Information and Enrollment Form for MB&B Research Courses

MB&B 470a, 471b, 478a, 479b

Alan Garen, Instructor in Charge (Fall 2009 and Spring 2010)

Single-term research projects under faculty supervision.

Registration

1. A student must be sponsored by a Yale faculty member, who will guide the project. See below for advice in finding a research supervisor.
2. To register, the student must complete the attached form and complete a one paragraph written plan of research.
3. Permission to enroll in these courses must be secured in advance from the student's Research Supervisor and the MB&B Faculty Advisor, both of whom must sign the attached form.
4. The signed Registration Form **must be submitted Dr. Garen's assistant, Liz Vellali, SHM CE26A by the date the student's course schedule is due.**
5. There will usually be no organizational meeting for this course - all the logistical information on how the course is run is included in this document. Students who have further questions after reading this document should contact the instructor in charge, Alan Garen.

Enrollment Limitations.

1. Enrollment in research for credit courses is usually limited to MB&B Juniors and Seniors who have successfully completed MB&B 300a and either MB&B 251La or 360Lb. Sophomores may take the course with permission of their advisor and the instructor in charge.
2. Enrollment in 478a and 479b is limited to Seniors. The DUS must sign the registration form for these two courses.
3. The student may not exceed the independent study credit limitations specified within the Academic Regulations of the University (which are: no more than one credit per term and no more than three credits total through end of junior year, and no more than two credits per term in the senior year) unless permission is granted by the Yale College Committee on Honor and Academic Standing.
4. Majors in the BS program may count no more than 2 independent research course credits toward the elective course requirements of the MB&B major (counting 1 credit as an MB&B elective, and 1 credit for the Sci elective).

Selection of Research Supervisor and Research Project.

1. Students may perform research under the supervision of an MB&B faculty member. They may also perform biochemical, biophysical or molecular biological research with a full-time member of a department other than MB&B with the consultation and permission of the MB&B Faculty Advisor.
2. A good place to find information on all the labs at Yale is the web site of the Yale Combined Program in the Biological & Biomedical Sciences (http://info.med.yale.edu/bbs/), which provides 1-page descriptions of research in over 200 labs at Yale. The web site is so

overwhelming that you will need help narrowing your choices. An excellent strategy is to talk to your MB&B academic advisor. He/she is very familiar with the other faculty at Yale.

3. To select a Research Supervisor, the student should make appointments to discuss research opportunities with one or more faculty members, preferably in the semester preceding the planned research start date. Before contacting a faculty member, make sure to read their research summary on the web site described above, and try to learn more about them by looking at some of their recent publications, asking your MB&B academic advisor about them, etc. Then contact the faculty member by email, explain that you are interested in carrying out an independent research project for credit, and make sure to explain why you have a specific interest in the research being done by that faculty member. Then ask if you can have an appointment to meet and discuss research opportunities.
4. Acceptance of a particular student into a laboratory is solely by decision of the Faculty Research Supervisor. It will depend upon several factors including: the qualifications of the individual for the proposed research, the completion of laboratory courses, and the availability of space.

Hour Requirement.

The student is required to work the equivalent of **10 hours per week for a single-credit course** (470a, 471b) or **20 hours per week for double-credit courses** (478a, 479b).

Work for Pay

Simultaneous research for credit and work for pay in the same laboratory is discouraged. Any exceptions to this policy must be with the permission of the Research Supervisor and the DUS. In these cases the work for pay must be in addition to the 10 hours per week for credit and the nature of the paid work must be distinct from the work done for credit.

Course Requirements.

1. ***Research Proposal (5% of overall grade)***.

•The student must submit by **the first Friday in October (470a, 478a) or the first Friday in February (471b, 479b)** an original typed research proposal describing the project. Submit the proposal by email to Dr. Garen's assistant Liz Vellali (Elizabeth.vellali@yale.edu). 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 (**Alan Garen**) based upon:

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

•The grade on the proposal will constitute 5% of the overall grade in the course.
•Students are strongly encouraged to retrieve the research proposal from the instructor in charge after it has been graded in order to improve the quality of the final report.

2. Group Seminar (35% of overall grade).

•The student must make a 12-15 min. oral presentation of the completed work 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. Did the student identify an appropriate set of follow-up experiments?
e. Was the overall presentation well organized and clear?

•The grade on the presentation will count toward 20% of the overall grade in the course.

