Chemistry Undergraduate Research
Chemistry 2891, 3881, 3891, 4881, 4891
Spring 2017 Syllabus

Instructor:
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Description:
Developing and refining the tools to perform independent research requires an introduction to the art of literature searching, reading scientific papers, formulating hypothesis, testing hypothesis, and writing key components of a scientific paper. We will work on the details of writing and revising each section of a scientific report including the introduction, experimental method, results, and discussion sections of a report as well as preparing figures and the properly citing the scientific literature. Even students with experience in scientific writing can benefit from careful writing. This course serves as an introduction to these topics with weekly discussions devoted to each topic. Throughout the course of the semester, student will be given exercises to develop skills in the topics. The exercises will be discussed individually with each student to develop clear thinking and strong writing skills. The class complements the independent research performed in one of the laboratories at Temple University. The culmination of the class is the preparation of a research report that emulates a scientific publication on the order of ten pages in length. Chemistry 4891 and 4881 represent follow-on semesters of research and course participation is not required but the syllabus should serve as a guideline for progress toward success. All students should seek guidance from research mentor and undergraduate research adviser throughout the semester.

Course Materials: selected readings as posted on BlackBoard and original literature in scientific publications

Helpful Reference:

Seminars: Plan to attend at least 3 during semester
+Graduate Seminars:
Tuesday, 4:00pm, BE162 (refreshments @3:45 outside room)

+Chemistry Department Seminars:
Thursday, 4:00pm, BE162 (refreshments @3:45 outside room)
**Schedule:**
Tuesday, 415 Beury 5 PM – 5:50 PM plus laboratory research

**Grading:**
The course grade will be based class attendance 10%, completion of assignments including weekly short posts to “research update” blog (through BB) 10%, Research Report 80%. The Final grade will be determined in with feedback from research adviser. Be sure to keep research adviser posted on progress and particularly in providing a draft paper early enough to get key feedback.

1: January 17: Organizational meeting. Structure of the course and expectations.

2: January 24
   A) Getting your project, expectations, and planning aligned for success.
   Reading: **Five Essential Skills for Every Undergraduate Researcher**, Adrienne Showman, Linh Anh Cat, Jacquelyn Cook, Natalie Holloway, and Tyler Wittman, CUR Quarterly, 33, 16-20 (Spring 2013) [On BB]
   B) Laboratory Notebook: Get organized and document your work. content, description of daily activities, new ideas concerning the project, copies of data, results etc. This should be as descriptive as possible and can be used to reconstruct the events leading up to a successful experiment.

3: January 31
   Scientific Literature: Foundational to research
   A) How to search the literature using Web of Science Searching past literature reveals key paper through citations. Reverse citation searching reveals up to the minute literature.
   B) Organizing key scientific literature in a database and proper citation within a paper. EndNote Web facilitates the process.
   Homework: Locate five references for paper and post to common EndNote Web folder (by February 7)

4: February 7: Reviewing literature citation strategy and supportive literature examples.
   Share best/most helpful cites for supporting your research
   Homework: Add 5 more references (10 total) for paper and post to common EndNote Web folder and post formatted bibliography attached to blog post (By February 14)

5: February 14: Ethics in science.
   Read: National Academy Press: On Being a Scientist
   - Honesty: In the scientific world, new knowledge and new understanding are the metric of progress. Honest assessment of individual contribution is essential. For Example: PNAS requires statement of contribution to
design, measurement and interpretation. From this approach we have the present world with medicine, and materials.

- Conflict of Interest: Working on projects that provide unfair advantage. Example: Reviewing peer proposals and papers.
- Allocation of Credit:
  o Plagiarism: “the wrongful appropriation or purloining, and publication as one's own, of the ideas, or the expression of the ideas ... of another” Oxford Dictionary
  o Due Credit: Use references for measurements, concepts and ideas taken from someone else. Use quotations and references for direct copying of another’s work (infrequent use in science).
- Error and negligence: Mistakes happen, erratum provides a means to correct the record. Negligence involves lack of appropriate controls, carelessness.
- Falsifying Results: Constitutes fraud → loss of job

6: February 21: The structure of a research paper
- title page
- abstract
- introduction
- experimental/theroretical
- results
- discussion
- conclusion
- references

The introduction begins broadly, introducing why the research is important (motivation) and reviews the literature pertinent to understanding the results presented. What are the research question(s). Should be well-organized, scholarly and complete. The final paragraph describes and justifies the approach taken (experimental and/or computational) to study the question.

7: February 28: Outlining the introduction
A) Outlining: Bullet points for each paragraph under broader sections
B) Research progress update: What to do when trouble strikes and the reaction won’t work?
   Homework: Outline introduction for discussion following week and post on blog (March 7)

8: March 7: Experimental/Theoretical Methodology
   Homework: Bring and post to blog one carefully formatted figure or table to class (March 21)

March 14: SPRING BREAK

9: March 21: Analyzing and visualizing results
Careful and accurate portrayal of data starts includes tables and figures. Start with careful observance of significant figures (common early mistake) and move towards consistent fonts and judicious use of color.

Read: Science and NSF Data visualization challenge: Gan, Judith; Appenzeller, Tim, "Introduction". Science 2014, 343 (6171), 599-599 (http://science.sciencemag.org/content/343/6171/599).

10: March 28: Putting it together
   Writing the introduction, experimental, results and discussion sections
   Homework: Bring draft of introduction to instructor for discussion (April 4)

11: April 4: Expectations for the paper
   Homework:
   • Prepare four slide four minute PowerPoint slides post on blog (Due April 11)
   • Discuss draft timeline with research mentor

12: April 11: Short presentations (4 minutes each)
   Set up appointments to check research and paper progress.
   Review paper section drafts

13: April 18: Last Minute Details; Finalize paper.

14: April 25: Open class to hand in paper or discuss last details prior to submission.