Chemistry Comps 2016-2017

The 2016-2017 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 2016-17 year is Chris Calderone (Trish Ferrett for 2015-16).

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 23, 2016.
   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 Chris Calderone, indicating your choice, by 5:00 pm Friday Oct. 14, 2016.
   c. Students seriously interested in doing an interconnected comps (more below) through the IDSC 398 seminar should contact Trish Ferrett via email by Monday May 23, 2016.

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.

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 – Interconnected Comps Seminar IDSC 398

There is a relatively new opportunity for seniors to become involved in an interdisciplinary team research project related to your departmental comps, to be conducted over the course of the senior year. Learn more about this option, and several examples of recent research projects, at this link: https://apps.carleton.edu/collab/gei/students/compsseminar/

This seminar involves 3-6 credits taken over your senior year, spread over the year (1-2 credits/term). This project is done in addition to your major comps project, but is related is some way (through topic or methods). You can either find your own team of students for this interdisciplinary project – or you can work with the Interconnected Comps faculty leaders (Scott Carpenter, Stacy Beckwith, & Trish Ferrett) to find other students with related interests.

On the Chemistry end, you can do a long paper or the group option, coupled to interconnected comps. However, you will need to take the time to develop the specific topic and tie to the research group theme over the summer and fall of 2016. If you want this option, you will need to enroll in IDSC 398 for all terms in your senior year, including in Fall of 2016. You can sign up in spring of 2016 or do a late add in the fall. Because the comps groups will not be determined until late in fall term 2016, interconnected comps is most amenable to the long paper Chemistry comps option.

If you are interested in exploring this option further, contact Trish Ferrett by email by May 23, 2016. This will serve to get you connected to the right people (lead faculty and student collaborators) and the process as you take the summer/fall to work out a more detailed focus for the team members and project focus.
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. 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 credit). 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. 14, 2016 5:00 pm** to Chris Calderone.
- Finalize the outline of your intended topic with your advisor in Fall 2016, before the registration period for Winter term 2017.
- 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 the Chemistry Admin. Asst. 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 to Trish Ferrett by **May 23, 2016 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 the Chemistry Admin. Asst., 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 the 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. 5-7.

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. 14, 2016 via email to Chris Calderone.

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 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 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 character-
istics, 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, Winter/Spring 2016-2017**

1. **Bioanalytical Chemistry & Neuroscience - led by Deborah Gross**

*Visiting Scientist: Jonathan Sweedler, Dept. of Chemistry, U. of Illinois Urbana-Champaign*

Research Web site: [http://www.chemistry.illinois.edu/faculty/Jonathan_Sweedler.html](http://www.chemistry.illinois.edu/faculty/Jonathan_Sweedler.html)

Dates of Visit: April 16 – 18, 2017

Date of Student Group Talk: Wed. April 5, 3:30 pm

Professor Sweedler is an analytical chemist who works on a range of projects from bioanalytical chemistry to
neuroscience. His research group works to develop analytical methods suitable for measurement in complex
microenvironments, down to single cells. They develop technology in capillary electrophoresis, mass
spectrometry, nanoliter NMR, and microfluidic sampling methods. They use these techniques to investigate a
range of neurochemical pathways in a variety of model organisms. Through the development of these new
tools for measurement, they are able to learn more about both neurochemistry and brain function. Professor Sweedler
is currently the Editor in Chief of the ACS journal *Analytical Chemistry* and was voted the #3 most influential
person in the analytical sciences in 2015 by The Analytical Scientist Powerlist.

Winter Term, register for 5 credits of **CHEM 400.05**

Spring Term, register for 1 credits of **CHEM 400.05**

2. **Photoelectrochemistry: Applications in solar cells, solar fuels, & Martian geology – led by Steven Drew**

*Visiting Scientist: Bruce Parkinson, School of Energy Resources & Dept. of Chemistry, U. of Wyoming*

Research Web Site: [http://www.uwyo.edu/parkinson/parkinson_research_group/index.html](http://www.uwyo.edu/parkinson/parkinson_research_group/index.html)

Date of Visit: April 20-21, 2017

Date of student group talk: Fri. April 7, 3:30 pm
Photoelectrochemistry is the study of how light can initiate electrochemical (redox) reactions, especially at the surface of semiconducting materials. Prof. Bruce Parkinson is a widely recognized expert in photoelectrochemical processes and has performed research on dye sensitized solar cells, metal oxide photocatalyzed water splitting, and perchlorate formation on Mars. The Parkinson comps group will develop an understanding of the fundamentals of photoelectrochemistry at semiconductor-electrolyte solution interfaces then apply that knowledge in a study of Prof. Parkinson’s research.

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

3. Antibiotic Resistance & Discovery - led by Chris Calderone
   Visiting Scientist: Gerard D. Wright, Dept. of Biochemistry & Biomedical Sciences, McMaster University
   Research Web site: http://thewrightlab.com
   Dates of Visit: April 27-28, 2017
   Date of student group talk: Fri. April 14, 3:30 pm

Though the discovery and wide availability of antibiotics is arguably one of history’s most important technological innovations in terms of its benefits to human health, the continuing emergence of antibiotic resistant pathogens is a public health crisis of global proportions, making formerly minor infections potentially lethal. Gerard Wright’s lab focuses on addressing this crisis by (1) developing biochemical approaches and strategies to discover new antibiotics and (2) elucidating the molecular mechanisms and evolutionary origins of antibiotic resistance in hopes of uncovering strategies to directly combat resistance. Among Professor Wright’s most significant contributions is the discovery of the “antibiotic resistome,” a reservoir of genes conferring antibiotic resistance that are widely distributed among both pathogenic and non-pathogenic bacteria (Science 2006, 374-377), and he has also published extensively on his discoveries of new potential antibiotics.

Winter Term, register for 5 credits of CHEM 400.02
Spring Term, register for 1 credits of CHEM 400.02
4. The Structure & Mechanism of Metalloproteins – led by Matt Whited & Joe Chihade
Visiting scientist: Catherine Drennan, Dept. of Chemistry, MIT
Research website: http://drennan.mit.edu
Dates of visit: May 4-5, 2017
Date of student group talk: Wed. April 26, 3:30 pm

The primary targets of research in the Drennan lab are enzymes that contain metals or metallocofactors. These metalloenzymes use the enhanced reactivity of transition metals to catalyze challenging chemical reactions including radical-based chemistry and manipulation of organometallic bonds. The lab is also interested in metalloproteins that sense changes in the cellular environment or act as redox mediators. The Drennan lab combines X-ray crystallography with techniques from biochemistry and biophysics to understand enzyme mechanisms. They like to call this approach “structural enzymology”. At the atomic scale, the group is interested in providing detailed three-dimensional information about the nature of complex metallocofactors to help understand how protein environment modulates reactivity. At the protein scale, they are interested in seeing how enzymes are constructed to control substrate access and specificity, and how they prevent loss of reactive intermediates or damage to expensive cofactors. Some recent work has involved proteins involved in DNA repair, metabolism, and light sensing.

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