

PLANT CELL AND DEVELOPMENTAL BIOLOGY
PCB 6528, section 7354, 3 credits
SPRING 2023

MEETING TIME and PLACE

MWF, 3rd Period (9:35 - 10:25 a.m.), 2318 Fifield Hall

INSTRUCTORS

Gilles J. Basset, Course Coordinator

Horticultural Sciences Department

1109 Fifield Hall

gbasset@ufl.edu

352-273-4808

By appointment

Kevin Folta

Horticultural Sciences Department

1251 Fifield Hall

kfolta@ufl.edu

352-273-4812 or 352-273-4766

Office hours TBA on an individual basis by
appointment

COURSE DESCRIPTION

The main objective of this course is for students to obtain a basic knowledge of the organization, dynamics, and development of plant cells and organs. Students should additionally learn the experimental approaches commonly used in plant cellular and developmental biology research and critically evaluate literature that forms the basis for current knowledge in these fields.

This course has four modules that are classified as: cellular organization and evolution, organelle genomes and transcription, signal transduction, and plant development. Each module reintroduces student to the basic concepts of cell and organelle biology. Students are quickly propelled into analyzing primary literature as a source of scientific knowledge and taught how to read and critique papers, gather information from multiple sources independently, design experiments, and interpret data. Successful completion of PCB 6528 will establish a strong foundation for advanced specialty courses, will complement advanced courses in molecular biology, and will provide the tools necessary for a career in experimental sciences.

LEARNING OBJECTIVES AND OUTCOMES

Students who successfully complete the reading and discussion of current research papers and lecture presentations in all four modules will be able to:

- Critically read and evaluate experimental science related to endosymbiosis, cellular evolution, cellular organization, and cellular dynamics, and development of plant cells and organs, and be able to explain the experiments to others.
- Find and utilize computational biology methods (e.g. prediction of subcellular targeting, co-expression analysis and gene network modeling) that graduate students can apply to their own research
- Find the required background material necessary to understand primary papers through web and reference database searches (e.g. KEGG, SUBA4, BRENDA) and textbook consultation
- Design experiments to test hypotheses using the information and techniques presented to them in lectures and papers.

PREREQUISITES

PCB 5065 Advanced Genetics or PCB 5530 Plant Molecular Cell Biology or permission

CLASS AND EXAM SCHEDULE

| Month | Date | Topic | Instructor |
|-------------------------|------|--|------------------------------------|
| Sections 1 and 2 | | | |
| January | M09 | Cell organization and organelle origins [1] | Basset |
| | W11 | Cell organization and organelle origins [2] | Basset |
| | F13 | Witnessing endosymbiosis | Basset |
| | M16 | Martin Luther King Jr. Day | |
| | W18 | Witnessing intracellular gene transfer (mitochondria > nucleus) [1] | |
| | F20 | Witnessing intracellular gene transfer (plastids > nucleus) [2] | Basset |
| | M23 | Structure and content of land plant plastomes | Basset |
| | W25 | Observing plastids in living cells (micrographs and movies) [1] | Basset |
| | F27 | Homework 1 (Horizontal gene transfer of organelle genomes and transplastomics) | Basset |
| | M30 | Observing plastids in living cells (micrographs and movies) [2] | Basset |
| February | W01 | Plastid division | Basset |
| | F03 | Structure and content of land plant chloroplasts | Basset |
| | M06 | Transcription in plastids and mitochondria | Basset |
| | W08 | Observing mitochondria in living cells (micrographs and movies) | Basset |
| | F10 | Import machineries of organelles- Plastids and mitochondria | Basset |
| | M13 | Retention of membrane proteins in the ER and the Golgi apparatus | Basset |
| | W15 | Homework 2 (Predictions of subcellular targeting) | Basset |
| | F17 | Import machineries of organelles- Peroxisomes and nucleus | Basset |
| | M20 | Subcellular fractionation methods | Basset |
| Section 3 | | | |
| | W22 | Covalent Protein Tagging/Proteolysis | Folta |
| | F24 | Introduction to hormones-what they are and how they work | Folta |
| | M27 | Auxins | Folta |
| March | W01 | Discussion paper | Folta |
| | F03 | Two-component regulators, ethylene and cytokinins | Folta |
| | M06 | Strigolactones | Folta |
| | W08 | SA, JA and pathogens | Folta |
| | F10 | Discussion paper | Folta |
| | | M20 | Spring Break (March 13 – March 17) |
| | M20 | Discussion paper | Folta |

