

# CHEM 449W: Chemistry Research Methods

## Syllabus for Spring 2014

**Instructor:** Holly D. Bendorf

**Office:** 209 Heim

**E-Mail:** [bendorf@lycoming.edu](mailto:bendorf@lycoming.edu)

**Phone:** 321-4365, home phone 998-8647

**Office Hours:** By appointment or just drop-by.

**Meeting Time:** Monday, 3:15-4:05 in Heim 215, plus an average of 12 hours of lab per week, arranged with your research advisor.

**Course Description:** This course focuses on the nature and practice of chemistry. Students will conduct research into a particular chemical problem with a faculty research advisor and will discuss their progress at a weekly seminar. Results from the laboratory and library research will be disseminated via a poster presentation, a colloquium presentation, and a final research paper.

**Text:** *The ACS Style Guide: A Manual for Authors and Editors*, 3<sup>rd</sup> ed.; Anne M. Coghill and Lorrin R. Garson, ed.; American Chemical Society: Washington, D.C., 2006.

### Learning Objectives

Students who successfully complete this course will:

1. Be able to search Chemical Abstracts and access the primary literature,
2. Gain experience in conducting original chemical research, and
3. Be able to communicate the results of their research, in both oral and written form.

### Departmental Objectives

This course helps to fulfill the following Department of Chemistry learning objectives:

1. Exhibit integrative, problem-solving skills, such as experimental design, data manipulation, and data interpretation,
2. Search the chemical literature, evaluate the results of the search, and access desired research materials,
3. Understand and use modern chemical instrumentation,
4. Demonstrate responsible conduct in the laboratory, including laboratory safety and ethical research practices,
5. Communicate the results of chemical investigations effectively in written and oral form.

### College Mission

The course supports the mission of Lycoming College to provide a distinguished baccalaureate education in the liberal arts and sciences.

## Writing-Intensive Course

CHEM 449 is designated as a W-course, meaning that it will partially fulfill your writing-intensive graduation requirement. Writing intensive courses include instruction on writing, and students in these courses complete at least ten pages of formal writing and fifteen pages of informal writing. Formal writing assignments in this course include the annotated bibliography, the research summary and the final paper. Informal writing assignments include free-writing exercises, peer reviews of drafts and presentations, and drafts of the paper.

## Grading Criteria\*

Annotated Bibliography	10%
Poster	10%
Colloquium	15%
Final Paper	20%
Resume, Cover Letter, Research Summary	5%
Paper drafts, practice talks and participation (class discussion, peer review)	10%
Effort in Lab and Library Research	20%
Laboratory Technique and Notebook	<u>10%</u>
	100%

\* Grades assigned in consultation with the research advisor. Grades for poster and colloquium assigned after consultation with entire chemistry faculty.

## Grading Standard (from the Lycoming College Catalog)

Final Grade	Interpretation
A	<i>Excellent:</i> Signifies superior achievement through mastery of content or skills and <i>demonstration of creative and independent thinking.</i>
B	<i>Good:</i> Signifies better-than-average achievement wherein the student reveals insight and understanding.
C	<i>Satisfactory:</i> Signifies satisfactory achievement wherein the student's work has been of average quality and quantity. The student has demonstrated basic competence in the subject area and may enroll in additional coursework.
D	<i>Passing:</i> Signifies unsatisfactory achievement wherein the student met only the minimum requirements for passing the course and should not continue in the subject area without departmental advice.
F	<i>Failing:</i> Signifies that the student has not met the minimum requirements for passing the course. A failing grade in the course may also result from academic dishonesty or from excessive unexcused absences.

**Attendance:** Attendance at the weekly seminar is mandatory and each unexcused absence will result in a 5% reduction of the final grade. A maximum of one excused absence (must be documented by a note from physician, Dean, etc.) will be granted.

You are expected to spend an average of 10-12 hours per week on laboratory work. While laboratory experiments don't always lend themselves to fixed work schedules, you and your advisor should agree on a regular lab schedule. Treat this time as you would a regular class or lab meeting; if you will not be able to be in lab at the designated time, notify your advisor ahead of time. While some of this time may be spent reading the literature and planning experiments, cutting back on designated lab time to finish a draft or study for an exam is highly frowned upon.

**Effort in laboratory and library research:** This takes the form of commitment to the project with regard to *both the time and thought* dedicated to the research. This includes an evaluation of your comprehension of the project and your intellectual input to the project (assessed via discussions about the project with the research advisor or 449 instructor, research presentations, and paper drafts).

**Laboratory Technique:** Your mastery of techniques relevant your project will be evaluated. Included in this category are the skills necessary for the maintenance of laboratory equipment, laboratory hygiene, and safety.

**Laboratory Notebook:** Keeping an accurate and detailed laboratory notebook and an organized file of spectral data is of paramount importance. While each lab has a slightly different protocol for keeping a lab notebook; please follow the protocol described by your research advisor. The laboratory notebook and spectral data will be submitted to the research advisor at the end of the semester and will be kept as part of the permanent records of the research laboratory (notebooks should remain in the laboratory as much as possible during the semester).

**Resume, Cover Letter and Research Summary:** A resume and cover letter will be prepared along with a research summary (this is useful to have on job interviews). Although only one draft of the resume and cover letter are required, you are encouraged to submit additional drafts if significant changes are suggested.

**Literature Search, Annotated Bibliography and Literature Review:** Two classes will be reserved for literature searches. You will use SciFinder to search Chemical Abstracts and locate journal articles that are pertinent to your research topic. These articles will form the basis for an annotated bibliography and the literature review. The literature review will ultimately be included in the final research paper.

