Plant Biochemistry, Spring 2021

HOS 6932
Meets: 10:40-11:30, MTWTh, on-line and in Fifield 2318, 4 graduate credits

Instructors:
Karen E. Koch 2147 Fifield Hall, 352-273-4833. kekoch@ufl.edu
Donald R. McCarty 2237 Fifield Hall, 352-273-4846, drm@ufl.edu
Bala “Saba” Rathinasabapathi 2247 Fifield Hall, 352-273-4847. 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

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Title</th>
<th>Presenter</th>
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</thead>
<tbody>
<tr>
<td>Jan 11</td>
<td>M</td>
<td>Intro + Plant cell compartments and metabolic micro-environments</td>
<td>All</td>
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<tr>
<td>Jan 12</td>
<td>Tu</td>
<td>Amino acids: Keys to protein structure and function</td>
<td>DM</td>
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<tr>
<td>Jan 13</td>
<td>W</td>
<td>Exploiting protein diversity for separation and purification</td>
<td>DM</td>
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<tr>
<td>Jan 14</td>
<td>Th</td>
<td>Fundamentals of protein structure, crystallography, NMR</td>
<td>DM</td>
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<tr>
<td>Jan 18</td>
<td>M</td>
<td>No Class -MLK holiday</td>
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<tr>
<td>Jan 19</td>
<td>Tu</td>
<td>Building 3D models of proteins by homology</td>
<td>DM</td>
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<tr>
<td>Jan 20</td>
<td>W</td>
<td>Clues to protein function: conserved domains &amp; phylogenetics</td>
<td>DM</td>
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<tr>
<td>Jan 21</td>
<td>Th</td>
<td>Working class proteins: Enzymes and catalysis</td>
<td>DM</td>
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<tr>
<td>Jan 25</td>
<td>M</td>
<td>Ruling class proteins: Transcription factors and protein kinases</td>
<td>DM</td>
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<tr>
<td>Jan 26</td>
<td>Tu</td>
<td>Movers and shakers: Molecular motors couple ATP to motion</td>
<td>DM</td>
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<tr>
<td>Jan 27</td>
<td>W</td>
<td>Discussion, integration and review for exam 1</td>
<td>DM</td>
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<tr>
<td>Jan 28</td>
<td>Th</td>
<td>Exam 1</td>
<td>DM</td>
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<tr>
<td>Feb 1</td>
<td>M</td>
<td>Light, photo-chemistry, and photoreceptors</td>
<td>KK</td>
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<tr>
<td>Feb 2</td>
<td>Tu</td>
<td>Photosynthesis: Photo-systems, electron transport, (\Delta G ) gradient</td>
<td>KK</td>
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<tr>
<td>Feb 3</td>
<td>W</td>
<td>Antioxidants, redox reactions, protective systems</td>
<td>KK</td>
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<tr>
<td>Feb 4</td>
<td>Th</td>
<td>Photosynthesis: CO_2 assimilation, photorespiration</td>
<td>KK</td>
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<tr>
<td>Feb 8</td>
<td>M</td>
<td>Photosynthesis: NO_3, NO_2, and NH_3 assimilation</td>
<td>KK</td>
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<tr>
<td>Date</td>
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<td>Instructor</td>
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<tr>
<td>Feb 9</td>
<td>Tu</td>
<td>C/N balance in C3, C4, and CAM photosynthesis</td>
<td>KK</td>
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<tr>
<td>Feb 10</td>
<td>W</td>
<td>Clock systems and diurnal regulation</td>
<td>KK</td>
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<tr>
<td>Feb 11</td>
<td>Th</td>
<td>Chinese New Year holiday (Feb 11th in US is 12th in China)</td>
<td>KK</td>
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<tr>
<td>Feb 15</td>
<td>M</td>
<td>Starch structure, biosynthesis, and metabolism</td>
<td>KK</td>
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<tr>
<td>Feb 16</td>
<td>Tu</td>
<td>Synthesis of sugars, amino acids, and their phloem transport</td>
<td>KK</td>
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<tr>
<td>Feb 17</td>
<td>W</td>
<td>Regulation of photosynthesis: Feedback via gene repression</td>
<td>KK</td>
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<tr>
<td>Feb 18</td>
<td>Th</td>
<td>Review</td>
<td>KK</td>
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<td>Feb 19</td>
<td>F?</td>
<td>Exam 2</td>
<td>KK</td>
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<tr>
<td>Feb 22</td>
<td>M</td>
<td>Sucrose import by sinks, its metabolism, sugar signaling</td>
<td>KK</td>
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<tr>
<td>Feb 23</td>
<td>Tu</td>
<td>Polysaccharides: Cell wall structure, biosynthesis, metabolism</td>
<td>KK</td>
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<tr>
<td>Feb 24</td>
<td>W</td>
<td>Glycolysis: Overview</td>
<td>KK</td>
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<tr>
<td>Feb 25</td>
<td>Th</td>
<td>Glycolysis: Update on enzymes and their significance</td>
<td>KK</td>
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<tr>
<td>Mar 1</td>
<td>M</td>
<td>Oxidative pentose phosphate pathway</td>
<td>KK</td>
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<tr>
<td>Mar 2</td>
<td>Tu</td>
<td>Mitochondrial functions: Electron transport, ( ^{1}H ) gradients</td>
