

BSPM 581A2 Plant Biochemistry in Agriculture Fall 2018

Instructor

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662-816-6214. Office hours- most mornings
111 Weed Research Laboratory

Meeting time and place

Monday, Wednesday and Friday
Conference room in Weed Research Laboratory

Targeted Student Population

The course is intended for graduate students in the plant sciences, such as botany, plant ecology, crop science, weed science or horticulture, but it is opened to other students with general interest in plants.

Course Learning Objectives

Upon successful completion of the 10 modules, computer modeling sessions and projects related to agriculture and health in this course, students will be able to do the following:

Module 1 – identify the building blocks of proteins and their assembly in macromolecules as well as interpret basic enzyme kinetic parameters

Module 2 – explain the conversion of light energy into chemical energy in photosynthesis

Module 3 – contrast the different mechanisms of carbon fixation in the plant kingdom

Module 4 – interpret the role ammonia assimilation in photorespiration

Module 5 – illustrate the carbon flow from glycolysis to carbohydrate synthesis

Module 6 – discuss various ways to manipulate fatty acid synthesis to benefit mankind

Module 7 – describe the relationships between the biosynthesis of photosynthetic pigments

Module 8 – contrast the role of sulfur assimilation in amino acid synthesis

Module 9 – differentiate the amino acid biosynthesis pathways

Module 10 – characterize the main biosynthetic pathways of natural products

Computer Modeling Practicum –build protein homology models and analyze key structural features
Plant Biochemistry in Agriculture and Health – explain how plant biochemistry plays a key role plant productivity, response to its biotic and abiotic environment, and has a positive influence on human health

This course will provide students with an experiential learning environment leading to mastery of biochemical methods of enzyme purification and assays, and important plant biochemical pathways. A theme that will underlie all of these areas will be the structure and function of enzymes in metabolic pathways and the contributions of these pathways to plant growth and development. To that end, students will become proficient in basic modeling of proteins throughout the semester. When appropriate, topics are taught as problem-based situations related to plant productivity, stress responses, chemical ecology and the production of secondary metabolites of importance to mankind. Students will be able to critically read the scientific literature pertaining to plant biochemistry and metabolism.

Course content

Module 1

2 –Plant Biochemistry in Agriculture Syllabus

Course learning objectives: Upon successful completion of this module, students will be able to identify the building blocks of proteins and their assembly in macromolecules as well as interpret enzyme kinetic parameters

Course content/topics: Amino acids, their assembly into macromolecules, and principles in enzymology

Objective level: Mastery

Module 2

Course learning objectives: Upon successful completion of this module, students will be able to explain the conversion of light energy into chemical energy in photosynthesis

Course content/topics: Light Reactions of Photosynthesis

Objective level: Mastery

Module 3

Course learning objectives: Upon successful completion of this module, students will be able to contrast the different mechanisms of carbon fixation in the plant kingdom

Course content/topics: Carbon fixation in C3 plants and variations in mechanisms of CO₂ fixation across the plant kingdom

Objective level: Mastery

Module 4

Course learning objectives: Upon successful completion of this module, students will be able to interpret the role ammonia assimilation in photorespiration

Course content/topics: Comprehensive study of photorespiration, ammonia assimilation and recycling

Objective level: Mastery

Module 5

Course learning objectives: Upon successful completion of this module, students will be able to illustrate the carbon flow from glycolysis to carbohydrate synthesis

Course content/topics: Glycolysis and citric acid cycle, carbohydrate metabolism; sucrose and starch synthesis

Objective level: Engagement

Module 6

Course learning objectives: Upon successful completion of this module, students will be able to discuss various ways to manipulate fatty acid synthesis to benefit mankind

Course content/topics: Structure and function of lipids; fatty acid biosynthesis, synthesis of membrane lipids

Objective level: Engagement

Module 7

Course learning objectives: Upon successful completion of this module, students will be able to describe the relationships between the biosynthesis of photosynthetic pigments

Course content/topics: Introduction to terpenoids and their involvements in carotenoid and chlorophylls

