



DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY
CHEMISTRY 3500, WINTER 2019
FRONTIERS IN CHEMISTRY -SGM 323

Instructor: Professor Lawrence J. Berliner

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Office Hrs: Very flexible – bit.ly/1UnHyz4

Frontiers lab: SGM 109 (open 24/7)

GTA: Brandon Taylor, SGM 232, brandon.taylor@du.edu

Course Description:

Frontiers in Chemistry is the capstone course in Chemistry and Biochemistry. The student will need to draw on the skills they have learned from all areas of chemistry: quantitative analysis, biochemistry, organic chemistry, and instrumental analysis.

This course is designed so that the student applies the (almost entire) scientific method to one specific project from start to finish. The instructor will divide the class into teams of 3 and provide **real** research projects. The teams will then work together to narrow down the topic, refine the research questions, and develop a number of specific hypotheses and proposed experiments to answer these questions. Each team will then work diligently in the laboratory, and the results will be presented (and possibly an oral presentation) to interested faculty, undergraduate and graduate students at a poster session during the last week of the quarter. Most important, each group member will turn in a written report of their study, in the format of a submission to a peer-reviewed ACS journal. (We will go over in more detail in class).

Course Goals:

Students completing this course should demonstrate the ability to:

- Apply their knowledge and skills to develop solutions to real problems (and perhaps solve some societal challenges)
- Learn independently by exploring the scientific literature using a variety of resources
- Develop hypotheses and test them using quantitative, qualitative scientific techniques
- Articulate applications and the impact of chemistry in the modern world
- Effectively communicate scientific information both verbally and in writing

Class time:

Frontiers is primarily a research-based course. The vast majority of time will be spent in the laboratory. During the first 1-2 weeks of the quarter, we will have discussions and activities during the first ~ 60 min of our class time and/or outside lectures. Some topics are how to work in groups, developing hypotheses, evaluating scientific writing, evaluating a scientific presentation,

instrumental techniques, experimental design and setup. This time will also be used for your research proposal presentations during Week 2. You will need to attend three (chemistry/biochemistry) seminars from outside speakers (TBA) for which you will write a graded review/critique. Since this is sometimes within our class time, it is expected that everyone will participate. Attendance is mandatory for all class-time lectures and research presentations (and we hope the outside lectures).

Frontiers is a 3-hr laboratory course. Once research projects are approved and agreed upon between the Instructor and the research team, it is expected that the team will work outside of the formally-decided class time. It is the responsibility of each team to prepare a written research plan to help guide the progress. Among other details, the research plan should include the hypothesis(es), instrumentation to be used, including detection limits and the experimental details (solvents, chemicals needed, etc.). More about this in class.

Also included in the research plan must be a research schedule which details when which students will be in the lab and which team member is primarily responsible for which set of tasks. For example, it is generally a waste of time for three students to sit around and watch a reflux or one member doing a titration. Keep everyone's strengths in mind when writing your research plan. As with all research, deviations are expected from the plan as the results (and perhaps failures) occur. *However the research plan must be presented and approved before ANY research can be conducted in the lab.* Therefore, it is in the team's best interest to put in a lot of work up front so that lab work can start as soon as possible. When deviations in the research plan are necessary over the course of the quarter, the team must inform the instructors and have Dr. Berliner approve it as soon as possible. Note that research activity is permissible without the physical presence of the instructor or GTA in the room. **HOWEVER, FOR SAFETY REASONS, STUDENTS ARE NEVER PERMITTED TO WORK ALONE.** Always work with other students, including students from other groups or courses (i.e., the MW section of Frontiers and Biochem Lab).

Assignments:

- Research proposal(13%): Before digging too deep, each team must agree on the topic. Dr. Berliner will provide you with a general description of one or possibly two research topics on Day 1. During the 2nd week of the quarter, **each student** will present, in about 10-15 min blocks, a specific hypothesis and means to carry out the project. Try to present as much detail of the actual research plan as possible, but it shouldn't be some pie-in-the-sky ideas – it must be based on peer-reviewed science and data. You should present previous research, as well as your broad research plan. The purpose is to try to convince us (an obviously your team) that THIS would be an exciting project and has the potential to lead to valuable and worthwhile results. NOTE: this should NOT be done in a vacuum. Consult Dr. Berliner and other faculty in the Department, as their expertise dictates. Following the research presentations, the team will focus on this project for the remainder of the quarter. Your grade will be based on your level of preparation and your knowledge about the topic.
- Research seminar attendance (7%): Each student will complete a written report on three research seminars (minimum 600 words). Provide a brief summary of the content, the high points, your reaction and critique (and occasionally answer a few short questions posted on Canvas). The paper is due 48 hours later. Late penalties of 33% per day will apply.
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- Other activities: Occasionally, short experiments or activities are required to help prepare groups for various aspects of their projects. These may include “mini labs” that address an important technique, chemical process, or chemical property specific to the research project.

