
CHM 305
RESEARCH METHODS IN CHEMISTRY

FALL 2018

Lecture Instructor: Dr. Rosalynn Quiñones
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Meeting Times: Engineering Building WAEC 1103, Wednesdays 12:00 – 12:50 pm. Sometimes we will meet on Mondays or Fridays at noon (refer to course schedule).

Office Hours: Mondays 9:00 am – 11:00 am or by appointment. I welcome drop-in visits, but cannot guarantee that I will be available to help you during non-office hours. Simple questions can be answered via email.

Course Description:

A course concerning the searching and use of the chemical literature, ethical issues relating to the conduct of scientific research, proposal writing, scientific presentations, and proper scientific laboratory conduct.

Learning Objectives:

1. To consider situations that could be ethically ambiguous and how to approach them,
2. To use the primary and secondary literature to find chemical information,
3. To learn how to extract information from a research proposal or literature paper,
4. To write a research proposal/literature paper and present it, and
5. To learn how to maintain a laboratory notebook.
6. To demonstrate your understanding and retention of fundamental chemistry concepts.

Materials: All materials are posted in MUOnline.

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. Furthermore, students are required to attend **one** seminar from the Chemistry Department during the semester. Seminars are scheduled either on Tuesdays at 11 am or Fridays at 2pm in S465. The list of the future seminar can be found in this link: <http://www.marshall.edu/chemistry/files/Download-the-Chemistry-Seminar-Schedule-PDF-33.pdf>

Grading: There are 5 tasks/assignments in this course:

1. writing a literature review or research proposal,
2. presenting the proposal/review to the class,
3. oral presentation of an assigned scientific research publication,
4. taking and passing the CITI ethics course,
5. writing the ethics paper, and
6. participating in the ethics discussion.
7. listening to one seminar from the Chemistry department.

The two written assignments (1 and 5) and each oral presentation (2 and 3) will be graded. Each missed assignment will result in a one letter grade reduction in your course grade. Each unexcused absence after the first unexcused absence will result in a letter grade reduction. Graded assignments turned in late will have their grades **reduced by one letter grade per day**. After three (**3**) days, the assignment will not be accepted.

There are due dates for several ungraded assignments and there will be consequences for turning them in late.

1. If assignments to be turned in for peer review arrive after the designated date and time, they will not be sent out for review, but will be graded as if they were.
2. If your peer review of an assignment arrives after the due date and time, the grade on your paper will be reduced by one-half letter grade for each 12 hour increment.
3. For the CITI ethics course, your course grade will be reduced by one-half grade per 24 hour period after the due/date and time.

Grading Scale:

90-100%	A
80-89%	B
70-79%	C
60-69%	D
Below 60%	F

Grading:

Research Proposal or Literature Review:	40%
Ethics paper:	40%
Oral presentation (2, each one worth 10%):	20%

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.

Ethics

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

1. Students will take and pass the CITI Chemistry Research Ethics course. A link to the instructions to the course appears on the MUOnline. The course will take a few hours to complete, so don't wait until the end to try it. Students must email me a .pdf copy of the completion certificate when you are done. In rare cases, students have been unable to download the certificate. In this event, take a screenshot and mail it to me showing that you passed.
2. Students will be given several written scenarios to read and consider. During the week of September 10th, we will meet in small groups with another faculty member. Students 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 early October, Students will write a paper discussing a scientific ethical problem. We will get together for a class period to discuss each article and go through the papers as a group. Two to three different scientific ethics problems will be discussed. Each student will be assigned a specific problem and write their ethics paper.
4. Students will read another student's paper before they are graded. Students should incorporate information from the peer reader and group discussion into your paper, if it is appropriate. This is a formal paper and should be written as such.

5. Your grade will be based on your use of English and logic of argument, not on whether the argument is “right” or “wrong.”
6. **Ethics Paper Format:**
 - a. The paper is to be at least 2 pages long and be double-spaced with 1 inch margins in either 12 point Times New Roman or 10 point Ariel font. There should be no extra spacing following paragraphs and should have only your name at the top of the paper.
 - b. There are 3 primary actors discussed: the student, her/his advisor/mentor, the ‘university’ (which comprises all persons of authority above the advisor as a group). You are to read the article and as much supplementary information as is necessary to make a determination of who acted least ethically in this series of events.
 - c. In the paper, you are to explain why the actor you chose behaved most offensively and to do that you must discuss why it is worse than the other two actors. Although it is your opinion, this is a formal paper and you should not use personal pronouns. 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.
 - d. The paper must have at least two references beyond the article. If you assert things as true they must either be in the article or you must have a reference. This includes the sequence of events. That is, if you assert one thing causes a second, the chronology must be correct. Internet references are acceptable for this paper.
 - e. Formatting of references should follow [ACS Referencing Style 1 \(as the Journal of American Chemical Society, JACS\)](https://pubs.acs.org/userimages/ContentEditor/1246030496632/chapter14.pdf):
<https://pubs.acs.org/userimages/ContentEditor/1246030496632/chapter14.pdf>.

