Biochemistry/Botany 621 **Plant Biochemistry** Spring, 2015

Plants harnness sunlight energy, fix atomospheric carbon dioxide, and produce a diverse array of chemical compounds to survive in challenging ecological niches. Plant-derived metabolites are also major sources of human food, fiber, fuel, and medicine. The Biochemistry/Botany 621 course covers topics related to plant metabolism and discusses how plants generate carbon and energy sources by photosynthesis and synthesize various compounds through complex networks of metabolic pathways. Various analytical tools (e.g., mass spectrometry, NMR) that are used in plant biochemistry research will be also introduced. The course is designed for graduate students and advanced undergraduates and has two 75-minute classes per week, which consist of lectures and student presentations based on primary scientific literature. General chemistry and biochemistry are prerequisites to this course.

Time and location: Tuesdays and Thursdays from 9:30-10:45 am in Biochemistry building room 1116.

Textbook:

There is no textbook for this course but we recommend two excellent plant biochemistry books.

- *Biochemistry and Molecular Biology of Plants*. Buchannan, BB, Gruissem, W, and Jones, RL editors. American Society of Plant Physiologists publisher (2000) (www.aspb.org) [or a new version, if becomes available]
- *Plant Biochemistry and Molecular Biology*. Heldt, H-W. Oxford University Press, 4th ed. (2010) http://www.sciencedirect.com.ezproxy.library.wisc.edu/science/book/9780123849861

Instructors:

Sebastian Y. Bednarek, Biochemistry, bednarek@biochem.wisc.edu
Hiroshi A. Maeda, Botany, maeda2@wisc.edu
John Ralph, Biochemistry, jralph@wisc.edu

Additional lecturers:

Jean-Michel Ané, Agronomy, jane@wisc.edu

Learning goals are to:

- Learn biochemical mechanisms underlying plant metabolism.
- Get familiarized with various analytical tools used in the field of plant biochemistry.
- Obtain critical scientific thinking skills (how to interpret data, identify unresolved questions).

Class format for each topics:

- Two to three 75-min lectures
- Assignment of problem sets (two or three essay-type questions, one question could be simply, "Describe an unresolved question in the field of photosynthesis light reaction."
- 75-min discussion based on an assigned primary literature (30-45 min discussion by a presenter, followed by discussion facilitated by an "editor".

Evaluation:

- Homework (1/3), problem sets for each topics (turn in within one week of assignment)
- Discussion based on primary scientific literature (presenter/editor/reviewer) (1/3)
    - **Presenter**: Present backgrounds, results, and conclusions of an assigned paper.
    - **Editor**: Facilitate discussion and write one page summary, which includes 1) main conclusion of the paper, 1) novelty and strength of the study, 2) weakness and shortfall of the study (e.g., if the conclusions are supported by the results), 3) potential future directions.
    - **Reviewers (the rest of the class)**: Provide your opinion to the class (editor) during discussion
- Proposal/Review (1/3) (5-10 pages)
    - Write either a review article or a research proposal on topics of your interest.
    - Consult with an instructor before starting to write a paper.
    - Follow the guideline described in **Current Opinion in Plant Biology** (http://www.journals.elsevier.com/current-opinion-in-plant-biology/, look for Guide for Author) for a review.
    - Submit to an instructor by April 21st to be reviewed.
      Revise and resubmit the final version by May 14th.

Lecture schedule:

BCH/BOT 621 schedule for Spring 2015

Tuesday / Thursday, 9:30pm - 10:45pm, Biochemistry 1116

date	week	Topics	Instructor	Due dates
20-Jan	Tue	**Introduction** (Overview of plant metabolism)	Hiroshi Maeda/Sebastian Bednarek	
22-Jan	Thur	**Light reactions** (Photochemisty / Z scheme / photophosphorylation)	Hiroshi Maeda	
27-Jan	Tue	Discussion (photosystem organization)	Hiroshi Maeda	
29-Jan	Thur	**Light reactions** (regulation, photo-oxidative stress)	Hiroshi Maeda	
3-Feb	Tue	Discussion	Hiroshi Maeda	
5-Feb	Thur	**Carbon fixation**	Hiroshi Maeda	1st quiz due
10-Feb	Tue	**Photorespiration / C4 and CAM photosynthesis**	Hiroshi Maeda	
12-Feb	Thur	Discussion	Hiroshi Maeda	
17-Feb	Tue	**Primary carbon metabolism** (sucrose/starch biosynthesis, photosynthate translocation)	Hiroshi Maeda	
19-Feb	Thur	**Cellular Respiration**	Hiroshi Maeda	
24-Feb	Tue	Discussion	Hiroshi Maeda	
26-Feb	Thur	**Nitrogen metabolism (Nitrogen assimilation)**	Hiroshi Maeda	2nd quiz due
3-Mar	Tue	**Amino acid biosynthesis** (GC-MS)	Hiroshi Maeda	
5-Mar	Thur	**Rhizobia-plant symbiosis**	Jean-Michel Ané	
10-Mar	Tue	Discussion	Hiroshi Maeda	
12-Mar	Thur	**Metabolomics**	Hiroshi Maeda	3rd quiz due
17-Mar	Tue	**Specialized metabolism I** (terpenoids)	Hiroshi Maeda	
19-Mar	Thur	**Specialized metabolism II** (phenylpropanoids, LC-MS)	Hiroshi Maeda	
24-Mar	Tue	Discussion	Hiroshi Maeda	
26-Mar	Thur	**Lipid metabolism I** (fatty acid biosynthesis)	Sebastian Bednarek	4th quiz due
Mar 28-Apr 5		*Spring break*		
7-Apr	Tue	**Lipid metabolism II** (glycolipids, plant cuticles)	Sebastian Bednarek	
9-Apr	Thur	Lecture continues	Sebastian Bednarek	
14-Apr	Tue	Discussion	Sebastian Bednarek	
16-Apr	Thur	**Plant cell wall I** (sugar metabolism)	Sebastian Bednarek	5th quiz due
21-Apr	Tue	**Plant cell wall II** (polysaccharides)	Sebastian Bednarek	*Paper 1st submission
23-Apr	Thur	Lecture continues	Sebastian Bednarek	
28-Apr	Tue	Discussion	Sebastian Bednarek	
30-Apr	Thur	**Plant cell wall III** (lignin, NMR)	John Ralph	6th quiz due
5-May	Tue	Lecture continues	John Ralph	
7-May	Thur	Discussion	John Ralph	
14-May				* Paper fina submission