

# Chem 212 JK: Survey of Organic and Biochemistry

The most fun you can have with your goggles on!

Jan. 15 - May 9, 2013      TTh 1:00-3:40 pm      Room 3170

- Instructor:** Charles Abrams, Room 3838, (773) 907-4073, [cabrams@ccc.edu](mailto:cabrams@ccc.edu)
- Websites:** [ccc.blackboard.com](http://ccc.blackboard.com) – *Classnotes from previous semesters, grades*  
[faculty.ccc.edu/cabrams](http://faculty.ccc.edu/cabrams) - *Information about Professor Abrams*  
[faculty.ccc.edu/cabrams/chem212](http://faculty.ccc.edu/cabrams/chem212) – *Practice quizzes, other info (model kits, etc.)*
- Office Hours:** MW 12:00-1:30; TTh 12:10-1:00pm and 3:40-4:40pm; also available by appointment
- Required\*:** [Introduction to Organic and Biochemistry](#), 9<sup>th</sup> ed., Bettelheim et al., ISBN 0-495-39116-6 **\$192**  
[Laboratory Experiments for .....](#), 7<sup>th</sup> ed., Bettelheim & Landesberg, ISBN 0-495-39196-4 **\$159**  
*Earlier editions are acceptable. A custom lab manual containing only the required experiments is available from the bookstore; it is not available elsewhere. You may purchase individual chapters from [cengagebrain.com](http://cengagebrain.com) for less than the cost of the custom lab manual. Search that site for the ISBN above and use the schedule in the syllabus to identify the experiments you need. A copy of the textbook is on reserve in the library*
- Optional\*:** Colored pens or pencils for taking notes (three colors plus black) **\$5**  
Molecular modeling kit (see link under “Syllabus” in Blackboard for details), **\$15-\$30**
- Catalog Description:** Survey of organic chemistry including: nomenclature and reactions of major functional groups essential to biochemistry, an introduction to the structure and function of biomolecules, and the metabolism of proteins, lipids, and carbohydrates. Writing assignments, as appropriate to the discipline, are part of the course. *Prerequisite:* Chemistry 201 or Consent of Department Chair.
- Mission Statement:** Our mission dedicates us to deliver high-quality, innovative, affordable, and accessible educational opportunities and services that prepare students for a rapidly changing and diverse global community.
- Method of Instruction:** The course will consist of lectures, demonstrations, laboratory activities, in-class discussion, in-class worksheets, and molecular model building.
- FERPA:** FERPA (Family Educational Rights and Privacy Act) is a federal law that protects the privacy of student educational records: [www.ed.gov/policy/gen/guid/fpco/ferpa/index.html](http://www.ed.gov/policy/gen/guid/fpco/ferpa/index.html). Faculty cannot reveal information about students, or discuss student records over the phone or unsecure e-mail. CCC student e-mail meets FERPA requirements.
- Course Objectives (Goals):** This is the final chemistry prerequisite for many allied health professional programs, including post-baccalaureate nursing, nutrition, and physical therapy. It extends concepts learned in general chemistry into organic and biochemistry. This course introduces the language of organic chemistry and fosters an appreciation of the ‘poetry’ of biochemistry. It provides the chemical basis for understanding biological structures including the lipid bilayer, carbohydrates, receptors, enzymes, and DNA, and biological processes including the mechanism of drug action. The course addresses three of the general education goals of the College: Goal 2: Students demonstrate the ability to gather, interpret, and analyze data; Goal 4: Students demonstrate the ability to perform effectively in the workplace; and Goal 6: Students demonstrate the ability to learn independently.

\* - Textbook costs are indicated here as required by the 2010 Higher Education Opportunity Act. However, these are the list prices; students may find bargains on-line or by purchasing older editions or used copies of the textbook.