In all cases, ethics discussions are confidential.

Research Proposal / Literature Review

This part of the course will have three components:

1. Students 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.*

Students 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, Students **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. The faculty will be contacted to corroborate that they can work with you.

2. If the student is *already doing research with a mentor*, the student will select one project and write a short research proposal describing their proposed capstone project. The proposal must have at least 5 relevant references from the primary literature. The project may have a brief description of preliminary results, but most of the proposal must be about what you plan to do.
3. If the student *is not doing research*, your 1st choice of a mentor will give you suggestion of various topics and you will write a literature research paper. Review the current scientific literature (in journals, SciFinder, etc); find 3-4 recent papers you are interested in investigating further. The topic you will select has to be similar to your future research. The research paper must demonstrate extensive use of the chemical literature. You may contact your future mentor for suggestions or feedback but it is not required. Students doing the literature research paper are expected to work independently.
4. **Literature review formats:** The report will be written in standard ACS style (refer to papers published in the Journal of the American Chemical Society) and will include a brief abstract (4 – 5 sentences, less than 200 words), an introduction explaining the motivation and establishing the significance of the topic along with the objectives of the literature review, context in where the students can discuss the evidence of each article and provide analysis and comparison of the importance of each article to similar ones (why is the research relevant?), conclusions in where students will summarize their main

findings, make clear how this review of the literature supports (or not) the research to follow, and may point the direction for further research including characterization techniques and instrumentations you may use, acknowledgments, and references. We will address the particulars of each section in class.

- a. It should be 4–5 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. Acknowledgements and 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 Referencing Style 1 \(as the Journal of American Chemical Society, JACS\)](https://pubs.acs.org/userimages/ContentEditor/1246030496632/chapter14.pdf):
<https://pubs.acs.org/userimages/ContentEditor/1246030496632/chapter14.pdf>.
5. **Research proposal formats:** The report will be written in standard ACS style (refer to papers published in the Journal of the American Chemical Society) and will include:
- a. *Title* – Include the title of the project, your name, and the name of your capstone mentor. Do not include a cover letter in the first page.
 - b. *Abstract* – A less than one page synopsis of your major accomplishments. It may include some information (4 – 5 sentences, less than 200 words) about significance and experimental descriptions.
 - c. *Introduction* – This should provide a brief history of the area of research, its significance, problem, and hypothesis and how your research objectives contribute to it. It should begin at the top of page.
 - d. *Experimental Section* – This describes the experiments you will perform in much the same way a lab manual does. It should also include the equipment you will use. Include materials, procedures, and methods such as characterization techniques. Consult with your advisor to be sure whether or how to cite this information.
 - e. *Expected Outcomes* – This section will include a succinct description of the experiments and significance of the project you will perform and expectations. This section should include both mathematical and chemical equations where relevant. Include tables of data, figures, and spectra as relevant. All three should have labels. Include future goals of the project.
 - f. *Summary or Conclusion*- This section will include a summary of the project. Here, student should address whether or not your semester goals have been met, future work and what you learned this semester.
 - g. *Acknowledgments* – Acknowledge funding agencies and others that have assisted with the research. Acknowledgment section do not count towards the page total.
 - h. *References* – This should include literature citations. 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 Referencing Style 1 \(as the Journal of American Chemical Society, JACS\)](https://pubs.acs.org/userimages/ContentEditor/1246030496632/chapter14.pdf):
<https://pubs.acs.org/userimages/ContentEditor/1246030496632/chapter14.pdf>.
 - i. *Grade Justification* – Briefly, assign yourself a grade based upon the scale set forth at the beginning of the semester and justify it based on your progress. We will address the particulars of each section in class.
- i. It should be 4–5 pages long not including references, 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.
 - ii. Students 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 (November 16th). The advisor may ask for it earlier than this. The research paper 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. The faculty signature should be in the form of an email verifying that s/he has read at least one draft of the proposal/review and provided comments.
Failure to provide an email will result in a one letter grade reduction on the proposal/review.

6. Each student will read another student's paper before they are graded. Students should incorporate information from the peer reader into your paper, if it is appropriate. This is a formal paper and should be written as such.
7. **Presentation of your paper:** At the end of the course, **all students in this course** will make a 8 – 10 minute presentation on your proposed research or literature review paper. It will be critiqued by two faculty members and the class. Occasionally, presentations require major changes. In those cases, students will have at least a week to make changes and must present them again. In that case, you will be informed of the date of your second opportunity. The presentation grade will be the average of your first and second trial of your presentation.

Scientific Research Presentation

All students in this course will be required to present an assigned research paper. The research paper will be assigned by your CHM 305 faculty mentor or CHM 305 instructor. Students will discuss the purpose of the work, the design of the research project used and its operational principles, the data presented, and the conclusions reached. This research paper can be related to the students' research proposal/review but it will not be the same presentation.

