



Plant Biochemistry, Spring 2023

HOS 6932, Section 4C66, Class 18107

Meets: 10:40-11:30, MTWTh, on-line via zoom and in Fifield 2318, 4 graduate credits

Instructors:

Karen E. Koch 2147 Fifield Hall, 352-273-4833. kekoch@ufl.edu
 Donald R. McCarty 2237 Fifield Hall, 352-273-4846, drm@ufl.edu
 Bala "Saba" Rathinasabapathi 2247 Fifield Hall, 352-273-4847. brath@ufl.edu

Office hours: Meetings by appointment

Topics will include:

- Biochemical adaptations to biotic and abiotic stresses
- Biochemical basis for diverse plant responses and phenotypes
- Metabolic phenotypes and their influence on plant development
- Metabolic micro-environments and their significance
- Biochemistry of specialized products (caffeine, cannabinoids, theobromine, etc.)
- Biosynthesis, storage, and metabolism of key plant products.
- Structure and function of plant proteins, from enzymes and transporters to motors and proteomics
- Mechanisms of enzyme and transporter function, from kinetics to ligand binding
- Principles of metabolic modeling and flux balance analysis.
- Fundamental aspects of plant biochemistry and metabolism in an organismal context.

Tentative Lecture Schedule: 2023

Date	Day	Title	Presenter
Jan 9	M	Intro + Plant cell compartments and metabolic micro-environments	DM
Jan 10	Tu	Amino acids: Keys to protein structure and function	DM
Jan 11	W	Exploiting protein diversity for separation and purification	DM
Jan 12	Th	Fundamentals of protein structure	DM
Jan 16	M	MLK Day - no class	
Jan 17	Tu	Non-covalent bonds in proteins	DM
Jan 18	W	Thermodynamics and principles of enzyme catalysis	DM
Jan 19	Th	Mechanisms of enzyme catalysis	DM
Jan 23	M	Proteomics methods	DM
Jan 24	Tu	Movers and shakers: Molecular motors couple ATP to motion	DM
Jan 25	W	Discussion, integration and review for exam 1	DM
Jan 26	Th	Exam 1	DM
Jan 30	M	Light, photo-chemistry, and photoreceptors	KK
Jan 31	Tu	Photosynthesis: Photo-systems, electron transport, ^+H gradient	KK
Feb 1	W	Antioxidants, redox reactions, protective systems	KK
Feb 2	Th	Photosynthesis: CO_2 assimilation, photorespiration	KK
Feb 6	M	Photosynthesis: NO_3 , NO_2 , and NH_3 assimilation	KK

Feb 7	Tu	C/N balance in C3, C4, and CAM photosynthesis	KK
Feb 8	W	Student presentations	KK et al.
Feb 9	Th	Starch structure, biosynthesis, and metabolism	KK
Feb 13	M	Synthesis of sugars, amino acids, and their phloem transport	KK
Feb 14	Tu	Regulation of photosynthesis: Feedback via gene repression	KK
Feb 15	W	Exam 2	KK
Feb 16	Th	Sucrose import by sinks, its metabolism, sugar signaling	KK
Feb 20	M	Polysaccharides: Cell wall structure, biosynthesis, metabolism (CV?)	KK
Feb 21	Tu	Glycolysis: Overview, updates, significance	KK
Feb 22	W	Student presentations	KK et al.
Feb 23	Th	Glycolysis: Regulation, significance, impacts	KK
Feb 27	M	Oxidative pentose phosphate pathway	KK
Feb 28	Tu	Mitochondrial functions: Citric acid cycle, updates, significance	KK
Mar 1	W	Mitochondrial functions: Electron transport, ΔH gradients	KK
Mar 2	Th	Regulation of primary metabolism	KK
Mar 6	M	Exam 3	KK
Mar 7	Tu	Fatty acid desaturation	BR
Mar 8	W	Fatty acid synthesis I	BR
Mar 9	Th	Fatty acid synthesis II	BR
Mar 10--		Spring Break – No class	
Mar 20	M	Fatty acid oxidation I	BR
Mar 21	Tu	Fatty acid oxidation II	BR
Mar 22	W	Health promoting secondary products	BR
Mar 23	Th	CBDs	BR
Mar 27	M	Flavonoids	BR
Mar 28	Tu	Phenolics and ESPS synthase	BR
Mar 29	W	Terpene synthesis	BR
Mar 30	Th	Carotenoids	BR
April 3	M	Alkaloids I	BR
April 4	Tu	Alkaloids II	BR
April 5	W	Exam 4	BR
April 6	Th	Thermodynamics of ligands binding to proteins	BR
April 10	M	Saturable binding I – single site	DM
April 11	Tu	Saturable binding II – multiple sites	DM
April 12	W	Cooperativity: Hill equation	DM
April 13	Th	Cooperativity: Monod-Wyman-Changeux model	DM
April 17	M	Equilibrium enzyme kinetics	DM
April 18	Tu	Steady-state enzyme kinetics	DM
April 19	W	Allosteric enzymes: cooperative kinetics	DM
April 20	Th	Metabolic Control Analysis: kinetics applied to pathways	DM
April 24	M	Flux Balance Analysis: systems modeling of metabolism	DM
April 25	Tu	Discussion, integration and review for exam V	DM
April 26	W	Exam 5	DM
April 27	Th	Reading day	---