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| | W22 | Phytochrome Signaling and Integration | Folta |
| | F24 | Blue Light Signaling and Response/Circadian Clocks | Folta |
| | M27 | Discussion paper | Folta |
| | Section 4 | | |
| | W29 | Homework 3 (Experimental designs for GFP-fusion strategies) | Basset |
| | F31 | Observing peroxisomes, ER, Golgi and nucleus in living cells (micrographs and movies) [1] | Basset |
| April | M03 | Observing peroxisomes, ER, Golgi and nuclei in living cells (micrographs and movies) [2] | Basset |
| | W05 | Observing peroxisomes, ER, Golgi and nuclei in living cells (micrographs and movies) [3] | Basset |
| | F07 | Discussion paper (ER/Golgi targeting) | Basset |
| | M10 | Cytokinesis | Basset |
| | W12 | Cytokinesis (micrographs and movies) | Basset |
| | F14 | Discussion paper (Peroxisome purification and proteomics) | Basset |
| | M17 | Discussion paper (Cryptic targeting signals/Dual targeting) | Basset |
| | W19 | Homework 4 (Plastoglobule targeting) [1] | Basset |
| | F21 | Homework 4 (Plastoglobule targeting) [2] | Basset |
| | M24 | Plasmodesmata [1] | Basset |
| | W26 | Plasmodesmata [2] | Basset |

READING

There is no required textbook for this course. However, there will be a great quantity of required reading in the form of review and research articles from the primary literature. These will be provided in electronic format. Discussion papers will be provided one week prior to the scheduled discussion. Papers will be emailed to students or the references given, allowing students to download papers, which will be freely available to members of the UF faculty and student body through the library system. Students are queried for availability of computers and color printers and accommodations will be made to ensure that each student has access to high quality reproductions of class notes and research papers. Each section of the course will feature a discussion paper from the current literature. The following books may be useful for background reading on various topics.

1. Molecular Biology of the Cell, 4th edition. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. New York: Garland Science; 2002. This book is available in search mode on NCBI's Pubmed
2. Biochemistry and Molecular Biology of Plants, B. Buchanan, W. Gruissem & R. Jones, 2000, ASPP (ISBN 0-943088-39-9) Wiley and sons.

CLASS ATTENDANCE

Students are expected to attend all class sessions. Attendance at sessions featuring a Discussion Paper is mandatory. Class attendance and participation are a major component of student's grades.

CLASSROOM ETIQUETTE

You are expected to be courteous to your fellow students, be on time and turn off your cell phones. Your attendance at all classes is a firm expectation, but if you are ill or an emergency occurs, you are expected to contact your instructor prior to the scheduled class time.

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

GRADING POLICY

The four sections of this course will be graded independently and non-cumulatively. The final grade will be determined by performance on 4 sections. Each section will be worth 100 points. For Sections 1/2 and 4 (Basset), homeworks will be assigned and graded and will constitute 80% of the grade. Active participation in class discussions is an essential part of this course and will constitute 20% of the grade. For Sections 3 (Folta), a section exam will test student comprehension of the material and ability to apply it to novel situations and will constitute 80% of the grade; 20% of the grade will be assigned to lecture and paper discussions.

The final grading scale is based on historical performance cut offs, as shown in the table below:

| Letter Grade* | Grade Points** | Percentage |
|---------------|----------------|------------|
| A | 4.0 | 80-100 |
| B+ | 3.33 | 70-79 |
| B | 3.0 | 60-69 |
| C+ | 2.33 | 55-59 |
| C | 2.0 | 40-54 |
| E | 0 | <39 |

*Letter grades below C are not considered passing grades at the graduate level, therefore not included. Letter grades A- and B- do not reflect a statistically different performance at the graduate level and are not included.

**Information on current UF general grades and grading policies can be found at <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx> and at the Graduate Catalog at <http://gradcatalog.ufl.edu/content.php?catoid=2&navoid=762#grades>

EXAMS

The course is divided into four sections. Sections 1/2 and 4 will be graded based on the continuous evaluation of homework. Sections 3 will have an exam following the completion of the section. Exams are either closed book/notes or take-home (see schedule). If a student has another exam scheduled for the time of a PCB 6528 exam, or if a PCB 6528 exam falls on a religious holiday that a student traditionally observes, an alternate time will be arranged for that student's exam. Please notify the instructor of these conflicts in advance of the exam. Students who cannot take a scheduled exam due to illness or last minute emergencies should contact the instructor prior to the exam if at all possible. Arrangements will be made for a makeup exam in those cases.

ACADEMIC HONESTY

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *"We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on

all work submitted for credit at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment."*

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

SOFTWARE USE

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

SERVICES FOR STUDENTS WITH DISABILITIES

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

- **Disability Resource Center, 0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/**

CAMPUS HELPING RESOURCES

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- **University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu/cwc**
 - Counseling Services
 - Groups and Workshops
 - Outreach and Consultation
 - Self-Help Library
 - Training Programs
 - Community Provider Database
- **Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu**