**Spring 2017**

**Course Title:** **Plant Biochemistry**, BCH/PLS/PPA 609

**Instructors**: David Hildebrand, 403 PSB, 257-5020x80760, dhild@uky.edu

 Robert Houtz, 401 PSB, 257-1982, rhoutz@uky.edu

 George Wagner, 202D KTRDC, 257-5974, gwagner@uky.edu

 Ling Yuan, 200D KTRDC, 257-4806, lyuan3@uky.edu

**Time**: T/R 9:30 to 10:45

**Place**: Plant Science Bldg. 360 conf. room; 360 PSB

**Credits**: 3

# Prerequisites: BCH 607, CHE 550 or equivalent.

**Description**: The course will consider the chemical constituents of plants, their synthesis and contributions to key metabolic processes and regulation of their biosynthesis. Included will be discussions of photosynthesis, carbohydrates, lipids, isoprenoids, phenylpropanoids; nitrogen fixation, reduction and assimilation; the synthesis of alkaloids and general secondary compound biosynthesis.

**Objectives**: To acquire a good working knowledge of the chemistry of important biological processes in plants. To be able to readily assess current developments in plant biochemistry.

**Grading**: 3 sectional exams, 130, 100, 90 points each 320 points

 Outline of plant biochemistry position paper 10 points

 Oral presentation & abstract of review 40 points

 Evaluation of other student presentations 10 points

 2 assignments or quizzes, 10 points each 20 points

 Class participation 10 points

**Plant Biochemistry Position Paper:** Review and take a position on a plant biochemistry topic for which different conclusions can be drawn from the currently information available. ~ 5 - 10 pages in length covering a minimum of 5 peer-reviewed sources of literature. Topic must be approved by instructor and should include a title, introduction/context, hypotheses addressed, techniques used, conclusions, future directions and literature cited. 90 points

 Total: 500 points

90-100 = A; 78-89 = B; 65-77 = C; 51-64 = D; 0-50 = E. Grades may be curved as necessary.

**Office hours**: David Hildebrand - Thursdays 11-1 PM or by appointment & web conferencing

**Class Text**: Biochemistry & Molecular Biology of Plants 2nd edition, B.B. Buchanan, W. Gruissem and R.L. Jones, eds., Wiley, 2015.

**Reference Materials**: Introduction to Plant Biochemistry 2nd edition, T.W. Goodwin & E.I. Mercer, Pergamon Press, Oxford, 1983; The Plant Cell vol. 7, #7 (July 1995) Special issue on Plant Biochemistry; Biochemistry, R.H. Garrett & C.M. Grisham, Saunders College Publishing, Fort Worth, 1995; Plant Biochemistry, P.M. Dey and J.B. Harborne, Academic Press, 1997; Plant Biochemistry, Heldt, Elsevier, 2005; Plant Biochemistry, Gleason & Chollet, Jones & Bartlett, 2012. Recent publications and reviews.

**Lecture/ Date Topic**

1. 1-12 Introduction – Class policies and overview. Integrated metabolism

2. 1-17 Carbohydrate metabolism- mono- & oligosaccharides, glycosides, ascorbic acid

3. 1-19 Carbohydrate metabolism- storage and structural polysaccharides

4. 1-24 Lipids- introduction, synthesis of fatty acids, waxes & cutin

5. 1-26 Lipids- synthesis of membrane lipids & triglycerides

6. 1-31 Lipids- fatty acid oxidation

7. 2-2 Nitrogen metabolism- nomenclature, N2 fixation

8. 2-7 Nitrogen metabolism- nitrate reduction, ammonia assimilation

 **2-7 Position-paper topic selection due**

9. 2-9 Nitrogen metabolism- “essential” and non-protein amino acids, porphyrins

10. 2-14 Nitrogen metabolism- sulfur reduction and assimilation, alkaloids

 **~ 2-15 1st section exam**

11. 2-16 Isoprenoids- source and nomenclature

12. 2-21 Isoprenoids- synthetic mechanisms

13. 2-23 Isoprenoids- biosynthesis of select isoprenoids

14. 2-28 Phenylpropanoids- secondary metabolites derived from phenylalanine

15. 3-2 Phenylpropanoids- lignin and lignin precursors

16. 3-7 Respiration- aspects of respiration unique to plants

 **~ 3-8 2nd section exam**

17. 3-9 Respiration- aspects of respiration unique to plants

18. 3-21 Photosynthesis- Introduction and overview of photosynthesis

19. 3-23 Photosynthesis- Unicellular photosynthetic pathways

20. 3-28 Photosynthesis- Models integrating electron transport, ATP/ADP

 3-28 **Position-paper** outlines due

21. 3-30 Chloroplastic compounds, inhibitors and the regulation of CO2 fixation

22. 4-4 Photosynthesis- Electron transport and energy capture

 **4-4 Position-paper** abstracts due

23. 4-6 Photosynthesis- Energetic considerations

 4-11 & 13 **Position-paper due** (4-11 for written paper deadline)**; Presentations**

24. 4-18 Photosynthesis- Organization of the PSII and PSI reaction centers

24. 4-20 Photosynthesis- Structural organization of the PS-II Rxn center

25. 4-25 Photosynthesis- ATP synthesis, chemiosmotic hypothesis and H+ transport

26. 4-27 Review & Integration of Plant Metabolic Pathways

 TBD 3rd section exam (May 4)

**Policies for BCH/PPA/PLS 609** (David Hildebrand’s part)

Attendance

As we encourage and utilize active learning and learn from each other when feasible in this class it is important that you be on time and try to minimize your absences. We are flexible about excusing your presence in class but ask that you get the instructor’s approval at least one class period prior to your absence except in emergencies.

Assignments

Assignments are due by the beginning of class on due dates.

Cheating and Plagiarism

According to UK regulations the minimum penalty for documented cases of cheating or plagiarism is an E for the course.

The Students Rights & Responsibilities handbook specifies the relationship between students and the University. It can be accessed on the University of Kentucky Web Page at:

<http://www.uky.edu/StudentAffairs/Code>

Printed copies can be requested from the following places:

Office of the Dean of Students Office of the Ombud

 513 Patterson Office Tower 109 Bradley Hall

Student Government Association Office William T. Young Library

120 Student Center

Specific shelter and evacuation instructions for CAFE buildings:

* Shelter locations: <http://administration.ca.uky.edu/SevereWeatherSafePlaces>
* Building Emergency Action Plans (including evacuation instructions): <http://administration.ca.uky.edu/node/135>