Objective level: Mastery

Module 8

Course learning objectives: Upon successful completion of this module, students will be able to explain the importance of sulfur and its assimilation in amino acid synthesis

3 –Plant Biochemistry in Agriculture Syllabus

Course content/topics: Overview of N and S assimilation, nitrate uptake and reduction

Objective level: Engagement

Module 9

Course learning objectives: Upon successful completion of this module, students will be able to differentiate the different amino acid biosynthesis pathways

Course content/topics: Glycine and serine synthesis and aminotransferase reactions; branched-chain amino acid, threonine and lysine metabolism; proline, arginine; non-protein amino acids; Cysteine and methionine synthesis and metabolism

Objective level: Engagement

Module 10

Course learning objectives: Upon successful completion of this module, students will be able to characterize the main biosynthetic pathways of natural products

Course content/topics: Natural products derived from aromatic amino acids and terpenoid pathways

Objective level: Engagement

Computer Modeling Practicum

Course learning objectives: Upon successful completion of this series of Computer Modeling sessions, students will be able to build protein homology models

Course content/topics: Blast protein databases, align protein sequences, build protein homology models, and evaluate the quality of these models

Objective level: Engagement

Plant Biochemistry in Agriculture and Health Projects

Course learning objectives: Upon successful completion of this series of projects on Plant Biochemistry in Agriculture and Health, students will be able to explain how plant biochemistry plays a key role plant production, response to its biotic and abiotic environment, and has a positive influence on human health

Course content/topics: Improving insect resistance, plant allergens, importance of glutamine synthetase, genetic engineering of lipids, frost tolerance, microbial toxins

Objective level: Engagement

Affected Department

1170 - Soil and Crop Sciences

1173 - Horticulture & Landscape Architecture

1401 - Warner College of Natural Resources

1472 - Forest & Rangeland Stewardship

1870 - Biochemistry & Molecular Biology

1878 - Biology

1476 - Ecosystem Science & Sustainability

Course Prerequisites

Students should have completed a course in BZ440 (Plant Physiology), HORT476 (Environmental Plant Stress Physiology) and a course general chemistry or equivalent with a grade of C or better.

Recommended Textbook

Biochemistry and Molecular Biology of Plants (2015) Buchanan, Gruissem and Jones, 2nd Edition, Wiley.

4 –Plant Biochemistry in Agriculture Syllabus

ISBN: 978-0-470-71421-8

Course Home Page

From Canvas, you will be able to access notes and lecture slides, take quizzes, view the course calendar, view exam scores, access study questions, read course announcements and find information concerning assignments.

Attendance Policy and Participation

Regular attendance in class is expected because successful completion of the course is highly unlikely without direct participation in the lecture instructor-student dialog and discussion of the course content. Lecture notes and slide sets serve primarily as an outline to direct the content presented in lectures, and should not be considered a detailed account of all content presented in the lectures. Attendance to the Student-Centered Projects and Computer Modeling sessions are required.

Occasional unavoidable absences will not necessarily impact student performance in the course. However, if extended absences become necessary, the student should contact the course organizer to discuss options and strategies of how to make up missed work.

Participation will be assessed according to the following criteria:

- Preparedness: the extent of your reading, analyzing and understanding of the material, demonstrated by contribution to discussion.
- Contribution to discussion: the extent to which you volunteered answers, asked relevant questions, expressed your own opinions and analyzed the contributions of others.
- Group skills: the extent to which you allowed others to contribute, avoided class domination, shared ideas with others, assisted others, provided positive feedback to others and exhibited tolerance and respect for others.
- Communication skills: the quality of your expression, clarity, conciseness, use of appropriate vocabulary, confidence.

Quizzes

A total of 10 quizzes will be given, in class or on Canvas. Quizzes given on Canvas will be open-book, but must be completed in 20 minutes. They will appear as pop-up windows—be sure this feature is enabled in your web browser.

The quizzes will consist of 5 – 10 questions on the previous two week's lectures, and each will count 10 points. The quizzes will test vocabulary, structures, and pathway details. The instructor reserves the option of adding quizzes not shown on the syllabus, replacing quizzes by homework assignments, or cancelling quizzes.

