

Information for Advisors of MB&B Intensive Research Courses for BS/MS Majors

MB&B 570a and 571b
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Two-term independent research projects under faculty supervision toward joint BS/MS degrees.

Introduction

Especially gifted and motivated students majoring in the Molecular Biophysics and Biochemistry Department can perform independent research toward the completion of joint B.S and M.S. degrees. The mentorship that students receive during these intensive research experiences is an important part of the student's scientific training. In turn, these exceptionally talented students often make meaningful contributions to the research endeavors of the University.

Selecting a Project for the Student

The choice of a project depends on many factors, including the qualifications of the student and the specific technical and conceptual demands of the research. For B.S./M.S. candidates, it is expected that the student will have a project or sub-project of his or her own, rather than serving as a technical assistant with no view of the overlying project. However, faculty mentors should be prepared for the possibility that students may not be capable of pushing a key project forward at the pace that might be expected of a more senior graduate student.

Hourly Requirement.

The student is required to work **20 hours per week on the project for both semesters.**

Work for Pay

Simultaneous research for double-credit and laboratory work for pay is prohibited.

Course Requirements.

- The 570a, 571b series is a year-long opportunity to perform independent research in a cutting edge scientific environment and prepare a Masters Thesis. As such, the requirements of these courses are arranged as a year long program with different expectations each semester.
- The student will receive a grade based upon written and oral presentations of the research project.
- Part of the grade will come from the Research Supervisor and part of the grade will come from the Instructor in Charge of the course.
- The grades are due by the end of finals week. The grading criteria and breakdown are as follows:

MB&B 570a Fall Semester

1. Research Proposal (30% of overall grade).

- The student must submit by **the first Friday in October**, an original typed research proposal describing the project. The text of the proposal must be single-spaced in 12 point font and must not exceed two pages of text, one page of bibliography and one page of figures. The proposal must include the following elements:

- a. Hypothesis.* One or two sentences about the project's focus, **stated in the form of a question.**

- b. *Background Information.* Two or three paragraphs describing the current state of the field and the scientific context for the project.
- c. *Specific aim(s).* A list of the research project goals with an explanation of how they will be achieved. Items a-c must fit within the two page limit.
- d. *Bibliography.* A list of 5-10 articles (including title, authors, journal name, volume, year, and page numbers) that provide the background and the context for the project. These references must be numbered and cited within the proposal description. The student must have read these papers. The bibliography should be included on page 3.
- e. *Figure.* One figure that helps clarify or explain the proposal. The figure must include a caption describing the contents of the figure. The figure should be included on page 4.

•The proposal will be **graded by the Instructor in Charge (not the Research Supervisor)** based upon:

- a. *Clarity of the scientific writing*
- b. *Demonstrated understanding of the project's rationale*
- c. *Compliance with proposal guidelines*

2. **Group Seminar (30% of overall grade).**

- The student must make a 12-15 min. oral presentation of the research progress to the Research Supervisor and his/her research group.
- The presentation must be made within two weeks prior to the first day of reading week.
- The presentation will be **graded by the Research Supervisor** based upon the following criteria:

- a. *Did the student demonstrate an understanding of the scientific background of the project?*
- b. *Did the student provide a clear description of the original data generated during the semester?*
- c. *Did the student correctly interpret these data?*
- d. *Was the overall presentation well organized and clear?*

•The grade on the presentation will count toward 40% of the overall grade in the course.

3. **Satisfactory Research Progress (40% of overall grade).**

- The **Research Supervisor will provide a grade** to assess the student's progress and effort toward completion of the Masters thesis.
- No research report is required for completion of 570a in the first semester.

MB&B 571b Spring Semester

1. **Research Presentation (40% of overall grade)**

- The student must make a 20-minute oral presentation that is open to MB&B faculty, staff and students.
- These presentations will be scheduled within the final exam period for the Spring term.
- The presentation will be **graded equally and independently by the Research Supervisor and the Instructor in Charge** (20% of overall grade each) based upon the same criteria used for the group seminar in the Fall term.

2. **Masters Thesis and Research (60% of overall grade)**

- The student must prepare a 50-60 page double-spaced Masters Thesis (text of approximately 12,000 words) including bibliography and figures. The Thesis must describe the basis for the laboratory work, summarize the data collected over the course of the project and describe any conclusions supported by the data.

- The Thesis must be submitted to the Research Supervisor and the Instructor in Charge no later than the last day of the Yale College Reading Period.
- The Thesis must include the following components:
 - a. *Title Page.* Title, the name and department of the faculty member in whose laboratory the project was performed, the name of the student, and the statement, "A Thesis Presented to the Department of Molecular Biophysics and Biochemistry, Yale University, in Candidacy for the Degrees of B.S./M.S., May 2004".
 - b. *Table of Contents.* One page with page numbers for each section.
 - c. *Abstract.* A one paragraph summary of the Thesis, including the scientific context of the work and its primary conclusions. This abstract should be 300 words or less.
 - d. *Introduction.* Scientific background for the Thesis project including a summary of the literature in the field and a justification that leads into the experiments that were performed.
 - e. *Methods.* A brief description or literature references to outline the experimental methods employed. Clarity and brevity in this section is critical. The methods section must be less than five pages (<1500 words) in length, unless the Master Thesis project is focused primarily upon methods development, in which case there is no specific limit.
 - f. *Results.* Description of experimental results and variables investigated. Include tables, charts or figures to summarize the data.
 - g. *Discussion.* Interpretation of the experimental data in relation to the scientific knowledge in the field and to the question posed in the original hypothesis in the research proposal.
 - h. *Bibliography.* A complete bibliography for the project. The bibliography of the research proposal may be used as a starting point. The references can be in *Cell* format (i.e. alphabetically by first author) or in *Nature* format (i.e. listed numerically in order of appearance).
 - i. *Figure legends.* Captions that describe the contents of each figure.

- The Masters Thesis must be the original work of the student. Where appropriate, the Thesis can utilize material from the research proposal, but the grade on the Thesis should be reduced if errors identified in the grading of the research proposal are not corrected in the Thesis.
- It is appropriate for the student to receive feedback on early drafts of the report from peers or other members of the laboratory. The oral presentations are an ideal opportunity for the student to receive critical feedback on the project. However, the Thesis must remain the original work of the student.
- The Thesis must follow appropriate practices for referencing the published or unpublished work of others.
- The Masters Thesis will be **graded equally and independently by both the Research Supervisor and the Instructor in Charge of the course** (30% each, for a total of 60% of the overall grade). The following criteria will be used to assign the grade on the Thesis:

- a. *Did the student demonstrate an understanding of the scientific background of the project?*
- b. *Did the student provide a clear description of the original data generated during the year of research?*
- c. *Did the student correctly interpret these data?*
- d. *Was the overall presentation of the Thesis well organized and clear?*
- e. *Did the student follow the Thesis guidelines?*

The grade of the Research Supervisor should also reflect the quality of the student's research in the laboratory.