PRESIDENTIAL ADDRESS

75th Annual Meeting

Excellence in Plant Pathology

R. E. Ford

I am going to allude to the past but speak primarily about adjusting some of our attitudes and philosophies to better enable us to achieve excellence in the future in plant pathology extension, teaching, and research.

Clarke said "In the long run the only human activities really worthwhile are the search for knowledge and the creation of beauty." "What's the difference," someone asked Aristotle, "between an educated man and an uneducated man?" And he replied, "The same difference as between being alive and being dead." To remain alive and to feel worthwhile, we need not only education but compassion.

Our Past. We're certainly alive! No one has a richer heritage than we whose profession is agriculture. But for the Land Grant Universities, agriculture would still be a second-rate profession and science. The Land Grant System, an $8 billion business, does 80% of all agricultural research. Agricultural research and development expenditures top all other government cost-benefit ratios with annual returns of about 50%; corn research alone has been calculated at nearly 200% return. Few other businesses approach such returns on investments.

Farm policy has become food policy. Current emphases on water (24), energy, and soil erosion control now overshadow the IPM thrusts of the past decade. However, maintenance of sustainable agroecosystems relies upon a highly integrated approach to farming. "Agroecosystem" has become an accepted term in both scientific and lay language. It describes the development of agriculture over the centuries, as contrasted with natural plant community ecosystems (1,7,29). The agroecosystem shifts with each change in technology. For example, not until the use of herbicides became firmly entrenched as a tactic to control weeds were farmers bold enough to abandon the moldboard plow in favor of the more energy and soil conservative farm implements (23,24).

Increasing consolidation and efficiency of family farms continues: My dad, one of eight children, was raised on an 80-acre farm; I, one of seven children, was raised on a 200-acre farm; now, the average two-child family Illinois and Iowa farm is a 600-acre productive unit. Each of you has helped agriculture become not just an art but a science.

It is difficult for some to accept the fact that Plant Pathology is an applied science and, as Williams (31) so aptly said, "rooted in the basic sciences." As late as 1950, someone said the study of plant disease had remained merely an aggregate of data—it had not attained the status of science (15). Many of us can jealously claim we are doing basic science, competing with the best in the traditional basic science areas. The Nobel prizes were given to Stanley and Borlaug for forefront research, both basic and applied. Likewise, our Society's prizes and awards go to those who set the pace of excellence in our science of Plant Pathology.

Each decade since the founding of The American Phytopathological Society has brought further progress. Looking back

25 years, we see a completely different organization. Emeriti who look back 50 years recognize phenomenal changes in APS and see a completely different science. As a graduate student, I reveled in the activities at our 50th anniversary meeting. I remember well the comraderie around the banquet table. But my clearest memory is of the scientific session involving a heated debate about the reconstitution of TMV. With great vigor and certainty, Wendell Stanley, Gerhard Shramm, and Barry Commoner each presented his concept of what drives a virus protein to reconstitute into a formation with the RNA. Now both hexagonal viruses and rod-shaped viruses have been reconstituted.

It has been said that the four singular achievements of this century have been unlocking the atom, escaping earth's gravity, the computer revolution, and genetic engineering. We are indebted to our emeriti who paved the way to make it both easier and harder for us—harder because what seemed to be the most obvious, easiest scientific questions have been answered and easier because now substantive issues can be dealt with methodically after the groundwork has been laid. They made it harder because we try to unravel complexes not imagined earlier and easier because chemistry, physics, and other knowledge bases are so advanced. I have developed a list of discoveries by decade since 1908 (Table 1).

Horsfall had good foresight in 1958 (15) when he conjectured that maybe plant pathology would be assigned a pioneering laboratory in the USDA (they were in virology). He also noted that "plant pathology has been rescued from the crops departments only recently in Illinois" and that "the scientific morale would improve." From firsthand knowledge I can say it did!

Now, in 1983, the 75th anniversary celebration will help us look ahead 25 years, to 2008. Where we go will depend on current graduate students. Professors, infuse your students with enthusiasm and stimulate them to think deeply about the philosophy of our science. Emeriti who laid the foundation for plant pathology will be honored in the tomorrows to come.

When The American Phytopathological Society operated completely as a volunteer organization, we published only PHYTOPATHOLOGY. The Classics were added in 1926 and Bruehl's Monograph was added in 1954. We met on college campuses and attended single paper sessions.

