

Undergraduate Student Learning Initiative

Genetics and Plant Biology Major

Department of Plant and Microbial Biology

Learning Goals

To provide students in the Genetics and Plant Biology major:

- I. Training in the basic sciences, i.e. math, physics, chemistry, biology and statistics;
- II. Training in the fundamental aspects of plant morphology, plant molecular genetics, plant cell biology, and the physiology and biochemistry of plants;
- III. Training in a wider variety of plant and microbial courses, which may be selected by the student to enhance their knowledge in areas of their specific interest;
- IV. Training in the essential laboratory techniques associated with genetics and plant biology;
- V. Training students to read and evaluate primary literature in the field of plant biology;
- VI. Training students to have a high level of competency in both oral and written presentation of scientific material;
- VII. Training students to carry out research projects independently (this includes critical thinking and the development of a hypothesis to test, designing experiments to specifically test their hypothesis, and other aspects of the scientific method including data analysis and interpretation, as well as oral and written presentation of their research);
- VIII. Training students to appreciate the relationship of their major to the community at large.

How the Learning Goals intersect with the Curriculum

- I. *Training in the basic sciences, i.e. math, physics, chemistry, biology and statistics;*
This training is met by the current lower division requirements (59 to 66 units), which includes basic training in mathematics, physics, chemistry, biology, statistics, as well as reading and composition.
- II. *Training in the fundamental aspects of plant morphology, plant molecular genetics, plant cell biology, and the physiology and biochemistry of plants;*
The core requirements of the major include 16 upper division units, which provide training in plant morphology, plant molecular genetics, plant cell biology, and physiology and biochemistry of plants.
- III. *Training in a wider variety of plant and microbial courses, which may be selected by students to enhance their knowledge in areas of their specific interest;*
To achieve this goal, the student may choose at least five courses totaling 15 units or more from a list of 25 courses offered by the PMB Department or elsewhere on campus.
- IV. *Training in the essential laboratory techniques associated with the genetics and plant biology major;*
The core courses each provide training in the requisite laboratory skills necessary for each course. In addition, the upper division science electives also contain a substantial number of laboratory courses.
- V. *Training students to read and evaluate primary literature in the field of plant biology;*
This goal may be achieved by the assignment of primary literature to students in PMB upper division core courses, as well as through the development of research projects in

PMB laboratories (see Goal VII). However, the evaluation of how well the students successfully meet this objective is often limited by time constraints on faculty and GSIs (see also Goal VI).

VI. *Training students to have a high level of competency in both oral and written presentation of scientific material;*

Except for some students that carry out well-supervised, independent research (see Goal VII), this goal is probably not adequately met in terms of the existing core curriculum. It is true that some professors require written summaries in terms of lab reports that may be evaluated by GSIs who therefore provide some feedback to the student. The difficulty is that there are serious constraints on faculty or GSI time, which make it difficult to achieve this goal to the best extent possible.

VII. *Training students to carry out research projects independently (this includes critical thinking and the development of a hypothesis to test, designing experiments to specifically test their hypothesis, and other aspects of the scientific method including data analysis and interpretation, as well as oral and written presentation of their research);*

This goal is achieved by offering students the opportunity to carry out research in PMB laboratories under the rubric of Honors Research (PMB H196), Supervised Independent Study and Research (PMB99 and PMB199) and by having students prepare written/oral evaluations of the research which they carried out under the supervision of a faculty member (or other competent person, postdoctoral student, GSI, etc.).

VIII. *Training students to appreciate the relationship of their major to the community at large.*

This goal may be achieved by those professors who stress the importance of their lecture topic to social issues and to the world at large.

Communicating Goals

The PMB department employs a number of strategies to inform undergraduates about the Genetics and Plant Biology program. These are:

- 1) the ePMB website, <http://pmb.berkeley.edu/newpmb/academic/undergrad-pb.shtml> (for convenience, the information contained on this website is reproduced in the Appendix below);
- 2) the ePMB Genetics and Plant Biology Undergraduate Program Handbook;
- 3) a one-page Genetics and Plant Biology major checklist ("snapshot").

In addition, the program is listed in the College of Natural Resources Undergraduate Program Announcement. Students may also receive guidance about learning goals by contacting the undergraduate advisor, and the student affairs officers.

Assessment

The first four learning goals listed above are essentially fulfilled by completion of the required lower division and upper division core courses. Currently, the main method of assessment is through the use of short question quizzes and exams. It is an open question as to whether students really gain a comprehensive and accurate conceptual familiarity with the subject material through this type of examination. The use of essay-type questions, especially if given in the form of a take-home paper, would probably provide a better means of assessing whether the student had really gained an accurate understanding of the concepts.

An even more challenging problem is how to assess and improve the specific learning goals enumerated under Goals V, VI and VII. These three goals relate to a special subset of students who are interested in pursuing research and/or teaching careers. In order to equip these students with the ability to excel in oral and written presentation of scientific material (Goal VI) and in carrying out independent research (Goal VII), it is essential that their progress in attaining these goals be adequately monitored. This means close supervision by faculty or other appropriate persons who will monitor their laboratory practice, data collection and analysis, write-up and presentation.

The major obstacle to the attainment of the learning goals mentioned above is clearly lack of adequate resources. Faculty persons are over-extended with regard to the time they have available for the close supervision described above. There are also insufficient resources available to employ GSIs or postdoctoral students to serve this same purpose. It is also difficult to see how one might achieve these goals for students by restructuring existing resources: new resources are desperately needed.

Other ideas given by individual professors within PMB are as follows. One colleague suggested that PMB majors might be provided a questionnaire via an interactive website whereby students completing the major can suggest improvements to the curriculum. Another colleague suggested that we might have a senior seminar format equivalent to that required by Conservation and Resource Studies students (ESPM 194). This seminar is taken in their senior year for one semester. Students present a research project that they are doing in a lab, or develop a literature-based research approach that they present. They also write a scientific paper on the research (abstract, intro, methods, results and discussion).

Another professor commented: "I really like the senior seminar idea, although perhaps it would be best to make it optional for Honor Thesis students who already have much of that incorporated into their program requirements."