**Paper Drafts:** While drafts will be returned with comments, they will not receive a letter grade. Drafts that are *submitted on time* and are reasonably well done will receive full credit (they don't need to be perfect – they are, after all, drafts!). However, submitting hastily written drafts that are short on content or littered with errors will

result in a reduction in the course grade. Similarly, failing to address critiques/suggestions from earlier drafts will result in a reduced grade.

**Research Presentations:** Several research presentations are scheduled throughout the semester. Although these presentations are somewhat informal, a reasonable degree of professionalism is expected: be prepared, be knowledgeable about your project, be able to describe the work in a concise and informed manner, and be able to answer student and faculty questions regarding the project. Presentations will be reviewed by the chemistry faculty and fellow 499 students.

**Colloquium and Poster:** You will present the results of your research to the Department of Chemistry in the form of a poster and a colloquium presentation. A formal practice talk will be given in class several days before the colloquium.

**Final Paper:** A report on the research project will be written in standard ACS style (refer to papers published in the Journal of the American Chemical Society) and will consist of an abstract, introduction, literature review, results and discussion, conclusions, an experimental section, and references. We will address the particulars of each section in class. Drafts of various sections will be due throughout the semester (submit copies to the course instructor *and* to your research advisor). We have found that at least three drafts of the entire paper are needed to ensure a final product that everyone can be proud of. **Please note that work will not be accepted after the Thursday of finals week.**

**Learning Differences and Disabilities:** Lycoming College provides academic support for students who have been diagnosed with learning, physical, or psychological disabilities. If you have a diagnosed disability and which to seek academic accommodations, please contact Mr. Dan Hartsock, Coordinator of Services for Students with Disabilities (570-321-4294; Snowden Library, 3<sup>rd</sup> Floor).

**Academic Integrity:** Be aware that in accordance with the College's policy on academic honesty, any work you submit must be your own. Any instances of plagiarism will be severely penalized.

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Finally, when nothing in the lab seems to go right, don't get discouraged! Instead, take a critical look at your project, try to brainstorm new experiments or solutions to problems, and realize that this is what makes research so rewarding when it does finally work out!

“I haven't failed, I've found 10,000 ways that don't work” - Thomas Edison

## Course Schedule, Spring 2014

**Please note:** Your research advisor should receive a copy of *every* draft you submit for this class. Please submit all work via e-mail.

Week	Topic	Reading Assignments and Preparation for Class	Student Presentations
<b>1</b> (1/6)	Course overview and expectations Annotated bibliographies, Informal research presentations, lab notebooks	Read <b>Chapter 1</b> (Ethics)	
<b>2</b> (1/13)	Searching the Chemical Literature Using SciFinder for literature searches	<b>Discuss project with research advisor,</b> Choose search terms.	
<b>3</b> (1/20)	Searching the Chemical Literature Substructure Searches, free-writing exercise	Choose substructures to be searched in consultation with advisor. Review what you have learned about your project.	
<b>4</b> (1/27)	Writing an introduction & literature review Using chemical drawing programs Citing references. <b>Due: Annotated Bibliography (W 1/29)</b>	Read <b>Chapter 2</b> (Scientific Papers), especially pages 19-24 Refer to <b>Chapters 4</b> (Writing Style and Word Usage), <b>9</b> (Grammar, Punctuation, and Spelling), <b>10</b> (Editorial Style), and <b>14</b> (References) as needed.	<b>Background Talks</b> Presentation on project design and related work. CCM, JRM
<b>5</b> (2/3)	Resumes and Cover Letters <b>Due: Draft of introduction &amp; lit. review (W 2/5)</b>	Read <b>Chapter 17</b> (Chemical Structures) <u>before</u> drawing structures. Consult <b>Chapters 15</b> and <b>16</b> before preparing figures or tables.	<b>Background Talks</b> JJJ, ENV
<b>6</b> (2/10)	Writing the experimental section Bring notebook and spectra <b>Due: Resume and cover letter (W 2/12)</b> <b>Due: 2<sup>nd</sup> draft of introduction &amp; lit. review (F 2/14)</b>	Refer to <b>Chapters 11</b> (Numbers), <b>12</b> (Names for Chemical Compounds), and <b>13</b> (Conventions) as needed.	

7 (2/17)	Writing the research summary <b>Due: Draft of experimental section (W 2/19)</b>		
8 (2/24)	Writing the Results and Discussion Section Free-writing exercise: results and discussion <b>Due: Draft of research summary (W 2/26)</b>	Review what you've accomplished on your project so far.	
9 (3/10)	Preparing for a Poster Presentation <b>Due: Draft of R and D section (W 3/12)</b> <b>Due: Poster images (F 3/14)</b>	Review <b>Chapters 15, 16 and 17.</b>	<b>Current Research Talks</b> CCM, JRM
10 (3/17)	Formal Research Talks – organization and presentation <b>Due: Peer reviews of R and D section (M 3/17)</b> <b>Due: Draft of Poster (F 3/21)</b>		<b>Current Research Talks</b> JJJ, ENV
11 (3/24)	Poster troubleshooting and peer review <b>Due: R and D second draft (W 3/26)</b>		
12 (3/31)	Colloquium practice talks <b>Due: Second draft of research summary (W 4/2)</b> <b>Due: Final draft of poster (F 4/4)</b>		<b>Colloquium Practice Talks</b> CCM, JRM
13 (4/7)	Colloquium practice talks <b>Due: First draft of complete paper, w/o abstract (W 4/9)</b>		<b>Colloquium Practice Talks</b> JJJ, ENV
14 (4/14)	Writing an abstract <b>Due: Polished “near final” draft of complete paper, with abstract (F 4/18)</b>	Read pp 21-22	
<b>Finals week</b>	<b>Due: Final draft of complete paper (Thursday, 4/24). Absolutely NO work accepted after Thursday, April 24</b>		