

**Plant Biochemistry, Spring 2015**  
**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, other times by appointment.

Dr. Charles Guy, 1535 Fifield Hall, [clguy@ufl.edu](mailto:clguy@ufl.edu) , 273-4528 Available most days; call before coming to be sure I'm there.

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/Learning Objectives***

The course is intended for students in the plant sciences. All topics are taught in the context of plant biology. Upon completion of this course students will be able to:

- Describe the structure and chemical and physical properties of amino acids, sugars, proteins, carbohydrates, and lipids.
- Explain the relationship between structure and function of macromolecules including proteins, enzymes, carbohydrates, and lipids.
- Perform calculations related to enzyme kinetics, protein-ligand binding, energetics of solute transport, and oxidation-reduction reactions.
- Outline pathways of intermediary metabolism, C<sub>3</sub> and C<sub>4</sub> photosynthesis, photorespiration, photophosphorylation, cell wall biosynthesis, nitrate and sulfate assimilation, plant secondary metabolism.
- Explain Michaelis-Menten enzyme kinetics.
- Use the computer program R to graph and analyze enzyme kinetic data.
- Predict the behavior and interactions of biomolecules in specified conditions in vitro and in vivo.
- Predict the effects of mutations, application of inhibitors or other perturbations on metabolism and physiological outcomes.
- Explain the principles of liquid chromatography and electrophoresis and apply various techniques to the purification and characterization of proteins.
- Explain how light energy is captured and converted to chemical forms of energy.
- Explain the chemiosmotic theory including its structural and thermodynamic requirements.
- Design experiments using techniques of genetics and biochemistry to address questions about the structure and function of biomolecules, metabolic pathways, and cellular processes.

### ***Course Prerequisites***

Students should have completed a course in introductory biology including plant biology (BSC 2010/11 or equivalent) and a course 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 Textbook***

*Lehninger Principles of Biochemistry*, 5<sup>th</sup> or 6<sup>th</sup> edition, print version or e-book, by Nelson and Cox (W.H. Freeman and Company).

### ***Recommended Textbook***

*Plant Biochemistry*, by Bowsher, Steer, and Tobin, Garland Science, 2008

### ***Course Home Page***

From e-Learning (Sakai) 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://lss.at.ufl.edu>, click on the Continue button under Sakai 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.

Each time you log onto e-Learning, it will open the **Sakai Workspace** page. This is your "home E-Learning portal," where all of your courses with an E-Learning component are listed. If you are registered for this section of BOT 6935, then a link for this course will be shown. If you **just** registered for this course, you will need to wait 24 hours before the link to this course appears. If this course is still not listed in your MyE-Learning page, contact your instructor.

### ***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.

***Assignments, Quizzes and 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 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, data analysis.

In addition to exams, Dr. Harmon will give quizzes worth a total of 40 points, Dr. McCarty will give two homework assignments worth 40 points each, and Dr. Saba will give quizzes worth 20 points.

***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**

There are 500 possible points from exams and 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**

