



**MATERIALS EDUCATION:
OPPORTUNITIES OVER
A LIFETIME**

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ABSTRACTS

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PLENARY LECTURE

The Magic School Bus Drives into Materials Science

Joanna Cole, Author

It was the end of a typical American school day. Our class had studied reading, math, computer skills, traffic safety, fire safety, stairwell safety, and the history of our city, county, and state. We had charted our family trees, read aloud from Harry Potter, made a “creative” map of Bermuda using only macaroni and string, and listened to a local police officer speak on the subject of avoiding date rape. Now we kids had only one question: When are we going to find time to learn about MATERIALS SCIENCE??!



Joanna Cole loved science as a child. “I always enjoyed explaining things and writing reports for class. I had a teacher who was a little like Ms. Frizzle. She loved her subject. Every week she had a child do an experiment in front of the room and I wanted to be that child every week,” she recalls. It’s no surprise that her favorite book as a child was *Bugs, Insects and Such*.

Ms. Cole has worked as an elementary school teacher, a librarian, and a children’s book editor. Combining her knowledge of children’s literature with her love of science, she decided to write children’s books. Her first book was *Cockroaches*, which she wrote because there had never been a book written about the insect before, and “I had ample time to study that creature in my low-budget New York apartment!” Since then she has written more than 50 nonfiction and fiction books for children, and she is the winner of the 1991 Washington Post/Children’s Book Guild Non-fiction award for the body of her work, which also includes the ALA Notable Children’s Book *How You Were Born*; *Bony Legs*; *Cars and How They Go*; and, with Stephanie Calmenson, *Give a Dog a Bone*.

Despite the hard work, Ms. Cole insists that writing “is the greatest fun in the world.” And the *Magic School Bus* books in particular provide the opportunity for Ms. Cole to combine the two things she loves: science and humor.

Communicating Science to the People

*Robert Coontz, Editor
Science Magazine*

Only a minuscule fraction of scientific research ever makes it into the popular media. To scientists, the winnowing process by which editors decide which science stories get told can seem bewildering and arbitrary, but it is logical (if sometimes messy). To understand how journalists communicate science, researchers must realize “what the public ‘should’ know” is only part of the newsmaking algorithm. Deadlines, space pressures, concepts of timeliness and story, and judgments about what people “want” to know (or will sit still for) also play major roles in shaping coverage.



Robert Coontz is deputy news editor for physical sciences at *Science* magazine. A 1990 graduate of the science-writing program at the University of California, Santa Cruz, he has worked as a senior editor at *The Sciences* (formerly published by the New York Academy of Sciences) and *Earth* and as a freelance writer and editor for *New Scientist*, *American Scientist*, *IEEE Spectrum*, and other publications.

The Role of Science Centers: Developing Science Itself With the Help of “Ordinary People”

*Hooley McLaughlin, Senior Advisor
Ontario Science Centre*

The Materials Research Society is developing a traveling public exhibition on materials science, with the aid of a team that includes materials scientists, museum advisers, public education evaluators, and research, design, and fabrication staff at the Ontario Science Centre in Toronto. This presentation will engage participants in a discussion on the role the interactive science center exhibition plays in the development of public literacy in science. The MRS exhibition has an ambitious mandate in that it endeavors to engender a basic understanding of the essential parameters of materials sciences – structure (both the underlying micro and the more overt macro aspects), properties, performance, and processing. As daunting a task as this is, a science center exhibition effectively goes further. It becomes a meeting-point for active scientific researchers and the average intelligent member of the public. Through the process of developing a public exhibition, the MRS is examining the basic nature of the materials sciences themselves. The goal of this session, therefore, will be to examine the premise that public education is not uni-directional. The future trajectory of a science is affected by the creation of a public education interface. The MRS exhibition could very well result in self-reflection within the Society and in new thinking with regard to the science of materials in the future.



