

**DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY**

**CHEMISTRY 3500, WINTER 2018**

**FRONTIERS IN CHEMISTRY**

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**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 (class-size pending) and provide a couple **general** research needs. The teams will then work together to narrow down the topic, form original research questions, and develop a small number of specific hypotheses. Each team will then test the hypotheses in the laboratory, of which the results will be presented in poster form to the Chemistry and Biochemistry faculty and graduate students. In addition, each **individual** in the group will turn in a written report of their study, to be formatted as a mock submission to a peer-reviewed journal. We will go over the formatting of this 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 societal challenges
* Learn independently by exploring the scientific literature using a variety of resources
* Develop hypotheses and test them using quantitative 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. As such, a majority of the time will be spent in the laboratory. However, during the beginning of the quarter (first 2-3 weeks), we will have lectures and activities during the first ~ 60 min of our class time. Typical lecture topics are how to work in groups, developing hypotheses, evaluating scientific writing, evaluating a scientific presentation, instrumental techniques, and experimental design and setup. This time will also be used for student presentations and proposals during Week 2. We will also attend one Chemistry Seminar from an outside speaker on **Jan 18 at 4:00 pm**, to which you will write a graded review**.** Since this is within our class time, it is expected that everyone will participate. **Attendance is mandatory for all lectures and research presentations!**

Frontiers is a 3-hr laboratory course. As such, once research projects are 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).

Also included in the research plan must be a research schedule which indicates when 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 four students to sit around and watch a reflux. Keep everyone’s strengths in mind when writing your research plan. As with all research, deviations are expected from the plan based on eventual results. **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. If and when deviations in the research plan occur over the course of the quarter, the team must inform Dr. Majestic as soon as possible. Note that research WILL BE permissible without the physical presence of the instructor 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: Before digging too deep, each team must agree on a topic. Dr. Majestic will provide you with “umbrella” 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. While not the detail of the actual research plan, it should NOT be some pie-in-the-sky idea – it must be based in peer-reviewed science and data. You must present previous research, as well as your broad research plan. The purpose is to try to convince 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. Majestic and other faculty in the Department, as their expertise dictates. Following the research presentations, we will have a class discussion and vote for one of the projects for which the team will focus their attention for the remainder of the quarter. Your grade will primarily be based on your level of preparation and knowledge about your proposed topic.
* Seminar evaluation: Each student will complete a short evaluation and written report on one research seminar. **This evaluation is due within one week of attending the seminar**. You will provide a brief abstract on the content, and answer a few short questions to be provided on Canvas. Outside speakers will be speaking the Department on Jan 18 and Jan 25 at 4:00 pm. Dr. Majestic will assign **one** of these for the entire class to attend.
* Research article evaluation: Dr. Majestic will provide the class with one peer-reviewed article. Similar to the seminar evaluation, each student will answer some short questions and provide a brief overview of the article. More details will be available on Canvas.
* Other assignments: 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. You will also be asked to record your time spent outside of formal class periods and report it weekly in Canvas.

**Presentations**:

Mostly informal progress presentations on your research topic will be required throughout the quarter. A formal final presentation will be given during the last class period of the quarter, **Tuesday, March 13**. The presentations will be in the form of a public poster presentation 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. Majestic during the FIRST WEEK of class. These presentations will be graded – but not by the Instructor. They will be graded by the Chemistry faculty and graduate students who talk to you about your poster during the poster session. Dr. Majestic will provide a rubric in class.

**Midterm exam:**

During week 5 or 6, an **oral** exam will be given to you to assess your knowledge on the research process in general, the analytical techniques important to your project, and the details of your actual project. This will occur during a portion of a scheduled class time.

**Paper**:

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. A draft (progress) report will be required midway through the quarter. Pay close attention to the requirements of the report and deadlines. A 10% penalty will be assessed for each additional class period that the assignment is late. The Final report is due on **Tuesday, March 13.**

**Textbooks:** There will be no dedicated textbook for this course. However, textbooks for your previous chemistry courses may come in handy.

**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](https://weboutlook.du.edu/owa/redir.aspx?C=3ydsSlim6E6DGXLnb4lVw_nboj7TctAIR83cegNovzIqMaAKWntXMA6i5nMzxBUSK0q_ky57r7I.&URL=mailto%3aresearch-help%40du.edu).

**Evaluation methods and grades**

Proposal Presentation = 10 %

Seminar Review = 10 %

Paper Review = 5 %

Midterm Exam = 15 %

Poster Presentation = 20 %

Final Report = 25 %

Participation/Attendance = 15 %

A ≥ 93 % C ≥ 69 %

A- ≥ 90 % C- ≥ 65 %

B+ ≥ 87 % D+ ≥ 62 %

B ≥ 83 % D ≥ 58 %

B- ≥ 80 % D- ≥ 54 %

C+ ≥ 74 % F ≤ 54 %

I reserve the right to make downward adjustments to this scale (i.e. adjustments in the direction of leniency). In no event will the actual scale used be adjusted upward from that described above, **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 final period (March 13). This requirement includes correct formatting as specified by the journal.