

# Survey of Organic and Biochemistry

The most fun you can have with your goggles on!

Chem 212 JK: Aug. 27 – Dec. 12, 2013 TTh 12:30-3:20 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*  
[ccc.gradesfirst.com](http://ccc.gradesfirst.com) – *Schedule tutoring and advising*  
[faculty.ccc.edu/cabrams](http://faculty.ccc.edu/cabrams) - *Information about Professor Abrams*
- Office Hours:** MW 8:30- 11:00 AM ; Th 3:30-4:30 pm; (walk-in); F 8:30-12:30 (by appointment)
- Required:** Sapling Online Homework (One-Term): ISBN 978-0-9833859-5-0 **\$25 (\$37** in bookstore) OR Sapling Online Homework (Full Year): ISBN 978-0-9833859-6-7 **\$50 (\$60** in bookstore)  
*See instructions below regarding the online homework*  
Introduction to Organic and Biochemistry, 9<sup>th</sup> ed., Bettelheim et. al., ISBN 0-495-39116-6 **\$192**  
Organic and Biochemistry, A Survey Course, a custom lab manual ISBN 0-495-47762-1 **\$50**  
*These books are available at [cengagebrain.com](http://cengagebrain.com), where one can rent, buy an electronic form, or purchase individual chapters. Earlier editions are acceptable; see the course web site for details. These options make the books much more affordable*
- Optional:** Colored pens or pencils for taking notes (three colors plus black) **\$5**  
Molecular modeling kit (will be discussed in class), **\$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. This section will be taught in the chemistry studio classroom, which facilitates group work, data sharing, and immediate discussion of laboratory results, fostering a continuous cycle of observation, reasoning, and experimentation that is the hallmark of the scientific method.
- Evaluation:** Your grade will be based on your performance in the following:
- |                                     |     |
|-------------------------------------|-----|
| Sapling Learning Homework           | 20% |
| 12 Labs (15 pts each, drop lowest)  | 20% |
| 2 Interim Exams (100 pts each)      | 40% |
| Final Exam (150 pts, comprehensive) | 20% |
- Letter grades will be assigned according to the following scale:
- |   |       |
|---|-------|
| A | 90%   |
| B | 80%   |
| C | 70%   |
| D | 50%   |
| F | < 50% |

\* - 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, used copies, renting, or electronic editions.

**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.

**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)

**Exams:** There will be two written exams and a comprehensive, multiple choice final exam developed by the American Chemical Society.

**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.

**Lab attendance:** Students who come late to lab are an unfair burden on their lab partners. If a student is more than 10 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 procedure, are a hazard to themselves and other students, and may be excluded from the experiment entirely in spite of prompt attendance.

**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 homework 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 will be no make-up homework or lab assignments; a makeup exam is only available in case of emergency.**

**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.

**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.

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

**Tutoring Center.** Free help for all students! (773)-907-4785, McKeon 177.

**TRIO Student Support Services.** For low-income students, first generation college students, or students with disabilities who need academic support: (773) 907-4797, Room 1435. 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. Room 1435. Registration is required at the start of each semester.

**The Wellness Center** provides support services for students including counseling, support groups, stress and time management coaching, referrals to community resources, and special support for victims of relationship violence and sexual assault. They can be reached at (773) 907-4786. Room 1946.

**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 cannot be deleted from the transcript.

## Sapling Learning Online Homework (Required)

Each week, an online homework assignment will be due, typically midnight on Monday night. The first assignment is due midnight, Monday September 2<sup>nd</sup>. Each homework assignment is graded out of 100 points. Your homework score contributes 25% to your grade in the course. The full grading policy is described on the Sapling Learning website. Multiple attempts are permitted, but each wrong answer incurs a penalty for that question.

Sapling's chemistry questions are delivered in a web browser to provide real-time grading, response-specific coaching, improvement of problem-solving skills, and detailed answer explanations. Dynamic answer modules enable one to interact with 3D models and figures, utilize drag-and-drop synthetic routes, and draw chemical structures - including stereochemistry and curved arrows. Altogether, Sapling provides more value than a solutions manual, and goes beyond a mere assessment exercise to give a learning experience.

To get started:

1. Go to <http://saplinglearning.com> and click "US Higher Ed" at the top right.
2. If you already have a Sapling Learning account, log in and skip to step 3.

If you have Facebook account, you can use it to quickly create a SaplingLearning account. Click the blue button with the Facebook symbol on it (just to the left of the username field). The form will auto-fill with information from your Facebook account (you may need to log into Facebook in the popup window first). Choose a password and time zone, accept the site policy agreement, and click "Create my new account". You can then skip to step 3.