|             |            | <b>BOT 6935</b> | <b>Plant Biochemistry</b>  | <b>Spring 2013</b> |                               |
|-------------|------------|-----------------|--|--------------------|-------------------------------|
| <b>DATE</b> | <b>DAY</b> | <b>#</b>        | <b>TOPIC</b>   |                    | <b>Instructor<sup>1</sup></b> |
| Jan 6       | T          | 1               | Introduction and Course overview   |                    | AH                            |
| 7           | W          | 2               | Membranes and plant cell compartments  |                    | AH                            |
| 8           | Th         | 3               | Amino Acids, Peptides, Proteins I<br><a href="http://jmol.sourceforge.net/demo/aminoacids/">http://jmol.sourceforge.net/demo/aminoacids/</a> |                    | AH                            |
| 12          | M          | 4               | Amino Acids, Peptides, Proteins II   |                    | AH                            |
| 13          | T          | 5               | Amino Acids, Peptides, Proteins III  |                    | AH                            |
| 14          | W          | 6               | Protein Tertiary and Quaternary Structure<br>(example: Rubisco)  |                    | AH                            |
| 15          | Th         | 7               | Enzymes I  |                    | AH                            |
| 19          | M          |                 | <b>Martin Luther King Day</b> – No class   |                    | AH                            |
| 20          | T          | 8               | Enzymes II   |                    | AH                            |
| 21          | W          | 9               | Enzymes III  |                    | AH                            |
| 22          | Th         | 10              | Protein-Ligand Interaction I   |                    | DM                            |
| 26          | M          | 11              | Protein-Ligand Interaction II  |                    | DM                            |
| 27          | T          | 12              | Protein-Ligand Interaction III   |                    | DM                            |
| 27          | T          |                 | <b>Exam 1</b> on classes 1-9, time and place TBD   |                    |                               |
| 28          | W          | 13              | Enzyme Kinetics I  |                    | DM                            |
| 29          | Th         | 14              | Enzyme Kinetics II   |                    | DM                            |
| Feb 2       | M          | 15              | Enzyme Kinetics III  |                    | DM                            |
| 3           | T          | 16              | Enzyme Kinetics IV   |                    | DM                            |
| 4           | W          | 17              | Enzyme Kinetics V  |                    | DM                            |
| 5           | Th         | 18              | Enzyme Kinetics VI   |                    | DM                            |
| 9           | M          | 19              | Enzyme Kinetics VII  |                    | DM                            |
| 10          | T          | 20              | Metabolic Control Analysis   |                    | DM                            |
| 11          | W          | 21              | Oxidation/reduction, bioenergetics, ATP and NAD(P)H  |                    | AH                            |
| 12          | Th         | 22              | Light-dependent reactions of photosynthesis I  |                    | AH                            |
| 16          | M          | 23              | Light-dependent reactions of photosynthesis II   |                    | AH                            |
| 17          | T          | 24              | Light-dependent reactions of photosynthesis III  |                    | AH                            |
| 17          | T          |                 | <b>Exam 2</b> on classes 10-20, time and place TBD   |                    |                               |
| 18          | W          | 25              | Carbohydrates I  |                    | AH                            |
| 19          | Th         | 26              | Carbohydrates II   |                    | AH                            |
| 23          | M          | 27              | Calvin Cycle   |                    | AH                            |
| 24          | T          | 28              | Rubisco; photorespiration  |                    | AH                            |
| 25          | W          | 29              | C4 Metabolism, CAM Metabolism  |                    | AH                            |
| 26          | Th         | 30              | Regulation of Metabolism   |                    | AH                            |
| DATE        | DAY        | #               | TOPIC  |                    | Instructor <sup>1</sup>       |
| Mar3-7      |            |                 | <b>Spring Break</b>  |                    |                               |
| 9           | M          | 31              | Glycolytic Pathway; Intermediates and reactions  |                    | CG                            |
| 10          | T          | 32              | Glycolytic Pathway continued   |                    | CG                            |
| 10          | T          |                 | <b>Exam 3</b> on classes 21-30, time and place TBD   |                    |                               |
| 11          | W          | 33              | Oxidative Pentose Phosphate Pathway; Roles and functions   |                    | CG                            |
| 12          | Th         | 34              | Citric Acid Cycle; Intermediates and reactions   |                    | CG                            |
| 16          | M          | 35              | Oxidative Phosphorylation; Electron transport/ATP synthesis  |                    | CG                            |
| 17          | T          | 36              | Plant mitochondrial functions  |                    | CG                            |

Plant Biochemistry Syllabus

| DATE  | DAY | #  | TOPIC   | Instructor <sup>1</sup> |  |
|-------|-----|--|---|-------------------------|--|
| 18    | W   | 37   | Sucrose synthesis and breakdown                             | CG                      |  |
| 19    | Th  | 38   | Starch structure and metabolism                             | CG                      |  |
| 23    | M   | 39   | Cell wall polysaccharides                                   | CG                      |  |
| 24    | T   | 40   | Acetylation/ deacetylation regulation of primary metabolism | CG                      |  |
| 25    | W   | 41   | Nitrogen fixation   | CG                      |  |
| 26    | Th  | 42   | Nitrate assimilation  | CG                      |  |
| 30    | M   | 43   | GS/GOGAT  | CG                      |  |
| 31    | T   | 44   | Sulfate assimilation and amino acid synthesis               | CG                      |  |
| Apr 1 | W   | 45   | Fatty acid desaturaion                                      | BR                      |  |
| 2     | Th  | 46   | Fatty acid synthesis I                                      | BR                      |  |
| 6     | M   | 47   | Fatty acid synthesis II                                     | BR                      |  |
| 7     | T   | 48   | Fatty acid oxidation I                                      | BR                      |  |
| 7     | T   | <b>Exam 4</b> on classes 31-45, time and place TBD       |   |                         |  |
| 8     | W   | 49   | Fatty acid oxidation II Oxylipins and jasmonates            | BR                      |  |
| 9     | Th  | 50   | Health promoting secondary products                         | BR                      |  |
| 13    | M   | 51   | Flavonoids I  | BR                      |  |
| 14    | T   | 52   | Flavonoids II   | BR                      |  |
| 15    | W   | 53   | Phenolics and ESPS synthase                                 | BR                      |  |
| 16    | Th  | 54   | Terpene synthesis   | BR                      |  |
| 20    | M   | 55   | Carotenoids   | BR                      |  |
| 21    | T   | 56   | Alkaloids I   | BR                      |  |
| 22    | 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; CG, Dr. Charles Guy, BR, Dr. Bala Rathinasabapathi