Now, we still volunteer, but we have a paid staff, a $1 million budget and we publish PHYTOPATHOLOGY, PLANT DISEASE, monographs, classics, compendia, slides, and books, and we have meetings with six to eight concurrent paper sessions and three symposia per year, discussions, teach-ins, workshops, and poster sessions.

The main ingredient of excellence is change; a university or any viable institution or program with excellence is always in the process of becoming something else, creating new programs to keep current with modern science. By any criterion, our universities are vastly superior to those 50 years ago. We evolved from the European system of being dominated by one "professor" to today's well-balanced faculties with sprinklings of excellence. Our challenges to excel do not differ from those of 25 or 50 years ago; they just differ in degrees. Some ideas become firmly established on the leading edge and some are bandwagons. Notice the many empty TV shelves in college classrooms because students prefer the professor in person rather than on a tube.

Extension. Research to reveal facts and education to reveal truth is our key product. It must be irrefutable. Extension transfers the resultant technology to production systems.

Many countries want to emulate our system. Excellence in extension is doing wonders. But Tom Melton, on my faculty, tells me he has to draw a line somewhere. He received a letter from a County Extension Advisor recently who asked, "Would you be able to actually bring some microscopes—perhaps even the electron microscope—so that our farmers can see some of the pathogens and other organisms that they can't normally see?"

Our great challenge is to interpret science to the public. Our best young scientists must devote their energies to this part of our profession (12), to "science literacy" (26). Our journal PLANT DISEASE and our compendia are serious, concerted efforts to put plant pathology into "ordinary-language science" (26). We'll not be satisfied until our efforts create excellence.

We're all professionals! Extension is primarily responsible for our professional image, our contact with farmers.

Fulkerson (9) directly and eloquently said,

> The influence of government actions on plant pathology as a profession has been an integral function of its research component. Plant pathology as a profession has been developed largely as a public enterprise in this country. . .its practice is to an overwhelming degree the result of governmental action. These actions have involved governments at all levels, ie, local, state, and federal, with local actions being directed primarily to the extension activity of the profession.

Extension plant pathologists have been combined doctors and druggists, but now the "agricultural druggists" (chemical salesmen, county agents, consultants, etc.) need your help. You're still making house calls as would a general practitioner, when you should be specializing. Horsfall (15) noted at our Golden Anniversary celebration that "a professional plant doctor cannot sell his services in competition with the tax-supported plant doctor." I agree. Let me provide a broad remedy so the celebration of our 100th year will record solid progress. APS encourages and supports excellence in each segment of our profession.

Society supports its professions based on the public's feelings and attitudes. Some basic differences among professionals are that: medical doctors deal primarily with the individual, and they send a bill; veterinarians are concerned primarily with individuals but also some with herds, and they send a bill; plant pathologists are concerned primarily with populations (crops), but we haven't yet learned how to send the bill.

We can change our image, our attitude, and the public's attitude most quickly through our plant clinics. Currently clinic support staffs are:

Medical Clinic	Animal Clinic	Plant Clinic
Receptionist	Receptionist	Receptionist/ secretary
Secretary	Secretary	Part-time graduate student
Cashier	Cashier	Professor
Insurance claim desk		
Nurses	Attendants	
Lab technicians	Interns	
Intern	Veterinarian	
Medical doctor		

Why don't we separate diagnosis from prescription? Why not charge for service actually rendered? We expect to pay for other professional services. We go to the doctor and pay, to the specialist and pay, to the lab and pay, and to the druggist and pay again. The image we must discard is free service! Homeowners, farmers, and commercial companies are willing to pay. But we're afraid to send the bill.

To encourage private plant doctors and pest management businesses, tax-supported plant clinics must charge more than private ones and must provide service free only to those unable to pay. State extension specialists should have a list of private practitioners to whom they can refer clients. Tax-supported plant clinics should be the final stop to resolve the toughest problems through special technology or further research. But, you say you must have the samples coming in to know what is happening out there. If you find yourself using that excuse, stop and think how extremely expensive a survey method this is. A hot line to the professionals who are scouting daily in a thorough, organized way would be better than receiving mailed samples with incomplete field histories.

