

PLANT BIOCHEMISTRY AND MOLECULAR BIOLOGY

SYLLABUS

This is an ONLINE course, part of ACCEPtS, available to students at Mississippi State University, Louisiana State University, Oklahoma State University, and the University of Arkansas.

INSTRUCTOR

Dr. Sorina Popescu

Department of Biochemistry, Molecular Biology, Entomology and Plant Pathology
Mississippi State University
Mississippi State, MS, 39759

Office Hours: Mondays and Wednesdays, 10 am to 12 pm

Email: Course Messages/MyCourses

Skype: scpopescu781

Office phone: 662-325-7735

Preferred method for reaching instructor: email, phone, skype (by appointment only).

CLASS ORGANIZATION:

The course will use the on-line MyCourses (Blackboard) management system at MSU. Students at other ACCEPtS Universities will be provided a MSU NetID to access MyCourses after enrolling in this course. Course materials (lectures, lecture notes, assignments, quizzes, etc.) will be posted weekly on MyCourses. Students are responsible for following all posted materials and submitting work on time. All quizzes and exams will also be administered through MyCourses unless otherwise specified. You will need your MSU NetID to access MyCourses. All questions and troubleshooting pertaining to MyCourses and accessing the on line materials will be resolved by the IT Help Desk <http://www.its.msstate.edu/Services/report-problem.php> or (662) 325-0631.

COURSE PREREQUISITES:

(1) Ability to use MyCourses/Blackboard system at MSU. **(2)** It is required that the student passed inorganic and organic chemistry, as the concepts discussed in this course rely on materials covered in these courses.

COURSE MATERIALS:

- **Required Textbook:** *Biochemistry & Molecular Biology of Plants*, 2nd edition, edited by Bob. B. Buchanan, Wilhelm Gruissem, and Russell L. Jones. ASBP and Wiley Blackwell, ISBN: 9780470714218. The ebook is available at <https://login.proxy.library.msstate.edu>
- **Published literature (journal articles)** – as needed to complete term projects.

EXPECTED LEARNING OUTCOMES:

- At the end of the course the conscientious student will: (a) Enumerate and define the general features and characteristics of the biomolecules and structures present in the plant cell; (b) Describe the fundamental biochemical processes involved in replication, metabolism and energy transformation in the plant cell; and, (c) Explain and give examples of how modern technology has impacted the field of plant biology.
- Course assignments will expose students to recent scientific literature; the assignments will link the class material with current research and foster development of student's scientific writing skills and critical thinking. Students will learn to represent biochemical pathways in standardized biochemical semantics and draw models of biochemical or regulatory pathways.

COURSE DESCRIPTION:

A comprehensive study of the structural organization and biochemical processes of plant cells, alongside ample discussions of the recent advancements in plant biology and the impact of molecular genetics on the field. The course is structured in five main units:

- (1) **Cell Organization.** This section is devoted to the general features and molecular organization of the plant cell, and includes information on membranes, organelles, cell wall, and protein transport and targeting among others.
- (2) **Cell Replication.** The unit will cover aspects of the structure and function of nucleic acids, amino acids and lipids, alongside examples of molecular, biochemical and genetic investigative approaches and applied research in plants.
- (3) **Pathways for Energy Flow** will cover fundamental aspects of photosynthesis, carbohydrate metabolisms, and the biochemical basis and roles of respiration and photorespiration in plants.
- (4) **Metabolism and Developmental Regulation.** This unit is devoted to plant-specific aspects of long-distance transport of resources and signals in vascular plants, and an overview of the uptake and use of the essential plant elements, nitrogen and sulfur.
- (5) **Fundamental discoveries: Plant-Environment-Agriculture.** This section will discuss molecular mechanisms underlying plant responses to biotic and abiotic stress factors, and will highlight modern methods and fundamental discoveries that impact our understanding of crops and plants in their native environment.