<td>KK</td>
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<tr>
<td>Mar 3</td>
<td>W</td>
<td>Mitochondrial functions: Overview of citric-acid cycle</td>
<td>KK</td>
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<td>Mar 4</td>
<td>Th</td>
<td>Citric acid cycle: Update on the enzymes and their significance</td>
<td>KK</td>
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<td>Mar 8</td>
<td>M</td>
<td>Regulation of primary metabolism</td>
<td>KK</td>
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<tr>
<td>Mar 9</td>
<td>Tu</td>
<td>Exam 3</td>
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<tr>
<td>Mar 10</td>
<td>W</td>
<td>Fatty acid desaturation</td>
<td>BR</td>
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<tr>
<td>Mar 11</td>
<td>Th</td>
<td>Fatty acid synthesis I</td>
<td>BR</td>
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<tr>
<td>Mar 15</td>
<td>M</td>
<td>Fatty acid synthesis II</td>
<td>BR</td>
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<tr>
<td>Mar 16</td>
<td>Tu</td>
<td>Fatty acid oxidation I</td>
<td>BR</td>
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<tr>
<td>Mar 17</td>
<td>W</td>
<td>Fatty acid oxidation II</td>
<td>BR</td>
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<td>Mar 18</td>
<td>Th</td>
<td>Health promoting secondary products</td>
<td>BR</td>
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<tr>
<td>Mar 22</td>
<td>M</td>
<td>CBDs</td>
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<td>Mar 23</td>
<td>Tu</td>
<td>Flavonoids</td>
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<td>Mar 24</td>
<td>W</td>
<td>Phenolics and ESPS synthase</td>
<td>BR</td>
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<td>Mar 25</td>
<td>Th</td>
<td>Terpene synthesis</td>
<td>BR</td>
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<tr>
<td>Mar 29</td>
<td>M</td>
<td>Carotenoids</td>
<td>BR</td>
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<tr>
<td>Mar 30</td>
<td>Tu</td>
<td>Alkaloids I</td>
<td>BR</td>
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<tr>
<td>Mar 31</td>
<td>W</td>
<td>Alkaloids II</td>
<td>BR</td>
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<tr>
<td>April 1</td>
<td>Th</td>
<td>Exam 4</td>
<td>BR</td>
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<tr>
<td>April 5</td>
<td>M</td>
<td>Thermodynamics of ligands binding to proteins</td>
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<tr>
<td>April 6</td>
<td>Tu</td>
<td>Saturable binding of molecules to proteins</td>
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<td>April 7</td>
<td>W</td>
<td>Cooperativity: Hill and Monod-Wyman-Changeux models</td>
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<tr>
<td>April 8</td>
<td>Th</td>
<td>Equilibrium enzyme kinetics</td>
<td>DM</td>
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<td>April 12</td>
<td>M</td>
<td>Steady-state enzyme kinetics</td>
<td>DM</td>
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<tr>
<td>April 13</td>
<td>Tu</td>
<td>Allosteric enzymes: cooperative kinetics</td>
<td>DM</td>
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<tr>
<td>April 14</td>
<td>W</td>
<td>Metabolic Control Analysis: kinetics applied to pathways</td>
<td>DM</td>
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<tr>
<td>April 15</td>
<td>Th</td>
<td>Flux Balance Analysis: systems modeling of metabolism</td>
<td>DM</td>
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<tr>
<td>April 19</td>
<td>M</td>
<td>Applications of Flux Balance Analysis</td>
<td>DM</td>
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<tr>
<td>April 20</td>
<td>Tu</td>
<td>Discussion, integration and review for exam V</td>
<td>DM</td>
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<tr>
<td>April 22</td>
<td>W</td>
<td>Exam 5</td>
<td>DM</td>
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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


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](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 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

<table>
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<tr>
<th>Letter Grade</th>
<th>Grade Points</th>
<th>%</th>
<th>Letter Grade</th>
<th>Grade Points</th>
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<tbody>
<tr>
<td>A</td>
<td>4.0</td>
<td>92-100</td>
<td>C</td>
<td>2.0</td>
<td>65-68</td>
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<tr>
<td>A-</td>
<td>3.67</td>
<td>87-91</td>
<td>C-</td>
<td>1.67</td>
<td>60-64</td>
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<tr>
<td>B+</td>
<td>3.33</td>
<td>83-86</td>
<td>D+</td>
<td>1.33</td>
<td>55-59</td>
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<tr>
<td>B</td>
<td>3.0</td>
<td>79-82</td>
<td>D</td>
<td>1.0</td>
<td>52-54</td>
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<tr>
<td>B-</td>
<td>2.67</td>
<td>73-78</td>
<td>D-</td>
<td>0.67</td>
<td>50-53</td>
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<tr>
<td>C+</td>
<td>2.33</td>
<td>69-72</td>
<td>E</td>
<td>0</td>
<td>0-49</td>
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</table>
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/
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 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.