Hooley McLaughlin joined the Ontario Science Centre in 1987. He holds a Doctor of Philosophy degree in Zoology, a Masters of Science degree and a Bachelor of Arts degree in East Asian Studies from the University of Toronto. His work at the Ontario Science Centre has included the development of thematic and strategic plans, as well as the content development, and at times project leadership, of many of the Centre’s major exhibitions. He has maintained a strong record for the development of public presentations on the latest cutting edge developments in science and technology, accomplished through business and research partnerships. Dr. McLaughlin continues to work with scientific researchers and societies concerned with advanced research with a view to creating exhibitions for the public, most notably the Materials Research Society. He has recently published his first book, *The Ends of Our Exploring*, an intriguing account of his international travels and his critique of our understanding and application of western and non-western scientific philosophy.

**Why Should I Listen?
The Importance of Bears, Onions, and Harry
In Explaining Science**

***David Kestenbaum, Correspondent
National Public Radio***

After college, learning is optional. This seems particularly true when the subject is science. In one study NPR has done, the average person was more interested in stock prices than a story about the origin of the universe. One obvious solution is to mention stock prices while you are talking about science. Even better is to hide the science in a story that seems to be about something else. A real story, with characters, maybe even a bear or an onion.



David Kestenbaum became unreasonably obsessed with small things at a young age. He studied quarks as an undergraduate at Yale University and in his graduate work in physics at Harvard University where he received his Ph.D. in 1996. David's thesis detailed part of the discovery of the top quark. David received a journalism fellowship from the American Physical Society the same year, and won the Evert Clark award for young science journalists in 1997. His work has appeared in *Science* magazine, *The New York Times*, *The New Republic*, and other places. David spent a year as a reporter for *Science* before moving to National Public Radio in 1999. He loves his job.

**Bringing the Excitement of Physics to the Public
On PhysicsCentral.com,
or
Fighting the War on Error**

*Jessica Clark, Public Outreach Specialist
American Physical Society*

Launched in December 2000, PhysicsCentral.com is a major public outreach initiative of the American Physical Society. A web site in a magazine-like format with continually updated content, it is designed to bring the excitement and importance of physics to everyone in a simplified but not simplistic way. It features both pedagogical elements and descriptions of recent developments in fast-moving areas of current research. Physics Central is designed to be attractive and informative, and to emphasize that physics is an interesting pursuit carried out by interesting people. Visitors to the site can learn a little bit of physics, can find out what is happening on the research frontier, and can find links to the rest of the best physics sites on the web. Physics Central carries the imprimatur of the American Physical Society and plays a unique role that is not duplicated by any other site in the universe.



Jessica Clark wants to bring the excitement of physics to the world. Since 2000 she has worked with the American Physical Society to produce the public outreach web site, PhysicsCentral.com. The site educates and entertains with features that include current research, bios of notable physicists, physics images, news, links, and a “How Things Work” column. Jessica is a former Clare Booth Luce Fellow at the College of William and Mary in Virginia, where she is currently putting the finishing touches on her Ph.D. thesis on muon capture under advisor David Armstrong.

Collaborating with “The Enemy”: Using the TV for Materials Education

*Alexis Clare, Professor
Alfred University*

A speaker at our opening Convocation quoted the following phrase: “TV is called a ‘medium’ because it is neither rare nor well-done.” People in education have often taken a dim view of television as a competitor for the interests and time of their scholars but used in the right way television is a tremendous educational tool, not only in the classroom but in public awareness and recruiting to the field. This talk will discuss our experiences using TV for class education, public education and recruiting students for Materials Science and Engineering. The future prospects incorporating new technology and some new ideas will also be discussed.



