
CHM 305
RESEARCH METHODS IN CHEMISTRY

Fall 2014

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Learning Objectives:

- 1) To use the primary and secondary literature to find chemical information,
- 2) To consider situations that could be ethically ambiguous and how to approach them,
- 3) To learn how to extract information from a research paper,
- 4) To write a research proposal and present it, and
- 5) To learn how to maintain a laboratory notebook.

Materials: All materials are located at <http://science.marshall.edu/castella/c305.html>, in Blackboard, or at http://muwww-new.marshall.edu/chemistry/request_for_capstone_research_advisor.pdf.

Attendance: Attendance is required for all class meetings. While it is possible to make up the missed tutorial in the chemistry literature portion of the class, even excused absences will cause problems in the ethics portion of the class because there is only one meeting per topic. Thus, it will be impossible for you to take away from the class what we hope you will learn if you miss classes.

Grading: There are 5 tasks/assignments in this course: writing a proposal, presenting the proposal, taking the CITI ethics course, writing the ethics paper, and participating in the ethics discussion. Each missed assignment will result in a one letter grade reduction in your course grade. Every second unexcused absence will result in a letter grade reduction. Assignments turned in late will have their grades reduced by one letter grade per day. The course grade will be determined by averaging your two proposal grades and ethics paper grade minus the deductions just described, as well as others that may be warranted.

Preface

When a research chemist develops an idea for an experiment, that person will almost always check the literature to find if someone else has already attempted it or something closely related. If not, information about how to go about achieving the researcher's goal will almost always be found there. A number of databases have been compiled to facilitate such searches. Experience will teach you to view each search from several angles, but at the beginning it is important to simply learn what kinds of information are stored in each database and how to retrieve it.

You will do most of your searches on SciFinder Scholar® or PubMed®. After a tutorial, you will learn to search the primary chemical literature by working with one faculty member on a project relating to her or his research.

The Proposal

This part of the course will have three components:

- 1) You will use the MUOnline (Blackboard) course page to examine the profiles of faculty members to determine which projects might interest you as a Capstone project, if you plan to do research. *If you plan to do an internship, select a project that seems interesting to you, but it **must** come from a chemistry department faculty member.*
- 2) You should meet with 3 faculty members to discuss their research with them. This is optional, but recommended. You **must** meet with the person you select and get his or her signature on the Capstone advisor form linked on the materials section of this syllabus. *If you do not plan a research project, you **must** choose a chemistry faculty member as a mentor, otherwise there is no restriction.* Be sure the faculty member you select is willing to mentor you before listing them as your first choice.
- 3) You will select one project and write a short research proposal describing the project as if you would be doing it. The proposal must have at least 5 relevant references from the primary literature. If you are currently working on a project, the project may have a brief description of preliminary results, but most of the proposal must be about what you plan to do.
- 4) The proposal should be 4-6 pages long, employing Times New Roman 12 point font or Arial 10 point font with 1" margins. It should be double spaced with no extra space between paragraphs or section headers. References do not count towards the page total. You may include figures, but use the 'wrap-around' function in your word processor to minimize the space it takes up. Formatting of references should follow [ACS Style](#).
- 5) You must give a draft of the paper for your advisor to comment on at least 5 days prior to the due date for the assignment (October 15). The advisor can ask for it earlier than this. The proposal must be reviewed and signed by your faculty mentor and will be read by a student in class before it is turned in for final grading. This is on the honor system, but your proposal will be graded on the assumption that it has been proofread and you have incorporated the suggestions.
- 6) At the end of the course, you will make a 10-15 minute presentation on your proposed research.

Literature Search

On one or two occasions we will get together to discuss various types of literature references that you may have to make use of during your careers. These include (at a minimum) *Chemical Abstracts*, *PubMed*, *Beilstein*, the "Comprehensive," "Advances in," "Progress in," and "Dictionary of" book series, and the *Kirk-Othmer Encyclopedia of Chemical Technology*. There will also be a demonstration of the online *Science Citation Index*. These books and book series constitute major review sources of information which can be very difficult to track down through the primary literature. We will discuss how to read a scientific paper in one of these meetings.

Laboratory Notebooks

There will be one class meeting to discuss the proper construction of a laboratory notebook.

Ethics

Finally, this course has an ethics component. There are several different projects in which you will participate.

- 1) You will take and pass the CITI Chemistry Research Ethics course. A link to the instructions to the course appears on the CHM 305 course website. The course will take a few hours to complete, so don't wait until the end of the course to try it. You must email me a .pdf copy of the completion certificate when you are done.

- 2) You will be given several written scenarios to read and consider. During the week of September 22, we will meet in small groups with another faculty member. You will be asked to describe how you would behave in such a scenario and then we will tell you what we would do. Ethics discussions require 2 hours, there will be several two hour blocks for you to choose from, but each group is limited to four students.
- 3) In mid-October, you will write a 2-3 page, double spaced paper (1" margins, 12 pt Times New Roman or 10 pt Arial font) discussing an ethical problem in the assignment and how you think it might best be dealt with. The topic in question is real and may be found at: <https://pubs.acs.org/cen/science/89/8932sci1.html>. We will get together for a class period to discuss the article and go through the papers as a group. Students will be partnered to read another student's paper before they are turned in to me. This is a formal paper and should be written as such. Your grade will be based on your use of English and force of argument, not on whether the argument is "right" or "wrong." For details on how to write a formal opinion, you might read op-ed pieces in a major newspaper like the NY Times or Washington Post.

In all cases, ethics discussions are confidential.

Progress of Course

Aug. 27 – Introduction – How to pick a research advisor and topic
Sept. 3 – How to use SciFinder® and PubMed® & sources and kinds of literature
Sept. 10 – Science Citation Index searching
Sept. 17 – A Brief History of Ethics
Sept. 22, 24, 26 – Ethics vignettes discussed all week (3-4 students per session)
Oct. 1 –
Oct. 8 – How to write a laboratory notebook
Oct. 13, 15, 17 – Discussion of issues raised in ethics paper (1/3 of class each day)
Oct. 23 –
Oct. 30 –
Nov. 5 – Making a professional presentation
Nov. 17, 19, 21 – Research proposals presented all week (must attend at least 2 sessions)
Dec. 4 –

Assignment Deadlines

September 10 – Advisor selection (turn in paper forms)
October 8 – Draft Ethics paper (submitted electronically as a Word file by noon)
October 15 – Draft research proposal and peer review of ethics paper (submitted electronically as Word files by 5:00 p.m.)
November 12 – Final draft of research proposal (submitted electronically as a Word file by 5:00 p.m.)
December 1 – Final draft of ethics paper (submitted electronically as a Word file by 5:00 p.m.)
December 5 – CITI Ethics course (certificate submitted by 5:00 p.m.)

Marshall University's policies regarding academic honesty, excused absences, and disabled students may be found at http://www.marshall.edu/wpmu/academic-affairs/?page_id=802.

If an assignment falls on a day that is cancelled by the university (e.g. a snow day), it should be turned in to me on the next day the university opens before 5:00 p.m.

Please turn off cell phone ringers before class. Failure to do so may result in you being removed from the room, even during an assignment.