The "already paid for" mentality has to be flexible. We'll not have an excellent environment in which to encourage and develop our crop pest consultant businesses as long as we continue to provide free services. The agronomists charge for soil and seed testing

Table 1. Scientific developments by decade since the founding of the American Phytopathological Society

1908	Germination of the idea of an association for the science of plant pathology
	Plant pathology taught (sometimes labeled as economic botany) during the past three decades
	Most departments started as one-man departments
	Bill introduced in Congress re: manufacturing, sale, and labeling of fungicides and insecticides
	Elemental sprays used as stop gaps for plant disease control
	Federal Plant Quarantine approved
1918	Terminology specifically for plant diseases developing
	Identifying pathogens
	Taxonomy in mycology was key
	USDA Plant Disease Surveys
1928	Crop orientation of plant disease courses
	Streamlining of plant disease diagnosis
	J. G. Horsfall introduced red and yellow cuprous oxide as vegetable seed protectants to control damping-off
	Organic fungicides—the era of dithiocarbamates
	Pentachloronitrobenzene found in 1937 to be long lasting in soil against sclerotia-forming fungi
	Alternate hosts discovered/Barberry eradication begun
1938	Emphasis placed on chemical control of plant diseases
	Mode of action of fungicides
	Antibiotic era began with discoveries of streptomycin (1942) and cycloheximide (1946)
	Virology born
	Wendell Stanley's (and Bawden and Pirie's) work on characterizing viruses
	Electron microscopy born
	Shift away from organic farming
	Men were absent during war effort
1948	Emphasis in curricula begin to shift toward the pathogen rather than the crop
	Gene-for-gene hypothesis introduced
	Genetic resistance received increased emphasis
	Races of pathogens
	Electrophoresis became common laboratory tool
	Ultracentrifuge came into common laboratory use
	Electron microscopy in virus research took viruses beyond the artifact
	Immunology became important tool in plant pathology
	Captan was introduced (1951)
	Prediction that microorganisms would develop resistance against man-made chemicals such as antibiotics
	Nematology-borne viruses
	USDA Plant Disease Surveys phase out
	Commitment to equal opportunity
1958	50th anniversary celebration of APS
	All major plant pathology departments now in place
	Fungal physiology/biochemistry (enzymes, toxins, phytoalexins)
	Physiology of disease (metabolic pathways)
	Systemic antifungal compounds introduced (thiabendazole, 1964; carboxin and oxycarboxin, 1966; benomyl, 1967)
	Virus reconstitution
	Host/pathogen/vector relationships evolving
	Ouchterlony agar diffusion for serological reactions
	Bacterial and viral genetics spawned molecular biology
	Pyramiding genes for more effective disease resistance
	Shift from PHYTOPATHOLOGY completely edited by volunteering scientists to paid secretarial and editorial assistance
	Educational expansion boom, atypical of our history
1968	New pathogens described (mycoplasmas, spiroplasmas, viroids)
	Mycorrhizae emerge in importance
	DNA plant viruses discovered
	Viral replication more clearly understood
	Mercurials for plant disease control banned in U.S.A.
	Microorganism resistance to chemicals verified
	Air pollution recognized as important cause of crop loss
	ELISA introduced
	Agroecosystem concept developed
	IPM emerges, forcing a shift toward the applied nature of our science, Diagnosis/clinics
	EPA created—RPAR = guilty until proven innocent (French system)
	City dwellers rediscovered the countryside
	Demand by Society for a no-risk environment
	Drop in student enrollments
	Shift from an all volunteer society to one professionally managed
	Purchased property, built APS headquarters, 3340 Pilot Knob Road, St. Paul, MN
1978	Biological control gained respect and importance
	Epidemiology evolved into a science
	Barberry eradication—final rites, program disbanded
	Genetic engineering
	Plasmids described and function understood
	Gene segments that are movable
	Circular ssDNA virus described
	Monoclonal antibodies
	ELISA a powerful, sensitive tool
	Southern blot technology developed
	Acid rain damage described
	Computers used in crop loss assessment, germ plasm conservation, environmental monitoring, IPM, economic assessments, molecular biology
	PLANT DISEASE a big success
	APS becomes a publishing business
	Compendia a big success
	Vocal segment of U.S. population asks for risk-free life
1983	Genetics of pathogens
	Molecular chemistry and biology
	Back to organic farming?
	Can the shift be made from chemical to biological control?
	Can genes be transferred in new ways?
1988	In the eighth decade:
	Many viral and plasmid genomes will be mapped routinely
	Viruses may be used as genetic vectors for gene splicing
	DNA hybridization will be used to aid diagnosis rather than reliance solely on symptoms, or serology
	IPM will require even closer cooperation between departments and with industry
	Computer-aided decisions will require a more complete data base of biological facts, more complete life cycles of microorganisms
	Virusoids will be understood
	Prions, a proteinaceous, subviral infectious particle will be better known
	Many more pathogens of pathogens will be studied
	The function of the genetic code will be better understood with the understanding of satellites in virus research
	Mysteries will be unraveled of some fungi that seem systemic or latent for protracted periods—especially those that express themselves only after stress or after a host physiology shift at fruit set
	Recognition-nonrecognition phenomena are now merging. If the host or the vector does not recognize the pathogen, it is not a problem. What are the biochemical keys to this recognition?
	Cross protection may be used increasingly as a disease control mechanism, such as RNA associated with and genetically related to CARNA 5
	RNA-directed synthesis of viroids has changed the earlier concept that all RNA and DNA production involved the other, such as DNA viroids; striking homologies between viroid-related RNAs and the 5′-terminus of eukaryotic U1 RNA
	Recombinant DNA technology and related nucleic acid technologies will permit applications of "reverse genetics." How many other pathogens have "satellites" or how many have developed or evolved mechanisms that moderate the disease they cause?

