The National Science Foundation

Director's Award for Distinguished Teaching Scholars

June 2, 2004

National Academy of Sciences
Washington, DC

The NSF Director's Award for Distinguished Teaching Scholars honors individuals who have made outstanding contributions to research in their discipline as well as the education of undergraduates and/or K-12 teachers and students. It is the highest honor bestowed by the National Science Foundation for excellence in both teaching and research.

The recipients of this award were selected in a national competition based on their outstanding accomplishments as scientists and engineers and as educators. In addition, each awardee submitted a proposal focusing on efforts to improve undergraduate education and/or the education of K-12 teachers and students that shows promise of impact beyond the awardee's institution.

Program

Welcome and Opening Remarks
Dr. Rosemary R. Haggett
Director, Division of Undergraduate Education
Education and Human Resources Directorate
National Science Foundation

Remarks from the Director
Dr. Arden L. Bement, Jr.
Acting Director, National Science Foundation

Keynote Address
Dr. Carl E. Wieman
Distinguished Professor of Physics, University of Colorado-Boulder
NSF Distinguished Teaching Scholar (2001)
Nobel Laureate (2001)

Presentation of Awards
Dr. Arden L. Bement, Jr.
Acting Director, National Science Foundation

Dr. Joseph Bordogna
Deputy Director, National Science Foundation

Closing Remarks
Dr. William A. Wulf
President, National Academy of Engineering

Reception*

Dr. Alice M. Agogino
Roscoe and Elizabeth Hughes Professor of Mechanical Engineering
University of California at Berkeley

Research Contributions: Dr. Agogino has established an internationally recognized research program in engineering design, sensor networks, and in engineering education. Her research in engineering design is focused on strategic product design, intelligent learning systems and Microelectronic Mechanical Systems (MEMS). Her research in sensor networks has led to the development of new algorithms frameworks for sensor monitoring, validation and fusion that have been implemented in a range of complex monitoring and diagnostic systems. She has published more than 150 journal and peer reviewed articles, 30 of which report the results of her research in undergraduate engineering education. She is a member of the U.S. National Academy of Engineering, and a Fellow of both the American Association for the Advancement of Science (AAAS) and the Association for the Advancement of Women. She has won three best-paper awards on her disciplinary research. She is the recipient of an IBM Faculty Development Award, a National Science Foundation Presidential Young Investigator, and was named Young Manufacturing Engineer of the Year by the Society of Manufacturing Engineers.

Educational Contributions: Dr. Agogino is well recognized for her leadership in engineering education, primarily at the undergraduate level. Of particular note are her multimedia case studies of engineering design and the two digital libraries she co-developed to share and promulgate excellent science and technology courseware - NEEDS (National Engineering Education Delivery System) and SMETE.org (Science, Mathematics, Engineering and Technology Education). Dr. Agogino has also made significant contributions to K-12 education and has supervised two doctoral students on research in innovations in middle school science technology education under Cal-Berkeley's interdisciplinary Studies in Engineering, Science, and Mathematics Education (SESAME) program. She received the IEEE Helen Plants Award for "Best Non-Traditional Session at Frontiers in Education," the Ralph R. Teetor Educator Award from the Society of Automotive Engineers, the Pi Tau Sigma Award for Excellence in Teaching, and two best paper awards in engineering education. Dr. Agogino was Director of the NSF-supported Synthesis Coalition for Undergraduate Engineering Education.

Director's Award Project: Dr. Agogino's project aims to develop and implement a service learning class on human-centered design for freshman and sophomores that is coupled with a senior/graduate level course on engineering education. She will also create a minor for all science, engineering and mathematics disciplines in which the senior/graduate course serves as the core practice course for the SESAME minor in engineering disciplines. Dr. Agogino also aims to catalog, evaluate and annotate on-line resources in science, engineering and mathematics education digital libraries as part of the senior/graduate class in engineering education.

