

## ISSUE PAPER

NUMBER 18

MAY 2001

# THE PROFESSIONAL PORTFOLIO: BEYOND THE CURRICULUM VITAE

## INTRODUCTION

Individuals in the agricultural professions make valuable contributions to society and produce the basic materials needed by all people for their food, clothing, and shelter. Yet, increasingly, the American public is asking fundamental questions about the relevance and value of these contributions and the impact of agriculture on the environment, human health, and the economy. Regrettably, many scientists are ill equipped to answer these questions.

Traditionally, a scientist's primary tool for documenting his or her value has been the curriculum vitae, a lengthy document that details the individual's work. This work is presented as a list of biographical information, refereed publications, and extramural funding, without attempting to interpret its scholarship or value to the general public. In fact, very few people are able to understand the full scope of the contributions or the impact of a professional's work as presented in the curriculum vitae. Even other professionals within the same discipline have difficulty interpreting the value of a colleague's contributions as presented there.

Yet professionals have a responsibility to communicate clearly what they do and why it is important. This communication is necessary to inform the public and funding agencies of the return on their investments in the individual's career. To this end, the authors propose the de-

**TASK FORCE AUTHORS:** James R. Fischer, Agriculture and Forestry Research System, Clemson University, South Carolina; David A. Knauft, University of Georgia, Athens; **REVIEWERS :** Brad Inman, Water Business Group, Gainesville, Florida; Paul Meyer, Meyer Hay Farm, West Point, Nebraska; Michael Mullen, Plant and Soil Sciences, University of Tennessee, Knoxville; R. B. Sleeth, Armour Swift (retired), Paradise Valley, Arizona; **TASK FORCE ASSISTANT :** Deborah Dalhouse, Clemson University, South Carolina

velopment of a professional portfolio to communicate the value of the contributions made by individuals in professional societies. A portfolio would not replace the vitae but would present career highlights and summarize accomplishments in terms that could be understood and appreciated by a broad spectrum of people — from the general public to funding agencies, colleagues, collaborators, and employers.

This paper was conceptualized from a proposal that grew out of "Conversations on Change," a program sponsored by the Council for Agricultural Science and Technology (CAST) with support from the W. K. Kellogg Foundation; the United States Department of Agriculture Cooperative State Research, Education, and Extension Service; the Farm Foundation; the American Phytopathological Society; the Entomological Society of America; the Entomological Foundation; and the Weed Science Society of America. These conversations included members of various professional societies. During conversations around the country, the authors realized that there was much to be gained from better definition and communication of the value of professional contributions made by individuals in these societies. The authors also realized that, with a more inclusive approach, professionals could communicate the value of their work more effectively to the public, as well as to their em-

ployers. In addition, a broader definition of scholarship would provide a foundation for professional societies to better recognize the contributions of nontraditional members who teach, conduct extension activities, or apply research knowledge.

A group of individuals active in the Conversations on Change program worked together to learn more about communicating professional excellence. The concept of a professional portfolio as used in the fine arts, and increasingly in the teaching profession, was researched and discussed in the context of the professions represented by members of CAST. In February 1998 at Tuskegee University, the professional portfolio model was presented to members of the Conversations on Change initiative, representing academia, industry, professional societies, and government. The presentation was received favorably, and this group was asked to develop the concept for dissemination to the full membership of CAST. The following proposal is presented as a result of that request. Although this paper uses examples of scientists at land grant universities, the authors believe that a professional portfolio would be useful for scientists in government and private industry as well as in academia.

### **THE NEED FOR A PROFESSIONAL PORTFOLIO**

Just as the life work of an artist represents a diverse group of interests, endeavors, and contributions, the life work of a scientist in academia, the public sector, or private industry represents a diverse array of goals, endeavors, accomplishments, and contributions. Not all these efforts can be communicated adequately in the traditional curriculum vitae.

The vitae is a good tool for describing the outputs of academic research. It does not, however, convey adequately the contributions made by professionals in teaching and extension activities, it rarely provides an opportunity to describe impact, and it is of limited value for individuals outside of academia. Additionally, the vitae often is too narrowly focused to be of value to the general public, to employers, or to others interested in accountability. CAST members are well aware of the growing need for an individual to demonstrate accountability to employers, state and federal governments, funding agencies, tax-

payers, and review boards. The vitae simply does not address these accountability issues, whereas a professional portfolio can.

