Editorial

From Gold to Diamonds

PAUL H. WILLIAMS
Department of Plant Pathology, University of Wisconsin—Madison

For two and a half years the American Phytopathological Society planned its 75th anniversary. Thor Kommedahl and I assisted in bringing together some of the most exciting glimpses into the future of our profession in the 75th anniversary volume, *Challenging Problems in Plant Health.* Twenty-five years ago APS produced the "Golden Book," *Plant Pathology Problems and Progress, 1908–1958.* Gold reflects the accumulation of wealth and traditional knowledge; diamonds capture the light of new knowledge and reflect it back with flashing insights into the future!

Let us reflect upon the gold of the past 25 years. But first, a conventional definition of ourselves. Plant pathology is the study of the nature and control of plant disease. It is an applied science rooted in the basic sciences. Twenty-five years ago virologists were unraveling the physical and chemical complexities of plant viruses, a task largely opened for us by the biochemist and the biophysicist. Bacterial and viral genetics spawned molecular biology. We plant pathologists thought we understood disease causation and resistance in plants. We studied enzymes, toxins, and metabolic pathways. The electron microscope opened new vistas within the cell. The ultracentrifuge, chromatography, and electrophoresis permitted separations. Immunology gave characterizations. Pyramiding of genes provided delaying and diversionary strategies against the relentless drive of pathogens seeking food from our crops. Dithiocarbamates and chlorinated hydrocarbons were poured on crops and mixed in soils to provide the "ultimate solution" to disease and arthropod control.

Much of what we have accomplished over the past 25 years will rest in the pages of the *Annual Review of Plant Pathology* volumes. Relatively little will be found in textbooks where fundamental concepts and classic contributions in biology are passed on to new generations. Does this pessimistic assessment of the past assign all real progress to the basic sciences and provide us in plant pathology with little to be heartened by? Not entirely. Beginnings have been made in studies of the ecology of pathogens in relation to disease control. Strategies for stabilizing crop-pathogen evolution are becoming clearer and the molecular basis for understanding disease and resistance is nearer than it was 25 years ago. As a profession we have grown in our understanding of plant diseases and their control. The important question that confronts us is whether we will be able to make the same assessment of our progress over the next quarter of a century.

Out of the historical traditions of plant pathology, nematology, and entomology, and from new perspectives in the agricultural crop and microbial sciences, *Challenging Problems in Plant Health* provides a redefinition of our profession that focuses on the "healthy plant." No longer can the study of plant disease be justified as an end in itself; rather, it must take its place as but one facet of the diamond that represents a holistic view of the *healthy plant.*

This necessitates breaking with traditional ways of looking at the diseased or unhealthy plant. It involves what R. G. Grogan refers to as the need for a "thorough-going etiology" in which disease is understood as resulting from a complex of causes. It may involve, as E. S. Luttrell suggests, the need to reassess the ways of looking at disease through conventional taxonomic classifications of etiologic agents to schemes in which diseases of a common pathology, or nosology as it is called in medicine, or of a common epidemiology are considered together. From such regroupings we may discover commonalities that will provide for more effective disease control. From yet another perspective, J. A. Browning envisions "the age of plants" as rapidly coming upon us, when dependence upon plants will become the central focus of nations with all the priorities afforded human health professions today. Such a view would call for national plant health systems, restructuring of our educational institutions, and the training of large numbers of plant health practitioners supported by specialized researchers.

Throughout many chapters is concern for the social implications of plant pathology's future contributions and a sense of urgency that time in which to provide meaningful solutions to the links between healthy plants and world hunger is running out. This view is forcefully presented by William C. Paddock who, in a chapter entitled "Healthy Plants—a Threat to Civilization (and a Challenge to the APS)," indicts plant pathologists for contributing to the death of generations to come by assisting in food production in nations having uncontrolled birthrates.

From molecular biology, cell biology, and genetic engineering is coming an avalanche of information of prokaryote and eukaryote biology fundamental to our understanding of the cell and plant. Such information is so vast and complex that it is already difficult for applied biologists to pick out what is useful and what is not.

Perhaps as much in the application of mathematics and statistics as of molecular biology lies the future for understanding the needs of the healthy plant. Only through complex mathematical models using multivariate statistics can the factors that create disease in crops be fully understood. It is through an understanding of mathematics and population genetics that the fundamentals of evolution and epidemiology interface with the concepts of complex disease etiology in the new science of plant health management.

Numerous chapters in the APS book attest to the fact that we have already reached a degree of complexity in understanding and experimentation that has outstripped the capabilities of the human brain. It is equally clear that we are well launched into the age of the computer. The computer is becoming more invasive and pervasive—in crop loss assessment, crop loss management, plant breeding and evolution, germ plasm conservation, environmental monitoring and regulation, epidemiology, integrated pest management, economic assessments, molecular biology, and genetic engineering. And in communication and teaching, the computer and its electronic information linkages are becoming central to our science.

On our 75th anniversary I believe the holistic view of the healthy plant is yet "a diamond in the rough." The facets on our stone have been well delineated by the contributors to *Challenging Problems in Plant Health.* Yet the single most important challenge to plant health scientists in the future will not be in the practice of their own specialties, but rather will be in the diligent and skillful application of the grit and the polishing of interdisciplinary communications. At first the grit will be rough, but as it becomes finer our diamond will sparkle!