

Molecular Biophysics & Biochemistry

Year 2-4 Report

May 21, 2007

Summary:

A thorough review of the Molecular Biophysics & Biochemistry graduate program has concluded that the program is in very good shape. A major review of the curriculum was conducted four years ago and led to the implementation of numerous new and revised courses that have been well received. Smaller changes have been implemented each year, including a number in response to the review of the program in the last year. A few areas have been identified for further consideration.

Overview of the program:

Students in MB&B take a minimum of seven courses (usual taking six in the first year), plus a laboratory rotation course and a course in the Responsible Conduct of research, both in their first year. A faculty-student committee meets with each student before the start of first-year courses to help customize a course plan and to address questions and provide advice about the program. Many students complete these requirements in their first year while some need to take one course in their second year. Students are expected to take their Qualifying Exam in the second year, with most completing this requirement in the fall term, and are admitted to candidacy at the end of the second year. Students serve as Teaching Assistants at the TF2 level for one course in each of their second and third years. Students spend most of their time conducting research in year two and nearly all of their time conducting research in years three and beyond. Students join labs and form their research committees at the end of their first year. The research committee consists of three or more faculty (including the advisor), at least two of whom must have appointments in MB&B. The research committee meets with the student in the spring of the second and third years and in both the fall and spring of years four and beyond. Students receive written reports after each research committee; students in all years also receive an annual letter on their progress and expectations from the DGS. According to the Graduate School, the median time to degree is approximately 5.5 years, meaning that most students satisfy all requirements for the PhD in just over five years.

Curricular review in 2003-2004:

The department thoroughly reviewed both the undergraduate and the graduate curricula in the 2003-2004 academic year with implementation of most changes in the 2004-2005 year. Thus, most of the new and revised courses have now met three times. The changes were designed to address redundancy and fragmentation in the presentation of some topics and to fill unmet needs in the curriculum. Three courses, Macromolecules, Proteins and Nucleic Acids, and the X-ray and NMR half-credit courses, were fused and integrated to form the two-term Macromolecules sequence now offered. A new course was developed covering Enzyme Mechanisms, a topic well represented in departmental research but long absent from the curriculum. A half-credit course, X-ray Crystallography Workshop, is now in its second year and provides an intensive introduction to the computational analysis of crystallographic data.

This advanced course is aimed at students conducting X-ray crystallographic studies. The final new course was Methods & Logic in Molecular Biology. This course was developed by the three MB&B faculty who took a similar course while students at MIT, all three of whom felt that it was their most valuable course. Students meet by themselves for three hours to discuss the nuts and bolts of three papers on one theme each week. The students then meet for an additional three hours with two faculty present to discuss the finer points of the logic of the studies. This course thus aims to develop critical thinking and analytical skills. Finally, the Eukaryotic Molecular Genetics course (now Advanced Eukaryotic Molecular Biology) was significantly revised and updated.

Collecting Student Input:

Student opinion about the graduate program was gathered in a number of ways, including direct meetings, surveys, and data on course enrollments. Numerous recommendations for improvements were considered by the Graduate Education Committee, the DGS, and the faculty, many of which have already been implemented. The sources of student input included the following:

Town Meeting: A town meeting open to all MB&B graduate students was held on May 23, 2006. The DGS and faculty members of the Graduate Education Committee attended. Following up on the meeting, the DGS sent an email to all students asking for feedback on the Year 2-4 project, which was a major topic of discussion.

Graduate Student Assembly: The DGS met on November 10, 2006 with the three MB&B members of the Graduate Student Assembly (Stefanie Lapetina, Dennis Mishler, and Sarah Roush).

Year 2-4 Survey: The Graduate School conducted a fall survey of all Yale graduate students in connection with the year 2-4 project aimed at enhancing the transition of students from the classwork years to their independent research, and at improving graduate education in general. The survey was conducted anonymously online. There were 13 responses from MB&B students, closely in line with the overall response rate. The survey consisted of four questions:

1. What is your overall assessment of your department/program? What are the strengths and weaknesses of its curriculum? What changes would improve the program? Please be specific.
2. Have you received adequate and timely feedback from your department/program? Are expectations clear?
3. If you are in the process of advancing to candidacy or have already done so, how could your department/program have better prepared you for research and writing?
4. Additional comments?

Graduate Education Committee: The Graduate Education Committee (Faculty: Mark Solomon, Don Engelman, Mark Hochstrasser, Tony Koleske, and Lynne Regan; Students: Chris DeFeo, Beth Grove, and Chad McCormick) met on October 23, 2006 to discuss the Year 2-4 project, the upcoming outside review of the department, and suggestions for improving the

program. The committee met again on May 14, 2007 to discuss a draft report that had been circulated.

