

**Plant Biochemistry, Spring 2016**  
**BOT 6935, section 1E55, 4 credits**

***Meeting time and place***

MTWTh, 4<sup>th</sup> Period, 133 Cancer/Genetics Research Complex

***Instructors***

Dr. Alice Harmon, 621 Carr Hall, [harmon@ufl.edu](mailto:harmon@ufl.edu), 392-9169. Office hours-most mornings.

Dr. Karen Koch, 2147 Fifield Hall, [kekoch@ufl.edu](mailto:kekoch@ufl.edu) meetings by appointment.

Dr. Bala Rathinasabapathi (Dr. Saba), 2247 Fifield Hall, [brath@ufl.edu](mailto:brath@ufl.edu) , 352-273-4847. Meetings by appointment.

Dr. Donald McCarty, 2237 Fifield Hall, [drm@ufl.edu](mailto:drm@ufl.edu), 352-273-4846. Meetings by appointment.

***Course Description/Goals***

The course is intended for students in the plant sciences. All topics are taught in the context of plant biology. Successful completion of this course will provide students with fundamental knowledge of biochemistry and specific knowledge of compounds and biochemical pathways that occur in plants.

Topics include

1. The biochemistry of amino acids and proteins, sugars and carbohydrates, and lipids.
2. Quantitative aspects of biochemistry including enzyme kinetics, protein-ligand binding, analytical techniques, and bioenergetics.
3. Intermediary metabolism, discussed in the context of plant cell structure and function.
4. Biochemical processes and metabolic pathways that are specific to plants, including photosynthesis, photorespiration, cell wall biosynthesis, nitrate and sulfate assimilation, and plant secondary metabolism.

***Learning Objectives and Outcomes***

Students will

- learn the structure, function and biosynthetic pathways of essential biochemical molecules including their key chemical and physical properties.
- understand plant cell structure and organization and apply specific biochemical functions to all components of plant cell structure.
- learn how membranes form and function and how the building blocks of membranes are made.
- learn amino acid structures and relate their chemical properties to the synthesis and function of proteins and enzymes.
- understand protein structural hierarchy and relate structure to function. The principles of enzyme kinetics will be learned and applied through hands on

problem sets. Students will be shown how enzyme properties contribute to metabolic processes.

- understand how light energy is captured and used to provide chemical forms of energy to power the functions of cells and whole plants. The importance of CO<sub>2</sub> fixation and carbohydrate metabolism will be presented. The nature and composition of plant cell walls will be explored.
- learn about the rich diversity of secondary compounds and metabolism in plants and how such compounds contribute to human health.

### ***Course Prerequisites***

Students should have completed a course in introductory biology including 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 and with "pushing electrons."

### ***Required Textbooks***

1. *Biochemistry & Molecular Biology of Plants*, Second edition, print or electronic version, 2015, Wiley Blackwell (Available on Google Play [https://play.google.com/store/books/details/Bob\\_B\\_Buchanan\\_Biochemistry\\_and\\_Molecular\\_Biology?id=9YAZCgAAQBAJ](https://play.google.com/store/books/details/Bob_B_Buchanan_Biochemistry_and_Molecular_Biology?id=9YAZCgAAQBAJ) for \$93.59)
2. A general biochemistry textbook - Check online booksellers for cheap older versions. Here are two old versions that are 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/>  
*Principles of Biochemistry*, 2<sup>nd</sup> edition, by Lehninger, Nelson, and Cox, New York: Worth, 1992 <http://www.bioinfo.org.cn/book/biochemistry/>

### ***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***

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. 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.

### ***Quizzes***

Quizzes and homework assignments will be scheduled by each instructor.

### ***Exams***

There will be five exams, which are each 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. Exams will consist of questions (multiple-choice, fill in the blank, short and long answer) and problems. The first four exams will be given at 5 or 6 pm on the days specified in the lecture schedule. The time and day of the fifth exam will be determined. Exams will cover details of structure, function, and pathways, major concepts, problem solving, and 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 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.

### ***Make Up Exams and Course Work***

Make Up exams 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	%
A	4.0	92-100
A-	3.67	87-91
B+	3.33	83-86
B	3.0	79-82
B-	2.67	73-78
C+	2.33	69-72
C	2.0	65-68
C-	1.67	60-64
D+	1.33	55-59
D	1.0	52-54
D-	0.67	50-53
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.

