EEB Graduate Program 2-4 Report
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The Dean's 2-4 Project to evaluate our graduate program coincided with our own internal effort to evaluate and revise EEB's pre-candidacy structure and requirements. Therefore, our 2-4 report reflects the process of its revision and establishment of new requirements and structures.

The EEB faculty is committed to a graduate program in which students achieve PhD candidacy in two years and complete the PhD in five years. Consequently, in our graduate program, most of the issues raised by the Dean's 2-4 Project initiative are relevant to Years 1-3, the period in which discussion with faculty and students demonstrated that this was the time window during which most critical issues and concerns were being raised. Functionally, this report is EEB Years 1-3 Report. It has the following structure:

- a description of the methods used during the evaluation,
- a summary of commentary on problems with various aspects of the program,
- a presentation of the revised system approved by the faculty, and
- a final commentary summarizing the perceived strengths of the new plan.

Methods
Over the past two years, R. Prum (DGS) and G. Wagner (Chair), or S. Stearns (2-4 Committee) met every semester for an open house discussion to which all EEB graduate students were invited. Meetings were held in the PM or lunch with food and drinks, and were attended by 12-18 students, including more than half of our or our 32 total students at one meeting or other.

Each meeting followed a similar agenda: (1) graduate program "news" items were reported to the students and discussed, and (2) students were requested to bring questions or concerns for the DGS concerning graduate student affairs. In addition, students were encouraged to attend the DGS weekly office hours or make an appointment to discuss any question or concerns they had.

The graduate program organization was also discussed in several faculty meetings during 06-07. The EEB faculty approved a committee of Prum and Stearns to propose a plan for revision of the graduate program in years 1-3. Prum and Stearns met several times to discuss possible revisions to the program, and to review Prum's drafts of the revision plan.

The initial plan to revise the pre-candidacy structure and requirements of the graduate program was presented to the faculty on in April 2007 Following discussion, a second plan reflecting broad faculty input was presented to the faculty in May 2007, and the faculyt approved trivial revisions through an email vote.

The following document reflects input from students and faculty during this process.

Previous PhD Requirements in of EEB Years 1-3.
For brief historical background, the traditional structure of the EEB graduate program has included:

1) Entry Committee evaluation in first week.
2) Student association with faculty sponsors through Research Rotations
3) Two Research Rotations in the first three semesters.
4) Successful passing of the intensive Advanced Topics Course in the first year with units in Ecology and Evolution as the Qualifying Exam.
5) Backup process when Advanced Topics Course was unavailable in Ecology or Organismal Biology: Written and Oral Qualifying Exams for topic in the third semester with a general committee of three faculty: DGS, an ecologist, and an evolutionary biologist,
6) Form a dissertation committee
7) Pre-prospectus and prospectus defense by end of second summer, or by fifth semester.
8) Teaching two semesters in Years 1-2 for requirement, and then for two more semesters before the end of Year 5 if on university fellowship in Year 5.

Summary of Student and Faculty Feedback

Admissions and Graduate Support
Though graduate admissions really concerns "Year 0" before entry in the program, admissions is central to the programs success. Because the university's policies restrict the use of teaching assistantships to support graduate students in EEB (the norm at other universities and peers institutions in our field), the sizes of graduate classes in EEB have been drastically restricted. In the past three years, we have enrolled cohorts of 3 (2004/05), 4 (2005/06) and 4 (2006/07, including one transfer supported by new faculty set-up funds). These entry classes have resulted in 2.4 students per faculty, and many small labs, a situation that has created genuine faculty disgruntlement and dissatisfaction. Senior faculty that have moved to Yale from other universities have found that it is substantially more difficult to maintain graduate training programs in their labs at Yale then at their previous institutions. This substantial impediment to the excellence of the program may become a faculty retention issue.