**Student Learning Outcomes:** Upon successful completion of this course, the student will be able to:

1. Identify, classify, organize, analyze, and draw **structures** of organic molecules.
2. Apply the basic rules of organic **nomenclature** to convert between structures and names.
3. Recall reagents and predict products for a defined set of organic **reactions**.
4. Draw organic structures consistent with the results of specific **chemical tests**.
5. Predict the **physical properties** of organic chemicals based on their structures (e.g. relative boiling point, melting point, and solubility.)
6. Analyze the influence of structure and physical properties of organic molecules on their **biological properties** (e.g. drug action, membrane fluidity, energy storage, cell signaling.)
7. Recall details of specific **case studies** that apply the chemical principles learned in class to biology and medicine (e.g. goiter, thalidomide, AquaDots, Gleevec, vorinostat, etc.)
8. Demonstrate proficiency in organic chemical **laboratory** techniques. (Chemical tests, extraction, filtration, instrumental analysis, molecular model building)

**Evaluation:** Your grade will be based on your performance in the following (subject to change):

7 Quizzes (20 pts each, drop lowest)	120 points
6 Homework (20 pts each – <b>no score dropped!</b> )	120
11 Labs (15 pts each, drop lowest)	150
2 Interim Exams (100 pts each – <b>no score dropped!</b> )	200
Final Exam (150 pts, comprehensive)	<u>150</u>
Total	740 points

Letter grades will be assigned according to the following scale:

A	90%
B	80%
C	70%
D	50%
F	< 50%

**Active Pursuit:** A student will be deemed not actively pursuing this course if they have missed more than 30% of the graded material through the midterm (for example, missing more than 4 out of 14 quizzes and labs combined, or missing the first exam). Students not actively pursuing the course objectives will be marked as administratively withdrawn (ADW), and may lose financial aid or other negative consequences. It is the responsibility of the student to contact the professor regarding missed work. **There are no make-up quizzes or labs; a makeup exam is only available in case of emergency.**

**Quizzes:** Quizzes (mostly multiple choice questions) will be given at the beginning of class, and will have a time limit, usually 20 minutes. Answer keys will be available after the quiz. *If you miss a quiz, you will not have a chance to make it up.* Practice quizzes and exams from previous semesters are available on the course website, but you should be aware that the order of topics may change each semester and you should not use the online quizzes as the only guide.

**Homework:** Homework will be assigned in place of half of the quizzes, and will be due on the same day as the scheduled quiz. The homework will consist of several challenging problems. You are *encouraged* to work in a study group to solve these problems, and may turn in one set of answers with the names of your study group partners, **up to 5 people**. If you disagree with an answer from the group, you may turn in answers yourself for that question. **Late homework will not be accepted.**

**Exams:** There will be two written exams and a multiple choice final exam. You must bring your own calculator (if you need one), pencil and eraser for exams. You are permitted to bring a molecular model kit, but it must be completely disassembled at the beginning of the exam. Cell phones may not be used at any time during the exam, *even as calculators*. Once the exam begins you may not leave the room unless you turn in the exam, so plan to take a bathroom break *before* class.

**Labs:** The procedure for each experiment is fully described in the laboratory manual. Therefore, you must have your own copy of the laboratory manual to perform the experiments. You are expected to read the experiment before coming to lab. **Students who come to lab with only a copy of the post lab questions or data sheet will not be permitted to perform the experiment.** You must hand in the prelab questions before lab begins. There are no make up laboratory experiments. No pre-lab, post-lab, or data sheets will be accepted from students who miss the lab period.

For most experiments, prelab questions will count as 5 points, and an evaluation of your lab performance during lab will count for the remaining 10 points. The in-lab evaluation will reflect on your ability to:

- Follow written and oral directions.
- Observe proper safety procedures, including wearing goggles and properly managing waste.
- Make careful observations.
- Demonstrate the dexterity and organization necessary to complete the experiment.
- Identify the unknown sample or produce a sufficient quantity of pure material in a synthesis.
- Obtain and interpret experimental data to verify the identity and purity of your product.

Students who come late to lab are an unfair burden on their lab partners. If a student is more than 5 minutes late for lab, they may have to work alone, may not complete the experiment, and may receive a poor grade on that assignment. No make-up lab periods or extra time after class will be available.

Students who are unprepared for lab, having not read the experiment, not prepared their laboratory notebook, or not in possession of the lab manual, are a hazard to themselves and other students, and may be excluded from the experiment entirely in spite of prompt attendance.

