The Education of Plant Pathologists in Biotechnology

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The challenge, to the progressive plant pathologist, is to embrace these technological innovations and apply them with a sound understanding of important problems. The problem faced by plant pathology departments becomes one of balancing the need to incorporate exposure to and understanding of the latest methods in biotechnology without significantly altering the time frame of graduate study. The approach selected by the Department of Plant Pathology of the University of California at Berkeley is probably similar to that of many departments throughout the country. The first stage in developing a curriculum is to decide what constitutes the minimum core offering in plant pathology every student must take to qualify for a Ph.D. degree in the field. The second stage is to design courses in the appropriate subdisciplines that can be chosen by students according to their interests and career goals. Requirements for courses within the department must not be so heavy as to curtail opportunities to take courses and do research in areas of specialization.

We have recently restructured our course offerings to provide two four-unit semester courses that offer instruction on principles and general methodology of plant pathology and on fungi, bacteria, and viruses as plant pathogens. These two courses plus a three-unit course on epidemiology and control of plant disease and a four-unit course on diagnosis of plant diseases constitute the plant pathology core. We also offer one- or two-unit courses on physiology of plant disease, genetics of plant-microbe interactions, advanced plant virology, advanced soil microbiology, molecular basis of plant disease, plant-pathogenic bacteria, and forest pathology. A student wishing to specialize in the molecular biology aspects of plant pathology would take the core courses plus courses on genetics of plant-microbe interactions, molecular basis of plant disease, and probably physiology of plant disease. This would constitute 20 semester units, and, depending on the adequacy of preparation, a student should not encounter any serious difficulties in taking additional courses in other disciplines, such as molecular biology, immunology, and computer science.

The following is a summary of the content of one semester of a typical two-semester core course. Lectures are devoted to experiments in preparing a researcher to exploit the potential of biotechnology as a means of addressing central problems in plant pathology. One is to obtain a degree in plant pathology, with course work and research emphasis in biotechnology; the other is to obtain a degree in molecular biology or a related field. There is, of course, no clearly best answer, and one’s preference depends on viewpoint and philosophy. We are biased toward the importance of training in plant pathology because without this background, identifying significant problems and keeping research in the proper plant pathology perspective can be difficult. Because graduate programs in molecular biology seldom include exposure to plant pathology and because molecular biology cannot be studied in depth in a plant pathology department, we believe that in many instances a team approach toward research is most likely to be successful. In our department, such research teams often include postdoctoral fellows trained in molecular biology. This significantly increases the breadth of the program, and plant pathology graduate students obtain substantial benefit from interaction with these researchers.

One of the primary purposes of a plant pathology graduate program with specialization in the biotechnology area is to prepare individuals to effectively participate in a cooperative program. We do not feel that the purpose of our program should be to train biotechnologists. If they are to be competitive, however, all plant pathology students must be exposed to the latest methodologies. We are convinced that departments with graduate programs in plant pathology should not lose sight of the distinct features of the discipline and its position as a bridge between basic and applied research.