Department of Microbiology
Assessment Report 2004-2005

A. Undergraduate Assessment in Microbiology

1. Student learning objective for undergraduates:

Philosophy

Our undergraduate program should provide basic knowledge of modern microbiology together with a solid background in the related sciences (i.e. physics, chemistry and mathematics). The program will prepare students for graduate work in Microbiology or for professions such as medicine, optometry, dentistry, oceanography, etc. A bachelor's degree will also allow for many careers in the food, pharmaceutical, health-oriented, agricultural, environmental and other industries including biotechnology.

Overview

The Department of Microbiology at UHM has an undergraduate program which meets the educational recommendations of the American Society of Microbiology. Graduates may sit for the ASM National Board examinations for certification as professional microbiologists. Today all biological and physical sciences overlap. Theory and instrumentation developed in one field are likely to find important applications in the others. A large number of all jobs in "microbiology" in the U.S. are in some way associated with human health. At U.H., the Microbiology faculty members work with their colleagues in Oceanography, Food Sciences, Public Health, Tropical Medicine, Genetics and Molecular Biology, Biochemistry, Tropical Agriculture and Civil and Mechanical Engineering and various research institutes. Faculty research and teaching interests span a wide range of disciplines.

Curriculum

We offer two degree options: the BA degree with a large choice of major elective courses and the more focused BS degree which is recommended for those planning to continue their studies following graduation. In addition, Microbiology courses are offered for students in nursing, dental hygiene, food science, travel and industrial management, and public health as well as for students planning to major in the many non-science fields.

2. These objectives are published on our web page at (http://www.hawaii.edu/microbiology/undergrad.htm)

3. How do the student learning objectives map into the curriculum?

Our curriculum is designed to meet the learning objectives discussed above. The first two years of our undergraduate curriculum for both the B.A. and B.S. require broad training in basic scientific disciplines such as chemistry, physics, mathematics, and biology. In the junior and senior years, our degree programs have the students take a range of microbiology course that cover both the academic and technical aspects of the discipline. Our faculty is quite small but has been carefully chosen to provide experts in every major area of microbiology. Accordingly, every one of our upper division courses is taught by someone who is specifically trained in that area (e.g., bacterial genetics, medical microbiology, marine microbiology, bacterial ecology, immunology). Moreover,

with one exception, all of our courses are accompanied by a 2-credit laboratory course that provided state-of-the-art technical training required of modern microbiology laboratories.

4. What methodologies are used to collect data on achieving the learning objectives?

Our main assessment of our teaching proficiency is via student evaluation. This includes CAFE prepared questionnaires (essentially multiple choice) and questionnaires form the department. These latter questionnaires asks students for one word answers (e.g., “what one word best describes the instructor?”) and provides several open-ended questions where students can write as much or as little as they want. The questions ask about the instructor, the course material, textbooks and student expectations.

Every class gives students the opportunity to evaluate the course. The questionnaires are given to every student in class at the end of every semester. The only data collect on the questionnaires about the students is their major; thus, data can be categorized according to whether the student is a Microbiology major. Response rates range from 50% to 80% or higher.

Data summaries are made via the CAFE system or by secretarial staff and student help. Faculty, instructor, and graduate students (i.e., teachers) and not involved in preparing the data summaries.

We do not have a “exit survey” for our graduating students.

5. How are the data used to modify the programs in order to better achieve the student learning objectives?

The main pedagogy changes that have transpired over the past few years are probably more related to availability of new technologies (mostly computer-related and include the use of PowerPoint and video clips available on the internet) than to course evaluation. However, it should be noted that today’s students expect “high tech” presentation and the use of overheads and “chalk talks” generally results in critical comments on student evaluations. Thus, students are driving many of the changes.

Last semester, we spent many hours discussing the curriculum can be improved. It is generally agreed that course changes are needed and some key changes should be in place by next year. The first, and perhaps most important change will come to MICR351+351L, the Biology of Microorganisms. This is our entry-level course for majors; it is taken by every Microbiology major (and many others) and is a prerequisite to most of our 400-level courses. This course will be dramatically changed to reflect recent changes in our knowledge of microorganisms. The second issue on the agenda is the addition of a capstone course for seniors; however, there are several suggestions on the table and it is not yet clear exactly what form this course will take. Seniors and graduate students that received their degrees from this department will be involved in designing the new courses and curriculum.

