

# CHEM 891: Doctoral Scientific Critique

7:20 - 10:00 Mondays  
Robinson Hall B106

## Course Information

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### Recommended Reading:

1. "Developing Quality Dissertations in the Sciences" by Lovitts and Wert
2. "Writing Successful Science Proposals" 2nd ed. by Friedland and Folt
3. "On Being a Scientist: A Guide to Responsible Conduct in Research" 3rd ed., released by the Engineering, and Public Policy Committee on Science, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine.

*Students are expected to act in accordance with the University Honor Code  
Cell phones and beepers are not allowed in class.*

# Course Description

Development of skills associated with scientific communication and research such as oral presentation of scientific material, analysis of scientific research and preparation of scientific proposals. In preparing scientific proposals, students will learn how to identify scientific questions of interest and how to plan a course of experiments to address these questions.

*This is a core course in the Chemistry and Biochemistry doctoral program.*

# Course Objectives

The overall objective of the course is to introduce graduate students to valuable resources and skills.

This course will:

1. Introduce students to electronic resources for locating and accessing journal articles, applications and databases.
2. Teach students how to critically read scientific papers and extract relevant information.
3. Train students to orally present scientific material.
4. Introduce students to the grant writing process and help them develop skills in this area.
5. Help students identify research project ideas and teach them how to develop research strategies based on these ideas.
6. Introduce students to ethical considerations associated with the conduct of scientific research.

# Focus Areas

- Paper Presentations
- Research Proposal
- Problem Sets
- Final grade will be determined based on student performance in each of the three areas, with each contributing 25% of your final grade (combining for 75% of final grade).
- Participation in in-class discussions and activities will account for the remaining 25% of final grades.

# Paper Presentations

- This semester, you will prepare two 30 minute presentations based papers from the current literature.
- Submit your proposed papers to the instructor for approval by January 30<sup>th</sup> (presentation #1) and March 5<sup>th</sup> (presentation #2).
- Papers should come from a top tier journal, such as *Science*, *Nature*, *PNAS*, *JACS* or *Biochemistry*.
- While each talk will center on a single paper, you need to examine the cited literature, and include/account for it in your analysis.

# Paper Presentations

- You will present your paper to the class.
  - Immediately following your first presentation, the class will discuss it and provide a critique (style as well as content).
  - Later in the semester, you will present a second paper/ topic to the class, factoring in comments from the first presentation.
  - As before, the class will provide a critical assessment of your presentation.
- You will be graded based on the quality of your presentations and how well you incorporate class recommendations and criticisms from your first presentation in your second presentation.

# Paper Presentations

- You are to present critical analyses of papers that you select from the current literature. In analyzing the paper and preparing your presentation, you should ask the following question (as well as others that are relevant to the paper):
- Purpose of the paper:
  - Why is it interesting?
  - What was the goal of the authors?
- Experimental:
  - Are the experiments appropriate?
  - Are the experimental procedures explained clearly?
- Results and Conclusions:
  - Did the authors achieve their goal?
  - Does their data support their conclusions?
  - What are the broader ramifications

# Designing Slides

- Powerpoint has made it very easy to make slides using a variety of fonts, font sizes, backgrounds and colors.
- When preparing a presentation, remember your audience will not be viewing your talk on your computer screen.
- Design your slides so that the person in the back of the room can read it clearly... text, figures and tables.
- If you borrow figures or quote text, make sure that you cite your sources.
- Avoid using large blocks of text... use bullets and figures where possible.

## Slides: Font and Color

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# Designing Slides

- Use a sans serif font such as:

**Helvetica**

**Arial**

**Geneva**

Comic Sans MS

Monaco

Chalkboard

- Generally avoid using serif fonts such as:

**Times**

**Times New Roman**

**Courier**

- Also avoid using some of the more exotic fonts:

*Lucida Calligraphy*

**!Braggadocio**

DESDEMONOA

- As for color: go for high contrast but not too bright.



# Designing Slides

- Figures and Tables:
  - Figures should be clear and relevant.
  - Tables should be readable and present data clearly.
  - Make sure that figures are large enough.
  - Do not clutter a slide... slides should be clearly laid out. If a slide is too crowded, consider splitting it into two slides.
- Backgrounds:
  - Be careful when using complex and colored backgrounds.
  - They can make it difficult to read text.
- Remember, content is more important than style.
  - Be careful with slide effects and animations.