Graduate Education Committee Survey: The GEC conducted its own fall survey of MB&B graduate students. The survey was conducted anonymously and there were 16 responses, representing students in all years of study except the first and the seventh years. The survey consisted of five questions:

1. Year you entered the graduate program:
2. How well did the classes you took prepare you for the Qualifying Exam? For the research you are conducting? For critical reading of the scientific literature? What could've been improved or was missing from the curriculum? (First-year students: Please address "How well are the courses preparing you...")
3. The curriculum was revised three years ago. Please comment on the changes, particularly if you have any before and after experiences.
4. What aspects of the graduate program do you feel work particularly well? Please consider all aspects of the program: Classes, seminars, rotations, TAing, thesis committees, qualifying exams,
5. What suggestions do you have for improving the graduate program?

Enrollment Patterns: Yale's Office of Institutional Research compiled data on the distribution of graduate students taking most of our graduate courses over the past 5.5 years. The main questions to be addressed by these data were whether there are any long-term trends in enrollment, and whether the revision of the curriculum three years ago had an effect on the numbers of graduate students from other departments who took the affected courses.

Student Feedback, Recommendations, and Implementation:

Overall, students were pleased with the current graduate program. Unlike the situation four years ago, concerns and suggestions related to modest issues, rather than major structural problems. Student feedback will be presented in the following sections, organized roughly in the order that students encounter the indicated topics. Recommendations have been considered by the DGS and/or the Graduate Education Committee, as appropriate, and most that have been accepted have already been implemented. There are only a couple of points on which further action is called for.

Courses and Teaching: On the whole, students like the current lineup of courses. There were very few comments concerning the content of courses. A few students felt that the curriculum could be improved through the teaching of a math or statistics course. This need was also noted four years ago but was not then addressed. Two new faculty have now developed a half-credit math course (with labs) that will be offered in the fall of 2007. It will cover selected topics that are normally taught in multiple math courses. The labs will focus on real data students could encounter in their research in MB&B labs.

Students were generally content with the quality of teaching, although there was dissatisfaction with the teaching of some of our courses. It would be appropriate for the

Graduate Education Committee or the Executive Committee to determine whether they also feel some courses are not as well taught as we would like and to consider how to ensure a high level of teaching in all of our graduate courses.

Curricular Revision: “Curricular revision” is used to indicate the changes to the curriculum implemented in the fall of 2004. This includes the fusion and integration of Macromolecules, Proteins and Nucleic Acids, and the X-ray and NMR modules into the two-term Macromolecules sequence now offered; the development of new courses in Enzyme Mechanisms, Methods & Logic in Molecular Biology, and the X-ray Crystallography Workshop; and the updating of the content of Eukaryotic Molecular Genetics (now Advanced Eukaryotic Molecular Biology). Feedback from the more senior students reiterated their dissatisfaction with the courses they had, including their desire for a Kinetics course, the view that a number of courses overlapped extensively, that the X-ray and NMR modules were not taught at the level appropriate either for future practitioners or for non-users, and the desire for the “teaching” of critical thinking skills. Some students also wanted courses in Statistics or advanced NMR.

Either through what they’ve heard or experienced, both senior and junior students felt that the curricular revisions remedied nearly all of the perceived deficiencies in course content. Besides the content issues, students felt that the development of critical analytical skills was incorporated in the Macromolecules course, Advanced Eukaryotic Molecular Biology, and Methods & Logic in Molecular Biology. There was particular praise for the Methods & Logic course.

A separate measure of the impact of the curricular revisions is to look at the enrollment of non-MB&B graduate students in our graduate courses before and after the changes to the curriculum. Whereas MB&B graduate are required to take these courses, non-MB&B students have other options. Declines in their enrollment would indicate that the courses no longer meet their needs. The results of such an analysis for our biophysical courses, Prokaryotic Molecular Genetics, and Eukaryotic Molecular Genetics/Advanced Eukaryotic Molecular Biology was conducted by Yale’s Office of Institutional Research. (The full OIR analysis is available upon request.) Although the numbers are small and subject to variability, there does not seem to have been a change in enrollment of non-MB&B students in biophysics courses following curricular revision, although there has been a substantial decline in enrollments in Prokaryotic Molecular Genetics and a small decline in Eukaryotic Molecular Genetics/Advanced Eukaryotic Molecular Biology. Thus, there were one, five and fourteen non-MB&B graduate students enrolled in Proteins & Nucleic Acids, Macromolecules, or NMR from the fall of 2001 through the spring of 2004 and eleven, three and three such students enrolled in Macromolecular Dynamics or Macromolecular Interactions from the fall of 2004 through the fall of 2006. In sum, 20 non-MB&B graduate students took these courses in the six semesters from the fall of 2001 through the spring of 2004 and 17 students took the corresponding courses in the five semesters from the fall of 2004 through the fall of 2006. In contrast, enrollment of non-MB&B graduate students in Prokaryotic Molecular Genetics declined from 43 in 2001 through 2003 to 24 from 2004 through 2006 and enrollment of non-MB&B students in Eukaryotic Molecular Genetics/Advanced Eukaryotic Molecular Biology declined from 51 in 2001 through 2003 to 30 in 2004 and 2005. These latter declines may be due to enhanced offerings to students in the MCGD track.

