

ADVANCED FOOD CHEMISTRY
FOS 6315C (section #1328)
Fall 2015, 4 credits

Lectures: McCarty Hall B (MCCB), Room 2102 (M, W, F; Period 2, 8:30-9:20 am)

Lab: FSHN Bldg., Room 310 (Thur.; Period 7-9, 1:55 – 4:55 pm)

Instructor: Dr. Jesse F. Gregory
 Office: Room 208, Food Science & Human Nutrition Bldg.
 Phone 392-1991 ext. 225 e-mail: jfgy@ufl.edu

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| Lab Instructors | |
| Bridget Stokes | Teaching lab manager |
| Gayathri Balakrishnan | Teaching assistant |
| Kaipeng Xu | Teaching assistant |

Office Hours: Monday and Wednesday 9:30-11:00am or by appointment

Course Description:

The course will deal with the chemistry of the principal components of foods, their properties and interactions, and the changes that occur during processing, storage, and utilization. Emphasis will be on evidence derived from original research literature, interpretation of research findings, and problem solving based on the scientific principles of food chemistry.

Prerequisites: Undergraduate courses in biochemistry and food chemistry or permission of instructor.

Objectives:

1. To provide an understanding of the chemical function and properties of major food components.
2. To provide an understanding of the chemical interactions of food components and their effects on sensory and nutritional quality, functional properties, and safety of foods.
3. To provide an understanding of the chemical basis of food preservation and the effects of processing and storage on food quality.
4. To familiarize the student with common analytical and experimental methods used in the study of the major food components.
5. To examine the basis of food chemistry-related issues in food safety, regulation and current events.

Format: Lectures, laboratory exercises, discussion of scientific literature. Participation in class discussion is expected.

Exams and Presentations: Written exams will be given covering approximately each third of the course. The final exam will not be cumulative. The 1st and 2nd exams are tentatively scheduled for 5:15-7:15pm on Wednesday 10/7/15 and Monday 11/16/15, respectively. The 3rd and final exam is 7:30-9:30am on Friday 12/19/15.

The exams will be in short essay format and will include questions involving: (a) basic factual material with emphasis on major topics/principles; (b) solving practical problems in food chemistry by application of food chemistry principles; and (c) application of the course material in the interpretation of research data.

Students also will prepare a written summary and critique of a recently published research paper, along with an oral presentation and class discussion of the paper. Tentative dates are shown in the lab schedule (last page of syllabus).

| Grading: | Percent of Grade |
|--|------------------|
| Written examinations (3) | 60 |
| Laboratory: | |
| Reports (~5 written) | 31 |
| Critique of research paper (presentation and written summary) | 9 |

Please note that the University of Florida revised its grading system to include the use of minus grades and, in doing so, revised the point value associated with each grade. Please see <http://www.isis.ufl.edu/minusgrades.html> for additional information.

| Grade Values for Conversion May 11, 2009 and After | | | | | | | | | | | | |
|--|-----|------|------|------|------|------|------|------|------|------|-----|-------------------|
| Letter Grade | A | A- | B+ | B | B- | C+ | C | C- | D+ | D | D- | E, I, NG, S-U, WF |
| Grade Points | 4.0 | 3.67 | 3.33 | 3.00 | 2.67 | 2.33 | 2.00 | 1.67 | 1.33 | 1.00 | .67 | 0.00 |

Reference book and class notes: There is no current book that is fully appropriate as a textbook for a graduate level course in food chemistry. Fennema's Food Chemistry, 4th Edition (Damodoran, Parkin and Fennema, eds.) will be our primary text and reference book. It is too long for use as a traditional textbook, and the chapters vary in depth and relevance to this course. However, I believe that it remains the best overall choice for a graduate course of this type. We will use this as the major source/reference book from which I will give assigned readings and select examples for presentation/discussion in lectures. **I consider this to be strongly recommended but not required since a copy of it will be on reserve in the library.** I also recommend it for your permanent library. Please be aware that a new (5th) edition will be published in 2016.

Lecture notes compiled by Dr. Gregory will be distributed as pdf files by e-mail. I will provide you with printed copies of the first two lectures only. You are strongly encouraged to make a printed copy.

Classroom Policies: Cell phones and other forms of electronic communication are disruptive and distracting and must be turned off in the classroom and laboratory (**please don't check your e-mail, texts, etc.**). Students are expected to be on time for lectures and lab. Attendance at lectures will not be taken, but students are expected to attend all lectures and labs. Students are expected to be familiar with the topic to be covered in lectures and participate in class discussion. Makeup exams are frowned upon and will only be given with the advance permission of the instructor.

Students are expected to attend class, labs and exams. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found in the online catalog at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

Academic Honesty:

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor.