Plan the presentation for about 5 to 6 minutes with 2 minutes for questions. This means about 10 slides. The presentation should be organized as follows:

1. Describe the chemical problem, why the analysis is needed and the motivation for the work,
2. Present details of the measurement method (how everything is fit together and how it works)
3. Present and discuss the measurements made and the data presented
4. Review the conclusions from the paper and
5. Offer your perspectives about what the future holds for the measurement method and what chemical or biochemical problems it could be used to help solve.

As you read through the paper, it may be necessary for you to obtain other literature in order to understand and explain the work presented. Also, note that when you find the article on the journal website, there is very often is supplemental information that you should access and use in your presentation. At the end of your presentation, list the citations you used.

Laboratory Notebooks

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

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.

Assignment Deadlines

EVENT	SUBMISSION / GUIDELINES	DEADLINE
Class Orientation	Attendance signature required	August 22
Advisor Selection	Turn in paper forms to my office (S 496) or mailbox in S 450.	August 31
Draft Ethics Paper	Submit in MUOnline/Course Content folder by 11:59 pm	October 12
Peer Review of Ethics Paper	Submit in MUOnline/Course Content folder by 11:59 pm	October 19
Final draft of Ethics Paper	Submit in MUOnline/Course Content folder by 11:59 pm	October 26
CITI Ethics course	Certificate Submitted by email before 5:00 p.m.	November 2
Draft Research Proposal/Literature Review	Submit in MUOnline/Course Content folder by 11:59 pm	November 16
Peer Review of Research Proposal	Submit in MUOnline/Course Content folder by 11:59 pm	November 30
Final Draft of Research Proposal/ Literature Review	Submit in MUOnline/Course Content folder by 11:59 pm	December 7

Tentative Course Schedule

Dates	Guide
Wednesday Aug. 22	Introduction – How to pick a research advisor and topic
Wednesday Aug. 29	How to use SciFinder [®] and PubMed [®] & sources and kinds of literature
Wednesday Sept. 5	A Brief History of Ethics
Sept. 10, 12, 14	Ethics vignettes discussed all week (3-4 students per session)
Sept. 19	How to write a laboratory notebook and research paper: figures and tables. ACS reference style
Wednesday Sept.26	*
Oct.1, 3, 5	Discussion of issues raised in ethics paper (1/3 of class each day)
Wednesday Oct. 10	Making a professional presentation and a poster
Wednesday Oct. 17	Presenting your assigned scientific publication
Wednesday Oct. 24	Presenting your assigned scientific publication
Oct. 29 and Oct. 31	Presenting your assigned scientific publication
Wednesday Nov. 7	Research proposals/reviews presented (must attend at least 2 sessions)
Nov. 12, 14, and 16	Research proposals/reviews presented all week (must attend at least 2 sessions)
Wednesday Nov. 21	THANKSGIVING BREAK
Wednesday Nov. 28	*

*There is no class meeting on these days under normal circumstances. Should campus be closed on the date of a class meeting, these days will be used in place of the missed day.

**** This schedule is subject to change. Changes, if necessary, will be announced in class****

Additional Policies:

I have an Open Communication Policy: If you have any questions class related please do not hesitate to email me or come by my office.

Three of the assignments for this class require you to be present and cannot be replicated because they involve group participation. Even with an excused absence, your grade will be reduced by a letter grade if you cannot make alternative arrangements with me by the first 24 hours occurring after the student is permitted to return to campus.

The papers are due on the date indicated in the syllabus. The papers cannot be made up unless the student presents a university-approved excuse to the instructor by the first 24 hours occurring after the student is permitted to return to campus. Likewise, if an assignment falls on a day that is cancelled by the university (e.g. a snow day), it should be turned in on time.

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.

University Policies:

By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy by going to www.marshall.edu/academic-affairs and clicking on “Marshall University Policies.” Or, you can access the policies directly by going to http://www.marshall.edu/academic-affairs/?page_id=802. Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment

Academic Honesty

The university policy will be enforced. See page 73-75 of the 2018 – 2019 undergraduate catalog. Some examples of academic dishonesty include (but are not limited to) copying another student’s assignment, lying about being ill on the day of a test, using a cell phone or other communication device during a test, quoting an author’s writing (including material found on the internet) without giving due credit.

http://www.marshall.edu/catalog/files/UG_17-18_published_09-15-17.pdf

Incomplete Coursework

The university policy will be enforced. See page 96 of the 2018 – 2019 undergraduate catalog.

http://www.marshall.edu/catalog/files/UG_17-18_published_09-15-17.pdf

Accommodations for Disabilities

Students with disabilities must contact the Office of Disabled Student Services in Prichard Hall 117, phone 696-2271 to provide documentation of their disability to ensure proper accommodation. Please visit

<http://www.marshall.edu/disabled> for additional information.

Sexual Harassment

This course will follow Marshall University’s policy on Sexual Harassment, which can be found on p. 71 of the 2018– 2019 online undergraduate catalog.

http://www.marshall.edu/catalog/files/UG_17-18_published_09-15-17.pdf