services. The veterinarians charge for both small and large animal clinical services. Farmers willingly pay for quality service. Let's provide the education, then we will see excellence in practicing as we have seen excellence in research and teaching.

Professionalism in plant pathology. We're proud that Cynthia Westcott was the first Ph.D. plant pathologist successful in an independent career. Next came R. Sid Cox, successful independent consultant in Florida. Others, like Ed Lloyd in North Dakota, have exploded the myth that these businesses could succeed only in the South. These pioneers have excelled by integrating plant pathology with other aspects of crop management and taking the product to farms and agribusinesses. Excellent practitioners are honest, they deliver a high-quality service, and they accept the farmer as a highly educated businessman. They excel by being scrupulously precise about the nature of their diagnoses. One must not draw conclusions beyond the data. The mark of excellence is to know the difference between fact and speculation and to stay clearly within the knowledge base.

Teaching. Will Rogers said "A man only learns in two ways, one by reading and the other by association with smarter people."

For teaching I will dwell on excellent writing in the education of graduate students. The Ph.D. degree, as a research degree in all fields of learning, pure and applied, is still adhered to by the Council of Graduate Schools. The doctoral dissertation, the capstone of the graduate educational experience, represents original, independent research (4). Some believe the standards for its evaluation have not been uniform, making it a poor educational tool (25). A recent study showed general agreement that the dissertation was valuable for both researchers and nonresearchers. Current practices seemed adequate. There was no substantial support for increasing standards and requirements or to accepting brief article-like reports rather than a dissertation, an internship in place of a dissertation, or alternative doctoral degrees not oriented toward research.

To those departments working to get alternative degree programs started, I suggest there is an innate acceptance of the status quo in the system that must be overcome. Those in extension must understand this more clearly than others.

Publications are now shorter articles, whereas theses tend to be monographic (20). Some plant pathology departments now accept published papers as part of the Ph.D. thesis, and theses are written in chapters to enable each chapter to be more easily published as a manuscript.

Traditionally, the doctoral dissertation has had the dual role of producing scientific knowledge and of training and certifying scientists. Early publication has been a strong predictor of later commitment to research. Prolific publishers most often emerged from strong departments.

What about coauthorship? Does it mean we are abandoning excellence (6)? I believe not. Rather, we are doing more interdepartmental, cooperative research and responding to administrators who stress numbers of papers for promotion.

The importance of originality in a thesis tends to increase with the prestige of the department. Engineers have considered practical relevance quite important but natural scientists almost ignored it. Plant pathologists emphasize the importance of both originality and practical relevance. The newly emerging and rapidly growing professionalism in our society will cause some of our Ph.D. theses to shift further toward relevance.