It is to be assumed that all work will be completed independently unless the assignment is defined as a group project, in writing by the professor. The many excellent literature retrieval services available online have revolutionized many fields of academics, especially in the sciences. Proper citation of your reference source, including web sites, reviews and original research literature is essential. These policies will be vigorously upheld at all times in this course. **Please be aware that faculty members may use at their discretion <http://www.turnitin.com> and other anti-plagiarism resources made available through UF e-Learning Support Services.**

Students with Disabilities Act:

The Dean of Students Office coordinates the needed accommodations of students with disabilities. This includes the registration of disabilities, academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services, and mediating faculty-student disability related issues. Dean of Students Office, 202 Peabody Hall, 392-7066. www.dso.ufl.edu. 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.

Campus Help Resources:

Students experiencing crisis or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. Both the Counseling Center and Student Mental Health provide confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career and academic goals, which interfere with their academic performance. The Counseling Center is located at 301 Peabody Hall (next to Criser Hall). Student Mental Health is located on the second floor of the Student Health Services in the Infirmary.

Phone numbers and contact sites for university counseling services and mental health services: <http://www.counseling.ufl.edu/cwc/Default.aspx>; 392-1575, University Police Department 392-1111 or 9-1-1 for emergencies.

Course Evaluations: Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

Software Use: All faculty, staff and students of the University are required and expected 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 as appropriate.

Reference Materials on reserve at Marston Science Library

1. Damodaran, S., K. Parkin, O. R. Fennema, eds. 2007. *Fennema's Food Chemistry*, 4th Ed., CRC Press. ISBN: 0849392721
2. Deutscher, M.P. 1990. Guide to Protein Purification. *Methods in Enzymology*, Vol. 182, Academic Press, San Diego, CA. Call # QP 601 .M49 v.182
3. Damodaran, S. Food proteins: properties and characterization. New York, N.Y.: VCH, c1996. Call # TP453.P7 F68 1996.
4. Nielsen, S.S. 2003. Food Analysis, Third Ed., Kluwer Academic/Plenum Publishers, New York. Call # TX 545 I 58 1998
5. Segel, I.H. 1976. Biochemical Calculations, 2nd ed. John Wiley and Sons, Inc., New York. Call # 442.7 S454b2
6. Troller, J.A. and Christian, J.H.B. 1978. Water Activity and Food. Academic Press, New York. Call # TX553 .W3 T76
7. Whitaker, J.R. 1994. Principles of Enzymology for the Food Sciences, 2nd Ed. Marcel Dekker, Inc., New York. Call # QP601.W44.1994

Online Reference Book: Food Chemistry by Belitz et al. (Springer, 2009; link below) is available online (separate pdf of each chapter can be opened). In many ways, this is a good (but slightly lower level) alternative and supplement for Fennema 4th ed. You must be logged on through the UF network to access it. (Belitz, H.-D., Grosch, W., and Schieberle, P. 2009. Food Chemistry, 4th ed. Edition 4, Publisher Springer Berlin Heidelberg, DOI 10.1007/978-3-540-69934-7, ISBN 978-3-540-69933-0 (Print) 978-3-540-69934-7 (Online, (<http://www.springerlink.com/content/x2117v/>)). We will refer to this occasionally in class.

Course Outline:

I. Physical and Chemical Properties of Water

- A. Structure and chemical properties
- B. Solute effects on water: state of water in foods
- C. Kinetic principles
- D. Water activity: principles, measurement, control, effects, related concepts
- E. Acid-base chemistry of foods and common additives

II. Proteins

- A. Physical properties of proteins in relation to protein structure
- B. Analytical methods (brief overview)
- C. Basic properties: hydration, ionization, colloidal behavior
- D. Functional properties
- E. Effects of food processing: changes occurring in chemical, functional & nutritional properties of proteins
- F. Nitrite function, chemistry and nitrosamine formation.

III. Enzymes (applied aspects will be discussed in lab lectures)

- A. Factors affecting reaction rate; characteristics of enzymatic reactions
- B. Deleterious enzymes in food systems: phenoloxidase example
 1. Reactions catalyzed by enzyme, nonenzymatic formation of melanin
 2. Approaches to inhibition of browning. Ascorbate and sulfite chemistry, effects, and mechanisms.
 3. Chemistry, effects, and safety concerns of sulfiting agents in foods.