Alexis Clare joined the Faculty of Ceramic Engineering and Materials Science of New York State College of Ceramics at Alfred University in 1989 after serving as a Post Doctoral Researcher at Sheffield University, U.K., where she also earned her B.Sc. in Chemical Physics and Ph.D. in Physics. She is author or co-author of over 50 technical papers and holds one U.S. patent. Her primary research field is the structure versus optical and biological properties of glass. She has won three teaching awards at Alfred University and the State University of New York Chancellors Award for excellence in teaching. In addition, she was awarded the National Institute of Ceramic Engineers Karl Schwartzwalder Professional Achievement in Ceramic Engineering Award in 1996 and the International Commission on Glass Vittorio Gottardi Prize for Glass Science in 2000. Alix is a Past Chair of the Glass and Optical Materials Division of the American Ceramic Society and is currently Vice President of the National Institute of Ceramic Engineers. She is Fellow of both the Society of Glass Technology, UK and the American Ceramic Society.

Engaging K-12 Children in Physical Science Competitions: Success Stories and Classroom Interactions

***Gerry Wheeler, Executive Director
National Science Teachers Association***

Over the past two decades the National Science Teachers Association (NSTA) has conducted a number of student competitions involving over a quarter of a million students and tens of thousands of teachers. The sponsors included corporations and governmental agencies. This talk will highlight the success and failures of these experiences as well as the benefits to the participants.



Gerald F. Wheeler is Executive Director of the National Science Teachers Association. Prior to that he was professor of physics at Montana State University, director of the Science/Math Resource Center, and program director for the American Association for the Advancement of Science (AAAS) in the area of Public Understanding of Science and Technology. Wheeler received his BS in 1963 from Boston University with a major in science education and his Ph.D. at SUNY at Stony Brook in 1972 in experimental nuclear physics. Between undergraduate and graduate school, he taught high school physics, chemistry and physical science. During his career Wheeler has taught at least 4 months in each grade level from Kindergarten to graduate physics. Trained as a nuclear physicist at the SUNY at Stony Brook, he has spent most of his energies in the past decade on the issues and problems of getting science to nonscientists.

Wheeler is a past president of the American Association of Physics Teachers, a fellow of the W. K. Kellogg Foundation and the AAAS, is on numerous national advisory boards including, PBS's ScienceLine project, the National Assessment of Educational Progress Project, (NAEP) and the Dept of Education's Expert panel on Exemplary Programs. He has served as staff physicist for The Children's Television Workshop (CTW) production of 3-2-1 CONTACT and been on the CTW national advisory board for CRO and Bank Street's production of THE VOYAGE OF THE MIMI. His publications include 4 Books, 2 book chapters, 2 physics abstracts, 3 nuclear-physics research articles, 5 educational articles, 11 reviews, and 4 television productions.

The Blame Game in the Science Preparation of Future Teachers

*Fredrick M. Stein, Director of Education
and Outreach
American Physical Society*

Who is responsible for the general lack of science preparation in our newly-certified K-12 teachers? If it is true that teachers “teach as they were taught,” then we must look to the college and university departments. The American Physical Society (APS), in partnership with the American Association of Physics Teachers (AAPT) and the American Institute of Physics (AIP), has initiated PhysTEC in concert with national reports calling for the improvement of K-12 science teaching. PhysTEC aims to help physics and education faculty work together to provide an education for future teachers that emphasizes a student-centered, hands-on, inquiry-based approach to learning science. Program components include: (1) A long-term, active collaboration between the physics department, the education department, and the local school community; (2) A Teacher-in-Residence (TIR) program that provides for a local K-12 science teacher to become a full-time participant in assisting faculty with both team-teaching and course revisions; (3) The redesign of content and pedagogy of targeted physics courses based on results from physics education research as well as utilization of appropriate interactive technologies; (4) The redesign of content and pedagogy for elementary and secondary science methods courses with an emphasis on inquiry-based, hands-on, approaches to teaching and learning; and (5) The establishment of a mentoring program for TIRs and other Master Teachers designed to meet the needs of an induction experience for novice science teachers. This includes the participation of physics faculty in increasing and improving a wide array of school experiences.