Otherwise, click "create account". Supply the requested information and click "Create my new account". Check your email (and spam filter) for a message from Sapling Learning and click on the link provided in that email.

3. Find your course in the list (listed by subject, term, and instructor) and click the link.
4. Select a payment option and follow the remaining instructions. Access cards can be purchased online or from the bookstore (i.e. when using a book voucher):

Sapling Learning Online Homework (One-Term Access)

ISBN 978-0-9833859-5-0 \$25 (\$37 in the bookstore)

*or*

Sapling Learning Online Homework (Full Year Access)

ISBN 978-0-9833859-6-7 \$50 (\$60 in the bookstore)

- Once you have registered and enrolled, you can log in at any time to complete or review your homework assignments.
- During sign up – and throughout the term – if you have any technical problems or grading issues, send an email to [support@saplinglearning.com](mailto:support@saplinglearning.com) explaining the issue. The Sapling Learning support team is almost always faster and better able to resolve issues than your instructor.

### 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.

**Expt. 12 – Isolation of DNA from an Onion.** Prelab is due at the beginning of class. You and a partner will be graded on your isolation of DNA and the results of the diphenyl amine test for deoxyribose.

## 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			

August/September 2013			
Monday	Tuesday	Wednesday	Thursday
26	27 First Class Topic A	28	29 Topic B, C
Sept 2 <i>Labor Day Holiday</i>	3 <b>HW 1</b> (A) <i>(all HW is due 12:00 AM)</i> Topic B, C	4	5 <b>Lab 1</b> Topic D
9	10 <b>HW 2</b> (B, C) Topic D	11	12 <b>Lab 2</b> Topic E
16	17 <b>HW 3</b> (D) Topic E, F	18	19 <b>Lab 3</b> Topic F
23	24 <b>HW 4</b> (E, F) Topic G Exam Review	25	26 <b>Exam 1</b> (A-F) <b>Lab 4</b> ( <i>no prelab</i> )

**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

October 2013			
Monday	Tuesday	Wednesday	Thursday
Sept. 30	Oct 1 <b>Lab 4</b> conclusion Topic G	2	3 <b>Lab 5</b> Topic H
7	8 <b>HW 5</b> (G) Topic H, I	9	10 <b>Lab 6</b> Topic I
14	15 <b>HW 6</b> (H) Topic I, J	16	17 <b>Lab 7</b> Topic J
21	22 <b>HW 7</b> (I) Topic J, K	23 <i>Mid-term grades due</i>	24 <b>Lab 8</b> Topic K
28	29 <b>HW 8</b> (J, K) Exam Review	30	31 <b>Exam 2</b> (G-K) Topic L part I

Lab 1 – Expt. 21: Structure in Organic Compounds (5<sup>th</sup> ed. #24) B, CLab 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, M

*Note: This schedule, including the list of topics and lab experiments, is subject to change.*

November 2013			
Monday	Tuesday	Wednesday	Thursday
4	5 Topic L Part I and II (worksheets)	6	7 <b>Lab 9</b> Topic L part II (worksheets)
11	12 <b>HW 9</b> (L1) Topic L review Topic M	13	14 Topic M
18 <i>Withdrawal deadline</i>	19 <b>HW 10</b> (L2) Topic N	20	21 <b>Lab 10</b> Topic N
25	26 <b>HW 11</b> (M) Topic N	27	28 <i>Thanksgiving Holiday</i>
26	27 <b>HW 12</b> (N) Topic O, P	28	29 <b>Lab 11</b> Topic O, P

**Biochemistry:**

L – Carbohydrates (nomenclature, reactions)

M – Lipids

N – Proteins

O – Enzymes

P – Nucleic Acids

December 2013			
Monday	Tuesday	Wednesday	Thursday
2	3 <b>HW 13</b> (O) Topic P	4	5 <b>Lab 12</b> Topic P
9	10 <b>HW 14</b> (P) Exam review	11	12 LAST CLASS <b>Final (A-P)</b>

Lab 1 – Expt. 21: Structure in Organic Compounds (5<sup>th</sup> ed. #24) A, B  
 Lab 2 – Expt. 24: Identification of Hydrocarbons (5<sup>th</sup> ed. #26) C, D, E  
 Lab 3 – Expt. 25: Identification of Alcohols and Phenols (5<sup>th</sup> ed. #28) F  
 Lab 4 – Expt. 22: Stereochemistry (5<sup>th</sup> ed. #25) G  
 Lab 5 – Expt. 21: pH and Buffer Solutions (5<sup>th</sup> ed. #?) H  
 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  
 Lab 12 – Isolation of DNA from an onion P

*Note: This schedule, including the list of topics and lab experiments, is subject to change.*