EEB has extremely competitive admissions; we have been admitting ~12% of applicants. We also have very high acceptance rates between 50-80%. Thus, excellent students want to study at Yale in EEB, the majority who get the opportunity to do so accept, and we reject many excellent students that could be successful in our program. This is all great news, except that it documents the costs to program success, faculty research productivity, and undergraduate educational experience of the very limited graduate program size.

The Dean's 2-4 Project coincided with a two-year discussion between EEB, the Provost's Office, and the Dean's Office to establish a workable solution to create a sustainable and excellent graduate program in EEB. A plan was finally approved in Spring 2007, that briefly:
- raised the teaching requirement to 3 semesters
- promised 3 years of UF support for each student
- set the goal of 40%, or two years, of support for each student to be provided by EEB from outside sources.
- established criteria for the incremental increase in numbers of admitted students above a base number of 20 (currently 1.4/faculty, or four students per year if all finish in five years) as EEB raises more outside graduate funds.

In Spring 2007, the EEB faculty accepted the plan only on the condition that the chair of EEB and the Provost's Office should revisit/revaluate the effects of the graduate support plan in two or three years. The EEB faculty are unhappy with the plan. They observed that the Provost's Office seems unwilling to abandon the self-funding, biomedical science model for the economics of the graduate program in EEB, even when economic situation at peer intuitions has been well documented, and the excellence of the undergraduate experience is clearly sacrificed (40% of our TAs come from outside EEB, see below). Faculty ask, why are graduate programs in Economics, English, and Psychology are better supported than in EEB, and how does the university justify these decisions? Also, graduate programs in science departments with historic endowments (e.g. Geology & Geophysics) are allowed to thrive, while the brand new EEB department that lacks these endowments are expected to pay its way. Meanwhile, despite honest efforts, EEB faculty members have managed to raise only a few tens of thousands of donations a year, and it is unclear whether the Provost's Office following through with their committment to attract larger donor's to the departments needs.

Unlike most students in the large BBS graduate program, many EEB students enroll with specific interests and background in the research of a specific faculty member. One consequence of making graduate student population growth contingent on raising outside funds is the pressure to admit students specifically to labs that have funds available. Currently, all the faculty participate in the admissions process, and the primary criteria for admissions are academic and future research excellence, with a secondary criterion being recruitment of students to junior faculty labs to support their research efforts and tenure prospects. The faculty are of mixed opinions as to whether the new funding situation will require us to change the admissions criteria. Some thought that the future support plan will require a *quid pro quo* arrangement in which faculty with grant money get new students of their choice. A majority, however, thought that it will be possible to avoid explicit conflicts between the admissions criteria and differential economic opportunities among individual labs. So long as the current funding policy persists, such tensions will remain unavoidable.

Entry Committee: The purpose of the entry committee is to evaluate deficiencies in the student record and to recomment the course work that needs to be completed successfully to make up for any deficiencies. The entry committee also helps the student

to identify courses that would be helpful in pursuing their area of interests. The DGS writes an official letter to the students (and their files) summarizing the committee's recommendations.

There was some student and faculty concern that the recommendations of the entry level committee can be rather vague, unofficial, or non-binding. Others said that no one followed up to see if they had completed these requests, and that they felt they could be ignored. Others said that students could rely much more on the faculty advisors for specific advise about course work to complete. Others were concerned about inconsistency among students and years as to what was considered a deficiency.

Rotations: The functions of research rotations are:

- to expose students early to different research methods and lab environments,
- to establish relationships with prospective advisors,
- to acquire new methods of use in dissertation research.

When Prum became DGS, EEB established written rotation reports that faculty fill out for the DGS to review. These reports are retained in the student's permanent file.

Because more and more students arrive in the graduate program with a strong intellectual affiliation with a specific faculty member, the research rotations are playing an ever diminishing role in the establishment of student/advisor relationships. Consequently, students are doing more rotations for acquiring methods outside of their advisor's lab. This resulted in cases where student had not done a rotation with their prospective advisor. If this relationship did not work out, there was no paper record of the faculty having evaluated the student's research abilities– no rotation report– and this led to problems in analyzing the roles of faculty and students in these conflicts.
Rotations can also fail as a consequence of lack of faculty involvement. Students complained that some rotations were associations with post-docs or students, and not with the faculty. Faculty inattention can also lead to uninformative rotation reports.