There is no substitute for an excellent basic science education. Because Vanderplank was a chemist working with rate constants, it was not foreign thinking to apply "r" to the rate of disease development. He revolutionized epidemiology and made it understandable and adaptable to modern computer technology. Because Brakke was a chemist, it was not foreign to him to adapt the density and centrifugal principles to help solve the problem of separating macromolecules from each other. As a result, virus purification became a common technique in most plant pathology laboratories. Because induced immunity to disease in plants caused by many pathogens is a complex topic requiring ample backgrounds in chemistry, mathematics, and physics as well as biology, only those with excellent academic backgrounds will obtain the answers (18,19). Because cell propagation in culture from many organisms has revolutionized thinking about gene manipulation (10), it allows us to study all properties of their tissue origin. No one will benefit more than plant pathologists who, through applicable research, can show how the grower will benefit immediately from reduced disease incidence.

Academia/government/industry. A triangle of academia, industry, and government characterizes the environment in which scientific education and research excel (12). Those of us in academia and the Land Grant tradition interact well with government, although some perceive that overcontrol exists (2), but we do not accept easily the third partner, industry. Yet some of the best research partners are industries. They have the resources to do some original and especially developmental research. They give our ideas the credibility, visibility, and applicability we all seek. A delicate balance must be maintained between the three partners. Universities with a flexible attitude toward government and industry and with the greatest financial independence can bargain most successfully for public funds.

Once the "marriage" with industry occurs, a delicate issue arises. Who will speak to whom? I recall clearly our 1981 riverboat-dinner cruise in the bayous of New Orleans hearing A. Kelman lamenting the fact that such marriages were cutting off open discussion among scientists. Knowledge has acquired increasingly a strategic economic value, and secrecy is becoming the norm. Secrecy cannot lead to excellence. Science requires open idea and information exchange. Smith said "Scientists themselves may be presumed to know, but the problem is they do not always tell. Philosophers invariably tell, but it cannot be presumed that they always know."

Some see scientists as the perpetrators of evils, but they do not see clearly because the discovery does not cause the difficulty. Modern technology both uses and abuses the knowledge we create. A scientist is seldom the first person to see a curious phenomenon but he is the first to observe it.

Research. McElroy (21), in his 1977 AAAS presidential address, predicted that a new problem-focused, rather than discipline-focused, research would emerge. That means that new respect has been gained for applicable research, the basis of our science from its inception. Yet we must take care not to abandon basic research in favor of applied research because no new answers can come from applied research only.

Achievement of basic research has been possible in the past and is possible in the future only through the freedom granted by Society to disregard all direction or control except for that imposed by the inner logic of the discipline (12). Because humans are political and social as well as scientific, we must determine what is the inner logic of plant pathology. Our inner logic must be to control plant diseases through excellence in applicable and pure research.

Haskins (12) asked poignant questions: How much should research (science) be subjected to public control? How should the inner autonomy of science be protected? Should the product of science be socially monitored? Should the process of research continue to be given freedom? Our most precious freedom is of speech and press, which produces education.

My concern is that a few unscrupulous scientists will ruin all scientists' credibility. The saddest commentaries I have read in the last few years are those involving scientific laboratories that have been discredited for dishonesty. Data were "manufactured" to help smooth a curve to fit an hypothesis. Papers have been retracted and careers finished!

A few scientists might still deny any responsibility to the public other than an obligation to pursue truth. They would claim that their "pure" knowledge is ethically neutral and that science is not responsible for applications. But da Vinci contemplated principles of flight without thought of intercontinental ballistic missiles, Descartes invented new systems of mathematics without worrying about atomic bombs, Mendel had no thought of genetic engineering when he crossed sweet peas, and Babbage built a computing machine without contemplating data banks and invasion of privacy.

Technology is never neutral. Machinery can keep people alive for prolonged periods but creates dilemmas of "when to pull the plug." Technology inevitably shapes our culture and the fundamental values of our culture reflect our technologies (22).

Recombinant DNA is clearly one of the few major breakthroughs of this century. Some fear the risk is too high and want more legislation (16). An excellent example is that of responsible scientists, studying recombinant DNA, who developed self-imposed guidelines and said let's not let our imaginations but solid facts guide us (3,11,13). Some think that patents would help control the risk, but others feel an undue restriction being placed on us. Watson (of Watson-Crick), critical of the regulations, said "It should be left to scientists' own good conscience." Who determines that each of you has the proper good conscience? Can scientists let their consciences be their guides (27)? I believe so. Do you?