Instructors: DM (Donald McCarty), KK (Karen Koch), BR (Bala “Saba” Rathinasabapathi)

Course Prerequisites

A course in introductory biology that includes plant biology (BSC 2010/11 or equivalent) and a course in organic chemistry (CHM 2210/11 or equivalent) with a grade of C or better. Students are expected to be familiar with the chemistry and reactions of functional groups.

Required Textbooks

1. *Biochemistry & Molecular Biology of Plants*, Second edition, print or electronic version, 2015, Wiley Blackwell
2. A general biochemistry textbook: Older versions are inexpensive. The following online version is free: *Biochemistry*, 5th edition, by Berg, Tymoczko and Stryer, New York: WH Freeman, 2002, <http://www.ncbi.nlm.nih.gov/books/NBK21154/>

Course Home Page

From e-Learning (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.

Login. Go to <http://elearning.ufl.edu>, click on the Continue button under Canvas System Entry, and use your Gatorlink ID and password to login. If you cannot access e-Learning using this password, contact the computing helpdesk helpdesk@ufl.edu or call 392-HELP or visit them in the Hub to solve the problem.

Attendance Policy

Course grading will include class participation (discussions during class and ongoing dialog between students and faculty during presentations). Also, 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. Occasional, unavoidable absences (1 or 2) will not necessarily impact student performance in the course. However, students should contact the course organizer to discuss options and strategies of how to make up missed work.

Quizzes and homework

Quizzes and homework assignments will be scheduled by each instructor.

Exams

There will be five exams, each worth 100 points. Exams are not comprehensive and will cover the lectures specified in the lecture schedule. However, some questions may require knowledge of material covered on previous exams. Some exams will be given in class, and others will be take-home. 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, and data analysis.

Exams for the units on central metabolism (KEK on photosynthesis and respiration), exams will include oral and written presentations on topics of special relevance to students. This work will be independent, in-depth investigations into current and classical literature, along with interpretation and creative presentations to colleagues.

Make up exams and coursework will be given for legitimate excuses such as student illness or death in the immediate family. Make up exams that are requested for any other reason, will be given at the discretion of the instructor. These must be arranged ahead of the student's absence.

Grading scale

500 possible points from exams and up to 100 possible points from quizzes and homework assignments

Letter Grade	Grade Points	%	Letter Grade	Grade Points	%
A	4.0	92-100	C	2.0	65-68
A-	3.67	87-91	C-	1.67	60-64
B+	3.33	83-86	D+	1.33	55-59

B	3.0	79-82	D	1.0	52-54
B-	2.67	73-78	D-	0.67	50-53
C+	2.33	69-72	E	0	0-49

Information on current UF grading policies can be found in the Graduate Catalog at:

<http://gradschool.ufl.edu/catalog/current-catalog/catalog-general-regulations.html>

Academic Honesty

The Honor Code for the University of Florida reads, “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 will sign all of your exam papers, which will confirm your pledge that you have neither given nor received unauthorized help in taking the exam.

Plagiarism: Please know the definition in an academic context. You may NOT use direct text from anyone or their website without “quotation marks.” Simple citation at the end of a borrowed section of their work is NOT adequate. It is also unacceptable to modify their wording slightly, and then add a quotation. Do not use AI-based resources (e.g. ChatGPT) for assignments and tests unless requested.

Software Use Policy

Students are expected to be informed of the University’s policy on use of proprietary software and use of IT resources. These policies can be found at:

<http://www.it.ufl.edu/policies/aupolicy.html>

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.

University Support Services

Resources are available on campus for students having test anxiety, personal problems or lacking clear career and academic goals that interfere with their academic performance. These resources include:

1. Counseling & Wellness Center, 301 Peabody Hall, 392-1575, personal and career counseling. <http://www.counseling.ufl.edu>
2. Student Health Care Center, 392-1161, personal counseling. <http://shcc.ufl.edu/>
3. Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling. <http://www.crc.ufl.edu/>
4. Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Classroom etiquette

You are expected to be courteous to your fellow students and not interfere with their learning. You are expected to be on time, turn off cell phones, and talk only when the instructor asks you to do so. You may use a laptop or tablet during class lectures, although using such devices for texting and other forms of personal communication are strongly discouraged.