To protect the student and the student's record from this problem, the DGS proposed that students evaluate faculty as well at the end of each rotation. A draft student Rotation Evaluation was presented to the EEB faculty. The students were enthusiastic about the idea, but the faculty were not. Faculty observed that these reports could or would become part of the faculty record, and could play an unpredictable part in promotion and tenure process. They would create a unique, new input to the record that other biology faculties were not recording, and that could have negative effects on our tenure candidates. The plan was discarded.

Some students and faculty were concerned that certain students can "fall between the cracks" of the rotation system, and that they could arrive at the time to prepare a prospectus without having made a substantial intellectual connection with a particular faculty or lab. Sometimes, this has been a matter of personality conflicts, expectation differences, or overly cautious social expectations, especially in foreign students. The department has specifically adopted a formal faculty mentor for all incoming students to address these problems (see Below).

Advanced Topics Course
The Advanced Topics Course was designed to create a unified, broad intellectual exposure to core research and intellectual perspectives in Ecology and Evolutionary Biology. It was created because of dissatisfaction with the traditional written and oral qualifying examinations, the intellectual skills that they foster, and the environment that they produce. Each semester, two or three professors taught month or six week long intensive seminar classes focused on their areas of research. Each student was required to write a final paper or project for each unit.

In reality, the Advanced Topics did not function as hoped. Because of the greater number of evolutionary biologists than ecologists, it was easy to staff the Evolutionary units, but not the Ecology Units. So, in most years, there was a full semester of Evolution units, but sometimes no Ecology units taught at all. Consequently, for those graduate cohorts students were required to take written and oral exams in Ecology without having received any common training in that subject at Yale.

Also, the actual material covered in the units within any year were sometimes highly complementary, but in other years they were substantially overlapping or even redundant. The result was a very patchy experience for different cohorts of graduate students.

Given that each of our graduate classes has been very small in recent years (3 or 4 students), the Advanced Topics class was an intense and inefficient use of our teaching effort, tying up faculty members who were not teaching elsewhere in the graduate curriculum. This may have contributed to reduction in the number of other graduate courses available for more advanced students (because 3-6 faculty were teaching the entry level students each year; see below).

In Spring 2006, the EEB faculty decided that the Advanced Topics class had not been working. The course was then converted into a variety seminar for incoming students that does not constitute a qualifying exam. In the Fall, students have a series of seminar/discussions with each member of the faculty to expose them to the breadth of the research programs of faculty in EEB and our affiliates in other departments. In the Spring, the Advanced topics course now offers (a) Bioethics and Professional Conduct in Research Training for the incoming students, and (b) outreach training in science writing for the public with science journalist Carl Zimmer.

Written and Oral Qualifying Exams
In recent years, EEB has required qualifying exams in Evolution, Ecology, and Organismal Biology (basically, detailed knowledge of a particular group of organisms). When the Advanced Topics course included both Evolution and Ecology units, then only qualifying exams in Organismal Biology were required. In most years, the Advanced Topics course did not include any Ecology units, so both Organismal and Ecology qualifying exams were required. Transfer students were required to take all three qualifying exams.

The faculty exam committee included the DGS, an Ecologist, and an Evolutionary Biologist. The committee prepared questions for each area; students were given 3-5 days to submit 5 page essay answers for each question. Within three weeks, each student met with the committee for an oral examination of their answer. Grades were based on both the written and oral components of the exam.

Opinions on these qualifying exams were highly mixed. Some students felt that it was difficult to prepare for such specific questions, and that the department was not explicit enough in preparing them for the exams. Some students felt that the grading and exam outcomes were unpredictable.