GRADING POLICY: Your final grade is based on three comprehensive exams (exam 1, 2 and 3), end-of-lecture quizzes, unit discussion assignments, and an individual study assignment (only graduate students). The final grade for this class is based on the scales below (numbers represent percentages):

Points:

Syllabus pre-test - 10

End-of-Lecture Quizzes – 100

Unit Assignments/Discussion – 100

Exam 1 – 100

Exam 2 – 100

Exam 3 (final) – 100

Review Paper: Abstract (graduate students) – 50

Review Paper: Review of literature (graduate students) – 100

Review Paper: Figures (graduate students) – 50

Total = 510/710 (undergraduate/graduate students)

Undergraduates

A = 90-100

B = 80-89

C = 70-79

D = 60-69

F = Below 60

Honors, graduates:

A = 92-100

B = 82-91

C = 70-79

D = 60-69

F = Below 60

Additional information on line Quizzes, Exams and Assignments

- **The pre-test** will verify your understanding of the course organization and syllabus.
- **End-of the lecture quizzes** will be administered at the end of each weekly lecture and will test the material covered in the lecture slides. Quizzes are administered online through MyCourses and can be taken at any time during each week of the course. Students will have only one attempt per quiz.

- **Exams 1, 2 and 3** will test the understanding of material from several course units (5 or less, as specified). These exams are proctored, timed (60-70 minutes per exam), comprehensive, and administered on site at each ACCEPtS University. Failure to complete an exam will result in 0 points unless previously discussed with the instructor.
- **End-of-Unit discussion and assignment** will cover the material of the respective unit and will include short assignments in the form of questions with open-ended answers or the representation of biochemical pathways using biochemical semantics. The discussions will take place on the *Discussion Board* (MyCourses). Students are required to post an answer to each unit assignment and engage in meaningful discussions with their peers on the specific topic. Both actions – (1) posting an answer) and (2) peer-to-peer discussion – will be graded. The assignment will be posted at the beginning of each unit and kept open for the duration of the unit.
- **Make-up Exam.** All the material covered in the required textbook and additional reading material can be subject to examination. A missed exam or assignment receives a grade zero, unless an advisor's (in the case of a conflicting university-sponsored activity) or physician's statement (in the case of illness) is provided regarding such failures. NO late work will be accepted.
- **Written assignments (Review paper).** Submit your assignment as a pdf file using the *SafeAssign* tool on MyCourses website. After submission, your written report will be checked against a database of published works and an originality report will be generated. I will examine the originality report to determine if proper citations and quotations were used in your written assignment (see below *Copyright and Fair Use Considerations*). Assignments showing improper or abundant use of published material (*SafeAssign* scores over 40) will receive a score of 0.

ONLINE CLASSROOM BEHAVIOR, DECORUM AND CIVILITY:

Students are required to obey the rules for the on line etiquette. Here are some general directions: Avoid communicating in ALL CAPS letters, which is the net equivalent to shouting. Always include a subject in the subject line to identify the purpose of your message; be brief and to the point. Never post personal information. Avoid using emoticons, slang or texting abbreviation. Ensure your posts contribute to the discussion prompts and your fellow classmates thoughts. State more than 'I agree' or 'good job'. Contribute a new and fresh perspective to the conversation. Be open minded and considerate of other's posts and point-of-view.

STUDENT Support Services. Students with a documented disability that requires academic accommodations, please notify the instructor as soon as possible. In order to receive accommodations in this course, you must provide a Letter of Accommodation from Student Support Services for coordination of campus disability services available to students with disabilities. Students who need additional academic accommodations are also encouraged to contact Julie Capella, at the Office of Student Support Services and Disability Support Services (662-325-3335) or visit <http://www.sss.msstate.edu>.

Copyright and Fair Use considerations in preparing the written report. The written assignment should be, in its entirety, a reflection of your own reasoning. All images or text from the reading material provided that you may use in your report, should be properly cited and quoted, respectively. Limit the use of published material (figures, text or diagrams) - use the minimum necessary to make your point. In case additional published material are selected from MSU Library to support your answers or bring additional relevant information, you should properly cite them in your work. List all those additional sources at the end of your assignment under the title "References". We can use open access materials or other Internet resources for which the "terms and conditions" permit the use; please cite all sources in your report. Additional guidance and help regarding copyright and fair use facts and resources can be found at <http://guides.library.msstate.edu/content.php?pid=20135&sid=157790>, a site maintained by the MSU Libraries (<http://lib.msstate.edu/>).