**Academic Support:** Students are hereby made aware of services available outside the classroom for academic assistance:

**Tutoring Center.** For students who need help with their assignments: room L129, 773-907-4785, [www.trumancollege.edu/student-services/tutoring](http://www.trumancollege.edu/student-services/tutoring).

**Student Success and Leadership Institute (SSLI).** For students who need various other support services to achieve their educational goals: 773-907-4714, [www.trumancollege.edu/student-services/ssli](http://www.trumancollege.edu/student-services/ssli).

**TRIO Student Support Services.** For low-income students, first generation college students, or students with disabilities who need academic support: 773-907-4797, [www.trumancollege.edu/trio](http://www.trumancollege.edu/trio). Registration is required at the start of each semester.

**Disability Access Center.** The Center verifies needs pursuant to the American Disabilities Act (ADA), determines student academic accommodations, and issues accommodation letters. 773-907-4725, [www.trumancollege.edu/student-services/dac](http://www.trumancollege.edu/student-services/dac). Registration is required at the start of each semester.

**Academic Integrity:**

"Academic dishonesty is a serious offense, which includes but is not limited to the following: cheating, complicity, fabrication and falsification, forgery, and plagiarism. Cheating involves copying another student's paper, exam, quiz or use of technology devices to exchange information during class time and/or testing. It also involves the unauthorized use of notes, calculators, and other devices or study aids. In addition, it also includes the unauthorized collaboration on academic work of any sort. Complicity, on the other hand, involves the attempt to assist another student to commit an act of academic dishonesty. Fabrication and falsification, respectively, involve the invention or alteration of any information (data, results, sources, identity, and so forth) in academic work. Another example of academic dishonesty is forgery, which involves the duplication of a signature in order to represent it as authentic. Lastly, plagiarism involves the failure to acknowledge sources (of ideas, facts, charges, illustrations and so forth) properly in academic work, thus falsely representing another's ideas as one's own" - p. 40, CCC Student Policy Manual ([www.ccc.edu/departments/Documents/studentpolicymanual.pdf](http://www.ccc.edu/departments/Documents/studentpolicymanual.pdf) accessed 1/10/12)

In this course, violation of the academic integrity policy will result in a grade of "F" in the course, which can not be deleted from the transcript.

**GradesFirst:**

I will be using GradesFirst to take attendance in this class. If you are absent, the GradesFirst system will generate an email to you and will also keep track of that. Your advisor should be listed in GradesFirst. If there is not an advisor listed, I recommend that you reach out to the Advising Office and ask that one be assigned. Advisors can be very helpful as you navigate your academic path at CCC. Log in to GradesFirst at [ccc.gradesfirst.com](http://ccc.gradesfirst.com) using your CCC username and password. This is the same username and password you would use for Blackboard and email.

**Extra Credit:**

This semester, we have a unique opportunity to interview Dr. Derek Lowe, a pharmaceutical chemist who also writes a popular, outstanding blog about medicinal chemistry: InThePipeline (<http://pipeline.corante.com>). If you are interested in earning the extra credit, (maximum 30 points) you will prepare a 10 minute presentation on a medicinal chemistry topic to be chosen in consultation with the professor, from the posts in Dr. Lowe's blog. You will research the topic before the interview (April 11<sup>th</sup>) so you are prepared to ask a question. We will schedule presentations for the last three weeks of class. More details about the format and the rubric for grading the presentation will be available in Blackboard.

### Lab Assignments

The experiment numbers listed below correspond with the sequence we will do this semester. They do not necessarily correspond with the numbers in the lab book. Make sure you read the correct experiment by matching the title of the experiment to that listed below!

**Expt. 1 - Structure of Organic Compounds.** Prelab is due at the beginning of class. Parts 1-5 will be done as a class, and you will complete parts 6-9 on your own in class and as homework. The report sheet will not be collected. Post lab questions are due the following class period.

**Expt. 2 - Identification of Hydrocarbons.** Prelab is due at the beginning of class. For the lab, we will skip the  $\text{H}_2\text{SO}_4$ ,  $\text{KMnO}_4$ , and combustion tests, and add  $^{13}\text{C}$ -NMR, which counts the number of sets of carbon atoms. You and one partner will together turn in a single report sheet with observations for solubility in water and ligroin, bromine test,  $^{13}\text{C}$ -NMR, and identity of your unknown. Post lab questions will not be collected.