Dr. Thomas F. Banchoff
Professor of Mathematics
Brown University

Research Contributions: Dr. Banchoff's research has influenced the fields of geometry and topology. He has published 90 articles, primarily in geometry, topology, and computer graphics in teaching and research. He has been the G. Leonard Baker Visiting Professor at Yale University, and a Visiting Professor at the Geometry Center at the University of Minnesota, the University of Notre Dame, the University of California at Los Angeles, and the University of Liverpool. He shared the Lester Ford Award for mathematical exposition, and was awarded the Joseph Priestly Medallion from Dickinson College. He has received honorary doctorates from Fairfield University and from Rhode Island College. Dr. Banchoff served as President of the Mathematical Association of American, chair of the Joint Policy Board for Mathematics, and chair of the Conference Board for the Mathematical Sciences. He is the author of "Beyond the Third Dimension", which has been translated into five languages, and co-author (with John Wermer) of "Linear Algebra Through Geometry" translated into Japanese and Greek. He was the Walter H. Annenberg Distinguished Professor of the Year at Brown University in 1998.

Educational Contributions: Dr. Banchoff pioneered the use of computer-generated films, videotapes, and slides in mathematical expositions and classroom instruction, primarily in the differential geometry of curves and surfaces and in multivariable calculus. He has written more than a dozen pedagogical articles describing the use of computer graphics in teaching and research. The computer animated film he co-produced (with computer scientist Charles Strauss) "The Hypercube: Projections and Slicing," was winner of the Prix de la Recherche Fondamentale at the Festival of Scientific and Technical Films in Brussells. As a Carnegie Fellow, he is the co-author of a chapter in a collection of Disciplinary Styles of Teaching and Learning published by the Carnegie Foundation. He received the Philip Bray Award for Distinguished Teaching of Science and Mathematics at Brown University; the Distinguished Teaching Award from the Northeastern Section of the Mathematical Association of America (MAA); and the National MAA Haimo Award for Distinguished Teaching. He was a Pew Scholar at the Carnegie Foundation and was named a Carnegie Scholar in 2000.

Director's Award Project: The goal of Dr. Banchoff's project is to disseminate widely Interactive Internet-Based Teaching and Learning in Mathematics, an original approach to undergraduate mathematics instruction that he has developed. Through a series of summer projects and activities at national meetings, he aims to make the approach more adaptable and scalable, for use in courses for mathematics majors, for science students, for liberal arts students, and for teacher training programs.

Dr. Walter C. Oechel
Professor of Biology and Director of the Global Change Research Group
San Diego State University

Research Contributions: The central theme of Dr. Oechel's broad array of research projects is to understand the factors that control the productivity and growth dynamics of plants and ecosystems. Currently, he oversees ecosystem experiments in Alaska, California, the Midwest, the Great Plains, and Mexico and collaborates with other researchers worldwide. Dr. Oechel's extensive and seminal work on CO_2 regulation and balance on every continent, save Antarctica, has had important implications for our understanding of global warming. His efforts impact virtually every aspect of research on climate change and ecosystems science. Dr. Oechel's work has been supported by the National Science Foundation, the International Arctic Research Consortium, the National Institute for Global Environmental Change, the Institute of Agrometeorology and Environmental Analysis, the US Department of Energy, the National Aeronautics and Space Administration, the USDA Forest Service, and the National Research Council of Canada.

Educational Contributions: Dr. Oechel is a member of the Center for Research in Mathematics and Science Education at San Diego State University, and has led the PISCES project in San Diego, which brings research data to the desks of K-12 students in California, Alaska, and Mexico in real time. The graduate and advanced undergraduate student fellows supported by PISCES serve as the Science Corps, bridging the gap between cutting-edge research and K-12 education. A very important component of Dr. Oechel's global change research is his commitment to sharing the research, in real time, with students at every level of education. Through the cutting-edge technology he employs, Dr. Oechel is able to provide ecophysiological data via the Web in near real-time for use in K-20 classrooms. Through an NSF Research Experiences for Undergraduates (REU) grant from the Office of Polar Programs, Dr. Oechel has supported undergraduates working in the Arctic, learning how to run ecological monitoring equipment and reducing data. With support from the Arctic research program, teachers have carried out field studies at Dr. Oechel's research sites in Barrow, Alaska.