Given the large amount of effort involved, and the fact that we are as selective as Yale College (we accept and enroll ~ 12- 10% of our applicants), the faculty concluded that the traditional written and qualifying exams were not worth the effort.

The elimination of the Advanced Topics course as a qualifying examination, and the dissatisfaction with the default mechanism of the written and oral qualifying examinations coincided in 2006-07 with the 2-4 Project. In the past academic year, the faculty took on the job of redesigning the qualifying examination process to address the problems raised.

Graduate Courses

The graduate students were uniform in their disappointment that there were not enough higher level, advanced graduate student courses offered in EEB. Partly, this is a result of the inefficient use of EEB faculty teaching effort for the Advanced Topics class. However, faculty respond that when they have offered graduate courses, few students enroll. This was blamed on the minimal course requirements for graduate students in the EEB, which matches the University minimum requirement. Faculty were hesitant to create greater enrollment in graduate courses by requiring more course work from the students. It appears that there are different groups of students– some that like to take courses, and others who want to concentrate on research as soon as possible.

Teaching

Graduate students were required to teach for two semesters, usually during their first two years, and for an additional two semesters before the end of their fifth year if they were supported by University Fellowships in their fifth year. Otherwise, they were able to teach for additional salary during any term, but teaching for additional salary does not count as teaching for requirement in the fifth year!

Students and faculty were very frustrated that the teaching requirements for fifth year students were not made clearer to them. The DGS was also dissatisfied that upon asking the Dean's Office for clarification of the requirement, Assoc. Dean Richard Sleight would only give verbal descriptions of the requirements details and would not or could not commit this policy into a clearly written statement that could be passed on to students and

faculty. The Graduate School's insistence on this oral lore has contributed *repeatedly* to problems in the management of the EEB graduate program, and questions by students and faculty about fairness, openness, and equity over the last three years. Students had the impression that the requirement was a moving target. For example, the issue arose several times as to whether the policy applied differently to students who had been supported for five years on University Fellowships alone, or had been supported on UFs only in Years 1, 2 and 5.

In an effort to respond to the students' request for clarification of the policy of teaching for requirement beyond two semesters, the DGS did write down his personal understanding of the policy, and did use his written version to represent the Graduate School's policy to the faculty and graduate school. (The DGS has repeated this version in the text here). However, the DGS's written interpretation of an oral policy is not a substitute for a written Graduate School policy.

Because of the Graduate's Schools reluctance to commit the oral policy clearly into an official written policy, this single issue was among the most frequent and difficult issues the DGS has had to deal over the last three years.

Students are uniformly positive about teaching in the Yale EEB program. The courses are worthwhile, the students are excellent, and the experience is professionally rewarding. Students have often elected to teach more than required. While the extra money is an obvious encouragement, it is also true that many students enjoy the engagement with undergraduate teaching.

Faculty are almost uniformly positive about the graduate student teaching. In some cases, we have some graduate students who are weak in teaching at the level required for Yale undergraduates, particularly in the writing intensive introductory Ecology and Evolutionary Biology course, where foreign students have had trouble with the language issues, and others with non-biological backgrounds have been weak on the biological content.

Faculty are quite concerned that ~40% of our TAs are not graduate students in EEB. Most of these positions are taken by Master's program students from the School of Forestry and Environmental Studies. Some are excellent, but that program is clearly not as selective as the EEB program, and some faculty have been disappointed with TA performance and its effect on the undergraduate educational experience in EEB courses.

Thus, the current teaching needs of the EEB program would support a much larger graduate student population. Further, as the faculty grows and faculty class offerings diversify, the need for more and more qualified graduate student TAs will increase.

The faculty are unanimous in thinking that teaching should be an integral part of the educational training in the EEB graduate program, and that graduate students and faculty should seek ways to make maximize the opportunities for graduate student professional development through teaching.