Participation and Attendance:

As you’ve likely discovered, this course requires a **significant** amount of your participation! You will need to apply yourself both in and outside of assigned class periods. Therefore, your participation and attendance will be graded. Attendance to all assigned class periods is expected and required. If you cannot attend class, please let me know in advance. This will be graded.

Peer Evaluations: twice in the quarter (midterm and final) you will fill out a confidential peer evaluation of your other group members. It will be part of your 10% evaluation grade

Presentations:

Mostly informal progress presentations on your research topic will be required throughout the quarter in group meetings with the instructors. A formal final presentation will be given during the last class period of the quarter (TBA jointly with biochemistry lab). The presentations will be in the form of a public poster presentation, probably in the Olin Rotunda. If you are out of town for a University-sanctioned event (e.g., athletic or music) on this date, you are responsible for informing Dr. Berliner during the **FIRST WEEK** of class. These presentations will be graded – but not only by the Instructors. We will also incorporate comments from Chemistry faculty and students who talk to you during the poster session. Dr. Berliner will provide a rubric in class.

Midterm progress report (20%). During week 5 or 6, you will be expected to provide a written report midway through the quarter. Pay close attention to the requirements of the report and deadlines. A 33% penalty is assessed for each additional class period that the assignment is late.

Final Paper (45%):

A research report (paper), in the format for **submission** to an ACS journal, will be required from each individual. A specific journal format will be selected by Week 2 and, as such, the guidelines will also be spelled out then. While the laboratory work will be completed in groups, each individual is responsible for their own written report. Pay close attention to the requirements of the report and deadlines. A late penalty will be assessed for late final papers. The Final report is due on TBA.

Other Resources: Since you will be performing original research, you will have the expectation to consult primary literature and resources. These will consist of websites (laboratories, trade associations, government sites, user groups, and list-servers), electronically available journals, and paper-based journals. Most journal articles published 1970-present are available in electronic format and may be printed and/or stored in journal publication format as *.pdf format. Three examples of where to look are as follows: A) the ACS journals (pubs.acs.org) are available from any DU-based URL; and B) many other journals are available free of charge from several databases available at the DU Library website (www.library.du.edu/). The most useful databases are Web of Science and Sciencedirect, a service with > 1000 full-text journals which the DU library

subscribes to. These can be accessed directly from the Penrose Library webpage (search the Databases at <http://library.du.edu/site/>). All of the library databases are available without a personal account from any campus-based URL; however, you can access them from off-campus through the DU library's website with proxy identification (your 87 number).

The University Libraries Research Center answers research questions seven days a week by phone, email, in-person, chat/IM or text. One-on-one research consultations in the Anderson Academic Commons are also available on a drop-in basis or by appointment. Consultations help students at any stage of the research process, from refining a topic, to finding books and articles, to creating a bibliography with RefWorks. Ask a question or make an appointment at 303-871-2905 or research-help@du.edu.

Evaluation methods and grades

Proposal Presentation/writeup	= 13 %
Seminar Reviews	= 7%
Peer evaluation/Participation	= 10 %
Midterm Progress Report	= 20 %
Poster Presentation	= 5 %
<u>Final Report</u>	<u>= 45 %</u>
TOTAL	= 100 %

A	≥ 93 %	C	≥ 69 %
A-	≥ 90 %	C-	≥ 65 %
B+	≥ 87 %	D+	≥ 62 %
B	≥ 83 %	D	≥ 58 %
B-	≥ 80 %	D-	≥ 54 %
C+	≥ 74 %	F	≤ 54 %

We may make downward adjustments to this scale (i.e. adjustments in the direction of leniency). In no event will the actual scale be adjusted upward, **with one exception** : if your final report is late, then it is impossible to obtain an A in this course. To obtain an A for this course, you must 1) achieve the threshold above and 2) your final paper must be ready, with the exception of minor edits, for submission to a peer-reviewed journal by the end of the finals (TBA). This requirement includes correct formatting as specified by the journal.

GROUPS

A	Marcano, Gabriel	Gabe.Marcano@du.edu
A	Seffense, Courtney	Courtney.Seffense@du.edu
A	Shove, Harry	Harry.Shove@du.edu
B	Ellinwood, Mitchell	Mitchell.Ellinwood@du.edu
B	Langeberg, Conner	Conner.Langeberg@du.edu
B	McCallum, Maximilian	Maximilian.McCallum@du.edu