Rotations: The current system of rotations was almost universally praised and compared favorably with rotations offered by other tracks. A number of comments fell into the broad category of enhancing the educational value of rotations. Thus, suggestions included more feedback on the rotation itself and on the rotation talk, clarifying (for both students and mentors) the amount of time expected to be devoted to rotations, and helping to improve students' oral presentations. Some of these suggestions have already been addressed. A new rotation evaluation form has been implemented this year and provides more structured feedback than the previous form. The conversion to a full-year grade from separate semester grades will allow for greater uniformity of grading, more honest feedback from rotation advisors, and the incorporation of a clear rotation talk component to the evaluation. Students now also receive specific comments from the DGS regarding each rotation talk. Before the first rotation talk, the DGS now provides suggestions on how to give a good short presentation. Students and faculty, particularly those outside of MB&B, will be reminded of our expectation that students devote approximately 15 hours per week to their rotations. One area still in need of improvement is the timely provision of the rotation evaluation to students. It has been the custom to distribute comments only after all faculty have returned their evaluation forms, which sometimes takes quite a while after the completion of the rotation.

Preparation for the Qualifying Exam: There was mixed opinion about how well courses prepared students for their qualifying exams. Most students felt that the courses prepared them well, but a significant number of students felt that they did not and that the student had to learn a lot of material on their own. It was not clear from the survey responses if the students who felt ill-prepared by coursework were referring to the facts taught in the courses (which can't prepare one for all future research interests) or to the core knowledge base and analytical skills covered by the courses. Many students praised the writing workshops, which were implemented a few years ago to help students prepare fellowship applications, and to prepare qualifying exam Abstracts. Some students commented favorably on the increased emphasis on written work, which was incorporated into a number of courses about three years ago. A couple of students asked for more faculty feedback on proposals, both before the oral defense and after the exam (perhaps in the form of marked-up copies of the proposals).

A widely expressed suggestion was for greater clarity on what constitutes an acceptable anti-thesis topic. Students are required to prepare two ~10-page proposals for subsequent oral defense. The topics of the proposals should be quite distinct, both in terms of subject matter and in terms of methodological approach. This issue has been addressed in each of at least the last three years, yet a couple of thesis/anti-thesis topics have been deemed too close in subject matter or approach each year. Beginning in the summer of 2006, students were encouraged to email brief statements of their proposed topics to either the DGS or the Qualifying Exam Coordinator one to two months before Abstracts were due. This early input helped in a couple of instances. Nevertheless, the issue has not been satisfactorily resolved, either from the points of view of the faculty or of the students, and will need to be revisited by the Graduate Education Committee.

TAing: There were few comments concerning TA assignments or duties. However, a couple of students requested more feedback from faculty on their teaching. Anonymous surveys of MB&B teaching assistants conducted by the DGS two and three years ago identified mentorship and workload (in lab courses) as the most pressing issues. The DGS reminds faculty

each fall of their obligations as TA mentors and provides suggestions for helping students learn how to teach.

Guidance and Feedback: Both the Year 2-4 Project and of the Engelman Committee report emphasized the importance of providing adequate feedback and making sure that expectations for each stage of the program are clear. A number of students indicated, without any prompting, that the highly structured MB&B program prevents students from falling through the cracks. Expectations were considered clear. There was general praise for our requirement that students meet with their research committees twice per year from year four on. (A few students did not find these meetings helpful.) Based on student input, the Graduate Education Committee recommended and the faculty approved a requirement that each research committee contain at least two faculty from MB&B, at least one of whom holds a primary appointment in MB&B. This change was designed to improve the uniformity of advice students receive and the standards to which they are held. A number of students praised the DGS in general, as well as the one-on-one meetings the DGS instituted with all first-semester third-year students in an effort to identify students who were struggling with research, motivation, or their advisor at this critical stage in the transition from student mode to independent investigator. Students also expressed a desire for more training in public presentation of their results. Consequently, the Graduate Education Committee recommended and the faculty voted to require that all students in years three and beyond give at least one public talk per year, either at Yale or elsewhere. (One poster presentation outside of Yale can replace a talk.) Most students already participate in one or more “research in progress” series. This policy will be implemented for the 2007-2008 year with a mechanism to ensure that all students are guaranteed at least one appropriate venue.