

**Plant Biochemistry, Spring 2017** updated 1/6/17  
**BOT 6935, section 1E55, 4 credits**

***Meeting time and place***

MTWTh, 4<sup>th</sup> Period, 236 Cancer/Genetics Research Complex

***Instructors***

Dr. Alice Harmon, 621 Carr Hall, [harmon@ufl.edu](mailto:harmon@ufl.edu), 392-9169. Mondays 2:30-4pm

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
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 2017
DATE	DAY	#	TOPIC	Instructor <sup>1</sup>
Jan 4	W	1	Introduction and Course overview	AH
5	Th	2	Plant cell structure and compartments	AH
9	M	3	Amino Acids, Structure and properties	AH
10	T	4	Amino Acids, Ionization and titration	AH
11	W	5	Peptides, Properties and purification methods	
12	Th	6	Protein purification	AH
16	M	7	<b>Martin Luther King Day</b> – No class	AH
17	T		Protein Structure (example: Rubisco)	AH
18	W	8	Enzymes and catalysis	AH
19	Th	9	Enzyme Structure/Function relationships	AH
19	Th		Optional <b>review session</b> for Exam 1 time and place TBD	AH
20	F		<b>Exam 1</b> on classes 1-9, time and place TBD	AH
23	M	10	Protein-Ligand Interaction I	DM
24	T	11	Protein-Ligand Interaction II	DM
25	W	12	Protein-Ligand Interaction III	DM
26	Th	13	Enzyme Kinetics I	DM
30	M	14	Enzyme Kinetics II	DM
31	T	15	Enzyme Kinetics III	DM
Feb 1	W	16	Enzyme Kinetics IV	DM
2	Th	17	Enzyme Kinetics V	DM
6	M	18	Enzyme Kinetics VI	DM
7	T	19	Introduction to Metabolic Control Analysis	DM
8	W	20	Introduction to Flux Balance Analysis	DM
?	?		Optional <b>review session</b> for Exam 2 time and place TBD	DM
?	?		<b>Exam 2</b> on classes 10-20 time and place TBD	DM
9	Th	21	Oxidation/reduction, bioenergetics, ATP and NAD(P)H	AH
13	M	22	Photosynthesis - Light absorption	AH
14	T	23	Photosynthesis Electron Transport	AH
15	W	24	Photosynthesis Q-cycle and ATP synthesis	AH

Plant Biochemistry Syllabus

DATE	DAY	#	TOPIC	Instructor <sup>1</sup>
16	Th	25	Bioenergetics, ATP and phosphorylation	AH
20	M	26	Sugar structure and function	AH
21	T	27	Calvin Cycle	AH
22	W	28	Rubisco; photorespiration	AH
23	Th	29	C4 Metabolism, CAM Metabolism	AH
23	Th		Optional <b>review session</b> for Exam 3	AH
24	F		<b>Exam 3</b> on classes 21-29, time and place TBD	AH
27	M	30	Sucrose: synthesis, transport, breakdown, signals	KK
28	T	31	Polysaccharides: Starch structure, metabolism	KK
Mar 1	W	32	Polysaccharides: Cell wall structure, metabolism	KK
2	Th	33	Glycolysis	KK
Mar 4-	12		<b>Spring Break</b>	
13	M	34	Glycolysis	KK
14	T	35	Mitochondrial functions: Citric acid cycle	KK
15	W	36	Mitochondrial functions: Electron transport and ATP	KK
16	Th	37	Mitochondrial functions: Other	KK
20	M	38	Oxidative pentose phosphate pathway	KK
21	T	39	Regulation of primary metabolism	KK
22	W	40	N: Fixation	KK
23	Th	41	N: Assimilation and GS/GOGAT	KK
27	M	42	N: Other	KK
28	T	43	S: Assimilation and impacts	KK
?	?		Optional <b>review session</b> for Exam 4 time and place TBD	KK
?	?		<b>Exam 4</b> on classes 30-43, time and place TBD	
29	W	44	Fatty acid desaturation	BR
30	Th	45	Fatty acid synthesis I	BR
Apr 3	M	46	Fatty acid synthesis II	BR
4	T	47	Fatty acid oxidation I	BR
5	W	48	Fatty acid oxidation II	BR
6	Th	49	Health promoting secondary products	BR
10	M	50	Flavonoids I	BR
11	T	51	Flavonoids II	BR
12	W	52	Phenolics and ESPS synthase	BR
13	Th	53	Terpene synthesis	BR
17	M	54	Carotenoids	BR
18	T	55	Alkaloids I	BR
19	W	56	Alkaloids II	BR
TBA			<b>Exam 5</b> on classes 43-56, date, time and place TBD	

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