The teaching profession recently has embraced the portfolio as a means for self-evaluation, reflection, and improvement, as well as a means for documenting professional development and effectiveness. Since 1995, more than 500 colleges and universities have adopted the portfolio as an evaluation method for teaching faculty. (For examples, see "Teaching Portfolios" in the References.) The portfolio provides a broader representation of a professional's total achievements beyond a list of peer-reviewed articles, grants, and society memberships. It can document skills, evidence of collaboration, and the progression of professional growth. The portfolio also includes vital information on the impact of professional achievements, presented in terminology that clearly explains the benefits so that they can be understood and appreciated by members of government, industry, academia, and the general population.

Improved appreciation of an individual's contributions can lead to increased support and funding for those endeavors, which further enhances the individual's ability to contribute to society. The cycle thus continues to encourage and reward creativity and accomplishments that benefit society. Improved communication also can help scientists at land grant universities reconnect with the people whom these institutions were designed to serve. The W.K. Kellogg Foundation, the National Research Council, Chancellor Emeritus James H. Meyer of the University of California-Davis, and others have suggested that the way to reconnect is through service-oriented research, extension, and university-community partnerships. (See "Need for Land Grant Universities to Reconnect" in the References.) This approach can enhance a land grant university's ability to address the needs of society and to work on the practical, everyday issues that affect the quality of life for the people it serves.

The portfolio also can provide information needed for award nominations in the CAST professional societies, such as evidence of skills, innovation, influence, accomplishments, and contributions. A professional portfolio would have this information assembled in an easy-to-read

format that could be used in the selection process for job applications, in the promotions review process for job evaluations, and in the recognition process for award nominations.

### DEVELOPING A PROFESSIONAL PORTFOLIO

The portfolio tells the story of the professional's educational process, his or her accomplishments, and the impact on society of those accomplishments. To tell this dynamic story, there needs to be great flexibility in how a portfolio is developed and what it contains. A portfolio is considered representative, not comprehensive, showcasing and interpreting selected accomplishments. Early in a person's career, a portfolio can focus on goals and growth. Later, it can link achievements to those goals and show a progression of professional growth and development.

The professional portfolio provides a broader definition of an individual's achievements that are beyond peer-reviewed articles and society memberships. It also embraces a broader definition of scholarship as proposed by, among others, Ernest Boyer of the Carnegie Foundation for the Advancement of Teaching. Boyer has defined *scholarship* as "a creative work that has been peer evaluated or reviewed and is then communicated to a larger audience" (Boyer 1990). This broader definition allows both better recognition of the contributions in teaching and extension activities and the inclusion of many activities conducted by professionals in the private sector. The portfolio also provides a means to chart an individual's growth and contributions as well as the impact of his or her life's work. It can provide a method for employers to assess the quality and value of an individual's work; it can serve as a tool for self-assessment; and it can provide the basis for career-long professional growth and development.

In summary, the professional portfolio should include evidence of skill, collaboration, impact, and dynamic growth.

- **Skill**

Evidence of skill would include the items currently found in a curriculum vitae, such as degrees earned, employment history, honors and awards, professional society memberships, refereed publications, grants, and

courses taught. This list provides the basis for an individual's achievements.

- **Collaboration**

The portfolio would then build on the basic list of achievements to explain the collaborative work of the professional, including examples of teamwork and partnerships within his or her discipline and across disciplines. The ability to function in a multidisciplinary team is increasingly important to the work of professionals and should be recognized by employers, funding agencies, and professional societies. What was the scope of the collaborations in which the individual participated? Did the collaboration include individuals from different disciplines? Did it include other universities or a combination of public and private entities? Did it include individuals from consumer or end-user groups?

- **Impact**

Next, the impact of the individual's contributions should be noted in the professional portfolio. A vitae lists publications; a portfolio tells the story behind the publications. Why was the individual's research important? How did it benefit society? These are questions being asked with increasing frequency by personnel in government agencies, businesses, and academia. The professional portfolio would provide answers in terms that could be understood and appreciated by people outside the individual's specific discipline. The impact of an individual's work can be defined as generating new knowledge or as having an effect in economic, social, or policymaking areas.

- **Dynamic Growth**

Finally, evidence of dynamic professional growth would be included in the portfolio. Such evidence would show lifelong career growth through ongoing training in the individual's current discipline. It could include taking courses outside one's discipline to add new skills, such as administration or a second language. It also would recognize leadership activities and explain what results or benefits were achieved because of

the individual's leadership role. Leadership activities could take place within a professional society, at the individual's place of employment, in the public policy arena, or in other settings, so long as those activities contribute to the advancement of the profession.

