

Plant Biochemistry, Spring 2018
BOT 6935, section 1E55, 4 credits

Meeting time and place

MTWTh, 4th Period, 236 Cancer/Genetics Research Complex

Instructors

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

Dr. Karen Koch, 2147 Fifield Hall, kekoch@ufl.edu meetings by appointment.

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

Dr. Donald McCarty, 2237 Fifield Hall, drm@ufl.edu, 352-273-4846. Meetings by appointment.

Course Description/Goals

The course is intended for students in the plant sciences. 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. Biochemical processes and metabolic pathways specific to plants, including photosynthesis, photorespiration, cell wall biosynthesis, nitrate and sulfate assimilation, distinctive aspects of central metabolism, and plant secondary metabolism.
3. Metabolism in a structure-function context from molecular to subcellular, cellular, organ, and whole-plant levels.
4. Quantitative aspects of biochemistry including enzyme kinetics, protein-ligand binding, analytical techniques, and bioenergetics.

Learning Objectives and Outcomes

Students will

- understand plant cell structure, organization, and apply specific biochemical functions to all compartments of the plant cell.
- learn the structure, function and biosynthetic pathways of essential biochemical molecules including their key chemical and physical properties.
- 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.

- 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 CO₂ fixation and carbohydrate metabolism will be presented. The nature and composition of plant cell walls will be explored.
- understand central metabolism, its plant-specific components, and their functional significance at multiple levels.
- learn about the rich diversity of secondary compounds and metabolism in plants and how such compounds contribute to human health.
- learn principles of enzyme kinetics and apply these through hands on problem sets. Students will be shown how enzyme properties contribute to metabolic processes.
- explore principles of metabolic modeling.

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.

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 two are free online -
Biochemistry, 5th edition, by Berg, Tymoczko and Stryer, New York: WH Freeman, 2002, <http://www.ncbi.nlm.nih.gov/books/NBK21154/>
Principles of Biochemistry, 2nd 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 “Continue” 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

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 (1 or 2) will not necessarily impact student performance in the course. However, students should contact the course organizer (in advance wherever possible) 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 needing help with test anxiety, personal problems, or clarification of career and academic goals that could aid 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 your instructors and the University of Florida overall. 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 help. 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 is strongly discouraged.

Lecture Schedule

		BOT 6935	Plant Biochemistry	Spring 2018	
DATE	DAY	#	TOPIC		Instructor ¹
Jan 8	M	1	Introduction and Course overview		AH
9	T	2	Plant cell structure and compartments		AH
10	W	3	Amino Acids, Structure and properties		AH
11	Th	4	Amino Acids, Ionization and titration		AH
15	M		Martin Luther King Day – No class		AH
16	T	5	Peptides, Properties and purification methods		
17	W	6	Protein purification		AH
18	Th	7	Protein Structure (example: Rubisco)		AH
22	M	8	Enzymes and catalysis		AH
23	T	9	Enzyme Structure/Function relationships		AH
24	W	10	Rubisco Function		AH
review session for Exam 1 time and place TBD					AH
Exam 1 on classes 1-10, time and place TBD					AH
25	Th	11	Oxidation/reduction, bioenergetics, ATP and NAD(P)H		AH
29	M	12	Photosynthesis - Light absorption		AH
30	T	13	Photosynthesis Electron Transport		AH
31	W	14	Photosynthesis Q-cycle and ATP synthesis		AH
Feb1	Th	15	Bioenergetics, ATP and phosphorylation		AH
5	M	16	Sugar structure and function		AH
6	T	17	Calvin Cycle		AH
7	W	18	Rubisco; photorespiration		AH
8	Th	19	C4 Metabolism, CAM Metabolism		AH
review session for Exam 2 time and place TBD					AH
Exam 2 on classes 11-19 time and place TBD					AH
12	M	20	Sucrose: synthesis, transport, breakdown, signals		KK
13	T	21	Polysaccharides: Starch structure, metabolism		KK
14	W	22	Polysaccharides: Cell wall structure, metabolism		KK
15	Th	23	Glycolysis		KK
19	M	24	Glycolysis		KK
20	T	25	Mitochondrial functions: Citric acid cycle		KK
21	W	26	Mitochondrial functions: Electron transport and ATP		KK
22	Th	27	Mitochondrial functions: Other		KK
26	M	28	Oxidative pentose phosphate pathway		KK

Plant Biochemistry Syllabus

DATE	DAY	#	TOPIC	Instructor ¹
27	T	29	Regulation of primary metabolism	KK
28	W	30	N: Fixation	KK
Mar1	Th	31	N: Assimilation and GS/GOGAT	KK
Mar 5-	10		SPRING BREAK	
12	M	32	N: Other	KK
13	T	33	S: Assimilation and impacts	KK
			Optional review session for Exam 3 time and place TBD	KK
			Exam 4 on classes 20-33, time and place TBD	KK
14	W	34	Fatty acid desaturation	BR
15	Th	35	Fatty acid synthesis I	BR
19	M	36	Fatty acid synthesis II	BR
20	T	37	Fatty acid oxidation I	BR
21	W	38	Fatty acid oxidation II	BR
22	Th	39	Health promoting secondary products	BR
26	M	40	Flavonoids I	BR
27	T	41	Flavonoids II	BR
28	W	42	Phenolics and ESPS synthase	BR
29	Th	43	Terpene synthesis	BR
Apr 2	M	44	Carotenoids	BR
3	T	45	Alkaloids I	BR
4	W	46	Alkaloids II	BR
			Optional review session for Exam 4 time and place TBD	BR
			Exam 4 on classes 34-46 time and place TBD	BR
5	Th	47	Protein-Ligand Interaction I	DM
9	M	48	Protein-Ligand Interaction II	DM
10	T	49	Protein-Ligand Interaction III	DM
11	W	50	Enzyme Kinetics I	DM
12	Th	51	Enzyme Kinetics II	DM
16	M	52	Enzyme Kinetics III	DM
17	T	53	Enzyme Kinetics IV	DM
18	W	52	Enzyme Kinetics V	DM
19	Th	53	Enzyme Kinetics VI	DM
23	M	54	Introduction to Metabolic Control Analysis	DM
24	T	55	Introduction to Flux Balance Analysis	DM
25	W	56	Flux Balance Analysis II	DM
			Exam 5 on classes 47-56, date, time and place TBD	

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