There have been no administrative changes to the curriculum. Committees make all major curriculum changes; there have been no major requirement changes in several years. With the exception of MICR351+351L, individual faculty are generally responsible for the content of their courses. This is because the faculty that teach the

400-level courses are experts in the subject taught and are best qualified to choose the course material.

6. General education assessment within the major.

Much of the learning in the life sciences is passive. This is because there is so much factual information that we want the students to know (i.e., memorize) and many complex theories underlying how we think about complex interactions of organisms, cells and molecules. Nonetheless, we often incorporate the latest data acquisition techniques in our laboratory courses (BA majors take at least 6 credits of Microbiology labs and BS majors take at least 8 credits). This includes generating information during wet-lab exercises (e.g., replicating key experiments in microbiology and understanding the logic that led to the original experiment) and using computers to learn about biological systems and phenomena (e.g., use computers to acquire DNA sequence data for proteins, compare sequence data from similar proteins, then use computers to make 3-D models of the proteins). These types of exercises provide students with problem solving skills and provide training and experience in the modes of inquiry and analysis that form the foundations of modern microbiology.

Some of our courses provide students with opportunities for oral presentations. However, we have not placed a great deal of our efforts on oral communication skills because that generally takes significant amounts of time (particularly for large classes) that we think is better used in other learning activities.

B. Graduate Assessment in Microbiology

1. Description of the Department and gradute student learning objectives.

General consideration for all graduate programs in Microbiology

The programs of the Department of Microbiology are designed to provide an atmosphere and environment of excellence, where the intellectual curiosity, research abilities and teaching qualities of each graduate student can be developed and expressed. Graduate programs are offered leading to the Master of Science or Doctor of Philosophy degrees. Depending upon previous preparation, each student starts his/her educational career in the Department by studying a core of essential course work in which microorganisms are explored in depth, at the functional, structural and molecular levels and with respect to their interaction with their environments and/or hosts. Further learning experiences towards the student's own professional goals are available through a broad range of courses determined by the student and his/her advisory committee.

These studies may include microbial genetics, cell biology, molecular genetics, microbial physiology and metabolic regulation, microbial ecology, pathogenesis of infectious agents, immunology, environmental microbiology, marine microbiology, virology, and course offerings in allied departments. The proportion of independent to supervised studies will depend on the student's previous training in the area chosen. Overall emphasis is placed on practice in critical and analytical thought and on the creative design and implementation of experimental procedures required for testing original and significant hypotheses.

Teaching experience can be gained by participation in instructional activities and by frequent presentation of literature and research seminars. Trainees have access to

laboratories equipped for cell culture, virology, animal experimentation, immunobiological and immunochemical analyses, monoclonal antibody facility, ultrastructure, microbial genetics, physiology and environmental microbiology. The wide range of faculty interests, and the availability of research space and facilities should give each student an opportunity to pursue the area of microbiology he/she wishes to study. In some cases, special interdisciplinary programs can be arranged.

Specific learning objective for the Master degree

The program leading to a Master of Science degree in microbiology is designed to provide students with basic knowledge of the field, to permit students to acquire technical competence in the fundamentals of research and to foster creative and independent thinking. Two calendar years for the completion of an original thesis (Plan A) or the passing of a comprehensive examination (Plan B) are usually needed to complete the recommended program of study.

Specific learning objective for the Ph.D. degree

The program leading to the Ph.D. degree is designed to develop the student's ability to pursue independent and original research in microbiology and allied fields, communicate the results of such research to the scientific community and serve as an effective teacher. Students normally enter the doctoral program after receiving a master's degree. Generally, four years are required to complete the program.

2. These objectives are published on our web pages at
http://www.hawaii.edu/microbiology/grad2.htm (general information)
http://www.hawaii.edu/microbiology/ms.htm (MS degree information)
http://www.hawaii.edu/microbiology/phd.htm (Ph.D. degree information)

3. The graduate curriculum and the learning objectives.

Both MS degree programs [Plan A (thesis) and Plan B (exam)] require student to take 30 hours of microbiology or related courses. These courses are provided by our graduate faculty (7 Microbiology faculty and 12 other graduate faculty) and other gradute programs (e.g., Public Health, Tropical Medicine and Microbiology, Oceanography). The student's program begins with a diagnostic exam testing the knowledge of each incoming student. The student and their advisor uses the results of this exam to design a program suited to the student's interests and knowledge base. As part of the program, student are also required spend a significant amount of time in research laboratories learning the latest techniques in cell and molecular biology and learning the problem-solving skills used in a research environment. Thus, students have a balance between classroom instruction and research training. For Plan A the balance is tilted toward research and for Plan B the balance is tilted toward classroom learning. The success of our MS graduates in finding jobs in microbiology, or continuing there education in research or as health professionals, give us confidence that we are providing students with the training needed to become microbiology professionals.