Portfolios can be structured in a number of ways and presented in a variety of formats, including web pages. It will be up to each group to develop a portfolio style for its department, corporation, or institution. One suggested approach is to include the following categories: goals, skills and abilities, values, service, growth, achievements, and impacts.

- **Goals**

Identify the goals and areas that have been targeted for improvement as they relate to serving the needs of society as a whole, one's professional society, students, or other constituents. These goals might include, but are not limited to, (1) immediate goals: specific technical output and improvements planned; and (2) long-term goals: technical, social or environmental, economic, and organizational.

- **Skills and Abilities** (See examples in the Appendix)

Examples of skills and abilities should be a story of professional contributions told in a manner that can be understood and appreciated by a broad range of people. It is important here to focus on how the professional's contributions address a need identified by the general public or by a large group of end users. The following items might be included although the specific information should be tailored to the individual: (1) leadership: local, state, and national; (2) organizational: local, state, and national; (3) technical: new techniques, either mastered or developed; (4) project management; (5) financial management; (6) communication; and (7) business acumen.

- **Values**

A discussion of values may include professional, ethical, and/or visionary applications. All professionals could benefit from

examining their values. Nonetheless, the choice to include a section on values, or any item, in a portfolio is left to the individual. If this section is included, the individual may wish to discuss what is important to him or her in the context of the items listed here or other topics reflecting personal concerns: (1) job; (2) community; (3) family; and (4) society in general.

- **Service**

Service may include contributions in teaching or mentoring students, enhancing university-industry relations, improving government affairs or the policymaking process, or other contributions that show evidence of implementing personal values in one's (1) job; (2) community; (3) family; and (4) society in general.

- **Growth**

Evidence of growth spans professional and personal development or self-improvement, both technical and personal/social. The following list includes some examples of professional growth: (1) sabbaticals; (2) promotions; (3) workshops; (4) ongoing professional development, including leadership and management skills; and (5) professional workplace activities.

- **Achievements**

A discussion of achievements should focus on what the individual has done that is of value to the general public, his or her professional society, students, or other constituents. Some examples of professional achievements are listed here: (1) publications; (2) grants; (3) committees; (4) patents; (5) program creation and implementation; (6) project leadership; and (7) honors and awards.

- **Impacts**

The impacts section of a portfolio addresses the bottom line and seeks to answer the questions (1) What has resulted from the work that the individual has done? (2) What is the benefit to society in general or to constituent groups? And (3) How has the individual's work improved the quality of

life for the people whom one serves?

This outline suggests one possible approach to the professional portfolio. One of the advantages of the portfolio is, however, that its contents can be customized to showcase the contributions of each individual.

### CONCLUSIONS AND RECOMMENDATIONS

The flexibility of the professional portfolio and the broadened definition of *scholarship* provide many opportunities for improved communication, inclusion, and recognition of professionals and their activities. But there are challenges to developing a professional portfolio. First, the portfolio concept represents a new way of doing things and requires new skills. Second, it represents a changing role for professional societies because they must become more than gatekeepers of journals. Instead, they must define the new process and set new standards for communicating the benefits of their members' contributions to society as a whole.

To be valued by society, professionals need recognition, and a professional portfolio can convey both value and meaning to that recognition. Unlike the curriculum vitae, however, the professional portfolio has no standard templates for development. Material included in the portfolio will depend on the individual. For someone just beginning his or her career, the portfolio can focus on goals and growth. As one's career develops, the portfolio can link achievements to those goals and show a progression of professional growth and development. If updated regularly, the portfolio can become a very useful tool when completing one's scope of work for prospective clients or when presenting one's impact on grant projects. Maintaining a portfolio becomes an effective means to showcase an individual's abilities, achievements, and the impact of one's professional contributions.

The portfolio is designed to be a tool for assessment, evaluation, and communication. As such, it is meant to be dynamic, collecting information on a continual basis and reflecting the best examples of an individual's work. The portfolio should be concise because it is meant to be representative rather than comprehensive. Therefore, it should contain perhaps no more than 10 pages, presenting selected highlights of a career

with supporting documents. It also should be designed so that stakeholders, administrators, and others outside the individual's discipline can understand the value of one's contributions. This understanding should create an appreciation of the individual, as well as of scientific contributions as a whole. The portfolio also would facilitate decisions in hiring, promotion, and award selections by translating one's accomplishments into a form that can be understood by a broader range of people.

