

Chemistry Comps 2013-2014

The 2013-2014 Chemistry Comps program begins with this document. Here we outline the timelines and options for successful completion of chemistry comps. The comps coordinator for the year is Dave Alberg.

Some Important Points

- Completing the chemistry comps requires more than a single term of work; since the bulk of the work usually takes place in the first term, it is normal to register for most of the six credits the first term with less the second term. This credit distribution may be different if you opt for an unusual schedule, and you will need to coordinate that with your advisor.
 - ‡ The Group Comps option is currently only offered winter/spring and therefore is only an option for students planning to be enrolled during both those terms of the senior year. All sections of Group Comps will meet during period 5A winter term.
 - ‡ The Individual Paper is also normally completed on a winter/spring schedule. In order to follow the less usual fall/winter schedule, a student must find a comps advisor in the spring term before starting comps. Timelines and required milestones in these schedules are outlined below.
- Special circumstances that may impact your ability to do group comps are: intent to graduate early, off-campus study during the senior year, multiple comps projects (such as a double major), and conflicts with other courses needed during period 5A of winter term.
- For any option, you must submit a comps proposal to the comps coordinator in the term *before* you plan to start work on your comps. The proposal deadline for the winter/spring schedule is midterm break of fall term. If you petition for a fall/winter schedule, you should submit your proposal and petition to the department before the last day of class in the spring term.
- If you will be off campus during fall term, it is important that you set up procedures for us to contact you while you are away. Work this out with your advisor *and* the chemistry comps coordinator.
- It is expected that all comps students will attend all comps-related talks (given by students and visitors) as part of your work in comps.
- There are several milestones for each comps option that must be achieved in order for you to be considered to be making adequate progress towards completing comps. If you do not meet these expectations, the department may require you to fulfill the comps requirement through other means (such as taking and passing a set of comprehensive exams).

Option I: The Individual Paper

There are two versions of the Individual Paper. The first involves a literature topic of your choosing, while the second version is an option for those who have done research and want to write a paper that expands on that research. The option exists for either version to present a public seminar on your topic.

The Individual Paper involves considerable independent work at all stages, including becoming familiar with the primary literature of your topic. Typical papers might have 5-10 primary literature articles that you have analyzed in great detail. The paper is not merely a library report but is designed to involve you in the topic as a critical scientist. Personal judgments, criticisms, and suggestions for future directions will play important roles in creating an excellent paper. Expect that the paper will go through multiple revisions, and a lot of work is still necessary after the completion of the first draft. Given how busy everyone gets at Carleton, it is crucial to treat this as a formal commitment, to start it early and schedule regular times during the week to make progress. *Please be aware that unusual comps paper topics (i.e. topics that are not covered in the mainstream chemical literature) will be considered, but they will require extra independent effort on your part and possibly a longer overall timeframe to make them work.*

Literature-topic Individual Paper. Those of you choosing this option will select a topic of personal interest on which you will write a paper of *20 to 30 pages in length* (with an absolute limit of 40 pages which includes all figures, illustrations, footnotes, endnotes, references, acknowledgements, etc). You must find a faculty advisor and submit a proposal to the department on your topic. If you would like to begin work this coming fall, you need to identify your advisor and submit a proposal to the comps coordinator *before you leave for the summer*. If

you elect to do comps in the winter, the proposal deadline is midterm break of fall term. *An individual-paper proposal should include 1-2 pages of text on the proposed topic with 2 attached original articles from the literature.* You also need a formal statement from your advisor indicating that he or she has agreed to work with you. You can consult with any of us in refining your topic and selecting your advisor.

Research-type Individual Paper. This option is available to those who have been involved in a research project either at Carleton or elsewhere. It is intended to provide an opportunity for you to *extend* the scope of your necessarily limited laboratory work to a broader perspective, quite like that of the "Literature-topic Individual Paper" option. The requirements and structure of the experience of the "Research Paper" are the same as for the "Literature Topic Paper". This is also true of the proposal you are required to submit (see above).

The Research Individual Paper is not just a very large lab report. It is still a research paper, utilizing the literature and laboratory work to explore a topic, part of which you have become familiar with through your research. The paper resulting from this option is also presented for discussion with two faculty members early in Spring Term as described above for the individual-paper option.

