RUTGERS
School of Environmental and Biological Sciences

Plant Physiology

11:776:382 (4 credits)
Spring Semester
Monday (lecture), Wednesday (lecture) 2:00 PM – 3:20 PM 126
Hickman Hall
Thursday (laboratory) 3:55 – 6:55 PM 194 Foran Hall

CONTACT INFORMATION

Instructor:	Dr. Hector Rodolfo Juliani
Office Location:	396D Foran Hall, 59 Dudley Rd., New Brunswick, NJ 08901
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Office Hours:	by arrangement

COURSE DESCRIPTION

The goal of the course is for students to have a comprehensive understanding of how plants work. Understanding structure and function relationships, and interactions with the environment, is a vital strategy for comprehending fundamental concepts of plant physiology. The course introduction recap the evolutionary history of plants and plants as organisms. The second section delved into understanding the importance of water and mineral nutrients for plant growth and development. The photosynthesis section focuses on how plants get their energy through photosynthesis and respiration. The growth and development section focuses on how plants complete their life cycles. The laboratories' main objective is to introduce plant physiology tools by running basic experiments, formulating and testing hypotheses, processing, analyzing, presenting results, and preparing a research report.

COURSE WEBSITE, RESOURCES, AND MATERIALS

- Course website: Canvas. As per the COVID and weather-related situation, some lectures will be delivered online using Rutgers Canvas Learning Management System. The classroom will be open 10- minutes before each class and available 10 minutes after the end of each class period.
- The course will use open educational resources: Teaching Tools in Plant Biology. The Plant Cell Journal and American Society of Plant Biologists. https://academic.oup.com/plcell/pages/teaching-tools-plant-biology
- Supplemental textbooks as a reference (not required):
- Introduction to Plant Physiology, 3rd. William G. Hopkins (recommended)
- Plant Physiology, 2nd. L. Taitz and E. Zeiger
- Plant Physiology, 4th. F. Salisbury and Cleon W. Ross

PREREQUISITES

01:119:115-116-117 General Biology OR equivalent AND 11:776:242 Plant Science. Recommended: Organic Chemistry

COURSE LEARNING GOALS

(Link to Plant Biology Undergraduate Program Goals: http://plantbiology.rutgers.edu/undergrad/plantbiology/)

By the end of this course, the student will be able to:

1. Comprehend the fundamental concepts of plant physiology (addresses program goal 1, *technical proficiency*)
2. Describe the physiological mechanisms of plant growth, function, and development (addresses program goals 1 and 2, *technical proficiency and context*)
3. Recognize and describe how plants respond to their environment (addresses program goal 2, *context*)
4. Understand how to generate scientific knowledge by designing, setting up experiments, collecting, processing data, and making a written output resembling a research publication (addresses program goals 3 and 4, *communication and critical thinking*)

ASSIGNMENTS/RESPONSIBILITIES AND ASSESSMENT

Grading

Lecture:	Percentage (out of 100)
First exam	20
Second exam	20
Third exam	25
Laboratory: Reports and presentations	25
Attendance and class participation	10
Total	100

Grades will be classified based on Rutgers approved system: A, B+, B, C+, C, D, and F.

Lab reports and presentations:

There will be nine laboratories (up to 4 hours weekly), where students will design and set up a greenhouse experiment by subjecting plants to different environmental factors (e.g., light, minerals). To foster learning and interaction among students, the research project is done in small groups. The experiments will run for 8 weeks, with students taking measurements of plant growth and development weekly. In addition, students will learn plant physiology lab procedures to measure the dependent variables. Students are required to install the R, the open-source statistical software, for data analysis, visualization, and statistical analysis. Students will learn about using R through demonstrations conducted during the labs and activities posted in Canvas. The laboratories finish with the submission of a research report with the structure of a research publication. The research report is worth 25 points.

Learning goals assessment: Specific questions on exams and participation in class will be used to assess student knowledge of course learning goals, including demonstrated mastery of fundamental terms and mechanisms in plant physiology. In graded laboratory exercises, students will communicate their understanding of techniques used in the discipline (course learning goals 2 and 3). The percentage score on these assessments will determine the level of mastery: >90% outstanding; 80-89% good; 70-70% satisfactory; <69% unsatisfactory.