Course Projects

Students will be required to participate in 7 Plant Biochemistry in Agriculture and Health Projects based on critical reading of scientific articles and 7 Computer Modeling Sessions.

Exams

There will be two exams and a final, which are each 100 points. Exams are not comprehensive and will cover the lectures specified on the schedule. However, some questions may require knowledge of material covered on previous exams. Exams will consist of questions (multiple-choice, fill in the blank, short and long answer) and problems. Exams will cover details of structure, function, and pathways, major concepts, problem solving, data analysis. Each exam will be given two scores, the raw score and the scaled score. The raw score is the number of points answered correctly on the exam. The scaled

5 –Plant Biochemistry in Agriculture Syllabus

score is the raw score plus a scaling factor, which weights the exam for difficulty. This system allows use of questions that are challenging for everyone in the class.

Exam and Assignment Policy

Everyone will receive access to exams and Assignments on the same day. I encourage you to make your best effort to submit all assignments and exams on time, but I understand that sometimes circumstances arise that are beyond your control. Students that miss an exam due to illness, family emergencies, or other University approved excuses will be able to make up exams by special arrangement.

Please note that assignments submitted late without prior approval will not be eligible for full credit. Exceptions are EXTREMELY limited.

For athletes and others with schedule conflicts; prior arrangements must be made.

Students who use alternative testing at RDS can contact me prior to the exam to make arrangements and sign applicable paperwork.

Please contact me ASAP if you miss an exam (preferably the day of the exam)

Grading Policy

Participation	10%
Quizzes	15%
Course projects	45%
Exams	30%

Grading will be based on the standard CSU grading policies found in the Graduate Catalog: <http://catalog.colostate.edu/general-catalog/academic-standards/grading/#grading-scale>

This course will adhere to the Academic Integrity Policy {Section 1.6} of the Colorado State University General Catalog, the Student Conduct Code, and University Principles of Community.

Please refer to The University Principles of Community found on page 9 of this syllabus.

Please refer to our cheating and plagiarism policy found on the Canvas homepage and page __ of this syllabus.

Student Conduct Code: <http://www.conflictresolution.colostate.edu/conduct-code.aspx#conduct>

Colorado State University General Catalog: <http://www.catalog.colostate.edu/>

Accommodations for Students with Disabilities

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.

The CSU Libraries Help Desk provides both research (970-491-1841) and technical (970-491-7276) support. Virtual assistance is also available via the Libraries' Ask Us chat and email services (<https://lib.colostate.edu/services/ask-us/>). In addition, Renae Watson is the librarian supporting this

course. Contact her for assistance at renae.watson@colostate.edu / ph. 970-491-5338. See her research guide at libguides.colostate.edu/agriculture

Principles of Community

In this course we strive to follow and extend Colorado State's University's Principles of Community, and welcome spirited discussion, lively debate and pursuit of knowledge in a manner that respects each of us as individuals.

The Principles of Community support the Colorado State University mission and vision of access, research, teaching, service and engagement. A collaborative and vibrant community is a foundation for learning, critical inquiry, and discovery. Therefore, each member of the CSU community has a responsibility to uphold these principles when engaging with one another and acting on behalf of the University.

Inclusion: We create and nurture inclusive environments and welcome, value and affirm all members of our community, including their various identities, skills, ideas, talents and contributions.

Integrity: We are accountable for our actions and will act ethically and honestly in all our interactions.

Respect: We honor the inherent dignity of all people within an environment where we are committed to freedom of expression, critical discourse, and the advancement of knowledge.

Service: We are responsible, individually and collectively, to give of our time, talents, and resources to promote the well-being of each other and the development of our local, regional, and global communities.

Social Justice: We have the right to be treated and the responsibility to treat others with fairness and equity, the duty to challenge prejudice, and to uphold the laws, policies and procedures that promote justice in all respects.

