



## Plant Biochemistry, Spring 2020

**HOS 6932, Section 4C66**, Class 22263

Meets: 10:40-11:30, MTWTh, Fifield 2318, 4 graduate credits

### Instructors:

Karen E. Koch 2147 Fifield Hall, 352-273-4833. [kekoch@ufl.edu](mailto:kekoch@ufl.edu)  
 Donald R. McCarty 2237 Fifield Hall, 352-273-4846, [drm@ufl.edu](mailto:drm@ufl.edu)  
 Bala "Saba" Rathinasabapathi 2247 Fifield Hall, 352-273-4847. [brath@ufl.edu](mailto: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
- 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: 2020

Date	Day	Title	Presenter
Jan 6	M	Plant cell compartments and metabolic micro-environments	All
Jan 7	Tu	Amino acids: Keys to protein structure and function	DM
Jan 8	W	Exploiting protein diversity for separation and purification	DM
Jan 9	Th	Fundamentals of protein structure, crystallography, NMR	DM
Jan 13	M	Building 3D models of proteins by homology	DM
Jan 14	Tu	Clues to protein function: conserved domains & phylogenetics	DM
Jan 15	W	Working class proteins: Enzymes and catalysis	DM
Jan 16	Th	Ruling class proteins: Transcription factors and protein kinases	DM
Jan 20	M	No Class- MLK holiday	
Jan 21	Tu	Movers and shakers: Molecular motors couple ATP to motion	DM
Jan 22	W	Discussion, integration and review for exam 1	DM
Jan 23	Th	<b>Exam 1</b>	<b>DM</b>
Jan 27	M	Light, photo-chemistry, and photoreceptors	KK
Jan 28	Tu	Photosynthesis: Photo-systems, electron transport, $^+H$ gradient	KK
Jan 29	W	Antioxidants, redox reactions, protective systems	KK
Jan 30	Th	Photosynthesis: $CO_2$ assimilation, photorespiration	KK
Feb 3	M	Photosynthesis: $NO_3$ , $NO_2$ , and $NH_3$ assimilation	KK

Feb 4	Tu	C/N balance in C3, C4, and CAM photosynthesis	KK
Feb 5	W	Clock systems and diurnal regulation	KK
Feb 6	Th	Starch structure, biosynthesis, and metabolism	KK
Feb 10	M	Synthesis of sugars, amino acids, and their phloem transport	KK
Feb 11	Tu	Regulation of photosynthesis: Feedback via gene repression	KK
Feb 12	W	Review	KK
Feb 13	Th	<b>Exam 2</b>	KK
Feb 17	M	Sucrose import by sinks, its metabolism, sugar signaling	KK
Feb 18	Tu	Polysaccharides: Cell wall structure, biosynthesis, metabolism	KK
Feb 19	W	Glycolysis: Overview	KK
Feb 20	Th	Glycolysis: Update on enzymes and their significance	KK
Feb 24	M	Oxidative pentose phosphate pathway	KK
Feb 25	Tu	Mitochondrial functions: Electron transport, $H^+$ gradients	KK
Feb 26	W	Mitochondrial functions: Overview of citric-acid cycle	KK
Feb 27	Th	Citric acid cycle: Update on the enzymes and their significance	KK
Mar 2-7		no Class - Spring Break	
Mar 9	M	Regulation of primary metabolism	KK
Mar 10	Tu	<b>Exam 3</b>	KK
Mar 11	W	Fatty acid desaturation	BR
Mar 12	Th	Fatty acid synthesis I	BR
Mar 16	M	Fatty acid synthesis II	BR
Mar 17	Tu	Fatty acid oxidation I	BR
Mar 18	W	Fatty acid oxidation II	BR
Mar 19	Th	Health promoting secondary products	BR
Mar 23	M	CBDs	BR
Mar 24	Tu	Flavonoids	BR
Mar 25	W	Phenolics and ESPS synthase	BR
Mar 26	Th	Terpene synthesis	BR
March 30	M	Carotenoids	BR
March 31	Tu	Alkaloids I	BR
April 1	W	Alkaloids II	BR
April 2	Th	<b>Exam 4</b>	BR
April 6	M	Thermodynamics of ligands binding to proteins	DM
April 7	Tu	Saturable binding of molecules to proteins	DM
April 8	W	Cooperativity: Hill and Monod-Wyman-Changeux models	DM
April 9	Th	Equilibrium enzyme kinetics	DM
April 13	M	Steady-state enzyme kinetics	DM
April 14	Tu	Allosteric enzymes: cooperative kinetics	DM
April 15	W	Metabolic Control Analysis: kinetics applied to pathways	DM
April 16	Th	Flux Balance Analysis: systems modeling of metabolism	DM
April 20	M	Applications of Flux Balance Analysis	DM
April 21	Tu	Discussion, integration and review for exam V	DM
April 22	W	<b>Exam 5</b>	DM

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 - Check online booksellers for inexpensive older versions. The following is free online –  
*Biochemistry*, 5<sup>th</sup> 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](mailto: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.

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.

### **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](mailto: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. 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.