### ***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/>

### ***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.

### ***Lecture Schedule***

		BOT 6935	Plant Biochemistry	Spring 2016	
DATE	DAY	#	TOPIC		Instructor <sup>1</sup>
Jan 5	T	1	Introduction and Course overview		AH
6	W	2	Plant cell structure and compartments		AH
7	Th	3	Amino Acids, Structure and properties		AH
11	M	4	Amino Acids, Ionization and titration		AH
12	T	5	Peptides, Properties and purification methods		
13	W	6	Protein purification		AH
14	Th	7	Protein Structure (example: Rubisco)		AH
18	M		<b>Martin Luther King Day</b> – No class		AH
19	T	8	Enzymes and catalysis		AH
20	W	9	Enzyme Structure/Function relationships		AH
20	W		Optional <b>review session</b> for Exam 1 time and place TBD		AH
21	Th	10	Protein-Ligand Interaction I		DM
21	Th		<b>Exam 1</b> on classes 1-9, time and place TBD		
25	M	11	Protein-Ligand Interaction II		DM
26	T	12	Protein-Ligand Interaction III		DM
27	W	13	Enzyme Kinetics I		DM
28	Th	14	Enzyme Kinetics II		DM
Feb 1	M	15	Enzyme Kinetics III		DM
2	T	16	Enzyme Kinetics IV		DM
3	W	17	Enzyme Kinetics V		DM
4	Th	18	Enzyme Kinetics VI		DM
8	M	19	Introduction to Metabolic Control Analysis		DM
9	T	20	Introduction to Flux Balance Analysis		DM
10	W	21	Oxidation/reduction, bioenergetics, ATP and NAD(P)H		AH
10	W		Optional <b>review session</b> for Exam 2 time and place TBD		DM
11	Th	22	Photosynthesis - Light absorbtion		AH
11	Th		<b>Exam 2</b> on classes 10-20 time and place TBD		

Plant Biochemistry Syllabus

DATE	DAY	#	TOPIC	Instructor <sup>1</sup>
15	M	23	Photosynthesis Electron Transport	AH
16	T	24	Photosynthesis Q-cycle and ATP synthesis	AH
17	W	25	Sugar structure and function	AH
18	Th	26	ATP and phosphorylation	AH
22	M	27	Calvin Cycle	AH
23	T	28	Rubisco; photorespiration	AH
24	W	29	C4 Metabolism, CAM Metabolism	AH
25	Th	30	Review for Exam 3	AH
25	Th	<b>Exam 3</b> on classes 21-30, time and place TBD		
Feb29-	Mar4	<b>Spring Break</b>		
Mar7	M	31	Sucrose: synthesis, transport, breakdown, signals	KK
8	T	32	Polysaccharides: Starch structure, metabolism	KK
9	W	33	Polysaccharides: Cell wall structure, metabolism	KK
10	Th	34	Glycolysis	KK
14	M	35	Glycolysis	KK
15	T	36	Mitochondrial functions: Citric acid cycle	KK
16	W	37	Mitochondrial functions: Electron transport and ATP	KK
18	Th	38	Mitochondrial functions: Other	KK
21	M	39	Oxidative pentose phosphate pathway	KK
22	T	40	Regulation of primary metabolism	KK
23	W	41	N: Fixation	KK
24	Th	42	N: Assimilation and GS/GOGAT	KK
28	M	43	N: Other	KK
29	T	44	S: Assimilation and impacts	KK
30	W	45	Fatty acid desaturation	BR
31	Th	46	Fatty acid synthesis I	BR
Apr 1	F	-	April Fool's Day: Think of a biochemical joke (optional)	
4	M	47	Fatty acid synthesis II	BR
4	M		Optional <b>review session</b> for Exam 4 time and place TBD	KK
5	T	48	Fatty acid oxidation I	BR
5	T	<b>Exam 4</b> on classes 31-44, time and place TBD		
6	W	49	Fatty acid oxidation II Oxylipins and jasmonates	BR
7	Th	50	Health promoting secondary products	BR
11	M	51	Flavonoids I	BR
12	T	52	Flavonoids II	BR
13	W	53	Phenolics and ESPS synthase	BR
14	Th	54	Terpene synthesis	BR
18	M	55	Carotenoids	BR
19	T	56	Alkaloids I	BR
20	W	57	Alkaloids II	BR
TBA		<b>Exam 5</b> on classes 46-58, date, time and place TBD		

<sup>1</sup>AH, Dr. Alice Harmon; DM, Dr. Donald McCarty; KK, Dr. Karen Koch, BR, Dr. Bala Rathinasabapathi