Need Help? Rams Take Care of Rams

Reach out and ask for help if you or someone you know is having a difficult time. Always feel free to come and talk to me; I will always make myself available to help connect you with any resources you need. CSU is a community that cares for you. If you are struggling with drugs or alcohol and/or experiencing depression, anxiety, overwhelming stress or thoughts of hurting yourself or others please know there is help available. Counseling Services has trained professionals who can help. Contact 970-491-6053 or go to <http://health.colostate.edu>. If you are concerned about a friend or peer, tell someone by calling 970-491-1350 (or visit <http://safety.colostate.edu/tell-someone.aspx>) to discuss your concerns with a professional who can discreetly connect the distressed individual with the proper resources. Rams take care of Rams.

Title IX: Sexual Assault, Sexual Violence, Sexual Harassment:

CSU's Discrimination, Harassment, Sexual Harassment, Sexual Misconduct, Domestic Violence, Dating Violence, Stalking, and Retaliation policy designates faculty and employees of the University as

“Responsible Employees.” This designation is consistent with federal law and guidance, and requires faculty to report information regarding students who may have experienced any form of sexual harassment, sexual misconduct, relationship violence, stalking or retaliation. This includes information shared with faculty in person, electronic communications or in class assignments. As “Responsible Employees,” faculty may refer students to campus resources (see below), together with informing the Office of Support and Safety Assessment to help ensure student safety and welfare. Information regarding sexual harassment, sexual misconduct, relationship violence, stalking and retaliation is treated with the greatest degree of confidentiality possible while also ensuring student and campus safety.

Any student who may be the victim of sexual harassment, sexual misconduct, relationship violence, stalking or retaliation is encouraged to report to CSU through one or more of the following resources:

-Emergency Response 911

-Deputy Title IX Coordinator/Office of Support and Safety Assessment (970) 491-1350

-Colorado State University Police Department (non-emergency) (970) 491-6425

Please Visit: <http://oeo.colostate.edu/title-ix-sexual-assault> for more information.

Service Animals in the Classroom

This course will follow all of the policies regarding service animal access to the classroom. The full university policy may be found here: <http://policylibrary.colostate.edu/policy.aspx?id=747> .

Plagiarism and Academic Integrity

We take the issue of academic integrity very seriously in this course. You are expected to do your own work and to not access notes or the web during an exam, copy from someone else's exam or to provide exam answers to another student during an exam. We reserve the right to proctor all exams and will take actions to ensure that all students are following this policy.

Plagiarism

"Plagiarism includes the copying of language, structure, ideas, or thoughts of another, and representing them as one's own without proper acknowledgment. Examples include a submission of purchased research papers as one's own work; paraphrasing and/or quoting material without properly documenting the source" (CSU Policies and Guiding Principles, 2017-2018).

Our motivation for rigorously enforcing a no-plagiarism policy is twofold: First, plagiarism is a form of theft. Taking someone else's words or ideas without attribution is stealing someone else's work. Second, copying someone else's work does not fulfill the purpose of the assignment, which is for you to develop critical thinking and analysis skills. You demonstrate this by presenting your own, new, synthesis and analysis in your writing. Simply copying or paraphrasing from source materials does not demonstrate

8 –Plant Biochemistry in Agriculture Syllabus

this, however insightful the source(s) may be. Good writing generates new knowledge. This should be your goal in this class, in other courses at CSU and in your career after you leave here.

In this course all written work will be spot checked for plagiarism issues by both instructors and originality checking software such as VeriCite. If you are caught plagiarizing materials you will receive a 0 for the assignment/exam/project, and depending upon the severity of the offense, an F in the course. All examples of plagiarism or academic dishonesty and will be reported to the Office of Conflict Resolution and Student Conduct Services for additional disciplinary action as outlined in the student handbook under the heading "academic integrity/Misconduct" (<http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/>).

Canvas Email System Utilization

Using the University's systems or networks for personal gain; for example, by selling access to your eID or to university systems or networks, or by performing work for profit with university resources (e.g. selling your notes or promoting a personal agenda) in a manner not authorized by the University is strictly forbidden within the CSU Code of Conduct and also CSU's policy for Acceptable Use for Computing and Networking Resources. All cases of this type of code violation will be reported to the Office of Conflict Resolution and Case Management and dealt with following CSU legal counsel guidance.