We are better educated, yet we worry more. As Delp (8) succinctly said, "Unfortunately, our options for self-regulation are being taken away as the fears and mistrust of the general population demand increased governmental controls." I agree. As John F. Kennedy told the National Academy of Sciences in 1961, "one of the problems of a free society is that all of the questions we must decide now are extremely sophisticated ones.... Those of us who are not expert must turn, in the last resort, to objective, disinterested scientists who bring a strong sense of public responsibility and public obligation."

Being a scientific advisor is a heady job. Kantrowitz (17) said "Many people have made a career of providing advice in Washington. Some try hard to be objective, but most are quite ready to offer advice on both scientific and related moral and political questions. Thus, they have a political influence far greater than if they merely stated the facts." For example, Barry Commoner lost some of his scientific credibility as a biochemist and plant virologist when he became embroiled in the highly charged political ecology issues.

Derek Bok (5), president of Harvard, put his blessing on applicable research, saying, "Professors should proclaim the values of basic research and understandably they should...resist pressures to channel their work toward excessively practical ends; but we should not press our case so far as to depreciate the value of applied research or to dismiss any effort to consider the potential applications of scientific work. Such attitudes could lead investigators to neglect important problems of genuine intellectual challenge and might subtly discourage their graduate students from choosing to pursue careers in industrial research." Or in extension.

Any movement to prevent research because of what it "might lead to" will be a real disaster for freedom in research. To decide not to know is futile. Someone, somewhere, sometime will learn, regardless of political influence. Consider how the USSR tried to squelch genetic research and knowledge. Those who argue that research must be immediately relevant are as misled as those who insist that basic, irrelevant research is the only true research. It is precisely because future applications of scientific discoveries are unpredictable that monitoring of science is neither plausible nor desirable. Only its use after discovery is for policymakers to determine. From research come new ideas and new technology. E. F. Schumacher said "When a country chooses its technology, it chooses its future." J. W. Gardner said "Change is always risky, usually uncomfortable, often painful. It isn't accomplished by apathetic men and women. It requires high motivation." After the recognition of risk came the social concept of risk/benefit. It is difficult to document and to quantify. Customarily, it is achieved through the political process (28). Technology creates many risks (14), and a few people on government committees and in government agencies decide the risks and the benefits (28). Henry Kissinger said, "The biggest problem in government is that the urgent steals all the time from the important."

Anyone telling you to do research without risk is telling you not to do research. Once the research is done, the public, through its political and policymaking systems, must decide *not* whether it is safe but whether the benefits are worth the risks (30). The rights of a Society conflict with individual rights. I submit that the benefit/risk ratio is an idea game for the legal profession. It establishes a contest for which the rules are seldom fixed, and the playing area is mostly without boundary lines. We scientists can usually draw the same conclusions from one set of data, but two lawyers can draw different conclusions from the same set of data. Lawyers exploit scientific data in the adversary setting and submit them to the psychology of categorical logic. Philipus Aureolus Paracelsus, a contemporary of Columbus, explained that "the poison is in the dose." Politicians accepted the Delaney idea that a hazard at any level is a hazard at all levels. Scientists know this is not true. This risk/benefit evaluation is based on the zero tolerance concept. The statement of risk has somehow become an accusation in Society, which I believe is unfortunate.

After the discovery, scientists should not get involved. But we are asked to come back in! A nonscientist needs no proof to claim risk, then often uses public fear of anticipated evils to force us to do research to prove benefit. The challenger is the nonscientist judge who tells us how we fared. We should not be caught in that game because we already did our job. The politics of prevention is expensive (30); money spent to verify or lessen risk cannot be used to increase knowledge or productivity. Excellence does not emanate from overregulation by government. The Rebuttable Presumption Against Registration (RPAR), with which you and I are so intimately familiar, required more than 700 scientists, some full-time. Their time spent in retesting is gone, not available for original research. Nothing excellent, nothing innovative, nothing novel came of that precious time. The spark of ingenuity that might have resulted from time spent in original thinking by many of those 700 is just a dream.

I'm not saying that time is wasted in ensuring safety to human health. But technical people could have done that job at lower cost. Why, then, does the government call on university scientists? Because we have established a record of unbiased excellence. Each scientist must decide whether to do "regulatory verification" work or original research.