**Expt. 3 - Identification of Alcohols and Phenols.** Prelab is due at the beginning of class. You and a partner will perform chemical tests to identify your unknown alcohol, and show your results to the professor before the end of the lab. Neither the lab report nor post lab questions will be collected.

**Expt. 4 - Stereochemistry** No prelab is due because this lab will take place immediately after exam 1. Skip the first section on "Cyclohexane", and start on p. 44 with "Chiral Molecules." No lab report will be collected. However, the pre-lab questions (2-5) and post-lab (questions 2-4) are due the following class period. These must be **stapled** together or they will not be accepted.

**Expt. 5 - pH and Buffer Solutions.** Prelab is due at the beginning of class. Your performance during the laboratory will be graded by the instructor, as you complete the laboratory report sheet, which will not be collected. No post lab questions or lab report will be collected. We will use pH meters instead of pH paper, and the set-up will be discussed in class.

**Expt. 6 - Isolation of Caffeine from Tea.** Prelab is due at the beginning of class. We will not do this experiment quantitatively, so skip step 1, do not weight the flask in step 10, and skip the calculations in step 11. The separation of the layers (step 6) will be done with large test tubes and pipettes rather than a separatory funnel; this will be demonstrated in class. No post-lab or report sheet will be collected, but you and your partner will be graded on the quality of the caffeine you isolate.

**Expt. 7 - Identification of Aldehydes and Ketones.** Prelab is due at the beginning of class. You and a partner will perform chemical tests to identify your unknown aldehyde or ketone, and show your results to the professor before the end of the lab. Neither the lab report nor post lab questions will be collected.

**Expt. 8 - Preparation and Properties of Soap.** Prelab is due at the beginning of class. *Note: The table referred to in the prelab (20.2) should be Table 13.1, or the first table in the lipids chapter.* Once you have prepared the soap and performed two chemical tests, you will have the opportunity to add food coloring or fragrance (bring your own) and form the soap in a mold that will be provided. Your grade will be based on the quality of your product. No lab report or post lab questions are due.

**Expt. 9 - Carbohydrates.** Prelab is due at the beginning of class. Start the acid catalyzed hydrolysis first, because it takes a long time. You will be graded on your observations and performance in the laboratory. No post-lab questions are due.

**Expt. 10 – Paper Models of Proteins.** You will receive a handout with instructions and paper models, and guidance during the experiment on how to construct them and use them for study.

**Expt. 11 - Isolation of Casein from Milk.** Prelab is due at the beginning of class. You and a partner will be graded on the quality of the casein you isolate, and on one assigned chemical test in part B.

### General Education Goals

The curriculum in Chemistry 212 addresses several of the general education goals of the College. Below are the rubrics for evaluating the goals addressed by the course.

