Chemistry Comps 2015-2016

The 2015-2016 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 Trish Ferrett.

Some Important Points

1. There are two options for comps: (1) the Group Option and (2) the Individual Paper Option. For the Group Option, three groups will work in winter/spring. The individual paper allows more flexibility in the timing of your comps - see below.
2. Comps Proposal Deadlines:
    a. Long-paper writers who want to work mostly in Fall term must submit a comps proposal via email to Trish Ferrett, indicating your choice, by **8:00 am, Monday, May 25, 2015.**
    b. Long-paper or group comps students who wants to do the bulk of work in Winter term must submit a comps proposal via email to Trish Ferrett, indicating your choice, by **5:00 pm Friday Oct. 16, 2015.**
    c. Students seriously interested in writing a long paper connected to the Global Engagement Initiative Research Teams must submit a brief statement of strong interest via email to Trish Ferrett by **8:00 am Monday May 25, 2015.**
3. See proposal format requirements below – they are different for the various options noted above.
4. 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 the terms your group is scheduled to work**. 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. In the case of Group Comps, you **may not** join a winter/spring comps group if you plan **not** to enroll in classes next spring.
5. 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!**

Special Opportunity for Seniors - Global Engagement Initiative Senior Research Team Comps

Through Carleton's Global Engagement Initiative, there is a new opportunity for seniors to become involved in an interdisciplinary team research project for comps to be conducted over the course of the senior year. See the final pages of this document for details. If you are interested, **contact Prof. Scott Carpenter ASAP**. There are *three emerging options* for this kind of special comps for next year related to Archeology, Food, and Walking.

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 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. 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 the larger picture.

Formal Requirements for Individual Papers

1. *Proposal*: For paper writers, the "proposal" is simply a statement of the paper topic and a signature (or email) from a chemistry faculty member to the comps director, indicating that he or she has agreed to serve as your advisor on the paper. 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. *Weekly meetings*. You and your advisor will arrange a regular weekly meeting time to discuss your topic and to monitor your progress.

3. *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.

4. *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.

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.

Register for **CHEM 400.01** (credits per term to be determined in consultation with your advisor).

Two Timelines for Completing Individual Papers

Two timelines for completing the Individual Paper comps option are outlined below and on the next page. The typical schedule is a winter/spring combination, with the bulk of the work occurring in the winter term (5 credits) and the remainder in the spring term (1 credits). A fall/winter combination is also possible, but you will need to move more quickly, so that you are ready to dig in at the beginning of Fall term. 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 outlined with boxes in the timelines. 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).

WINTER-SPRING COMPS (the standard schedule):

Fall term and winter break:

- Submit proposal by **Oct. 16 2015, 2015 5:00 pm.**
- Finalize the outline of your intended topic with your advisor in Fall 2015, before the registration period for Winter term 2016.
- Schedule specific times for winter term weekly meetings with advisor.
- 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 7-8: 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. Proposal must be submitted by **May 25, 2015 at 8:00 am.**
- Schedule regular meetings with your advisor before registering for Fall classes.
- Gather interesting papers from the library's paper and electronic journal collections as well as Interlibrary Loan (ILL).

Fall term and winter break:

- 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. 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 date for the comps student seminar will be set by the department by the beginning of Fall term. The details as they are currently known for the specific groups forming for next year are given on p. 5-6.

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).

The Group Option Proposal, due by 5:00 pm, Friday Oct. 16, via email to Trish Ferrett: Your selection to Group Comps is based on a carefully prepared typed statement concerning your motivation for doing group comps. Your proposal should convince 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 the 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.

Important: At the end of your proposal, you should indicate your preference for specific comps groups. Please indicate your group preferences by ranking them from 1-4. Feel free to provide information about how strongly you feel about your preferences. If you would be equally happy to join either of two or more groups, say so. We will strive to place you in either your first or second choice group. 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 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 that 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.

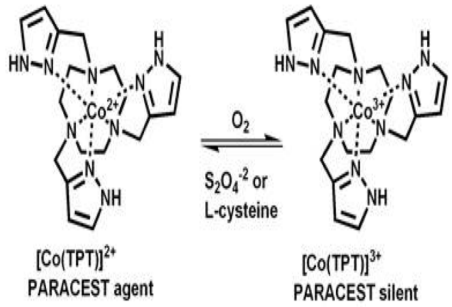
Group Topics for Chemistry Comps, 2015-2016

Winter/Spring Chemistry Comps Groups

1. **Development of Paramagnetic Complexes for Medical Imaging - led by Marion Cass**
   Visiting Scientist: Janet R. Morrow, Dept. of Chemistry, The State University of New York at Buffalo
   Research Web site: http://chemistry.buffalo.edu/people/morrow/
   Dates of Visit: April 21-22, 2016

   Janet Morrow and her research group work on the development of paramagnetic complexes that can be used as medical MRI shift reagents. They have developed a class of **para**magnetic complexes that act as **C**hemical **E**xchange **S**aturation **T**ransfer (**paraCEST**) agents. To quote from her website "ParaCEST agents produce contrast that can be turned on and off with a presaturation pulse, eliminating the need for pre- and post-contrast agent MRI scans. Metal ions with excellent magnetic properties for paraCEST include the biologically relevant metal ions Fe(II), Co(II) and Ni(II). We have prepared macrocyclic complexes of these metal ions that are inert towards dissociation. These complexes produce intense CEST contrast that is shifted far from the signal from bulk water in tissue. These complexes are being further developed and tested *in vivo* in collaboration with Roswell Park Cancer Institute imaging scientists."