Title IX. MSU is committed to complying with Title IX, a federal law that prohibits discrimination, including violence and harassment, based on sex. All educational programs and activities at MSU must be free from sex discrimination, sexual harassment, and other forms of sexual misconduct. If you or someone you know has experienced sex discrimination, sexual violence and/or harassment by any member of the University community, you are encouraged to report the conduct to MSU's Direction of Title IX/EEO Programs at 325-8124 or by email to titleix@msstate.edu. Additional resources are available at <http://www.msstate.edu/web/security/title9-12.pdf> or at <http://students.msstate.edu/sexualmisconduct/>.

MSU Student Honor Code. The MSU honor code is as follows: "As a Mississippi State University student, I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do." Students will be required to state their commitment to the Honor Code on all academic work, including examinations. MSU is committed to promote academic integrity and to reduce academic misconduct. Academic misconduct can have serious consequences for student's final evaluation and grading in this course (Grade of "F"). Please visit: <http://honorcode.msstate.edu/policy>.
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– Mississippi State University Honor Code

Other Important Notes. Students are expected to follow all policies and procedures listed in the MSU AOP 10.08 – Classroom Regulations including procedures related to the use of cell phones and electronic devices during exams and quizzes. The Course Instructor reserves the right to make changes to the Syllabus during the semester; changes will be announced via MyCourses or in class.

COURSE TOPICS AND STRUCTURE:

Unit 1 – Plant Cell Compartments (WEEKS 1 and 2)

Lecture 1: Membrane Structure; Membranous Organelles;
Lecture 2: The Cell Wall
Lecture 3: Membrane Transport; Protein Targeting
Lecture 4: The Cytoskeleton and its role in transport

Unit 3 – Plant Cell Reproduction (WEEKS 3 and 4)

Lecture 5: Nucleic acids
Lecture 6: Genome Structure and Organization
Lecture 7: Amino acids, Protein Synthesis, Folding and Degradation;
Lecture 8: Fatty acids, membrane lipids, storage lipids

Unit 4 – Metabolic and Developmental Integration (WEEKS 5-7)

Lecture 9: Long-Distance Transport
Lecture 10: Biosynthesis of Hormones
Lectures 11 and 12: Signal Transduction
Lectures 13 and 14: Senescence and Cell Death

Unit 5 – Plant Environment and Agriculture (WEEKS 8-10)

Lectures 15 and 16: Responses to Plant Pathogens;
Lectures 17 and 18: Response to Abiotic Stress
Lectures 19 and 20: Mineral Nutrients Acquisition, Transport and Utilization

COURSE ORGANIZATION:

Week	Topic	Contact hours
1	Composition, synthesis, and functions of nucleic acids (DNA, RNA)	4
2	Genome structure and organization; regulation of gene expression	4
3	Composition, synthesis, and functions of amino acids	4
4	Protein synthesis, folding and degradation	4
EXAM 1 (covers Week 1-4) Abstract of review paper due (graduate students)		
5	Composition, synthesis, and functions of lipids; genetic engineering of lipids	4
6	Biosynthesis of plant hormones (gibberellins, abscisic acid, cytokinins, auxins, ethylene, brassinosteroids, polyamines, jasmonic acid, salicylic acid, and strigolactones)	5
7	Molecular and biochemical mechanisms in signal transduction (signal perception, intracellular signal transduction, hormone signal transduction, signal integration)	5
EXAM 2 (covers Week 5-7)		
8	Responses to plant pathogens (pathways for PAMP-triggered immunity and Effector-triggered immunity)	5
9	Responses to plant pathogens (local and systemic defense signaling, control of plant pathogens by genetic engineering)	5
10	Responses to abiotic stress (gene expression and signal transduction in oxidative stress, cross talk in stress responses)	5
EXAM 3 – comprehensive Review paper and figure(s) due (graduate students)		
TOTAL		45