This paper does not intend to dictate a single "right" way to design a professional portfolio. The time has come, however, to bring the portfolio concept into reality in the sciences and to implement it as the new paradigm for evaluating professionals.

### APPENDIX

Although it is difficult to provide specific wording for a professional portfolio because the details will depend on the individual, this Appendix offers some examples of information that might be included in the "Skills and Abilities" section. Although individual content and presentation would be unique, the information should be designed to address how the professional is meeting a specific need of society in general or of the professional society to which he or she belongs. It is no longer enough to say that the professional is an entomologist or an agricultural engineer. According to the new scenario, a portfolio should answer the question, "What has this individual contributed to society?" A sample "Skills and Abilities" section for a plant scientist follows.

- **Plant Scientist**

The growing interest in herbal medicines such as *ginkgo biloba*, *echinacea*, and *golden-seal* has directed my investigations to discover the pharmaceutically active ingredients in these plants. My efforts are focused on putting science behind the herbal medicine movement by understanding the complex combinations of chemicals in these plants.

Although my research as a plant physiologist is focused on laboratory analysis of the active ingredients, I am working with colleagues in other disciplines to provide a



broader understanding of herbal medicine. My partners in horticulture are studying the most effective techniques for growing, harvesting, and processing pharmaceutical plants to preserve the active ingredients. Other partners are physicians, who are conducting clinical trials to test the effects of herbal medicines on human patients. Together, we hope to contribute to a better understanding and a more effective use of herbal medicines. So far, our research has indicated that ellagic acid, found in certain fruits and nuts, has the ability to inhibit the growth of cancer cells both in laboratory tests and in human patients.

In addition, I am active in a national consortium of universities, physicians, and corporations that conducts research on plant production and processing, as well as clinical trials on product safety and efficacy and production of herbal medicines for consumer use. One of our goals is to encourage efforts to standardize and federally regulate herbal medicines to ensure dependable dosage levels as these products are integrated into the practice of medicine in this country.

#### **Authors' Note:**

The Plant Scientist's profile addresses many of the points recommended for a professional portfolio. It describes the situation, the actions taken, and the impact of those actions. It also identifies contributions beneficial to a broad segment of society; it notes multidisciplinary collaborations; and it points out examples of continuing professional development. Following are three additional examples of "Skills and Abilities" profiles in different disciplines.

- **Packaging Scientist**

As public concern about improving environmental quality grew, so did my interest in this issue. Throughout my career with a major packaging corporation, I focused on decreasing the environmental impact of packaging materials. This effort included playing a major role in the commercial development of aluminum can recycling in the United States and advocating that the packaging industry adopt environmentally acceptable packaging as the industry standard. As part of this effort, I codeveloped an in-

novative, multimedia presentation calling attention to the issue of packaging waste and the industry's duty to deal with the problem. This presentation was shown to audiences in industries, civic groups, and government agencies throughout the United States and Canada.

I served as national spokesperson on environmental issues for my company and for the packaging industry before the United States Senate, state and local legislative bodies, and the news media. In addition, I was concerned with quality assurance issues and new product development. As a result, I worked on improving production methods and exploring innovative packaging concepts, such as ultra-thin foil composite materials.

After 20 years in private industry, I moved to academia. The packaging industry was in need of young professionals, and I was asked to design and direct a university packaging science program to meet this need. In this capacity, I built a nationally recognized program that serves as a model for cooperation between industry and academia and that has a 100% placement rate for graduates. My efforts include establishing a co-op program, which places students in internships with leading packaging corporations, and developing two research laboratories equipped with state-of-the-art machinery donated by industry. These laboratories are used by various groups, including students, university researchers, and corporate engineers, to develop new packaging concepts and to evaluate existing packaging and ensure that the product meets the highest possible quality standards.

- **Environmental Engineer**

A commitment to balance environmental quality with agriculture led me to explore more effective methods to identify agricultural pollution in groundwater and to produce farm-raised catfish. To identify groundwater pollution, I developed a technique known as electromagnetic terrain conductivity, which rapidly and economically locates contaminated areas within agricultural watersheds. This approach is now being used to

target areas in need of treatment and remediation as a means of preventing future water contamination.

Another area of interest is improving the production rate and decreasing the environmental impact of commercial fish farming. For this, I initiated a research program that radically modifies the traditional pond approach to producing fish. The new design is a partitioned aquaculture system that produces three to four times more fish than conventional systems do and requires only one-eighth as much water. The process has been patented and is being used by commercial growers in the United States and several foreign countries. A goal of this new system is to increase the amount of beneficial protein in the diets of economically disadvantaged people while preserving water resources.