I have talked about research: its risk and its relevance. Perhaps Harvey Brooks said it best:

> Certainly there must be some scientists who are relevant all of the time, and conceivably, one might ask that all scientists be relevant some of their time, but it would be the deepest of national tragedies to demand that all scientists be relevant all of the time.

Excellence. Clifton Cox, president of Armour Company, said recently at a faculty awards ceremony,

> Nothing so eludes the masses of mankind as the gift of being very good at what they do. Today, men and women who cultivate excellence in their field are our century's endangered species. In place of true excellence we have enshrined the instant celebrity pop gods and goddesses. We lionize any scientist adroit at throwing buzz words around to catch the media's attention. [Note the current buzz words in NSF grants, Table 2.] In academia we are guilty of bestowing the accolade of greatness on research and scholarship that are less than original and far short of brilliant. We encounter TRUE excellence rarely because we have cheapened the concept by doling it out so lavishly.
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> The reason excellence is so rare today is that the vast majority of mankind feels infinitely safer without it. Excellence, you see, begets greatness, and greatness can be uncomfortable to live with, work beside, and compete with. Greatness by its very nature is a mute rebuke to mediocrity. Unfortunately, we find excellence disturbing and we are skirting dangerously close to denying the desirability of excellence. This antigreatness philosophy at work today in our society is enfeebling us. Someone said that "Thou shalt not excel" is the first commandment of organized labor, and surely you've seen examples of how the system "wipes" out people who try to excel either within or without the system. Concomitant with fiscal stringency is a major push for mandated, uniform salary increases in many states' legislatures spurred on by academic unions attempting like vultures to gain a toe hold in academia.

Let us not aim for the lowest common denominator, or mediocrity. We can achieve excellence only by aiming for the highest common denominator. Said another way, an employee asked, "Is this good enough?" and the boss replied, "Is this the best

Table 2. Buzz words (in bold type) in 1983 in grant titles of recipients of NSF postdoctoral research fellowships in plant biology

The anaerobic stress **response** of maize
Cloning of the gene and mRNA **encoding** ADPG pyrophosphorylase from maize and investigating its developmental **regulation** in seed maturation
Development of a **gene vector** system for the plant pathogen, *Cochliobolus heterostrophus*
Differential modulation of pyruvate Pi dikinase gene **expression**
Do viroids exist in the form of nuclear **ribonucleoproteins**?
Evolutionary comparison with cyanobacteria of red algal nuclear genes **encoding** a phycobilisome linker polypetide
Identification of the origin of **replication** of cauliflower mosaic virus
Investigating tissue-specific gene **expression** in maize
Isolation and characterization of a plant membrane receptor to **elicitors**
The isolation and use of insertional **mutations** in maize Adhl-S to study RNA processing
Molecular studies on gene structure, function, and **expression** of phenylalanine ammonia lyase
The organization, **expression,** and **regulation** of a developmentally **regulated** soybean gene **encoding** lipoxygenase-1
The organization and **expression** of tubulin genes in maize
Phytochrome **regulation** of nuclear genes in *Lemna*
Plastid RNA polymerase-**promoter** interactions
Regulation of alcohol dehydrogenase **expression** in maize
Regulation of chloroplast ribosomal protein genes in *Chlamydomonas reinhardtii*
Regulation of ethylene production in higher plants
Regulation of gene **expression** in maize from a distal, Cis-acting Region in DNA
Replicative potential of CaMV in cell cultures of *Zea mays*
Sequence differences and strain severity, construction of novel viroids
Site-specific **mutagenesis** of *Rhodospirillum rubrum* ribulosebisphosphate carboxylase/oxygenase
Studies on the replication and **expression** of the maize mitochondrial genome
Transcriptional **regulation** of maize alcohol dehydrogenase

you can do?" If we reward mediocrity and cannot reward superior performance, we'll destroy initiative and motivation in higher education. If any administrator shies away from the difficult task of making superior performance judgments, that department will lose the great opportunity to reach excellence. It is very difficult for organized labor to unionize academia, a system in which we, by our very nature, tend to seek excellence in all we do. Grade school kids know the intellectual order among themselves even though parents and teachers attempt to camouflage it by such murky grading systems as P–F or S–U to protect the slow (educationally or experientially deprived).

