Drifting in the Sea of Biotechnology

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Biotechnology is currently perceived as a magic word that not only brings instant prestige to universities, departments, and individual scientists but also attracts fortunes in new research grants and venture capital into academic and industrial coffers. In fact, biotechnology has opened the door to extensive new resources for the support of research in the plant sciences. Dozens of new commercial concerns have sprung from nowhere in the past 10 years—all founded on the expectation that the application of recombinant DNA techniques will allow the efficient transfer of useful genes to, and their expression in, plants. With the support of these companies, much new research has been initiated in the plant sciences at many state and private universities. In addition, private foundations and the U.S. Department of Agriculture have greatly increased their allocations of research dollars to plant biotechnology. Much of this intensive effort concerns the potential utilization of genes for disease resistance, and this work is being supported at greatly expanded levels in many private and public institutions. The recent demonstration that introduction of certain microbial genes into plants provides increased levels of resistance to herbicides and to insect pests supports the concept that biotechnology is the wave of the future.

Not surprisingly, therefore, many departments of plant pathology have added or are planning to add molecular biologists to their faculties. No department wants to be left behind. All want to tap these new sources of research funds at a time when many other sources have vanished. All want to provide opportunities for training graduate students in an area where many new job opportunities exist. This rush to molecular biology is creating a whole set of new problems in our profession, however. Biotechnology may be the wave of the future, but we may be drifting into its path without proper steering mechanisms. As a profession, we lack a clear vision of the ultimate objectives of molecular plant pathology and have failed to provide a mechanism to channel these new resources in an effective, focused manner. Plant pathology in academia is at a difficult juncture; each institution needs to carefully assess the long-term objectives of their departments and the resources of their state or region.

One matter that needs to be resolved is whether all 50-plus departments of plant pathology in the United States, in addition to several federal laboratories, need to establish biotechnology units. The resources that can be applied to this area of research, as well as the strengths of associated, supporting departments, must be analyzed critically. Then, there is the philosophical problem. Most plant pathology departments today are in a period of retrenchment. Should resources be shifted to the molecular area at the expense of other staffing needs? Should activities that serve the demands of the agricultural community be reduced in favor of basic research not mission-oriented at this stage? Today, departments often must add scientists who lack unique plant pathology experience or perspective.

An obvious problem is that the expertise in molecular biology lies outside plant pathology. Very few recent graduates from plant pathology departments have in-depth expertise in molecular biology. We must search for talent, therefore, in departments of biochemistry, genetics, microbiology, etc., and we must compete effectively with industry and academia for the brightest individuals. Theoretically, this is not all bad. No field can grow effectively only from within, and the influx of talent from other fields is both necessary and important for the future of plant pathology. We should be able to attract bright young researchers into our field because it deals with some of the most important, challenging problems in the whole realm of plant sciences. One can point out that the promise of plant biotechnology is based almost entirely on systems to transfer genes into plants that were borrowed from certain unique plant pathogens.

In practice, however, many plant pathology departments are not in a position to compete effectively for top talent. Molecular biology research is extremely expensive. The equipment, the enzymes, the isotopes, the sequencing facilities, and the need for space place great demands that most departments cannot meet. Start-up packages of $100,000–200,000 for faculty in this area are not uncommon. Even the department that attracts a bright molecular biologist by stretching resources to the maximum soon finds out that one person does not provide the critical mass needed. The new staff member has allegiance to another field and quite naturally is unable to participate fully in teaching plant pathology courses. The new member tends to continue working with familiar systems that are likely to provide some answers and to avoid systems involving plant pathogens, where the methodology has not been worked out. (An exception to this is virology, where molecular approaches have been the rule for decades.) One of the most difficult responsibilities of a department chairman is to integrate this new staff member into the profession of plant pathology. Also, the new staff member who gathers substantial amounts of support from outside agencies requires additional laboratory space and inevitably competes with other staff members for space and facilities. This is not a new problem, but molecular biologists have access to large sources of research support and can attract numerous graduate students and postdoctoral fellows, so their demands for space are greater today than in the past.

In the last two decades, molecular biology has changed the entire face of the plant sciences. Not surprisingly, the mission and orientation of plant pathology are also changing. We must recognize that plant pathology has not kept pace with the rapid changes occurring in other branches of biology. For example, biochemists and geneticists have made the recent advances in our understanding of crown gall disease, with little or no input from plant pathologists. Also, some of the best work on disease resistance is being done in laboratories with no clear allegiance to plant pathology. Yet, one of the major research goals of our profession is the application of biotechnology to the elucidation of the biochemical mechanisms of disease resistance in plants. Our profession must not default on our claim and our past investment in this area.

The tests ahead for our profession are difficult but must be faced. We must not lose contact with the farming community to which we owe our existence. At the same time, we must face the problems created by the revolution in biotechnology and we must participate in this new field to the measure of our capabilities and resources. How well we do this in the next 10 years may well determine the future strength and viability of our profession.