   One example (shown below) is a cobalt complex that can be turned on and off as a paraCEST agent from the reaction with oxygen; starting in the paramagnetic Co(II) form and being oxidized to the paraCEST silent Co(III) form.



   Winter Term, register for 5 credits of **CHEM 400.04**
   Spring Term, register for 1 credits of **CHEM 400.04**

2. **Biophysical Chemistry of Ion Transport Proteins – led by Trish Ferrett & Ryan Steed**
   Visiting Scientist: Christopher Miller, Dept. of Biochemistry, Brandeis University
   Research website: www.hhmi.org/scientists/christopher-miller
   Dates of visit: April 28-29, 2016

   Chris Miller's career has centered on understanding the generation of cellular electricity. The asymmetric distribution of ions across biological membranes results in electrochemical potentials that are involved in many cellular processes. He has focused on several proteins that generate and consume these potentials, from early work on K^+ ion channels involved in transmission of nerve signals to current work on how toxic

F^- anions are pumped out of cells. His research involves the use of protein and membrane biochemistry, X-ray crystallography, and electrical recordings. These methods help to determine the molecular mechanism by which ion pumps and channels accomplish the task of selectively and efficiently moving charged particles across a greasy membrane, sometimes working against the potential and moving ions uphill.

Winter Term, register for 5 credits of **CHEM 400.03**
Spring Term, register for 1 credits of **CHEM 400.03**

3. **Green Homogeneous Catalysis & Organometallic Chemistry - led by Gretchen Hofmeister & Matt Whited.**
   Visiting Scientist: David Milstein, Dept. of Organic Chemistry, Weizmann Institute of Science, Israel
   Research Website: http://www.weizmann.ac.il/weizsites/milstein/
   Dates of Visit: April 14-15, 2016

   Professor Milstein is a leader in the field of transition metal catalysis, with a particular focus on the development of new reactions facilitated by cooperation between metals and the organic ligands surrounding them. The Milstein laboratory has made huge strides in the development of "green" and sustainable catalytic reactions, including the direct synthesis of amides by oxidative coupling of alcohols and amines, which was named a "2007 Breakthrough of the Year" by Science Magazine. Our comps group will examine Milstein's work, with particular focus on understanding mechanisms of catalytic reactions and their application in organic synthesis.

   Winter Term, register for 5 credits of **CHEM 400.02**
   Spring Term, register for 1 credits of **CHEM 400.02**

Global Engagement Initiative Senior Research Teams

As mentioned on the first page of this document, there is a newish opportunity at Carleton for seniors to become involved in an extended interdisciplinary team research project that can be connected to a Long Paper Chemistry Comps option. Learn more here about this general option: https://apps.carleton.edu/collab/gei/teambasedcomps/

This research team experience provides 3 credits during your senior year (1 credit per term) and supplements and supports the Chemistry Comps experience. Basically, you would end up getting 9 total credits – 3 credits for the research team experience and 6 credits for Chemistry comps. Your tie to a team project – which spans the entire year - will allow you to work with others, contributing to a larger project as you work on your own related comps paper.

On the Chemistry end, you will need to express your intent to do a long paper in fall or winter. You could then take the time to develop the specific topic and tie to the research group theme over the summer or fall of 2015. If you want this option, you will need to enroll in the Team Research Seminar for all terms in your senior year, including in Fall of 2015. You can sign up in spring of 2015 or do a late add in the fall.

If you seriously interested in this option, submit a **brief statement of serious interest by May 25, 2015 to Trish Ferrett via email**. This will serve to get you connected to the right people and the process as you take the summer/fall to work out a more detailed focus for your long paper.

So far, we know of three topics that are emerging as options for this kind of special comps. If you are interested in learning more about any of these, please **contact Prof. Scott Carpenter** at scarpent@carleton.edu ASAP.

- **Archeological Fieldwork**, involving geology major Liza Davis. She will be spending her summer doing archaeological fieldwork in both Greece and Turkey and would love to be part of a larger research team -- maybe looking at ancient ideas about the Earth or water in those regions, changes in the physical landscape over time as settlement patterns changed, etc. She and others could also do geochemical analysis of pottery or any rock samples that she brings back from her summer work. While Liza's focus will on ancient Greece

and Turkey, not all members of the team would necessarily have that region as their focus. For example, a student could propose a similar project in Peru or some other location.

- **Food Group**. Scott Carpenter indicates that there will probably be 2-3 students (at least) pursing comps papers related to food. If you would like to explore some chemical or biochemical perspectives related to food, this might be of interest. You might consider issues of biochemistry, nutrition and more from the chemical side of things.

- **Walking Group**. John Schott in CAMS has a long relationship with walking. Though it may be a stretch to imagine how a Chemistry Comps paper might interface to walking, we want you to know about this. If this captures your interest, contact John Schott to learn more.