignment will be worth 130 points.

### ***Due Dates for Homework Assignments***

***Assignment 1:*** Due on Monday, Oct 02, 11:59PM

***Assignment 2:*** Due on Monday, Oct 30, 11:59PM

***Assignment 3:*** Due on Monday, Nov 20, 11:59PM

***Assignment 4:*** Due on Friday, Dec 15, 11:59PM

### ***Final Grading Scale***

Final grades will be calculated by summing the total scores for the pre-discussion questions (130 points) and for the homework assignments (520 points), for a maximal total score of 650 points. Final grades in the A-F scale will be assigned based on the distribution of point totals. A typical conversion scale between final points (%) and letter grades might be:

**A:** 585 (90%) - 650 (100%)

**AB:** 553 (85%) - 584.5 (89.9%)

**B:** 520 (80%) - 552.5 (84.9%)

**BC:** 488 (75%) - 519.5 (79.9%)

**C:** 455 (70%) - 487.5 (74.9%)

D: 390 (60%) - 454.5 (69.9%)

F: <390 (<60%).

Students are expected to attend lectures and participate in the discussions. If you cannot attend due to illness or important scheduling conflicts, please contact the instructor to discuss possible accommodations.

## **REQUIRED TEXTBOOK, SOFTWARE & OTHER COURSE MATERIALS**

Assigned readings in the form of published research papers will be made available on Canvas. References to review papers relevant to the material discussed in many lectures will also be posted on Canvas, FYI.

## **EXAMS, QUIZZES, PAPERS & OTHER MAJOR GRADED WORK**

There will be no final exams in this course. Instead, there will be 26 pre-discussion assignments (one per lecture, starting in lecture 2) and four homework assignments during the semester, which will involve answering questions on one or two assigned papers. Assignment contents are described under "Grading". Both pre-discussion and homework assignments will be posted on Canvas. Pre-discussion assignments will be due **1 h before the** corresponding lecture. **Homework assignments will be due at the dates indicated in the course calendar (see below).**

## **PRIVACY OF STUDENT RECORDS and the USAGE of AUDIO RECORDED LECTURES**

See **information** about [privacy of student records and the usage of audio-recorded lectures](#).

### **Usage of Audio Recorded Lectures Statement:**

Lecture materials and recordings for Genetics 631 are protected intellectual property at UW-Madison. Students in this course may use the materials and recordings for their personal use related to participation in this class. Students may also take notes solely for their personal use. If a lecture is not already recorded, you are not authorized to record lectures without permission unless you are considered by the university to be a qualified student with a disability requiring accommodation. [Regent Policy Document 4-1] Students may not copy or have lecture materials and recordings outside of class, including posting on internet sites or selling to commercial entities. Students are also prohibited from providing or selling their personal notes to anyone else or being paid for taking notes by any person or commercial firm without the instructor's express written permission. Unauthorized use of these copyrighted lecture materials and recordings constitutes copyright infringement and may be addressed under the university's policies, UWS Chapters 14 and 17, governing student academic and non-academic misconduct.

## **STUDENTS' RULES, RIGHTS & RESPONSIBILITIES**

It is important to prioritize our collective health and safety to keep ourselves, our campus, and our community safe. As a university community, we must work together to

prevent the spread of diseases and to promote the collective health and welfare of our campus and surrounding community.

### **QUARANTINE OR ISOLATION DUE TO DISEASE**

Students are encouraged to maintain safe distances from each other during lecture. Students should continually monitor themselves for disease [symptoms](#). If you have symptoms or have been in close contact with someone with an infectious disease, please stay home and attend the lectures and discussions that will be streamed via Zoom. Also, please let the instructors know you will be absent. Students are strongly encouraged to communicate with their instructor concerning their illness and the anticipated extent of their absence from the course (either in-person or remote). The instructor will work with the student to provide alternative ways to complete the course work.

### **COURSE EVALUATIONS**

Students will be provided with an opportunity to evaluate this course and your learning experience. Student participation is an integral component of this course, and your feedback is important to us. We strongly encourage you to participate in the course evaluation. UW-Madison now uses an online course evaluation survey tool, [AEFIS](#).

In most instances, you will receive an official email two weeks prior to the end of the semester when your course evaluation is available. You will receive a link to log into the course evaluation with your NetID where you can complete the evaluation and submit it, anonymously.

### **ACADEMIC INTEGRITY**

By virtue of enrollment, each student agrees to uphold the high academic standards of the University of Wisconsin-Madison; academic misconduct is behavior that negatively impacts the integrity of the institution.

Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these previously listed acts are examples of misconduct, which may result in disciplinary action. Examples of disciplinary action include, but is not limited to, failure on the assignment/course, written reprimand, disciplinary probation, suspension, or expulsion.

### **ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES**

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policyb3 (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities are a shared

faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized.

Faculty [I] will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA. (See: [McBurney Disability Resource Center](#)).

## **DIVERSITY & INCLUSION**

[Diversity](#) is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals. The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world.

## Fall 2023 Calendar: Draft

### Meets T and R, 11:00-12:15 PM

Date	Instructor	Lecture Topic
Sept. 7	Brunkard	Introduction to Developmental Systems - Life Cycles
12	Masson	Genetic Methods: Forward Genetics
14	Masson	Genetic Methods: Reverse Genetics and Reverse Epigenetics
19	Masson	Genetic Methods: Mosaic Analysis
21	Masson	Meiosis, Recombination and Segregation Distortion
26	Masson	Transcriptional Regulation of Gene Expression/Epigenetics
28	Masson	Gametogenesis and Sex Determination
<b>Homework Assignment #1 (Due on Canvas by Monday, Oct 02, 11:59PM)</b>		
Oct. 3	Masson	Self-Incompatibility and Crossing Barriers
5	Masson	Apomixis
10	Brunkard	Heterosis: Dominance, Overdominance, and Epistasis
12	Brunkard	Cytoplasmic Inheritance
17	Brunkard	Incompatibility
19	Brunkard	Jumping Genes: Domestication and Transposable Elements
24	Brunkard	Structural Variation and Genomics
26	Brunkard	Genome Shocks!: Synteny and Polyploidy
<b>Homework Assignment #2 (Due on Canvas by Monday, Oct 30, 11:59PM)</b>		
31	Brunkard	Quantitative Traits
Nov. 2	Brunkard	Metabolic & Posttranscriptional Regulation of Gene Expression
7	Brunkard	Disease Resistance Genetics and Interactions with Development
9	Brunkard	Reverse and Speed Breeding
14	Masson	Auxin and Cytokinin Signaling and Plant Development
16	Brunkard	Embryos: Pattern Formation and Morphogenesis
<b>Homework Assignment #3 (Due on Canvas by Monday, Nov 20, 11:59PM)</b>		
21	Brunkard	Seeds: Desiccation, Dormancy, Germination, and Hormones
23-26	THANKSGIVING	
28	Masson	Root Development and Branching
30	Masson	Mechanotransduction
Dec. 5	Brunkard or Masson	(Shoot Development and Branching )
7	Brunkard or Masson	(Phase Transition)
12	Brunkard or Masson	(Flower Development)

**Homework Assignment #4 (Due on Canvas by Friday Dec 15, 11:59PM)**