In the academic arena, I develop and teach courses that show university students how to use natural resources to preserve environmental quality. I also write textbooks and scientific articles to encourage the protection and wise use of land, air, and water resources by university students and practicing scientists. In addition, I meet with citizens' groups to identify their environmental concerns so that I can focus my own efforts, and encourage other scientists to focus their efforts, on the topics that are most important to society.

- **Animal Scientist**

An academic interest in animal science, nutrition, and forages developed into a research focus on the effects of fescue toxicosis in pregnant mares. This condition, which is caused by a fungus in fescue grass pastures, results in severe reproductive problems, including spontaneous abortions, stillbirths, and even death of the mare.

My research identified a medication that blocked the effects of the infected grass, resulting in a healthy pregnancy, normal delivery, and a healthy foal. The medication also increased milk production in mares not suffering from fescue toxicosis. Further research suggested that the medication may have broader applications, including treating infertility in humans and increasing the re-

productive rate in other livestock.

As a result, the medication was patented for use in all mammals, and a new company was developed through the university's technology transfer unit. Currently, in addition to teaching and conducting research at the university, I manage a company to produce and market the medication.

## REFERENCES

### Teaching Portfolios

- Iowa State University  
<http://www.cte.iastate.edu/teaching/portfolio.html>
- Ohio State University  
<http://www.osu.edu/education/ftad/portfolio>
- Penn State University  
<http://www.psu.edu/celt/portfolio.html>
- University of Georgia  
<http://www.arches.uga.edu/~major/portfolios.html>
- University of Washington  
<http://www.fish.washington.edu/people/fdong/teach.html>
- University of Western Australia  
<http://www.csd.uwa.edu.au/portfolio/>

### Need for Land Grant Universities to Reconnect

- Bonnen, J. T. 1993. Reflections on the land grant idea. Staff Paper No. 93.8. Department of Agricultural Economics, Michigan State University, East Lansing.
- Campbell, J. R. 1995. *Reclaiming a Lost Heritage: Land Grant Initiatives for the Twenty-First Century*. Michigan State University Press, East Lansing.
- Christenson, J. A., D. A. Dillman, P. D. Warner, and P. Salant. 1995. The public view of land grant universities: Results from a national survey. *Choices* 10(3):37-39.
- Fischer, J. R. 1999. *21st Century Land Grant Universities: Action on Issues*. Agriculture & Forestry Research, Clemson University, South Carolina.
- Fischer, J. R. 2000a. What is public service? Issue paper for the Provost's Committee to Define Public Service. Agriculture & Forestry Research, Clemson University, South Carolina. Available: <http://www.clemson.edu/agforestryresearch>
- Fischer, J. R. 2000b. The food system: Balancing roles between public and private sectors. Presentation at The Food System of the 21st Century Workshop. Agriculture & Forestry Research, Clemson University, South Carolina. Available: <http://www.clemson.edu/agforestryresearch>
- Fischer, J. R. 2000c. The idea of a land grant university. Presentation to the president's colloquium. Agriculture & Forestry Research, Clemson University, South Carolina. Available: <http://www.clemson.edu/agforestryresearch>
- Meyer, J. H. 1997. *Re-Engineering the Land Grant College of Agriculture*. A study funded by the W. K. Kellogg Foundation. University of California Reprinting and Reprographics Services, Davis.
- National Association of State Universities and Land Grant Colleges. 1996. *From Issues to Action — A Plan for Action on Agriculture and Natural Resources for the Land Grant Universities*. Board on Agriculture of the National Association of State Universities and Land Grant Colleges, Washington, D.C.
- National Research Council. 1996. *Colleges of Agriculture at the*

