



Plant Biochemistry, Spring 2025

HOS 6932, Section 4C66, Class 22263, meets 10:40-11:30, MTWTh, on-line and in Fifield 1304, 4 credits.
 Registration questions: Curtis Smyder, 1509 Fifield Hall, (352) 273-4781, curtistr@ufl.edu

Instructors:

Karen E. Koch 2147 Fifield Hall, 352-273-4833. kekoch@ufl.edu
https://scholar.google.com/citations?user=4H_lhe8AAAAJ&hl=en
<https://hos.ifas.ufl.edu/people/on-campus-faculty/karen-e-koch/>

Donald R. McCarty 2237 Fifield Hall, 352-273-4846, drm@ufl.edu
<https://scholar.google.com/citations?user=5btrEm8AAAAJ&hl=en>
<https://aspb.org/wp-content/uploads/2020/06/Legacy-Society-Founding-Members-Donald-McCarty.pdf>

Bala "Saba" Rathinasabapathi 2247 Fifield Hall, 352-273-4847. brath@ufl.edu
<https://scholar.google.com/citations?user=m-40uqwAAAAJ&hl=en>
<https://twitter.com/DrSaba>

E-mail: Any time

Office hours: Meetings by appointment

Learning objectives will include:

- Evaluating strategies for climate-proofing plants: Biochemical adaptations to biotic and abiotic stresses
- Critical analyses of biochemical mechanisms for altering plant responses and phenotypes
- Interpreting metabolomics, metabolic micro-environments, and their significance
- Assessing metabolic phenotypes and their means of impacting plant development
- Problems in biochemistry of specialized products (caffeine, cannabinoids, theobromine, etc.)
- Engineering biosynthesis, storage, and metabolism of key plant products.
- Evaluating structure and function of plant proteins, from enzymes and transporters to motors
- Altering mechanisms of enzyme and transporter function, from kinetics to ligand binding
- Application of principles for metabolic modeling and flux balance analysis.
- Regulation of biochemistry and metabolism in an organismal context.

Tentative Lecture Schedule: 2025

| Date | Day | Title | Presenter |
|--------|-----|--|-----------|
| Jan 13 | M | Amino acids: Keys to protein structure and function | DM |
| Jan 14 | Tu | Exploiting protein diversity for separation and purification | DM |
| Jan 15 | W | Proteomics analysis | DM |
| Jan 16 | Th | Fundamentals of protein structure | DM |
| Jan 20 | M | MLK Day – no class | |
| Jan 21 | Tu | Determining protein structure: AlphaFold, crystallography, NMR | DM |
| Jan 23 | W | Physical bases of enzyme catalysis | DM |
| Jan 24 | Th | Enzyme mechanisms and catalysis | DM |
| Jan 27 | M | Movers and shakers: Molecular motors couple ATP to motion | DM |

| | | | |
|----------|-----|---|------------|
| Jan 28 | Tu | Discussion, integration and review for exam 1 | DM |
| Jan 29 | W | Exam 1 | DM |
| Jan 30 | Th | Strategies for enhancing photosynthesis? The big picture | KK |
| Feb 3 | M | Sink strength regulates photosynthetic genes | KK |
| Feb 4 | Tu | Sugar sensing and signaling in sources and sinks | KK |
| Feb 5 | W | Vulnerabilities of photosynthetic thylakoid systems and +H gradients | KK |
| Feb 6 | Th | Metabolites as signals: Critical analysis | students |
| Feb 10 | M | Critical roles of antioxidants, redox reactions, protective systems | KK |
| Feb 11 | Tu | Engineering photosynthesis: Questions of balance and interaction | KK |
| Feb 12 | W | The quest for C4 rice, engineering CAM, and roles of C/N balance | KK |
| Feb 13 | Th | Altering NO ₃ , NO ₂ , and NH ₃ assimilation? Benefits? Hazards? | KK |
| Feb 17 | M | Phloem biochemistry: Transporters, sugars, metabolism, and water | KK |
| Feb 18 | Tu | Exam 2 | KK |
| Feb 19 | W | Designer starch, fructans, and polysaccharides | KK |
| Feb 20 | Th | Altering polysaccharides: Cell walls and beyond | CV (guest) |
| Feb 24 | M | Glycolysis and endogenous low-oxygen micro environments | KK |
| Feb 25 | Tu | Critical analysis of respiratory perturbation: Genetic, abiotic, other | students |
| Feb 26 | W | Oxidative pentose phosphate pathway | KK |
| Feb 27 | Th | Mitochondrial functions: GABA, Glyoxylate, and Citric-acid cycles | KK |
| Mar 3 | M | Mitochondrial functions: Electron transport | KK |
| Mar 4 | Tu | Vulnerabilities of respiratory cristae, H ₂ O ₂ , and links beyond | KK |
| Mar 5 | W | Exam 3 | KK |
| Mar 6 | Th | Fatty acid desaturation | BR |
| Mar 10 | M | Fatty acid synthesis I | BR |
| Mar 11 | Tu | Fatty acid synthesis II | BR |
| Mar 12 | W | Fatty acid oxidation I | BR |
| Mar 13 | Th | Fatty acid oxidation II | BR |
| Break | M-F | Spring break March 15-23 | all |
| Mar 24 | M | Health-promoting secondary products | BR |
| Mar 25 | Tu | CBDs | BR |
| Mar 26 | W | Flavonoids | BR |
| Mar 27 | Th | Phenolics and ESPS synthase | BR |
| Mar 31 | M | Terpene synthesis | BR |
| Apr 1 | Tu | Carotenoids | BR |
| Apr 2 | W | Alkaloids I | BR |
| Apr 3 | Th | Alkaloids II | BR |
| April 7 | M | Exam 4 | BR |
| April 8 | Tu | Thermodynamics of ligand binding to proteins | DM |
| April 9 | W | Analysis of saturable binding to non-interacting sites | DM |
| April 10 | Th | Fitting binding equations by non-linear least squares | DM |
| April 14 | M | Interacting sites: Hill and Monod-Wyman-Changeux models | DM |
| April 15 | Tu | Equilibrium and steady-state enzyme kinetics | DM |
| April 16 | W | Allosteric enzymes: cooperative kinetics | DM |
| April 17 | Th | Metabolic Control Analysis: kinetics applied to pathways | DM |
| April 21 | M | Flux Balance Analysis: systems modeling of metabolism | DM |
| April 22 | Tu | Discussion, integration and review for exam V | DM |
| April 23 | W | Exam 5 | DM |

