

Botany 780 Plant Metabolism / Stress Physiology

Spring Semester, 2005

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Class Meetings: Monday 12:30-1:45, Wednesday 4:00-5:15, Stevens 329
Prerequisites: Botany 380, Biochemistry 460, or equivalent
Text: Buchanan BB, Gruissem W, Jones RL (2000) Biochemistry and Molecular Biology of Plants. Am Soc Plant Biologists, Rockville, MD

Course Objectives: Botany 780 is a course intended to provide a detailed overview of metabolic processes in plants, with attention given to the continual metabolic adjustments that occur in plants according to the environmental conditions to which they are exposed. The focus will be on carbohydrate and lipid metabolism under normal conditions and how metabolism changes when plants are exposed to various stresses. An additional goal is that lecture topics serve the individual interests of the students, where attention will be given to selected topics and presented within the context of plant metabolism.

Format: The course will consist of two 75-min lectures each week. Students are encouraged to offer questions or comments at any time during the lecture. During an initial organizational meeting, students will have an opportunity to discuss their research and other interests and class time will be allotted to address student-selected topics, ideally as they relate to core topics (listed below). Two class periods will be reserved for a student-centered activity in which students will design a crop plant with a prescribed phenotype. The product of this exercise will be a short group paper. Students will also be responsible for selecting a topic within the context of plant metabolism and for delivering a 30 minute presentation at assigned dates at the end of the semester.

Lecture Topics:

Core Topics

Photosynthesis – Ch. 12
Carbohydrate Metabolism – Ch. 13
Respiration & Photorespiration – Ch. 14
Lipid Metabolism – Ch. 10
Secondary Metabolism – Ch. 24
Biotic Stresses – Ch. 21
 Pathogens, some insects
Abiotic Stresses – Ch. 22
 Cold, light, water

Additional Possibilities

Gene Expression & Signal Transduction
Protein Synthesis & Protein Sorting
Cell Cycle / Tissue Growth
Senescence
Nitrogen Fixation
Nitrogen Assimilation / Amino Acids
Mineral Nutrient Uptake and Utilization
Additional Stresses
 Pollutants, heat, salt, more insects
Other topics

Grading: There will be three exams during the semester that will cover the topics presented in lecture. Exams will be predominantly of an essay and short answer format and will be worth 100 points each. The group paper will be worth 50 points (all students within each group receiving the same score) and presentations will be 50 points. Grades will be assigned according to the standard grading scale:
≥ 90 = "A", 80 - 89.9 = "B", 70 - 79.9 = "C", 60 - 69.9 = "D", < 60 = "F".

Special Needs: Any students who need special accommodations for learning or who have special needs are invited to share these concerns and requests with the instructor as soon as possible.

Academic Responsibility: All work in this course must be completed in a manner consistent with NDSU University Senate Policy, section 335: Code of Academic Responsibility and Conduct (<http://www.ndsu.nodak.edu/policy/335.htm>).

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Tentative Class Schedule

Core Topics

Photosynthesis, Carbohydrate and Lipid Metabolism, Biotic and Abiotic Stresses

Additional Topics Selected According to Student Interests

Effects of stress on cell division, growth, and differentiation; Seed maturation (including formation of oil bodies) and germination; Plant reactions to pollutants

January 11	T	Introduction / Organizational Meeting	
13	R	Photosynthesis Overview / Light Absorption	
17	M	<i>ML King Holiday – No Class</i>	
19	W	Photosynthetic Electron Transport / ATP Synthesis	
24	M	Carbon Fixation / Rubisco	
26	W	Calvin Cycle Regulation / Hexose Phosphates	
31	M	Starch & Sucrose Synthesis	
February 2	W	Starch & Sucrose Synthesis	
7	M	Starch & Sucrose Catabolism	Material for Exam I
9	W	Glycolysis & Oxidative Pentose Phosphate Pathway	
14	M	Exam I	
16	W	TCA Cycle, Regulation of Respiration	
21	M	<i>President's Day – No Class</i>	
23	W	Fatty Acid Synthesis & Metabolism	
28	M	Fatty Acid Metabolism / Oil Body Formation	
March 2	W	Fatty Acid Catabolism / Gluconeogenesis	
7	M	Student Discussion – Plant Engineering Problem	
9	W	Seed Maturation & Germination	Material for Exam II
14	M	<i>Spring Break – No Class</i>	
16	W	<i>Spring Break – No Class</i>	
21	M	Student Discussion – Plant Engineering Problem	
23	W	Exam II	
28	M	<i>Easter Holiday – No Class</i>	
30	W	Secondary Metabolism – Isoprenoids, Phenolics, and Alkaloids	
April 4	M	Response of Plants to Pathogens	
6	W	Response of Plants to Pathogens	
11	M	Responses to Abiotic Stress – cold, drought – Paper Due	
13	W	Responses to Abiotic Stress – oxidative stress, pollutants	
18	M	Cell division, growth, differentiation – influence of stress	
20	W	Catch up	
25	M	Student Presentations	
27	W	Student Presentations	
May 2	M	Student Presentations	
4	W	Student Presentations	
10	T	Exam III 10:30 AM – 12:30 PM	