PARTICIPATION GRADE AND ABSENCE POLICY

Attendance will be recorded. There will be no make-up for missed exams or labs. Students unable to attend may contact the instructor via e-mail before the missed class or may use the University absence reporting website (https://sims.rutgers.edu/ssra/) to indicate the date and reason for the absence. An e-mail is automatically sent to the instructor.

COURSE TOPICS

Lecture schedule

Week*	Topic**
	Introduction
1	Course overview: Student introduction, lab schedule, and activities. Why study plants?.
2	Plants as Photosynthetic, multicelluLAr aNd Terrestrial organismS.
	Plant Water Relations
2	Plant-water Relations: Uptake and transport.
3	Plant water Relations: Water deficit.
	Plant Nutrition
4	Introduction to Plant Nutrition.
5	Macro and micronutrients. Exam I
	Photosynthesis
6	Photosynthesis overview. Light, pigments, and plastids
7	Photosynthetic light-dependant reactions
8	Photosynthesis: Carbon Fixing reactions. C3, C4, and CAM Plants.
9	Spring Break
	Growth and Development
10	Growth and Development. Carbon assimilation
11	Introduction to Plant Hormones. Exam II.
12	Auxins and cytokinins
13	Giberellins and Absicic acid
14	Ethylene and others
15	Plant Movements. Plants and their neighbors. Class wrap-up. Exam III

*Two lectures per week. ** Pace of lectures subject to change

Laboratory schedule

Week	Topic and activities
1	Research Methodology and Writing. Setting up the experiment: hypothesis, dependent and independent variables.
2	Seeds, growing media, and germination. Starting the experiment in the greenhouse. Installation of R Studio and introduction to R statistical software (scripts, data processing, and visualization)
3-8	Weekly measurements of dependent variables. Plant physiology procedures: chlorophyll and carotenoid amounts, total proteins, leaf area, microscopy, water content, and water potential, among others. Data entry and processing using R, examples of scripts, data visualization (box plots, bar graphs, regression analysis), and statistical analysis. Preparation of the research report, starting with “Materials and Methods” and “Introduction”.
9	Finalize and submit the research report

FINAL EXAM/PAPER DATE AND TIME

The Online Final exam Schedule: http://finalexams.rutgers.edu/

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Please follow the procedures outlined at https://ods.rutgers.edu/students/registration-form. Full policies and procedures are at https://ods.rutgers.edu

ACADEMIC INTEGRITY

The university's policy on Academic Integrity is available at http://academicintegrity.rutgers.edu/academic-integrity-policy/

The principles of academic integrity require that a student:

- Properly acknowledge and cite all use of the ideas, results, or words of others.
- Properly acknowledge all contributors to a given piece of work.
- Make sure that all work submitted as his or her own in a course or other academic activity is produced without the aid of impermissible materials or impermissible collaboration.
- Obtain all data or results by ethical means and report them accurately without suppressing any results inconsistent with his or her interpretation or conclusions.
- Treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress.
- Uphold the canons of the ethical or professional code of the profession for which he or she is preparing.

Adherence to these principles is necessary in order to ensure that:

- Everyone is given proper credit for his or her ideas, words, results, and other scholarly accomplishments.
- All student work is fairly evaluated and no student has an inappropriate advantage over others.
- The academic and ethical development of all students is fostered.
- The reputation of the University for integrity in its teaching, research, and scholarship is maintained and enhanced.

Failure to uphold these principles of academic integrity threatens both the reputation of the University and the value of the degrees awarded to its students. Every member of the University community therefore bears a responsibility for ensuring that the highest standards of academic integrity are upheld.

STUDENT WELLNESS SERVICES

Just In Case Web App http://codu.co/cee05e

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.

Counseling, ADAP & Psychiatric Services (CAPS)
(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901/ www.rhscaps.rutgers.edu/

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

Violence Prevention & Victim Assistance (VPVA)
(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / www.vpva.rutgers.edu/

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

Disability Services
(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / https://ods.rutgers.edu/

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at

the campus where you are officially enrolled, participate in an intake interview, and provide documentation: https://ods.rutgers.edu/students/documentation-guidelines. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: https://ods.rutgers.edu/students/registration-form.

Scarlet Listeners
(732) 247-5555 / http://www.scarletlisteners.com/

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.