IV. Lipids

- A. Content and role in foods

- B. Analytical methods
- C. Chemical, nutritional and physical properties
- D. Processing of fats and oils
- E. Degradation reactions

V. Carbohydrates

- A. Simple sugars, sugar derivatives and oligosaccharides
 1. Basic chemistry; conformation, anomeric forms, equilibria, reactivity, sweetness
 2. Sugar derivatives: sugar alcohols, glycosides, etc.
 3. Browning and related reactions
 4. Case studies – acrylamide and furan formation in foods
- B. Polysaccharides
 1. Basic structures and properties: starches, celluloses, gums, modification techniques
 2. Dietary fiber: components, properties, analysis

2015 LECTURE SCHEDULE: This schedule is tentative and may be altered as the course progresses. In addition to the lectures listed below, introductory lectures will be presented at the start of many of the lab periods.

Notes: a. **Days off:** The following are official holidays (classes cancelled): 9/7/15, Labor Day; 11/6/15, UF Homecoming; 11/11/15, Veterans Day; 11/25 - 11/27/15, Thanksgiving.

b. **Supplemental readings:** Appropriate sections of Food Chemistry (Fennema 4th ed., 2007) will constitute the main supporting material for each group of lectures, with chapters/pages listed below. Handouts will be provided on certain topics, while current literature references and sections of books on reserve in the Marston Science Library will be assigned in class periodically. References to journal articles (mostly available online) will be provided in class.

| <u>DATE</u> | <u>TOPIC</u> | <u>FENNEMA READINGS</u> |
|-------------|--|---|
| Aug 24 | Introduction; water in foods | Ch. 1 and 2; also Belitz, Ch 1 |
| Aug 26 | Water | |
| Aug 28 | Water | |
| Aug 31 | Water | |
| Sept 2 | Water | pp 707-712 |
| Sept 4 | Water, acid-base principles, food applications | pp 791-799 |
| Sept 7 | Labor Day Holiday – class cancelled | |
| Sept 9 | Proteins | Ch. 5 |
| Sept 11 | Proteins | |
| Sept 14 | Proteins | |
| Sept 16 | Proteins | |
| Sept 18 | Proteins | |
| Sept 21 | Proteins | |
| Sept 23 | Proteins | |
| Sept 25 | Proteins | |
| Sept 28 | Proteins | |
| Sept 30 | Proteins | |
| Oct 2 | Proteins | |
| Oct 5 | Enzymes (kinetic principles) | pp 332-355 |
| Oct 7 | Enzymes (phenol oxidase, sulfiting agents, etc.) | Whitaker, Principles of Enzymol, 2 nd ed, pp 543-6 |
| Oct 11 | Enzymes (phenol oxidase, sulfiting agents, etc.) | Fennema pp 407-412 |
| Oct 12 | Enzymes | |

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| Oct 14 | Lipids | Ch. 4 |
| Oct 16 | Lipids | |
| Oct 19 | Lipids | |
| Oct 21 | Lipids | |
| Oct 23 | Lipids | |
| Oct 26 | Lipids | |
| Oct 28 | Lipids | |
| Oct 30 | Lipids | |
| Nov 2 | Lipids | |
| Nov 4 | Lipids | |
| Nov 6 | UF Homecoming – Class Cancelled | |
| Nov 9 | Carbohydrates | Ch. 3 |
| Nov 11 | Veterans Day Holiday – Class Cancelled | |
| Nov 13 | Carbohydrates | |
| Nov 16 | Carbohydrates | |
| Nov 18 | Carbohydrates | |
| Nov 20 | Carbohydrates | |
| Nov 23 | Carbohydrates | |
| Nov 25 | Thanksgiving Holiday – class cancelled | |
| Nov 27 | Thanksgiving Holiday – class cancelled | |
| Nov 30 | Carbohydrates | |
| Dec 2 | Carbohydrates | |
| Dec 4 | Carbohydrates | |
| Dec 7 | Carbohydrates | |
| Dec 9 | Carbohydrates; Conclusion | |
| Dec 17 | Final exam (10:00-noon) | |

FOS 6315 LABORATORY

1. Lab Reports:

Although you will conduct in experiments in lab groups, please prepare your written lab report individually.

Lab report format:

A. Title page. Be sure to include: title of assignment, dates on which the work was done, and lab partners with whom you worked.

B. Purpose of the exercise. Clearly state objectives.

C. Introduction. Briefly state the nature of the phenomenon or problem and the chemical principles involved. Three paragraphs or less is sufficient - more is not better. Cite appropriate references used.

D. Experimental. Describe the procedures briefly. In most cases you may simply refer to the lab handout, but state any changes made in materials or methods. For example, "All procedures were identical to those described in the lab handout except that the sample weight was changed from 5 to 10 g as directed by the instructor."