#### Goal Two: Students demonstrate the ability to gather, interpret, and analyze data.

	Exceeds Expectations	Meets Expectations	Unsatisfactory
1. Uses appropriate research methodologies	<ul style="list-style-type: none"> <li>Engages in independent research that utilizes ancillary scholarly resources</li> <li>Enlists additional protocols</li> </ul>	<ul style="list-style-type: none"> <li>Establishes reason for gathering data</li> <li>Defines research methodologies</li> <li>Utilizes appropriate resources as required by the assignment</li> <li>Uses current and classic data</li> <li>Acknowledges and documents resources as required</li> <li>Follows stipulated protocols</li> <li>Verifies findings</li> </ul>	<ul style="list-style-type: none"> <li>Does not clearly define research methodologies</li> <li>Uses few or inappropriate resources</li> <li>Uses outdated information</li> <li>Incorrectly acknowledges or documents resources</li> <li>Ignores stipulated protocols</li> <li>Fails to verify findings</li> </ul>
2. Collects and records data	<ul style="list-style-type: none"> <li>Integrates data from other disciplines or previous coursework or courses</li> </ul>	<ul style="list-style-type: none"> <li>Selects and records appropriate data accurately and thoroughly</li> <li>Categorizes and organizes data clearly and logically</li> <li>Provides examples</li> </ul>	<ul style="list-style-type: none"> <li>Provides inaccurate evidence</li> <li>Does not categorize data clearly</li> </ul>
3. Interprets and analyzes data	<ul style="list-style-type: none"> <li>Gives diverse perspectives on interpreting the evidence</li> <li>Observes multiple causes or effects of causes</li> <li>Suggests further implications of conclusions</li> </ul>	<ul style="list-style-type: none"> <li>Interprets evidence and sources of evidence</li> <li>Evaluates sources of evidence</li> <li>Observes cause and effect relationships</li> <li>Distinguishes between fact and opinion, objectivity and subjectivity</li> </ul>	<ul style="list-style-type: none"> <li>Provides little or no interpretation of evidence</li> <li>Does not evaluate sources or distinguish between fact and opinion, objectivity and subjectivity</li> <li>Draws inaccurate or irrelevant conclusions</li> </ul>
4. Presents data clearly and accurately	<ul style="list-style-type: none"> <li>Presents concisely, with explicit logical links among the parts of the presentation</li> <li>Provides interpretations of graphs and tables</li> </ul>	<ul style="list-style-type: none"> <li>Organizes presentation clearly, as stipulated by the assignment (e.g. tables, graphs, presentations, reports, or care plans)</li> <li>Computes data without error</li> </ul>	<ul style="list-style-type: none"> <li>Does not organize presentation clearly</li> <li>Grammatical, syntactical, or mechanical errors inhibit reader's comprehension of the presentation</li> <li>Makes errors in computation</li> </ul>

#### Goal Four: Students demonstrate the ability to perform effectively in the workplace.

SLO	Exceeds Expectations	Meets Expectations	Does Not Meet Expectations
Follows instructions and completes assignments and required tasks on time	Requires no guidance; always prompt	Requires minimal guidance; late with submissions once or twice	Requires significant guidance; routinely late and/or missing assignments
Accepts responsibility	Consistent, dependable	Mostly consistent, usually dependable	Inconsistent, hardly dependable
Exhibits effective interpersonal skills	Always listens actively, expresses self clearly, and behaves professionally	Usually listens actively, expresses self clearly, and behaves professionally	Rarely listens actively, expresses self clearly, or behaves professionally
Works collaboratively	Always initiates teamwork to meet goals; always accepts & gives constructive feedback	Frequently initiates teamwork to meet goals; frequently accepts & gives constructive feedback	Occasionally initiates teamwork to meet goals; occasionally accepts & gives constructive feedback

#### Goal Six: Students demonstrate the ability to learn independently.

Criteria	Exceeds Expectations	Meets Expectations	Unsatisfactory
Students relate previous knowledge to new knowledge			
Students integrate knowledge from different disciplines			
Students use knowledge and skills efficiently and effectively to negotiate a complex task			
Students exhibit a reflection as a form of self-assessment			
Students restate/paraphrase concepts in their own terms			

January 2013			
Monday	Tuesday	Wednesday	Thursday
14	15 First Class Topic A	16	17 <b>Quiz 1</b> (A) Topic B, C
21 MARTIN LUTHER KING HOLIDAY	22 Topic B, C <b>Lab 1</b>	23	24 <b>Quiz 2</b> (B, C) Topic D
28	29 Topic D <b>Lab 2</b>	30	31 <b>Quiz 3</b> (D) Topic E

**Organic Chemistry:**

A – Review of Bonding, Lewis Structures, VSEPR and Chem 201

B – Functional Groups

C – Alkanes

D – Alkenes

E – Aromatics (Benzene and related compounds)

F – Oxygen and Sulfur functional groups

G – Chirality

H – Acids and Bases

I – Amines

J – Aldehydes and Ketones

K – Acids and Derivatives

**Biochemistry:**

L – Carbohydrates (nomenclature, reactions)