Formal Requirements for Individual Papers

1. *Weekly meetings.* You and your advisor will arrange a regular weekly meeting time to discuss your topic and to monitor your progress.
2. *The second reader.* One other faculty member must read your paper. You should think about whom this second reader should be (with advice from your advisor) and select him or her early in the process. After the project has been outlined and has some focus, you should plan to meet with the two faculty readers, so that both are familiar with your plan and topic. The second reader should be provided with drafts of your paper-in-progress on a schedule you have arranged with your advisor.
3. *The oral defense.* Your project will conclude with a 45 to 60 minute closed discussion with your two faculty advisors and will cover the material discussed in your paper. You also have the option of presenting a public seminar on your topic (30 minutes is a reasonable timeframe for your talk). If you do choose to give a general public talk, then you will also have the choice on whether to include the public talk as part of the evaluation in Comps. Please talk to your advisor about how to make these choices.
4. After completing your defense, you will make any final revisions of your paper and then archive this final draft at the library digital archive web site (<https://contentdm.carleton.edu/comps/>). Instructions for archiving are available on the web site.

Two Timelines for Completing Individual Papers

Two timelines for completing the Individual Paper comps option are outlined on the next page. The standard schedule is a winter/spring combination, with the bulk of the work occurring in the winter term (4 credits) and the remainder in the spring term (2 credits). The fall/winter combination, which distributes the work more equally between the two terms (perhaps 3 credits in each term) is more unusual and you must petition the department by the last day of class in the spring term prior to starting comps to request this schedule. Your petition should state your reasons for pursuing the unusual schedule. In either schedule, the non-negotiable deadlines are outlined with boxes; otherwise, you may have some flexibility in completing the other tasks associated with writing your paper, as determined in your meetings with your paper advisor.

WINTER-SPRING COMPS (the standard schedule):**Fall term and winter break:**

- Determine your intended topic and advisor before midterm break. Overcommitted faculty members may not be available to be your advisor.
- Submit your comps proposal before midterm break.
- Schedule specific times for winter term weekly meetings with advisor (before the end of fall term).
- Gather interesting papers from the library's paper, electronic journal collections, and Interlibrary Loan (ILL).
- Read papers.

Winter term:

- Read papers in depth.
- Refine topic and create outline.
- Expand outline and identify topics about which more needs to be learned.
- Start to expand the outline with text (intro, etc.).
- Assemble a first draft.
- Week 9: Submit a reasonably complete draft with figures, bibliography, etc. to advisor.
- Week 10: Discuss the draft with your advisor and identify areas for more work.

Spring Term:

- Week 1: Schedule date for oral defense with advisor and second reader.
- Revise!
- Weeks 4-5: Defendable draft is due at least one week before your defense date.
- Week 6: Oral defense must take place before the end of this week.
- Weeks 7-9: Submit two clean, bound copies of your final draft to Wendy Zimmerman as well as electronically to the library.

FALL-WINTER COMPS (the alternate schedule):**Spring term (of year before starting comps) and summer break:**

- Determine topic and advisor.
- Submit your comps proposal and petition the department for this schedule (before the last day of class in spring term).
- Gather interesting papers from the library's paper and electronic journal collections as well as Interlibrary Loan (ILL).
- Read papers.

Fall term and winter break:

- Week 1: Schedule regular meetings with your advisor.
- Read papers in depth.
- Refine topic and create outline.
- Expand outline and identify topics about which more needs to be learned.
- Start to expand the outline with text (e.g. introductory and background material).
- Submit a reasonably complete first draft on or before the last day of class fall term.
- Schedule winter term meetings with advisor (before the end of fall term).

Winter Term:

- Week 1: Submit a complete draft with figures, bibliography, etc. to advisor.
- Week 2: Meet with advisor to discuss draft; schedule date for oral defense with advisor and second reader.
- Revise!
- Weeks 6-7: Defendable draft is due at least one week before your defense date.
- Week 8: Oral defense must take place before the end of this week.
- Week 9: Submit two clean, bound copies of your final draft to Wendy Zimmerman, as well as electronically to the library.

Option II: The Group Discussion (“Group Comps”)

In this Comps option, groups averaging five to eight students meet with one or two faculty members for in-depth discussions on specific topics from the recent scientific literature. Groups typically form around one scientist’s research, and the project often culminates with that person visiting campus and having lengthy discussions with group members, or with the group visiting the campus and research group of a local scientist. The details as they are currently known for the specific groups forming for next year are given on the last page of this document.

In spite of being the most popular option, joining a comps group is not for everyone. You must know that you work well in a group setting and be willing to make a full contribution by participating at *every* meeting and comps must take a high priority among your various activities. Undoubtedly, you will have to find time outside of the regular weekly meetings to work with other group members. Group Comps is probably not a good option if you have other inflexible commitments on your time or if you prefer working and learning on your own or in smaller groups. Under these circumstances, it would be better to opt for an Individual Paper. *Also, you must be enrolled in the college during both the winter and spring terms. If you plan to complete your course work at the end of winter term you cannot do Group Comps.* The Group option can be a very educational way to do comps, but it does require lots of effort by all members of the group for success. The Individual Paper is a suitable options for a more individualized comps experience.