The Ph.D. training program is very flexible but it clearly focuses on research and analytical skills need to do work in state-of-the-art research environments. Most of our Ph.D. students have a Master's degree in Microbiology or a closely related field. Their research and training program revolves around the subdiscipline they have chosen (e.g., bacterial genetics, immunology, virology) and the laboratory where they spend

most of their time doing research. The research and course work needed for the Ph.D. are unique to each student and designed by the student, the advisor and the Ph.D. committee.

4. All Microbiology graduate courses (except 699 and some 795) have student evaluation and all students taking the courses are asked to participate in the evaluation.

5. Graduate student progress is monitored at various times throughout their tenure as graduate students.

All incoming students take a diagnostic exam to determine their initial knowledge of microbiology subdisciplines and to aid in designing a program of study appropriate for their interests and knowledge base.

Most of the 600-level courses have exams or other means of testing to determine the student's knowledge in the subject.

Plan A Master's degree students must write and defend a thesis on their research and pass written comprehensive exams covering four areas of microbiology (a general microbiology exam plus three additional exams in areas of their choice).

Plan B Master's degree students must pass written comprehensive exams covering six areas of microbiology (general microbiology plus five additional exams in ares of their choice).

Ph.D. students must pass four qualifying exams covering general microbiology plus three areas of their choice to become degree candidates. They must also take a comprehensive exam that is provided by their Ph.D. advisory committee. This exam includes written answers to question provided by each committee member (five committee members is minimum). This is followed by an oral exam where the student must defend and/or further explain the written answers. Additionally, the student must orally answer question on any subject related to the written exam or their research discipline and their Ph.D. research plan.

All Plan A MS students and all Ph.D. students must write an approved thesis on their original laboratory research and must defend that research in a public seminar and to their advisory committee. Plan B MS students must write a short paper for the research laboratory where they did their MICR699 research.

All M.S and Ph.D. student are required to take 1 credit MICR690, Microbiology Seminar. This is a weekly research seminar series. Although all students are strongly encouraged to attend seminar every week, students that take the course for credit must give one of the seminars (usually on their current research).

Many of our other graduate courses require students to orally present their research or discuss current research reports from the scientific literature. Student presentation skills and their mastery of the material is usually the basis for grades in these types of courses.

6. Many of our graduate student present data (either as an oral presentation or a poster) at professional meeting. Usually 3-8 graduate students per year present research results at the national American Society for Microbiology (ASM) annual meeting. This meeting brings together more than 10,000 microbiologists. Students also participate in other national or international meetings, depending on there area of research. In addition, the Hawaii Branch of the ASM has an annual meeting where 12-

16 students give oral presentation. The best presentations get monetary awards (often funds to attend the national ASM meeting). In addition, as part of the graduate program, every student must give an oral presentation at one of the Department's weekly seminars.

The great majority of Master's Plan A students and Ph.D. students, as well as many of the Master's Plan B students, publish research results in peer-reviewed professional journals. It is rare when a faculty member publishes research results without one or more graduate students as co-authors (usually a graduate student is first author).

7. We have no formal system in place to monitor or track where our graduates are working. However, many graduate stay in Hawaii and/or keep in touch with their mentor. Thus, although only anecdotal, we have information on many of the graduates.

8. Our assessment of the Microbiology Graduate programs and classes has resulted in some changes in graduate courses. However, factors apart for assessment seem to be driving the major changes in our courses and our training program. One important factor in changing pedagogy is not the assessment of the program but increased enrollment. Ten years ago, most of the graduate courses had less than five students enrolled. Now, our program has grown such that most of the courses have more than five students and occasionally more than ten. Though these numbers are still small, they significantly change how instructors deal with students and how much participation each student has in classroom discussions and exercises. Another factor that has recently and significantly influenced pedagogy in Microbiology is the information available via computers and the internet. Much of molecular biology, the mainstay of modern microbiology, requires computers for designing experiments, gathering data, data analysis and graphic representation of the data. These changes change the way we do research and how the results are interpreted. In turn, this changes how certain courses are taught. Thus, as the department and the discipline of microbiology evolve, so does our teaching. Our assessment of graduate student leaning makes us think we are keeping up with the times but, at this time, changes in enrollment and science are leading the development of the instructional program.