Chemistry Comps 2017-18

Link to submit comps proposal:
https://goo.gl/forms/muUVDF7tthDgCQGI2

This document outlines the timelines and options for successful completion of chemistry comps. The comps coordinator for the year is Chris Calderone.

Some Important Points

1. You may fulfill your requirements for comps either by writing an individual paper, or by working in one of four groups. Groups will meet over winter and spring terms next year; the individual paper allows more flexibility in the timing of your comps (see below).
2. Special circumstances may limit your choice (and timing) of comps project, such as intent to graduate early, off-campus study during the senior year, your status as a double major, etc. **Of special note:** you **must** be a registered student (minimum of 12 credits) while you are doing comps. For paper writers, this means you **must be registered the term you complete your comps**. For Group Comps, **you must be registered both winter and spring terms**. For instance, if you intend to complete your course work by the end of the winter term next year, than an individual paper **must** be completed at the end of winter term, as well. Similarly, you **may not** participate in a comps group if you plan not to enroll in classes next spring.
3. 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. **Attendance is a requirement – plan accordingly!**
4. **You must submit a proposal to participate in comps in any form.** Proposals will be submitted via a Google form, with more details provided below. Regardless, you **must submit your proposal by one of the deadlines below:**
    a. Individual paper writers who wish to work over Fall/Winter terms: 8:00 am, Monday, May 22, 2017.
    b. Individual paper writers who wish to work over Winter/Spring terms or those who wish to participate in a group: 5:00 pm, Friday, October 6, 2017.

Option I: The Individual Paper

You may write an individual paper either focusing on a literature topic of your choosing, or by expanding on research you have performed on- or off-campus. An 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

paper will go through multiple revisions, with significant effort required after the completion of the first draft. Typically, you will meet weekly with your advisor until the paper is complete.

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.). Most importantly, you must find a faculty advisor who agrees to work with you. You may consult with any of the faculty for advice about selecting a topic and 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 Research Paper is not just a very large lab report. It requires that you explore in depth a topic that you have become familiar with through your research, incorporating your work into a larger picture.

Formal Requirements for Individual Papers

1. For paper writers, the "proposal" is simply a statement of the paper topic and the name of a chemistry faculty member who has agreed to serve as your advisor on the paper submitted via Google form. Your potential advisor will have to approve of your topic and may require you to flesh out your proposal before agreeing to work with you.
2. You and your advisor will arrange a regular weekly meeting time to discuss your topic and to monitor your progress.
3. 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.
4. Your project will conclude with a 45-60 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.
5. 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://comps.carleton.edu/comps/). Instructions for archiving are available on the web site.

Timeline for Completing Individual Papers

The timeline for completing the Individual Paper comps option is outlined below. The typical 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), though a fall/winter schedule is also possible. With either schedule, 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. These non-negotiable deadlines are highlighted below. 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).

Leading up to the first term of comps

- Gather interesting papers from the library's paper, electronic journal collections, and Interlibrary Loan (ILL).
- Read papers.

First term of comps (usually Winter)

- 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.***

Second term of comps (usually Spring)

- Revise!
- Week 1: Schedule date for oral defense with advisor and second reader.
- ***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 7-8: Submit two clean, bound copies of your final draft to Tami Little as well as electronically to the library.***

Option II: The Group Discussion ("Group Comps")

In this Comps option, groups of 6-10 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. The projects usually culminate with two important events: (1) a public seminar prepared and delivered by the comps group, followed by (2) a campus visit by the comps "subject" for lengthy discussions with group. The details as they are currently known for the specific groups forming for next year are given on the last pages of this document. In spite of being the most popular option, joining a comps group is not for everyone. You must commit to participating at *every* meeting *and* to working on your own and

with other group members outside of the regular meetings. Comps must take a high priority among your various activities. Group Comps is not a good option if you have other inflexible commitments on your time or if you prefer working and learning on your own. Under these circumstances, it would be better to opt for an Individual Paper.

Comps groups meet at set times during the term. The winter/spring groups meet during period 5a in the winter term, with additional meetings (to be determined by the group) during spring term. 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 public seminar, and supplemental library work).