Fredrick M. Stein is the director of Education and Outreach for the American Physical Society (APS). Recently, APS with Stein, as PI and project director, was awarded a five-year, \$5.76 million grant by the National Science Foundation, in partnership with AAPT and AIP, for the Physics Teacher Education Coalition (PhysTEC). Prior to joining APS, Stein was the director of the Center for Science, Mathematics & Technology Education and professor of chemistry at Colorado State University, where he was the PI and project director of the *Collaborative for Excellence in Teacher Preparation*, the *Comprehensive Partnership for Minority Student Achievement* for Denver Public Schools, and *Small-Scale Science: Teachers-as-Researchers* program for in-service teacher enhancement. From 1987-1991, Stein was the director of the Philadelphia Renaissance in Science and Mathematics (PRISM), the *Comprehensive Regional Center for Minorities*, and the facilitator for the Philadelphia site of *AAAS Project 2021*. A former professor, he is widely published. Stein holds a Ph.D. in chemical physics from Indiana University and a B.S. in chemistry from the University of Colorado.

Materials Camp: High School Students Learn that Careers in Materials and Engineering can be a Lot of Fun

*Charles R. Hayes, Executive Director
ASM International Foundation*

*Thomas Stoebe, Professor Emeritus
University of Washington*

MATERIALS CAMP is a one-week live-in summer experience in materials science and engineering for high school juniors. The program, sponsored by the ASM Foundation, provides 60 students with real-life, hands-on experiences in materials science and technology. Students are recruited globally for MATERIALS CAMP programs currently located at two sites, ASM Headquarters near Cleveland, OH, and University of Washington in Seattle, WA.

The MATERIALS CAMP program is divided into three segments, one dealing with materials background knowledge, the second relating to a materials failure project and the third relating to career awareness, networking and related activities. Background knowledge is developed using parts of the Materials Science and Technology curriculum project, a program focused on high school level materials technology. Volunteer professionals (from ASM chapters and affiliates) act as mentors to the students as they carry out their failure analysis projects in teams, learning to use basic metallographic and analytical equipment. Career awareness comes from interacting with the professionals present, field trips and social activities.

Chuck Hayes was born in Detroit and raised in Pittsburgh in an Irish working-class family. As a youth, he worked as a cobbler and in construction. He received a bachelor's degree in Social Work/Psychology from Mercyhurst College, then received his master's degree in Guidance and Counseling from Gannon University. Before becoming the first Executive Director of the ASM International Foundation, he held senior fund raising and executive positions in the United Way system, and with independent schools and private family service agencies.

Tom Stoebe is an emeritus professor of Materials Science and Engineering at the University of Washington. He has developed a series of institute programs funded by NSF which teach secondary school teachers to teach materials science and technology in their classrooms. His research areas relate to optical and luminescent properties of materials, semiconductor processing and ceramic materials properties. He is a fellow of ASM International, a former Board member of ASM, and a member of the Board of the ASM International Foundation.

The Development of a Dynamic Materials Educational Program for Pre-College Students

*R.P.H. Chang, Professor
Northwestern University*

The Materials World Modules Program is designed to use inquiry-based activities and design projects on materials topics for middle and high school students. Each module has a teacher's booklet, a student's booklet, and a materials kit for the whole class. These modules are used to connect science concepts to the world we live in through the use of materials. Today, nine modules are in circulation and a tenth module is under development. In addition, an internet version of the modules is under development and is also being field-tested. In this talk, I will discuss the dynamics of the program and the potential impact to science and math education.