Selection to Group Comps will be based on your proposal, which is your way to express your interest and convince us of your commitment. Your past record as a chemistry major and “citizen” of the chemistry department will also be considered. Participation in a group is not assured. The department reserves the right NOT to select a student for Group Comps if we are not convinced that the student will contribute to the process in an active and positive manner. Be aware that selection to Group Comps is made by the department and is decided before the particular group assignments are made.

Comps groups meet three times a week during period 5A in the winter term, and additional meetings are required during the early weeks of the spring term as well. Students in a group will decide on the direction of the readings, the discussion topics, and the nature of the written and oral assignments during the term. The faculty advisor is meant to be a facilitator who, if things succeed, will remain in the background and will be a discussion peer. Each member is required to participate actively. Active participation includes keeping up with reading assignments selected by the group, preparing presentations or handouts on various topics for the group, actively engaging in discussion and decision-making at *each* meeting, as well as other assignments (*e.g.* discussion summaries, short papers, preparing the departmental seminar, and supplemental library work).

The Group Option proposal is a carefully prepared typed statement concerning your motivation for doing group comps. Provide any evidence you can offer indicating that you possess the ability and determination to be a *fully active participant* throughout the process. No discussion of the specific science of any of the group topics should be included. This is a statement of your intent, desire, and ability to participate in a student-motivated, group-learning endeavor. This need not be a lengthy statement and should be kept to no more than one page of text. You should also indicate any group preferences you may have, in your proposal. When possible, we will try to accommodate your group preferences.

Please note that Group Comps will meet during winter term at period 5a. Take this into account when making your decisions about Comps, and during registration for your other winter classes. Finally, if you are selected to the group, you will be required to attend a meeting with your advisor near the end of fall term, where expectations for group members are made clear.

Option III: The Directed Project

The department has begun to explore a new option for comps, the Directed Project. This project involves one to several students working on a project that is proposed by a faculty member. Generally these projects involve laboratory work in addition to regular weekly discussions, with the goal of bringing the project to completion in the form of a tangible product, such as a revised or new undergraduate lab project, or the preparation of a manuscript to be submitted to the *Journal of Chemical Education*, for instance. Unlike the group or long paper option, the number of positions available in the directed project is very limited. Also,

because these projects are expected to be quite unique, the timeline for completing the work would be determined in consultation between student and advisor, on a case by case basis. This year, Will Hollingsworth is offering a directed project (see below).

Departmental Policy on Earning Distinction in Comps

As a preamble to comments about the department's policy on distinction, please keep in mind that distinction in comps does not really matter much when it comes to your future plans. Whether your plans include joining the work force, graduate school, medical school, or a service or volunteer job, distinction in comps will have little impact. What matters most is your overall record at Carleton and your recommendation letters. In fact, many decisions about your future may be made before anyone knows who got distinction. Nonetheless, you may decide to make it a personal goal to strive for distinction, and we support this goal.

Distinction in Comps is a difficult issue for chemistry majors and faculty, particularly with our department's Group Comps option. This issue is less sticky if you do an individual paper involving library work or research. Since a Individual paper is an individual effort, a comps advisor who sees a quality paper and oral presentation can more easily recognize and recommend distinction. In the group format, however, these decisions may not be as clear cut. Of course, distinction in group comps, like distinction on an individual paper, requires an unusual understanding of the material and the demonstrated ability to communicate your knowledge and understanding to others. The group experience particularly focuses on communication. Some attributes which make a group work well include cooperation, collaboration, teaching, listening, planning together, and celebrating achievements of understanding or, in other words, being a good colleague. Some of these characteristics, in some circumstances, may be odds with the attributes that could lead to individual accomplishment. In addition, faculty advisors do not always have a complete understanding of how the group truly operates, especially as the group becomes more independent and does a lot of work outside of the scheduled meeting times. In this case, a student who is perhaps less verbal during discussions with the faculty member but is actually the "backbone" of the group outside the formal discussions may be overlooked by the advisor when deciding whom to recommend for distinction. These complications in awarding distinction to members of a discussion group tend to lead to fewer distinctions compared to individual options.

To achieve distinction in comps, whether it be for work done in a discussion group or an individual project, keep in mind the following the sage advice of an esteemed retired faculty member: *A lot of hard work does not distinction make*. In other words, creativity, synthesis, unusual understanding, presentation of new proposals, and integration of disciplines are some of the hallmarks of an outstanding comps effort. Students who get distinction are often not trying for distinction; instead they are just interested in learning due to their own intellectual satisfaction. A faculty member can recognize when these qualities are coming together to create an outstanding comps product. If a comps advisor sees these qualities in your project he or she will recommend you to the department for distinction in comps. A discussion of all the candidates for distinction will follow in a department meeting until a consensus is reached.