Instructors: DM (Donald McCarty), KK (Karen Koch), BR (Bala "Saba" Rathinasabapathi)

Course Prerequisites

A course in introductory 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 basics.

Recommended Textbooks (not required)

- 1--- *Biochemistry & Molecular Biology of Plants*, 2nd edition, print or electronic version, 2015, Wiley Blackwell (Still the best in 2025. About \$120 new, much less if used. Great visuals and explanations.
- 2--- A general biochemistry textbook - Check online booksellers for inexpensive older versions.
- 3--- Build your own custom textbook by supplementing in-class materials with personal notes from lectures and your own insights. Information for exams and long-term learning will be presented and discussed in class. Slide sets are meant as guides for in-class discussions so will not necessarily be complete without additional notes from attendees.

Course Home Page

From e-Learning (Canvas): you will be able to access notes and lecture slides, 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 or call 392-HELP or visit them in the Hub.

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 howto make-up missed work. Students at UF-RECs are expected to participate via zoom.

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 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 at:

UF grading policies: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>.

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. See additional information here:
<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>

Plagiarism: This is an important one! You may NOT use direct text from anyone or their website, including ChatGPT, 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 citation. To do so is a violation of the UF honor code with requisite disciplinary action and is also considered professional misconduct at all levels of the scientific community.

IT Resources and Software Use Policy

All UF faculty, staff and students are required to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken when appropriate. The University policies on use of proprietary software and IT resources can be found at the following sites. Please be sure you understand this information:

<https://it.ufl.edu/it-policies/acceptable-use/acceptable-use-policy/>

Accommodations for Students with Disabilities

For general information on resources: See 5, www.disability.ufl.edu

To request accommodations, register in advance with the Disability Resource Center (352-392-8565; <https://disability.ufl.edu/get-started/>) Appropriate documentation will be requested. Once registered, students will receive an accommodation letter to present to instructors when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.”

Other UF Resources

If you or someone you know are having anxieties or other challenges that interfere with general well-being and/or academic performance, please check UF resources available to help.

These include the following:

Resource Overview: Student Success Initiative, <http://studentsuccess.ufl.edu>

The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu/cwc/ (keep scrolling at this site for specific information).

Options include:

- Counseling Services Groups,
- Workshops,
- Outreach, and Consultation
- Self-Help Library
- Wellness Coaching (see also GatorWell below)

U Matter, We Care: If either you or someone you know is in distress (regardless of crisis level), please call 352-392-1575 or connect via umatter@ufl.edu to refer or report a concern and a team member will reach out to the student in distress. 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.
<https://umatter.ufl.edu/>

Student Health Care Center: Call 352-392-1161 for 24/7 information to help you find the care you need, or visit the Student Health Care Center website: <https://shcc.ufl.edu/>

GatorWell Health Promotion Services: For prevention services focused on optimal wellbeing, including Wellness Coaching for Academic Success, call 352-273-4450 or visit the GatorWell website at <https://gatorwell.ufsa.ufl.edu/>

University Police Department: Visit UF Police Department website or call 352-392-1111 (or 9-1-1 for emergencies). <https://police.ufl.edu/>

UF Health Shands Emergency Room / Trauma Center: For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; Visit the UF Health Emergency Room and Trauma Center website at <https://ufhealth.org/locations/uf-health-shands-emergency-room-trauma-center>

Academic Resources

E-learning technical support: Contact the UF Computing Help Desk at 352-392-4357 or via e-mail at helpdesk@ufl.edu

Career Connections Center: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services. <https://jobs.ufl.edu>

Library Support and Literature Searches: Various ways to receive assistance with respect to using the libraries or finding resources.

<https://uflib.ufl.edu/>

<https://uflib.ufl.edu/find/databases/>

Teaching Center: Broward Hall, 352-392-2010 or to make an appointment 352- 392-6420. General study skills and tutoring (a subdivision of U Matter). <https://umatter.ufl.edu/office/teaching-center/>

Writing Studio: 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers. Valuable for students, postdocs, and faculty – improve at all levels.

<https://writing.ufl.edu/writing-studio/>

Classroom etiquette

You are expected to be courteous to your fellow students and not interfere with their learning. Please be on time, silence your cell phone, and limit use of electronic devices to class-related material.

Please give us feedback *during* the course so we can improve!

Please consider providing suggestions for course improvement during the semester. The sooner we know what would make this course better, the sooner we can do it. This would be much appreciated!