Bob Chang is Professor in the Department of Materials Science and Engineering and Director of the Materials Research Center at Northwestern University. His B.S. is in Physics from Massachusetts Institute of Technology, and he received a Ph.D. in Plasma Physics from Princeton. His primary research area currently is advanced thin films. Dr. Chang is a Councillor of the Materials Research Society and Principal Editor of the Journal of Materials Research. He was President of MRS in 1989, and was founding president, board of advisers for the International Union of Materials Research Societies which he chaired in 1993-94. An honorary member of the materials research societies of India, Japan and Korea, Dr. Chang also is a Fellow of AVS. He has been a subcommittee member, division of materials research, advisory subcommittee member, division of materials research, advisory board committee, mathematics and physics science directorate of the National Science Foundation.

An Innovative University-Industry Initiative to Enhance and Improve Enrollment of K-12 Students into Science and Engineering Programs

***Ranji Vaidyanathan, Manager of Advanced Materials
Advanced Ceramics Research, Inc.***

The Summer Engineering Academy (SEA) is an innovative partnership between the University of Arizona and local businesses to attract qualified high school students into engineering disciplines. The idea is to show students how an idea becomes reality. Students learn to use sophisticated 3-D modeling and design software to design aerodynamic cars and produce models using Rapid Prototyping techniques. They attend lectures conducted by university faculty and industry personnel. The students' designs are emailed to Advanced Ceramics Research and the parts are built for the teams on the rapid prototyping machine while the students are touring the facilities. The participants test their model cars in a specially built wind tunnel and make a PowerPoint presentation to an audience of about 300 on the last day of the week-long program. For a total of 80 seats, nearly 500 students from all over the U.S. apply. Out of the students who attended in 1999, 27 students have enrolled in the University of Arizona engineering programs, with similar results for the 2001 program. There has been a clear improvement in the number of minority and women students entering the undergraduate engineering program after the Summer Engineering Academy was initiated. It is expected that participation in this program would encourage students to enter into engineering programs, become interested in graduate school and employment in industries of the future with rapid prototyping and flexible manufacturing industries.



Ranji Vaidyanathan holds a B.Tech. degree in Metallurgical Engineering from Banaras Hindu University, an M.S.M.E. in Mechanical Engineering from North Carolina A&T State University, and a Ph.D. in Materials Science and Engineering from North Carolina State University. He was a Postdoctoral Research Fellow at Johns Hopkins University in 1996, and has been an Adjunct Associate Professor in the AME and MSE Departments at the University of Arizona since 2000. Prior to joining Advanced Ceramics Research in 1998, Dr. Vaidyanathan was Senior Scientist with MER Corporation. He received the R&D 100 Award in 2001 for developing a water-soluble mandrel material for polymer composite materials.

Diversity in Materials Research and Education: An NSF Perspective

***Lance Haworth, Executive Officer
Division of Materials Research
National Science Foundation***

Despite some gains over the past decade, the representation of women and minorities among NSF grantees in materials research – a field ranging broadly from fundamental condensed matter physics and solid state chemistry to functional materials including polymers, ceramics, metals and electronic and optical materials – is still much lower than their representation in the US population as a whole. The ‘leaky pipeline’ for science starts in elementary school and secondary school and progresses through undergraduate, graduate and postdoctoral programs to the faculty level. Science in general, and materials science in particular, underlie current and future technologies and will have a profound impact on life in the 21st century. Yet public awareness of and appreciation for the value and importance of materials research remains low, and its potential as a vehicle for science education remains largely untapped. The challenges of science education, diversity in science, and public awareness of science are strongly related. What is being done, and what might be done better, to address these challenges for materials science in particular? In this brief talk I will try to give an NSF perspective on these issues and some thoughts on possible future directions.



Lance Haworth joined the Division of Materials Research at NSF as the first Program Director for Materials Research Groups in 1984. He was Program Director for Materials Research Laboratories from 1986-94 and guided the planning and development of the Materials Research Science and Engineering Centers Program. He assumed his current position in 1999. Dr. Haworth was educated at Liverpool University, the University of Alberta, and Yale University. After two years as a postdoctoral research associate in Metallurgy at the University of Illinois at Urbana-Champaign, he joined the faculty of the College of Engineering at Wayne State University. He was also a visiting Staff Scientist and then Vice President with Central Solar Energy Research Corporation and visiting Associate Program Director for Metallurgy at the National Science Foundation. His research interests focused on structure-property relationships in materials, cyclic deformation and fracture, and nondestructive evaluation of materials.