Revision of the EEB Graduate Program

In response to faculty discussion of many of the points described above, the faculty requested a committee of Prum and Stearns to propose a revised structure for the entry years in the EEB graduate program. Prum and Stearns produced a proposal that was reviewed by the faculty, subsequently revised by Prum and Stearns, approved by the faculty after minor changes, and then circulated to the graduate students.

In the coming year, the EEB Program will be adopting the following program structure and requirements.

1) **Entry Committee**- Upon arrival in the Fall, the entry committee will review the academic records of the new students, and recommend course work and rotations. Course work recommendations will include (a) specific and binding requirements of courses to be taken, and passed, to address academic deficiencies, and (b) suggestions of courses that will facilitate their development in their chosen area of research.

2) **Graduate Mentors**– Each incoming student will be assigned a faculty mentor. In most cases, the mentor will be a prospective advisor. If the student's prospective advisor is on leave, then another faculty member will be assigned as graduate mentor. The graduate mentor will be responsible for providing space and support for the first year, and supervising the academic recommendations of the entry committee (i.e. course requirements, language training, etc.). The graduate mentor will make a written progress report to the DGS by the end of the Spring semester of the first academic year that will document the student's progress and the Mentor's commitment to supervise the student in the coming year.

3) **Teaching**– Teaching will provide both a fundamental part of professional training and a common intellectual experience . In the new graduate support structure, students will have three semesters of required teaching for the PhD degree. Eachstudent will be required to teach:

- one semester of EEB 122 in their first two years,
- one higher level class, preferably in their area of specialization,
- one organismal, biodiversity class.

Modification these requirements will be by agreement with the DGS and the student's mentor or advisor.
Students will still be required to teach an additional, fourth semester before the end of their fifth year if they are supported by UFs in the fifth year.

4) **Rotations**- Each student will complete two semester long rotations during their first two years. At least one research rotation must be in the laboratory of their prospective advisor. At the end of each rotation, the rotation supervisor will write a rotation report to the DGS.

5) **Advancement to Candidacy**- Completion and approval of the PhD dissertation prospectus will constitute the PhD qualifying exam. During oral defense of the prospectus, the committee has the responsibility to assess the candidate's breadth of knowledge in areas of Ecology and Evolutionary Biology appropriate to the area of research.

The Dissertation Committee should be formed by the end of the third semester. Approval of the pre-prospectus is expected before March 15th of the fourth semester, and prospectus approval within 5 months thereafter. Immediately after the preprospectus meeting, the committee will inform the student in writing, with a copy to the DGS, of the committee's specific requirements for the general knowledge component of the prospectus defense. The DGS is expected to attend the Prospectus defense of all students in the department.

Candidacy is achieved after presenting and defending a preprospectus and prospectus to the dissertation committee. Following advancement to candidacy, the Graduate Mentor, or other supervising professor, will be considered the primary advisor of the student.

Students that fail to advance to candidacy, but meet all other requirements, will leave the graduate program with a MS degree. Students will be expected to advance to candidacy during their second year, though extensions are possible with the permission of the DGS.

6) **Advanced Topics Seminar**- The seminar will continue with introductions to the research programs of professors in the department, a two week session on writing about science for the public, and a four week session on ethics and responsible conduct of research.

7) **Classes-** The requirement for taking classes will remain unchanged and equivalent to the graduate school requirements.

Expected Outcomes of the Revised Program Structure

The revised program structure will address many of the complaints and problems raised by both students and faculty. For example, the program has combined the current prospectus defense and the qualifying exams, eliminating separate qualifying exams that have ceased to function as an independent assessment of a student's status in the program. Teaching requirements have been increased with the new support plan, but teaching has also become more central to graduate education in the department. The Advanced Topics course is functioning well in a new, more modest form. Faculty will be freer to teach more advanced, graduate level classes, though it remains to be seen whether graduate students will take them.

Graduate student support issues will continue to be an issue for the faculty, and it remains to be seen whether substantial additional funds will be obtained from outside sources. The faculty continue to be actively engaged in applying for training grants (multiple NFG IGERT proposals, Templeton Foundation, etc.).