If you have decided to set the personal goal of achieving distinction on your comps, please talk to us and especially to your comps advisor to get a better feeling as to how we think about distinction. We are certainly happy to discuss this topic with you now so that there will be no misunderstandings at the end of the comps process next spring.

Group Topics for Chemistry Comps, 2013-2014

1. Fluorinated Compounds in the Environment—led by Deborah Gross

Scientist: Scott Mabury, Department of Chemistry, University of Toronto

Research Website: http://www.chem.toronto.edu/ppl/faculty_profile.php?id=35

Dates of Visit: April 13-15, 2014

Professor Mabury states on his website that “Understanding the mechanisms and pathways that determine the environmental fate, disposition, and persistence of chemical pollutants is fundamental to formulating solutions to current and future environmental problems.” In this group, we will study the work in Professor Mabury’s group, focusing on fluorinated species in the environment. They are unnatural, amazingly stable due to their C-F bonds, and now found in everything (including you). We will investigate the sources and fates of these compounds in the environment and also study the analytical approaches needed to measure them. Due to the earliness of his visit in the spring term, students must be prepared to give their comps talk during the first week of the spring term or at the end of the winter term.

2. Chemistry of Nanostructured Materials —led by Trish Ferrett

Scientist: Debra Rolison, Naval Research Laboratory

Website with Further Information: <http://www.nrl.navy.mil/media/news-releases/2011/nrls-debra-rolison-honored-with-acs-award-in-the-chemistry-of-material>.

Dates of Visit: April 10-11, 2014

When Deb Rolison won the 2011 ACS Award in the Chemistry of Materials, Prof. Mark Ratner (Northwestern) said “Debra uniquely combines nanoscience, inorganic chemistry, electrochemistry, and materials chemistry to make new systems with unique and controllable properties”. She is a physical chemist who has moved without fear into the interdisciplinary area of materials science, where complexity reigns. She is particularly well known for materials developed for batteries and fuel cells, and for sensing technologies. She has designed and characterized mesoporous materials (pores 2-50 nm in diameter) for use in many applications. She has also been active nationally as a voice for diversity in science and engineering (see *C&ENews* article “A Title IX Challenge, Mar. 13, 2000) and will give one of her famous “uppity women” talks while at Carleton.

3. “Genomic Enzymology”—led by Dave Alberg and Chris Calderone

Scientist: John Gerlt, University of Illinois

Research Website: <http://www.life.illinois.edu/gerlmlab/research.html>

Dates of Visit: May 1-2. (There is a small possibility that the visit may be one week earlier.)

Professor Gerlt’s group has been a leader in developing the area of “genomic enzymology”. To paraphrase from his website: this approach to the study of enzymes involves mining the ever-growing genome sequence data available for numerous eubacteria, archaea, and eukaryotes, to discern fundamental principles in enzymology. For instance, this approach can uncover essential structure/function relationships that are important in catalysis. It can also shed light on the strategies used by Nature to evolve “new” enzymes. In particular, Professor Gerlt’s lab studies three “superfamilies” of enzyme that derive from common ancestors: the enolase superfamily, the D-ribulose-1,5-bisphosphate carboxylase/oxygenase (RuBisCO) superfamily, and the orotidine 5'-monophosphate (OMP) decarboxylase superfamily. The later family is interesting in that many members of the family catalyze different reactions that do not share any mechanistic features, suggesting that Nature is opportunistic and has developed versatile active site templates that can be used to generate new enzymatic activities.

Direct Project Topic for Chemistry Comps, 2013-2014

Will Hollingsworth

This directed project will focus on two laser applications involving the atomic spectroscopy of the neon atom. In particular, the goal is to work towards producing documents that explain the intricate workings of the familiar helium-neon (HeNe) laser and use of the photogalvanic effect on a neon lamp as an undergraduate physical chemistry experiment using a pulsed YAG-pumped dye laser--neither of these projects has been known to appear previously in the context of supporting chemical education. Mapping out the atomic spectroscopy of neon is not trivial due to its many excited states and closely-spaced transitions in the red part of the spectrum, and the use of an unfamiliar coupling scheme naming neon's states. The NIST atomic data base is a great resource that will be crucial for understanding the detailed kinetics of the flow of energy through the various excited states and a careful literature search would be conducted to see what has been reported previously in different research communities relating to these two applications and neon's specific coupling scheme and selection rules.

The bulk of the work would take place in the fall, with a commitment to scheduling regular consultations during 5a as well as a minimum of a half-day per week of lab work with the laser and analysis. The project would continue through the winter and wrap up in the spring with a written summary and a seminar presented to the department. The prerequisite coursework is Chem 302 and 344, with Chem 354 certainly being recommended but not required. This project could proceed with 1-3 students but two might work best.