Choosing Group Comps

Participation in Group Comps starts with a formal proposal to participate submitted via Google form. Your proposal should be a carefully prepared statement concerning your motivation for doing group comps that convinces the faculty of your commitment to be an active group member. Provide any evidence you can offer indicating that you possess the ability and determination to be a *fully active participant* throughout the process. Also, your past record as a chemistry major and "citizen" of the chemistry department will be considered in the selection process. 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 entire department and is decided before particular group assignments are made. *In your proposal, 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.

As part of your proposal submission, you will be asked to rank your group preferences. Feel free to provide additional information about how strongly you feel about your preferences or if you would be equally happy to join either of two or more groups. We will strive to place you in either your first or second choice group, but keep in mind that the group sizes need to be reasonably balanced. Once you are assigned to a group, it will not be possible to switch groups.

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 an 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 Comps 2017-18

1. Tunneling Effects in Chemistry (led by Will Hollingsworth)
Visiting scientist and dates TBD

Of all quantum phenomena, perhaps none is more intriguing than the Tunnel Effect, i.e. the ability of a wave particle to escape its confinement region provided that the energy barrier and the forbidden region that it must negotiate are not too great. Light particles have the easiest time tunneling and the effect is well established in electron- and proton-transfer reactions. This comps group will focus on recent work to see how evidence for tunneling is also accumulating for nuclei heavier than hydrogen, with direct application to spectroscopy, reaction mechanisms, and kinetics.

Because the literature is broader than just one scientist, it would be good to meet a few times late in the fall term to locate and narrow resources. A natural option for this type of comps project is to also write a summary report. I am currently working to find a scientist who will come at the end of our project to referee our findings.

2. Elucidating the Chemical and Physical Principles that Govern RNA and DNA Assembly (led by Dave Alberg)
Visiting Scientist: Nicholas Hud, School of Chemistry and Biochemistry, Georgia Institute of Technology
Research Website: http://ww2.chemistry.gatech.edu/hud/research
Dates of Visit: April 19 and 20, 2018

From Professor Hud's website: "The research in our laboratory is directed towards elucidating the fundamental chemical and physical principles that govern nucleic acid (RNA and DNA) assembly. We are interested in how the physical properties of nucleic acids govern biological functions in contemporary life, and how these same properties provide clues to the origin and early evolution of life. We are also applying our knowledge of nucleic acids to problems that are of current importance in medicine and biotechnology. Specific projects include investigations of: 1) the origin and evolution of RNA; 2) cation, solvent and small molecule interactions with nucleic acids; 3) nucleic acid condensation and packaging; and 4) folding and evolution of the ribosome. Our research involves the application of a wide variety of physical and chemical techniques."

3. Atmospheric Chemistry (led by Deborah Gross)
Visiting Scientist: Paul Wennberg, R. Stanton Avery Professor of Atmospheric Chemistry and Environmental Science and Engineering, California Institute of Technology
Research Web site: http://web.gps.caltech.edu/~wennberg/
Dates of visit TBD

From his website, Professor Wennberg's research group applies traditional physical chemistry techniques (e.g. LIF, absorption spectroscopy, mass spectroscopy) to study the mechanisms of chemical transformation in the Earth's atmosphere and the carbon cycle. Currently, this research falls under one of two categories: Carbon Cycle Science and Oxidative Chemistry of the Troposphere. In the former area, they have helped develop the Total Carbon Column Observing Network, to measure carbon concentrations globally. In the latter area, they measure atmospheric trace gases in the lab and in the field.

4. Engineering Biology (led by Chris Calderone and Joe Chihade)
Visiting Scientist: Andrew Ellington, Fraser Professor of Biochemistry, The University of Texas
Research website: http://ellingtonlab.org
Dates of visit: May 3 and 4, 2018

Professor Ellington's research is focused on engineering nucleic acids and proteins for applications ranging from point-of-care diagnostics, to generating therapeutic antibodies and immunoprofiling, to expanding the genetic code beyond the "normal" twenty amino acids. To achieve these goals, Professor Ellington's research draws on techniques from synthetic biology, molecular evolution, and nanotechnology. Most ambitiously, work in the Ellington Lab is ultimately aimed at the design of DNA circuits that "should form the basis of a new, modular cellular operating system."