A Society enfeebled and dispirited does not want to hear about another's excellence. Well, we're not that way in APS. We are proud to give credit where credit is due. Therefore, let it be known before those of us here assembled that the recipients of awards here (the Award of Distinction, Fellows, the Ruth Allen Award, the Lee M. Hutchins Award, and the CIBA-Geigy Award) have been judged excellent. They took risks along the way and were willing to put their reputation on the line. There was no shortcut. To be good is demanding, exhausting, and fatiguing, and it takes as much perspiration as it does inspiration.

LITERATURE CITED

1. Altieri, M. A., Letourneau, D. K., and Davis, J. R. 1983. Developing sustainable agroecosystems. Bioscience 33:45-49.
2. Anonymous. 1980. Accountability: Restoring the quality of the partnership. Science 207:1177-1182.
3. Bodde, T. 1981. RAC votes to relax recombinant DNA guidelines. Bioscience 31:423-425.
4. Boeckmann, M. E., and Porter, A. L. 1982. The doctoral dissertation in the biosciences. Bioscience 32:272-277.
5. Bok, D. 1983. Editorial. Chem. Eng. News, June 1, 1983. p. 3.
6. Broad, W. J. 1982. Crisis in publishing: Credit or credibility? Bioscience 32:645-647.
7. Browning, J. A. 1983. Whither plant pathology? Whither plant health? Plant Dis. 67:575-577.
8. Delp, C. J. 1980. What price regulation? Plant Dis. 64:901.
9. Fulkerson, J. F. 1983. Government programs. Pages 498-500 in: Challenging Problems in Plant Health. T. Kommedahl and P. H. Williams, eds. The American Phytopathological Society, St. Paul, MN.
10. Graf, L. H., Jr. 1982. Gene transformation. Am. Sci. 70:496-505.
11. Hanson, E. D. 1982. Recombinant DNA and responsible intervention. Bioscience 32:730-733.
12. Haskins, C. P. 1976. Public and private science. Am. Sci. 64:493-499.
13. Helling, R. B., and Allen, S. L. 1976. Freedom of inquiry and scientific responsibility. Bioscience 26:609-610.
14. Hohenemser, C., and Kasperson, J. K., eds. 1982. Risk in the Technological Society. Westview Press. 339 pp.
15. Horsfall, J. G. 1959. A look to the future—The status of plant pathology in biology and agriculture. Pages 63-70 in: Plant Pathology Problems and Progress 1908-1958. Holton et al, eds. University of Wisconsin Press, Madison.
16. Hubbard, R. 1976. Gazing into the crystal ball. Bioscience 26:608-611.
17. Kantrowitz. 1975. Controlling technology democratically. Am. Sci. 63:505-509.
18. Kassanis, B. 1980. Therapy of virus-infected plants and the active defense mechanism. Outlook on Agriculture 10:288-292.
19. Kúc, J. 1982. Induced immunity to plant disease. Bioscience 32:854-860.
20. Lacy, W. B., and Busch, L. 1982. Guardians of science: Journals and journal editors in the agricultural sciences. Rural Sociol. 47:429-448.
21. McElroy, W. D. 1977. The global age: Roles of basic and applied research. Science 196:267-270.
22. Peterson, R. W. 1979. Impacts of technology. Am. Sci. 67:28-31.
23. Phillips, R. E., et al. 1980. No-tillage agriculture. Science 208:1108-1113.
24. Pimentel, D., et al. 1982. Water resources in food and energy production. Bioscience 32:861-867.
25. Porter, A. L., et al. 1982. The role of the dissertation in scientific careers. Am. Sci. 70:475-481.
26. Shen, B. S. P. 1975. Science literacy. Am. Sci. 63:265-268.
27. Smith, J. E. 1980. Science and conscience. Am. Sci. 68:554-558.
28. Starr, C., and Whipple, C. 1980. Risks of risk decisions. Science 208:1114-1119.
29. Vandermeer, J. 1981. The interference production principle: An ecological theory for agriculture. Bioscience 31:361-364.
30. Wildavsky, A. 1979. No risk is the highest risk of all. Am. Sci. 67:32-37.
31. Williams, P. H. 1983. From gold to diamonds. Plant Dis. 67:592.