Director's Award Project: The goal of Dr. Oechel's project is to develop a Web-based curriculum that will provide accessible lessons to diverse sets of users on how different regions are affected by climate change. The new curriculum will highlight the importance of climate change, the real-world application of scientific data and concepts, and how climatic events in one region, such as El Niño events, affect climate change, such as arctic oscillations, in other regions.

Dr. David F. Ollis
Distinguished Professor of Chemical Engineering
North Carolina State University

Research Contributions: Professor Ollis' research focuses on biotechnology and photo-catalysis. He has published more than 150 articles in catalysis, biotechnology, photochemical engineering, and engineering education. His co-authored textbook, *Biochemical Engineering Fundamentals*, has appeared as an international edition and been translated into Russian. The number of citations to his work place him in the top 1% of all US chemists and chemical engineers and is indicative of the broad recognition of his scholarly achievement in the areas of biotechnology and photocatalysis. Dr. Ollis received the International $Ti0_2$ Award from the *Journal of Advanced Oxidation Technology*. He received a Young Faculty Award and Dreyfus Teacher-Scholar Award while on the faculty at Princeton University's Engineering School, the Corcoran Award from the Chemical Engineering Division of the American Society for Engineering Education (ASEE), and North Carolina State University's Distinguished Graduate Professor Award.

Educational Contributions: Dr. Ollis has developed several innovative engineering courses during his career at North Carolina State University. He has, for example, piloted a "take-apart" course in which first-year undergraduate students disassemble common products like photocopiers and bar code scanners to develop an appreciation for the engineering concepts behind their design. This pilot course was eventually scaled up and now includes more than 1,000 students entering the College of Engineering each year. Dr. Ollis' textbook *Biochemical Engineering Fundamentals* was the dominant text in its area for over 10 years, and arguably has educated an entire generation of U.S. biochemical engineers. He has received the University of North Carolina Board of Governors' Award for Excellence in Teaching, North Carolina State University's highest teaching honor, an Outstanding Teacher Award from North Carolina State University, the United Technologies Excellence in Teaching Award, and the Sterling Olmsted Award from the Liberal Education Division of ASEE.

Director's Award Project: Dr. Ollis' project will explore the use of light-driven technology modules in teaching non-engineering courses with appreciable technical content, to students in the College of Humanities and Social Sciences, the College of Education, and the College of Design at North Carolina State University. Through collaborations with colleagues in diverse colleges he seeks to serve engineering and science students enrolled in foreign language courses, grade 6-12 teachers of technology, and industrial design students.

Dr. Susan E. Powers
Professor of Civil and Environmental Engineering
Clarkson University

Research Contributions: Dr. Powers research seeks to understand the physical and chemical phenomena associated with the transport of contaminants in subsurface systems, with specific emphasis on the fate, transport, and remediation of nonaqueous phase liquids in complex systems. Her research provides an understanding of the environmental fate of oxygenated gasoline, for example, and has implications for regulatory and policy decisions. She has published 39 journal and other refereed articles within her research specialty areas. In 1998, she received the J.W. Graham Faculty Research Award at Clarkson University for outstanding research achievement by a junior faculty member. She has served on the editorial boards of the *Journal of Environmental Engineering, the Journal of Contaminant Hydrology, Environmental Technology, and Advances in Water Resources.* She presently serves on the U.S. Environmental Protection Agency Science Advisory Board, Environmental Engineering Committee.

Educational Contributions: Dr. Powers' educational contributions include implementing project-based learning opportunities for students at middle school through PhD levels. She has been actively involved with Clarkson's NSF-funded Environmental Manufacturing Management IGERT program and is the director of a National Science Foundation-supported GK-12 project. This program, which engages graduate and undergraduate students in collaboration with middle schools, has excelled at attracting women students to become Fellows. It has allowed middle school teachers to update their teaching methods and curricula, and learn to incorporate problem-based learning within their traditional lesson modules. For their part, Clarkson University students have benefited from learning teaching methods; developing the ability to communicate complex scientific challenges to non-specialist adults and young children; and how to manage large, complex projects involving teamwork. Dr. Powers' efforts have been recognized by her receiving the Clarkson Outstanding New Teacher and Outstanding Advisor Awards, the Albert D. Merrill Award twice from the Department of Civil and Environmental Engineering, the Boeing Outstanding Educator Award, and the Distinguished Service Award from the Association of Environmental Engineering and Science Professors.