Materials Education in the New Century

***Subra Suresh, Professor
Massachusetts Institute of Technology***

This presentation will provide some views on how the curricula and the character of Materials Science and Engineering departments are likely to evolve in the coming years in light of technological, industrial, academic and social trends. Particular attention will also be devoted to an examination of how rapidly evolving distance-education and communication technologies will influence teaching and research in these departments. Evolving trends in the broadening of coverage in materials education from the classical processing-structure-properties-performance connections in materials to include such hitherto disconnected topics as biology, information technology and systems engineering for materials used in small-volume applications will also be considered.



Subra Suresh is the R. P. Simmons Professor and Head of the Department of Materials Science and Engineering at MIT, and the Coordinating Editor of *Acta Materialia*. Suresh has worked in the areas of micromechanics and nanomechanics of thin films and bulk materials, and mechanical properties. He is the author/coauthor of approximately 200 research articles, coeditor of five books and co-inventor on ten US and international patent applications. He was the first MIT Chair of the Advanced Materials Program of the Singapore-MIT Alliance (SMA); he currently serves as a Program Advisor for SMA.

Dr. Suresh is the recipient of numerous awards from the U.S. Department of Energy, the National Science Foundation, the Ford Foundation, and universities both in the United States and internationally. He has been elected a Fellow of TMS, the American Society of Mechanical Engineers, the American Ceramic Society, and the American Society for Materials International.

**Materials and their Role in Shaping our World
From the Stone Age to the Age of Silicon:
Making Science Accessible to Non-Scientists**

*Stephen L. Sass, Professor
Cornell University*

Materials have enabled revolutionary advances in how we work, fight, live and travel, hence the naming of eras after them – the Stone, Bronze and Iron Ages. My book, The Substance of Civilization: Materials and Human History from the Stone Age to the Age of Silicon, and the course based on it, explores the role of materials in the development of modern industrial Western civilization by embedding technology in a historical context. My course, which is designed to satisfy the science requirement for non-scientists in the Arts College at Cornell, traces the advances made possible by innovations with stone, ceramics, glass, metals and electronic materials, starting with the Stone Age. Connections between critical developments are identified and explored, for example, the relationships among materials, agriculture and written languages in the fourth millennium B.C., and among the Exodus of the Hebrews, the general tumult in the Eastern Mediterranean and the onset of the Iron Age, at the end of the second millennium B.C. The roles of China and Islam in stimulating revolutionary advances in technology are examined. Beautiful works of art illustrate early technologies. Lectures, demonstrations and hands-on laboratory experiments elucidate the origin of the unique properties of materials such as polymers, ceramics, metals and glass.



Stephen L. Sass, Professor of Materials Science and Engineering, joined the Cornell faculty in 1967 after receiving his B. Ch. E. from the City College of New York and his Ph.D. in Materials Science from Northwestern University. He teaches a cross-disciplinary course, "The Substance of Civilization", which was designed to educate non-scientists about science. The course is based on his book with the same title, written to make science and technology accessible to non-scientists, by putting it into a historical context. Enthusiastic about the educational value of engaging undergraduates in high technology research, in 1993 Sass took the lead in developing research opportunities for freshmen. He was the mentor of Cornell Merrill Presidential Scholars, Helen Jean Yoo, in 1995, and Panitam Wanakamol, in 2000; and a Rhodes Scholar, Jessika Trancik, in 1997; and the recipient of the Douglas Whitney '61 Excellence in Teaching Award in the College of Engineering in 1996. He was recently named Stephen H. Weiss Presidential Fellow, a university-wide award at Cornell, for "effective, inspiring and distinguished teaching of undergraduates and outstanding contributions to undergraduate education."

