

PLS/MCB/ECOL/CHEM/BIOC 448/548

Plant Biochemistry and Metabolic Engineering

Tues/Thurs 2:00-3:15pm Shantz 247

Description of Course

This course covers biochemical processes specific to plants and is aimed to allow students to gain an understanding and appreciation of how biochemical components are synthesized and utilized by plants during growth and development and in their interactions with their environment, as well as how these processes can be manipulated. This course includes topics in photosynthesis, carbohydrate, nitrogen, and lipid metabolism, specialized metabolism, and plant metabolic engineering.

Course Prerequisites or Co-requisites

A background in plant biology, general biochemistry or chemistry is expected. Note that concurrent registration in any of these courses will NOT meet this requirement. Students must have completed both semesters of O-chem and a biochemistry course that covers general metabolism prior to taking this course.

Instructor and Contact Information

Office hours are made upon request Mon-Friday 8am-5pm. Email to set up an appointment.

Contact information for Instructor

Monica Schmidt: 303 Keating/BIO5 Institute

Office phone: 626-1643

Email: monicaschmidt@email.arizona.edu

Course Format and Teaching Methods

Course format is lecture only, with all lecture material on D2L.

Course Objectives and Expected Learning Outcomes

This course covers biochemical processes specific to plants and is aimed to allow students to gain an understanding and appreciation of how biochemical components are synthesized and utilized by plants during growth and development and in their interactions with their environment, as well as how these processes can be manipulated. This course includes topics in photosynthesis, carbohydrates, nitrogen and lipid metabolism, specialized metabolism and plant metabolic engineering. Flux and genomics-based techniques, such as proteomics, transcriptomics and metabolomics are discussed in relation to metabolism.

Upon completion of the course, students will be familiar with a range of plant specific biochemical pathways and how they are regulated by the feedback from their environment. Through lectures and exposure to primary literature students will gain an appreciation for the complexity of plant metabolism and the intricate ways pathways intersect and influence each other. Knowledge of basic

pathways and subcellular compartmentalization and regulation are then applied to metabolic engineering efforts. Students will have an opportunity to apply their recent knowledge of biochemistry to current agricultural problems. All students will gain experience in critical thinking through discussions and a critique on a scientific article and graduate student will gain experience at writing a grant pre-proposal. In addition to assignments, there will be four in class exams.

Absence and Class Participation Policy

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>

Participating in the course and attending lectures are vital to the learning process. As such, attendance is highly recommended at all lectures and discussion sections.

Required Texts or Readings

Textbook: *Biochemistry & Molecular Biology of Plants* edited by Bob B. Buchanan, Wilhelm Gruissem, and Russell L. Jones.

Required or Special Materials

None

Required Extracurricular Activities (if any)

None

Assignments and Examinations: Schedule/Due Dates

There will be four equally weighted in-class exams, 1 article critique and 1 in class presentation for all students of this course. In addition, graduate students will have 1 grant pre-proposal. Formats for exams will be short answer and/or essay format. The university scale will be employed for grading purposes. Dependent on performance, we reserve the right to scale the scores of individual examinations or the class as a whole. Exams may not be missed except for medical emergencies (Doctor's note required), or for circumstances leading to a University approved absence form. In these cases, make-up exams will be provided and taken within 48 hrs. Incomplete grades will only be given under exceptional circumstances and with the approval of the instructor, specifying the work to be completed and the timeframe.

Final Examination or Project

The date and time of the final exam or project, along with links to the Final Exam Regulations, <https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information>, and Final Exam Schedule, <http://www.registrar.arizona.edu/schedules/finals.htm>

Grading Scale and Policies

The grading scheme is different for undergraduates (448A) than for graduate students (548A). For undergraduates, the four exams consist of 70% (each 17.5%), article critique 20% and presentation 10%. For graduate students, four exams 55% (each 13.75%), article critique 15%, presentation 10% and grant pre-proposal 20%.

Marking Scheme

	448A	548A
4 tests	70% (17.5% each)	55% (13.75% each) Article
critique	20%	15%
Presentation	10%	10%
Grant proposal	-----	20%

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

Honors Credit

Students wishing to contract this course for Honors Credit should email me to set up an appointment to discuss the terms of the contract. Information on Honors Contracts can be found at <http://www.honors.arizona.edu/faculty-and-advisors/contracts>.

Scheduled Topics/Activities

Aug 23th – Logistics of the course; introduction to plant metabolism
Aug 25th – Protein Interactions
Aug 30th – ER continuity and compartmentalization of metabolic end products I
Sept 1st – ER continuity and compartmentalization of metabolic end products II
Sept 6th – Vesicular trafficking and metabolic compartmentalization I
Sept 8th – Vesicular trafficking and metabolic compartmentalization II
Sept 13th – Biotechnology and the endomembrane system. Eliot Herman Guest Lecturer
Sept 15th – **Test 1**
Sept 20th – Photosynthesis part I
Sept 22th – Photosynthesis part II
Sept 27th – Engineering Photosynthesis
Oct 29th – Plant Respiration
Oct 4th – Nitrogen Metabolism
Oct 6th – Water Usage
Oct 11th – Engineering Nitrogen and/or water usage
Oct 13th – **Test 2**
Oct 18nd – Lipid Biosynthesis part I
Oct 20th – Lipid Biosynthesis part II
Oct 25th – Engineering Lipid Biosynthesis
Oct 27st – Predator Plants. **Pick article in class for critique**
Nov 1st – Secondary Metabolites
Nov 3rd – Engineering Secondary Metabolites
Nov 8th – Chemical Isolation of Secondary Metabolites. Leslie Guest Speaker
Nov 10th --- **Test 3**
Nov 15th – **presentations I**
Nov 17th – **presentations II**
Nov 22nd – Starch and Cell Wall Metabolism. **Grad student's preproposal topic**
Nov 24th – thanksgiving holiday – NO CLASS
Nov 29th – Carbohydrate Engineering
Dec 1rd – Current State of Plant Biotechnology. **Article Critique Due**
Dec 6th – **Test 4**
TBD ---- Final Exam – Grant Pre-proposals Due

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

**As a courtesy to others, please switch off your phones during the class period.
Electronic devices can be used for course work only during class hours.**

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

Accessibility and Accommodations

Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact the Disability Resource Center (520-621-3268) to establish reasonable accommodations. For additional information on the Disability Resource Center and reasonable accommodations, please visit <http://drc.arizona.edu>.

If you have reasonable accommodations, please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.

Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

The University Libraries have some excellent tips for avoiding plagiarism, available at <http://www.library.arizona.edu/help/tutorials/plagiarism/index.html>.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

Dr. Schmidt holds the copyright in the lectures and course materials. Copyright includes student notes or summaries that reproduce these lectures or materials. These course materials are made available only for personal use by students, and students may not distribute or reproduce the materials for commercial purposes without your express written consent. Violation of this copyright may result in course sanctions and violate the Code of Academic Integrity.

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students

UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>

Student Assistance and Advocacy information is available at <http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Confidentiality of Student Records

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.