- Land Grant Universities: Public Service and Public Policy.* Board on Agriculture, National Research Council, Washington, D.C.
- Phillips, M. J. 1997. Land grant colleges of the future: Recommendations of the National Research Council. *Choices* 12(2):4-7.
- Schuh, G.E. 1986. Revitalizing land grant universities. *Choices* 1(2):6.
- Theobald, R.. 1997. *Reworking Success — New Communities at the Millennium.* New Society Publishers, Gabriola Island, British Columbia, Canada.
- Redefining Scholarship**
- Boyer, E. 1990. *Scholarship Reconsidered: Priorities of the Professorate.* The Carnegie Foundation for the Advancement of Teaching, San Francisco, California.
- AMERICAN ACADEMY OF VETERINARY AND COMPARATIVE TOXICOLOGY ■ AMERICAN AGRICULTURAL ECONOMICS ASSOCIATION ■ AMERICAN ASSOCIATION FOR AGRICULTURAL EDUCATION ■ AMERICAN ASSOCIATION OF AVIAN PATHOLOGISTS ■ AMERICAN ASSOCIATION OF CEREAL CHEMISTS ■ AMERICAN BAR ASSOCIATION SECTION ON ENVIRONMENT, ENERGY AND RESOURCES, COMMITTEE ON AGRICULTURAL MANAGEMENT ■ AMERICAN DAIRY SCIENCE ASSOCIATION ■ AMERICAN FORAGE AND GRASSLAND COUNCIL ■ AMERICAN MEAT SCIENCE ASSOCIATION ■ AMERICAN METEOROLOGICAL SOCIETY ■ AMERICAN PEANUT RESEARCH AND EDUCATION SOCIETY ■ AMERICAN PHYTOPATHOLOGICAL SOCIETY ■ AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE ■ AMERICAN SOCIETY FOR NUTRITIONAL SCIENCES ■ AMERICAN SOCIETY OF AGRONOMY ■ AMERICAN SOCIETY OF ANIMAL SCIENCE ■ AMERICAN SOCIETY OF PLANT PHYSIOLOGISTS ■ AMERICAN VETERINARY MEDICAL ASSOCIATION ■ AQUATIC PLANT MANAGEMENT SOCIETY ■ ASAE: THE SOCIETY FOR ENGINEERING IN AGRICULTURAL, FOOD, AND BIOLOGICAL SYSTEMS ■ ASSOCIATION OF AMERICAN VETERINARY MEDICAL COLLEGES ■ CROP SCIENCE SOCIETY OF AMERICA ■ ENTOMOLOGICAL SOCIETY OF AMERICA ■ INSTITUTE OF FOOD TECHNOLOGISTS ■ INTERNATIONAL SOCIETY OF REGULATORY TOXICOLOGY AND PHARMACOLOGY ■ NATIONAL ASSOCIATION OF COLLEGES AND TEACHERS OF AGRICULTURE ■ NORTH CENTRAL WEED SCIENCE SOCIETY ■ NORTHEASTERN WEED SCIENCE SOCIETY ■ POULTRY SCIENCE ASSOCIATION ■ RURAL SOCIOLOGICAL SOCIETY ■ SOCIETY FOR RANGE MANAGEMENT ■ SOCIETY OF NEMATOLOGISTS ■ SOIL AND PLANT ANALYSIS COUNCIL ■ SOIL SCIENCE SOCIETY OF AMERICA ■ SOUTHERN WEED SCIENCE SOCIETY ■ WEED SCIENCE SOCIETY OF AMERICA ■ WESTERN SOCIETY OF WEED SCIENCE
- Rice, R. E. 1996. Making a place for the new American scholar. Working Paper Series. American Association for Higher Education, Washington, D.C.
- Schon, D. A. 1995. The new scholarship requires a new epistemology. *Change* 27(6):27-34.
- Weiser, C. J. 1996. The value system of a university: Rethinking scholarship. Presentation at the Scholarship Unbound Workshop. College of Agricultural Sciences, Oregon State University, Corvallis.

Additional copies of this issue paper are available for \$3.00. Linda M. Chimenti, Managing Scientific Editor. World Wide Web: <http://www.cast-science.org>.

**THE MISSION OF THE COUNCIL FOR AGRICULTURAL SCIENCE AND TECHNOLOGY (CAST)** is to assemble, interpret, and communicate science-based information regionally, nationally, and internationally on food, fiber, agricultural, natural resource, and related societal and environmental issues to our stakeholders — legislators, regulators, policymakers, the media, the private sector, and the public. CAST is a nonprofit organization composed of 37 scientific societies and many individual, student, company, nonprofit, and associate society members. CAST's Board of Directors is composed of representatives of the scientific societies and individual members, and an Executive Committee. CAST was established in 1972 as a result of a meeting sponsored in 1970 by the National Academy of Sciences, National Research Council. ISSN 1070-0021

Nonprofit Organization  
U.S. POSTAGE  
PAID  
Permit No. 4890  
Des Moines, Iowa

Council for Agricultural Science and Technology  
4420 West Lincoln Way  
Ames, Iowa 50014-3447, USA  
(515) 292-2125, Fax: (515) 292-4512  
E-mail: [cast@cast-science.org](mailto:cast@cast-science.org)