# Research Proposal

- Over the course of the semester, you will prepare a research proposal.
- The proposal can be based on literature or can be related to your graduate research project.
- The proposal should represent cohesive and well rounded research project with clear specific aims and deliverables.
- Plan your proposal and design the project assuming a 2 year timeline.

# Research Proposal

- Specifically:
  - You will prepare a preproposal describing a project of your own design.
  - You will prepare an outline of the research plan including specific aims.
  - You will prepare a research plan with references in accordance with the provided guidelines.
- Students in the class break up into “study sections” to review and evaluate your research plan.
- You will revise your proposal based on the comments of the “study section”.

# Preliminary proposal

- Prepare a 1 page preproposal describing the proposed project.
- The preproposal should contain the following sections:
  - Challenge: What is the paradigm/problem that will be addressed?
  - Innovation: What is novel or innovative about the project?
  - Rationale and Specific Aims: What are the specific aims of the project? What logic or rationale were used to develop the hypothesis and design the project.
  - Impact statement: Why is the project important? How will it impact the field, science in general and society?
  - Include up to 5 references on a separate page (do not count towards 1 page limit)
- The preproposal is due 2/8

# Proposal

- **Abstract/Summary:**
  - Should provide a short and accurate description of the proposed project.
  - Include: project's long term goals, specific aims, anticipated outcomes, relevance/impact.
  - 30 lines or less.
- **Research Plan:**
  - **Specific Aims:** state concisely the goals of the project and summarize anticipated outcomes. (1 page)
  - **Research Strategy:** (8 pages)
    - Background and Significance
    - Innovation
    - Approach

# Proposal

- **Research Strategy:**
  - a) **Background and Significance:**
    - Provide background information on the problem
    - Explain the importance of the problem
    - How will proposed project improve knowledge, technical capability and/or practice?
    - How will methods, knowledge and /or technology developed in the course of the project impact the field if the aims are achieved?
  - b) **Innovation:**
  - c) **Approach:**

# Proposal

- Research Strategy:
  - a) Background and Significance:
  - b) Innovation:
    - How does the project shift current research and paradigms?
    - Describe novel concepts, approaches, methodologies or instrumentation to be developed associated with the project.
    - Explain refinements, improvements or new applications of theoretical concepts, approaches, methodologies or techniques.
  - c) Approach:

# Proposal

- Research Strategy:
  - a) Background and Significance:
  - b) Innovation:
  - c) Approach:
    - Describe the overall strategy, methodology, and analysis that will be used to accomplish the specific aims.
    - Discuss potential problems and solutions or alternative strategies.
    - Describe strategy to prove feasibility if project is in early stages.
    - Point out any particularly hazardous agents that will be required by the project... and indicate precautions.
    - Provide a timeline and deliverables/milestones.

## Formatting Rules

- Use a sans serif font (i.e. Helvetica or Arial) at no smaller than 11 point, or use a serif font (i.e. Times or Times New Roman) at no less than 12 point.
- All margins must be greater than 0.5 inches.
- Use standard ACS format for bibliography (See journal such as *Biochemistry* or *JACS*)

## Problem Sets

- Over the course of the semester, a sets of problems/ challenges will be distributed to the class.
- You are to provide viable solutions or strategies to address these problems.
- You may want to provide alternative solutions should your original approach not work.
- Provide figures and diagrams as necessary.
- Provide clear explanations and justification of your approach to solving the problem.
- You should provide references to support your solutions.

# Problem Set #1

Hydrogel particles can be formed from cross-linked mixed acrylamide polymers. Such particles have diverse applications including drug delivery. Some of the most interesting of these particles are consist of polymeric N-isopropylacrylamide (NIPAm) or copolymers of NIPAm. Such copolymers are of particular interest because NIPAm is relatively inert, but if one introduces other functional monomers (acidic – acrylic acid or basic – allylamine) one can dramatically alter the properties of the hydrogel particle.

Unfortunately it can be challenging to quantify the amount of acrylic acid or allylamine incorporated in the hydrogel particles. Your challenge is to devise strategies for doing just this.

- 1.) Propose an method for quantifying allylamine in particles
- 2.) Propose a method for quantifying the acrylic acid content of hydrogel particles.

Remember that these are polymeric materials and are not really in solution. They are highly solvated but not really in solution.... They are more accurately thought of as suspended in the aqueous solution. Unfortunately pH titrations whether using a pH meter or an indicator are not reliable, nor is the ninhydrin assay for quantifying free amine.