E. Results. Tabulate all data collected and observations made. **Show sample calculations that include the proper cancellation of units.** Use appropriate labeling, proper units, and only justifiable significant figures. Rarely are more than three significant figures acceptable: e.g., 2.34 nmol/L, NOT 2.3399374 nmol/L. All graphs should be labeled with proper units on the axes, a title, and your name and date. **The importance of proper presentation of data cannot be overemphasized.**

See the following web site for a useful guide to the concept and proper usage of significant figures: <http://qetools.com/qetools-reference/Rules%20on%20Significant%20Digits.htm>

F. Discussion. Discuss the experiment in terms of your observations and the objectives of the exercise. Show or describe the chemical reactions involved in the phenomenon being studied, including the physical or chemical basis of the analytical method(s) used. Don't overdo it, however. Also discuss the agreement of your results with those expected or those previously published (cite references). Postulate reasons for any discrepancies, and briefly discuss sources of experimental error. Concise reports are greatly favored by your instructor.

G. Conclusions. Give a brief summary of the chemical principles illustrated in the exercise. Don't just restate the objectives.

H. References. Cite all references used in the report. Selection of pertinent reviews or research articles is encouraged. References to internet web sites are acceptable ONLY from sites of refereed journals or government databases. Use of Wikipedia.org is not acceptable scholarship. Also, citing lectures by your instructor in your reference list is not acceptable. Cite the original references.

The ability to communicate clearly and concisely in grammatically correct written English is essential. Please prepare your reports using the software of your choice. Unless otherwise specified, the lab reports will be due at the start of the laboratory period one week after completion of the exercise. The lab reports will ordinarily be graded on the basis of 10 points per weekly exercise. In cases experiments extend over several weeks for a single lab report, the point value will be increased accordingly. Please note that 25% of the grade of each lab report will be based on accuracy in calculations, proper use of units, and proper use of significant figures.

2. Lab Policies, Safety and General Procedures:

- Attendance:** Laboratory attendance is expected. Be on time and be prepared. It is usually difficult if not impossible to make up missed lab exercises. If you must miss lab due to extenuating circumstances, please notify Dr. Gregory *in advance*.
- No eating or drinking in the laboratory.
- Know the location of fire extinguishers and safety shower.
- Use care when working with solvents and other potentially dangerous materials. Use volatile compounds in the fume hoods as instructed.
- Do not pour chemicals down the drain. Use the waste bottles provided.
- Wear safety goggles and gloves** when working with potentially hazardous chemicals.
- The use of a lab coat or plastic apron is optional but recommended.

- H. If reagents are spilled on the bench, floor, or outside of their container, please WIPE UP THE SPILL.
- I. If you take equipment or reagents from the original location, please return them. It isn't fair to make other students spend lab time looking for them.
- J. Clean up after yourself. Rinse glassware and place it where designated. This will make cleanup simpler and will ensure that hazardous chemicals do not remain in the glassware.

· ADVANCED FOOD CHEMISTRY LAB SCHEDULE – Fall 2013 (subject to change as needed)

| Dates | Topic | Relative Point Value |
|--------------|---|---|
| 8/27/15 | Lab procedures and safety review Water activity measurement, principles, demo of water activity measurement | no report assigned |
| 9/3/15 | Water and food stability – initiate long-term study | no report assigned |
| 9/10/15 | Food proteins Protein isolation and observation of solubility introduction to online protein databases | |
| 9/17/15 | Measurement of protein concentration | 10 (Report 1= isolation, measurement, and informatics due 9/25/15) |
| 9/24/15 | Electrophoresis | |
| 10/1/15 | Protein solubility study (pH, heat, carbohydrate interactions) | 20 (Report 2= PAGE, sol./denaturation, due 10/8/15) |
| 10/8/15 | Enzymes: assays and kinetic principles & inhibition | 10 (Report 3 due 10/15/15) |
| 10/15/15 | Food lipid extraction and characterization | |
| 10/22/15 | Food lipid extraction and characterization | |
| 10/29/15 | Food lipid extraction and characterization | 15 (Report 4 due 11/5/15) |
| 11/5/15 | To be scheduled as needed | |
| 11/12/15 | Analysis of water and food stability study | 15 (Report 5 due 11/19/15) |
| 11/19/15 | To be scheduled as needed | |
| 11/26/15 | Thanksgiving | |
| 12/3/15 | Research paper presentations | |

FOS 6315
ADVANCED FOOD CHEMISTRY
FALL 2015
STUDENT INFORMATION SHEET

Due: Friday, August 28, 2015 in class

Name: _____

E-mail: _____

Hometown: _____

How long have you been at UF? _____

Major (Dept. and Curriculum): _____ Anticipated graduation date: _____

Why are you taking this course? _____

Is there an aspect of food chemistry that interests you most? _____

List some of your accomplishments to date: _____

What chemistry and biochemistry courses have you taken? _____

Hobbies and outside interests: _____