3. Research and Research Report (60% of overall grade)

•The student must prepare a 12-15 page double-spaced research report (text of approximately 3500 words, not including bibliography and figure legends). This report 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 report will be grade both by the research supervisor and by the instructor in charge of the research course. Since the instructor in charge of the research course is unlikely to be a specialist in the student's area of research, the report must be written so that a scientist with a general knowledge of biochemistry can understand and appreciate the specific scientific issues and any specialized techniques used in the research.
•The report must be submitted both as to the Research Supervisor and the Instructor in Charge **no later than the last day of the Yale College Reading Period**. Submit to the Instructor in Charge by emailing an electronic copy to Dr. Garen's assistant Liz Vellali (Elizabeth.Vellali@yale.edu).
•The research report must include the following components:

a Title Page. Including title, the name and department of the faculty member in whose laboratory the project was performed, the name of the student, and the date.
b. Abstract. A one paragraph summary of the research project, scientific context and primary conclusions. This abstract should be 250 words or less.
c. Introduction. Scientific background for the research project including a summary of the literature in the field and a justification that leads into the experiments that were

performed. If desired, one or two figures (original or taken from the literature and referenced) can be included in this section.

d. *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 two pages (<750 words) in length, unless the research project is focused primarily upon methods development, in which case there is no specific limit.

e. *Results*. Description of experimental results and variables investigated. Include tables, charts or figures to summarize the data.

f. *Discussion*. Interpretation of the experimental data in relation to the scientific knowledge in the field and the question posed in the original hypothesis in the research proposal. If the project did not yield productive results, this should be indicated and possible explanations provided.

g. *Bibliography*. A complete bibliography for the project. The bibliography of the research proposal may be used as a starting point. Each reference must be cited in the text and should include authors, title, journal name, volume, year and page numbers.

h. *Figure legends*. Captions that describe the contents of each figure.

•The entirety of the research report must be the original work of the student. Where appropriate, the research report can utilize material from the research proposal, but the grade on the report will be reduced if errors identified in the grading of the research proposal are not corrected in the final report.

•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 presentation is an ideal opportunity for the student to receive critical feedback on the project. However, the report must remain the original work of the student.

•In those cases where a student has performed research on the same project over the course of multiple semesters, it is appropriate to edit and modify a previous report. The grade on the report will be reduced if errors or suggestions from the prior submission are not corrected in the updated report. The report should also clearly differentiate results obtained in the current semester from those obtained in earlier semesters.

•The following criteria will be used to assign the grade:

a. *Did the student follow the guidelines of the research report?*

b. *Did the student demonstrate an understanding of the scientific background of the project?*

c. *Did the student provide a clear description of the original data generated during the semester?*

d. *Did the student correctly interpret these data?*

e. *Was the overall presentation well organized and clear?*

•The research report will be graded independently by both the Research Supervisor (35%) and the Instructor in Charge of the course (25%). The grade of the Research Supervisor will also reflect the quality of the student's research in the laboratory.

•Students are strongly encouraged to obtain the graded research report from the Instructor in Charge. This will be useful for improving the scientific writing for a revision that might be included in the paper for the Senior Project.

Failed Course

In the absence of a Residential College Dean's authorization, failure to meet the deadline for submission of the report can result in the recording of a failing grade by the Yale College Registrar.

Yale College Undergraduate Regulations

Cheating on examinations, plagiarism, improper acknowledgment of sources in essays, and the use of a single essay in more than one course except in academically appropriate circumstances with the prior permission of the instructors.*

*See the memorandum of the Yale College Executive Committee, Cheating, Plagiarism, and Documentation, which appears as appendix F for the Yale College Undergraduate Regulations.

MB&B RESEARCH COURSE REGISTRATION FORM

Alan Garen, Instructor in Charge (2009-2010)

This form must be completed and submitted with all required signatures to Dr. Garen's assistant, Liz Vellali, SHM CE26A, by the date on which the student's course schedule is due in the Fall or Spring Term. A one-paragraph summary of the research project to be undertaken must be attached to this form. It is recommended that you make a copy of this form of your files.

STUDENT: Name:_____ Class:_____

I.D.#:_____ College:_____

Tel:_____ E-Mail:_____

RESEARCH SUPERVISOR: Name:_____ Department:_____

Campus Address:_____

Tel:_____ FAX:_____ E-mail:_____

COURSE: MB&B 470a___ MB&B 471b___ (single credit)

MB&B 478a___ MB&B 479b___ (double credit)

By signing this form, the student agrees to submit a four page research proposal, to complete by the last date of the Yale College Reading Period the work arranged with the Research Supervisor, to give a group seminar in the group of the Research Supervisor, and to submit a 10-15 page report of the laboratory work to the Research Supervisor and to the Instructor in charge. The Research Supervisor agrees to supply a grade to the Instructor in Charge by the middle of the examination period, as specified in the Yale College Programs of Study. If a grade is not supplied at that time and the student's College Dean has not authorized late submission of work, a grade of Incomplete will be sent to the Registrar's Office. By the rules of Yale College, if an instructor reports a mark of incomplete for which there has been no authorization by the College Dean, the incomplete will be reported by the Registrar's Office as a grade of F.

SIGNATURES

Student: _____ Date:_____

Research Supervisor: _____ Date:_____

MB&B Faculty Advisor: _____ Date:_____

SUPERVISORS: You will be reimbursed $500 per semester for costs associated with your student's research, **but only if** you fill in the PTAEO number below of a <u>non-restricted</u> (e.g. special use) account into which the funds can be deposited.
PTAEO for reimbursement:

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