Director's Award Project: The goals of Dr. Power's project are to identify the knowledge and skills necessary to increase the technical and environmental awareness of energy issues and to improve the implementation of project-based energy and environment curricula in K-16 classrooms, particularly in New York State. Teacher and faculty workshops will be conducted for training in the use of the newly developed K-12 curricular materials.

Dr. Julio J. Ramirez
R. Stuart Dickson Professor
Department of Psychology
Davidson College

Research Contributions: Dr. Ramirez's research explores the recovery of memory function after central nervous system injury. The National Science Foundation, the National Institutes of Health (NIH), the North Carolina Board of Science and Technology, the Pew Charitable Trusts, and the Howard Hughes Medical Institute have supported his research. He has published more than 30 articles in leading science and education journals, many with undergraduates as co-authors.

Educational Contributions: Being named the first R. Stuart Dickson Professor at Davidson College, acknowledges Dr. Ramirez's commitment to science and science education. He founded Faculty for Undergraduate Neuroscience (FUN) with three other colleagues in 1991 and served as its founding president. This national organization is committed to promoting and enhancing neuroscience education for undergraduate students by serving as a resource for neuroscience educators. He was co-founding senior editor of the *Journal of Undergraduate Neuroscience Education*, the flagship journal of FUN, which provides educators of undergraduate neuroscience students with a peer-reviewed forum for sharing innovative laboratory experiences, media, and teaching methods. Dr. Ramirez is a founding member of the Psychology Division of the Council on Undergraduate Research (CUR) and served as a Councilor in its Biology Division. He was one of two inaugural CUR Fellows and the Faculty for Undergraduate Neuroscience awarded him a Career Achievement Award, the highest honor bestowed by that organization. The Charlotte/Mecklenburg Arts and Science Council honored Dr. Ramirez for his contributions to and excellence in research and science education when they named him an Arts and Science Council Fellow. Because of his dedication to bringing science to the public, Dr. Ramirez was named to the Board of Trustees of the Discovery Place Museum of Science in Charlotte, North Carolina.

Director's Award Project: Dr. Ramirez's project will focus on mentoring and mentorship. It consists of summer research programs in the neurosciences for undergraduate students wherein junior faculty members and students receive intensive mentoring. The faculty members will be mentored in launching and maintaining a career that integrates teaching and research. The undergraduate students will be mentored in conducting research.

Dr. Kenneth G. Tobin
Presidential Professor of Urban Education
Graduate Center of the City University of New York

Research Contributions: Dr. Tobin's research concerns the teaching and learning of science in urban schools, and co-teaching as a way of learning to teach in urban high schools. He has developed an assessment instrument to identify students who would benefit from less abstract forms of learning, called the Test of Logical Thinking, which was been used internationally. His research on the use of ethnographic research to study how teachers interact with students in a class, published in the *Journal of Research in Science Teaching,* has been identified as one of the most significant papers published in the journal. Dr. Tobin has won numerous outstanding-paper awards for his research. He received the Cattell Early Career Award from the American Educational Research Association (AERA). He has been a Visiting Professor at Curtin University of Technology, Perth Western Australia and Queensland University of Technology, Australia; a Visiting Fellow at the National Taiwan Normal University, Taipei, Taiwan; a Visiting Scholar at the Universite de Quebec a Montreal, Canada; and Lansdowne Professor at the University of Victoria, Canada. He was a Fulbright Senior Scholar and is a Fellow of the American Association for the Advancement of Science (AAAS). His book, *At the elbows of another: Learning to teach through co-teaching*, received the Choice Award in the category of Outstanding Academic Titles for 2002.