M – Lipids

N – Proteins

O – Enzymes

P – Nucleic Acids

*Note: This schedule is subject to change.*

February 2013			
Monday	Tuesday	Wednesday	Thursday
4	5 Topic E, F <b>Lab 3</b>	6	7 <b>Quiz 4</b> (E) Topic F
11	12 Topic F Exam Review Topic G	13	14 <b>Exam 1</b> (A-F) <b>Lab 4</b> ( <i>no prelab</i> )
18 PRESIDENT'S DAY HOLIDAY	19 Topic G	20	21 <b>Quiz 5</b> (G) Topic H
25	26 Topic H <b>Lab 5</b>	27	28 <b>Quiz 6</b> (H) Topic I

Lab 1 – Expt. 21: Structure in Organic Compounds (5<sup>th</sup> ed. #24) A, BLab 2 – Expt. 24: Identification of Hydrocarbons (5<sup>th</sup> ed. #26) C, D, ELab 3 – Expt. 25: Identification of Alcohols and Phenols (5<sup>th</sup> ed. #28) FLab 4 – Expt. 22: Stereochemistry (5<sup>th</sup> ed. #25) GLab 5 – Expt. 21: pH and Buffer Solutions (5<sup>th</sup> ed. #?) HLab 6 – Expt. 28: Isolation of Caffeine from Tea (5<sup>th</sup> ed. #35) ILab 7 – Expt. 26: Identification of Aldehydes and Ketones (5<sup>th</sup> ed. #29) JLab 8 – Expt. 34: Preparation of Soap (5<sup>th</sup> ed. #38) K, MLab 9 – Expt. 32: Carbohydrates (5<sup>th</sup> ed. #36) L

Lab 10 – Paper models of proteins (handout) N,O

Lab 11 – Expt. 40: Isolation of Casein from Milk (5<sup>th</sup> ed. #44) M, N

March 2013			
Monday	Tuesday	Wednesday	Thursday
4	5 Topic I <b>Lab 6</b>	6	7 <b>Quiz 7 (I)</b> Topic J
11	12 Topic J <b>Lab 7</b>	13 <i>Midterm grades due</i>	14 <b>Quiz 8 (J)</b> Topic K
18	19 Topic K <b>Lab 8</b> Exam Review	20	21 <b>Exam 2 (G-K)</b> Topic L part I
25 <i>Spring Break</i>	26 <i>Spring Break</i>	27 <i>Spring Break</i>	28 <i>Spring Break</i>

**Organic Chemistry, continued:**

I – Amines  
 J – Aldehydes and Ketones  
 K – Acids and Derivatives

**Biochemistry:**

L – Carbohydrates (I: nomenclature, II: reactions)  
 M – Lipids  
 N – Proteins  
 O – Enzymes  
 P – Nucleic Acids

April/May 2013			
Monday	Tuesday	Wednesday	Thursday
1	2 Topic L Part I and II	3	4 <b>Quiz 9 (L1)</b> Topic L part II
8 <i>Drop deadline</i>	9 Topic L review Topic M <b>Lab 9</b>	10	11 <b>Quiz 10 (L2)</b> Topic M, N <b>Derek Lowe interview</b>
15	16 Topic N <b>Lab 10</b>	17	18 <b>Quiz 11 (M)</b> Topic N
22	23 Topic N, O <b>Lab 11</b> <i>XC presentations</i>	24	25 <b>Quiz 12 (N)</b> Topic O <i>XC presentations</i>
29	30 Topic O, P <i>XC presentations</i>	May 1	May 2 <b>Quiz 13 (O)</b> Topic P <i>XC presentations</i>
May 6	May 7 <b>Quiz 14 (P)</b> <i>XC presentations</i> Final Review	May 8	May 9 Last Class <b>Final (A-P)</b> <i>XC presentations</i>

Lab 6 – Expt. 28: Isolation of Caffeine from Tea (5<sup>th</sup> ed. #35) I  
 Lab 7 – Expt. 26: Identification of Aldehydes and Ketones (5<sup>th</sup> ed. #29) J  
 Lab 8 – Expt. 34: Preparation of Soap (5<sup>th</sup> ed. #38) K, M  
 Lab 9 – Expt. 32: Carbohydrates (5<sup>th</sup> ed. #36) L  
 Lab 10 – Paper models of proteins (handout) N,O  
 Lab 11 – Expt. 40: Isolation of Casein from Milk (5<sup>th</sup> ed. #44) M, N