Educational Contributions: Dr. Tobin's efforts have been focused on improving science education in urban schools by improving the education of science teachers. He received an award from the National Association for Research in Science Teaching (NARST) for practical application of research for the classroom teacher, and an AERA Award for relating research to practice, the John W. Shrum Award for excellence in the education of science teachers. In 2004, he received Outstanding Science Teacher Educator of the Year (10+ years) from the Association for the Education of Teachers of Science.

Director's Award Project: To improve the quality of college science teaching, especially in courses for teachers and teacher candidates, and improve the quality of urban science education in classes taught by new teachers, Dr. Tobin will undertake professional development activities that will impact researchers of teaching and learning science, science teacher education, curriculum development and policy formulation.

Dr. Dean A. Zollman
Distinguished University Professor of Physics
Kansas State University

Research Contributions: Dr. Zollman focuses on physics education research and curriculum development, concentrating on researching the use of technology for teaching physics. He has been a Fulbright Research Fellow at the University of Munich and the Institute for Science Education in Kiel, Germany, and is a Fellow of the American Physical Society. His research efforts have resulted in the publication of a large numbers of papers in refereed journals as well as the development of innovative instructional materials. Dr. Zollman has twice received the Computers in Physics Top Award for Outstanding Educational Software.

Educational Contributions: While Dr. Zollman has taught a full range of courses from graduate-level quantum field theory to conceptual physics for non-science students, his primary focus is on non-physics majors and future teachers. He is the Director of the Visual Quantum Mechanics project aimed at creating instructional materials for high school students, non-science college students, biology majors and physics majors. He has received numerous teaching awards including the William Stamey Outstanding Teaching Award, the Burlington Northern Faculty Achievement Award, as well as Kansas State University's highest award, Coffman University Distinguished Teaching Scholar. He has also received the American Association of Physics Teacher's Robert A. Millikan medal for outstanding contributions in physics teaching. The Carnegie Foundation for the Advancement of Teaching and Council for the Advancement and Support of Education named Dr. Zollman as its National Doctoral University Professor of the Year.

Director's Award Project: Dr. Zollman aims to conduct research on the reasoning and models that students use as they transfer basic physics knowledge to the application of physics in contemporary medicine, and use the results of this research to develop active engagement teaching-learning materials to help students learn about the applications of 20^{th} and 21^{st} century physics to contemporary medical diagnosis procedures.

2001 Awardees

Arthur B. Ellis
Meloche-Bascom Professor of Chemistry
University of Wisconsin-Madison

Leah H. Jamieson
Professor of Electrical and Computer Engineering
Purdue University

Gretchen Kalonji
Kyocera Chair
Department of Materials Science and Engineering
University of Washington

Eric Mazur
The Gordon McKay Professor of Applied Physics
Harvard University

Joseph O'Rourke
Olin Professor of Computer Science
Smith College

H. Eugene Stanley
University Professor and Professor of Physics
Boston University

Carl E. Wieman
Distinguished Professor of Physics
University of Colorado-Boulder

2002 Awardees

Tanya Atwater
Professor of Geological Sciences
University of California, Santa Barbara

Robert Devaney
Professor of Mathematics
Boston University

Christopher D. Impey
University Distinguished Professor
Steward Observatory
University of Arizona

Richard McCray
George Gamow Distinguished Professor
Department of Astrophysical and Planetary Sciences
University of Colorado at Boulder

Harold Vincent Poor
Professor of Electrical Engineering
Princeton University

Nicholas J. Turro
William P. Schweitzer Professor of Chemistry
Columbia University

2003 Awardees

David P. Billington
Gordon Y. S. Wu Professor of
Civil and Environmental Engineering
Princeton University

Daniel J. Klionsky
Abram Sager Collegiate Professor of Life Sciences
University of Michigan-Ann Arbor

Mary Lee S. Ledbetter
Professor of Biology
College of the Holy Cross

Chris Rogers
Professor of Mechanical Engineering
Tufts University

Harry L. Shipman
Annie Jump Cannon Professor of Physics and Astronomy
University of Delaware

Lee Spector
Dean, School of Cognitive Science
Associate Professor of Computer Science
Hampshire College