Issues of Teaching Materials Science and Engineering at the College/University Level

***William D. Callister, Adjunct Professor
University of Utah***

This presentation will discuss a number of issues that pertain to the introductory materials science and engineering course taught at the college/university level. Topics to be addressed include the following: (1) the “typical” introductory course; (2) generating student interest; (3) providing relevance to topic discussion; (4) dealing with the breadth versus width dilemma; (5) traditional (i.e., “metals first”) versus integrated organizational approaches; (6) topic coverage decisions; (7) incorporation of a design component; (8) computer/web resources (visualization software packages, web-based testing/homework/self-assessment schemes, web sites, instructor ancillary materials, electronic texts); and (9) textbook issues.



Bill Callister received his B.S. in Ceramic Engineering at the University of Utah and his graduate degrees in Materials Science and Engineering from Stanford University. He did a post doc at the University of Utah, and has had faculty appointments (and taught) at the Montana College of Mineral Science and Technology (Montana Tech), Brigham Young University, and the University of Utah. Since 1995 he has been a full-time author. The first edition of his book *Materials Science and Engineering — An Introduction* was published in 1985. The sixth edition is to be released in July of this year. An alternate (print-electronic hybrid) version, published in December 2000, received a Texty Award given by the Text and Academic Authors Association. Dr. Callister serves on the International Council on Materials Education. He is a member of the American Society for Engineering Education, and was an officer in its Materials Division.

Demonstrations for Materials Education: Making the Nanoworld Comprehensible

*Arthur B. Ellis, Professor
University of Wisconsin-Madison*

Nanotechnology is a frontier of materials science that can capture the imagination of teachers, students, and non-technical audiences. A challenge in communicating themes from nanoscale science and engineering is to make the tools, materials and devices associated with nanotechnology accessible. This presentation will include a number of hands-on demonstrations that show how materials can be imaged and constructed on the nanoscale; and how their electrical, magnetic, mechanical and optical properties can be manipulated to create new materials and devices.



Arthur B. Ellis is Meloche-Bascom Professor of Chemistry at the University of Wisconsin-Madison. He has served on the UW-Madison faculty since 1977. Dr. Ellis's research is in the area of chemical sensors and smart materials. He coordinates the education and outreach activities of the Materials Research Science and Engineering Center on Nanostructured Materials and Interfaces based at UW-Madison, supported by the National Science Foundation. He and his co-workers have developed a variety of instructional materials, including kits, articles, and CDs, for integrating cutting-edge materials research into education and outreach activities. These products are described at <http://www.mrsec.wisc.edu/edetc>

Continuing Education, Lifelong Learning and the Materials Profession

*Frank Mayadas, Program Director
Alfred B. Sloan Foundation*

Materials Science, along with associated design and manufacturing tools and techniques, is at the heart of the revolution that has enabled production of smaller, lighter, cheaper and more reliable products in manufacturing industries. This is true for consumer or industrial products, which are also being introduced into the marketplace at a quickening pace. These trends will continue, and they will force an even closer relationship between industry and academe, as engineers and scientists strive to stay abreast of new developments in the materials fields. This against a backdrop in which societal trends are reducing the discretionary time available for study, course-taking etc. Internet learning provides a partial solution. In this talk, we will discuss what is actually being done today in the use of computers and the internet for technical education and training, and what is likely to happen in the coming years, and why this is important for continuing the kind of progress we have recently seen.

Frank Mayadas is involved in a number of areas for the Sloan Foundation: online education, globalization of industries, industry studies, and career choice in technical fields. He started the Sloan online learning program in 1993. This program (known as Asynchronous Learning Networks or ALN) has had a profound impact in moving the field forward. Members of the Sloan Consortium now number about 80 (55 grantees and 25 others who have joined the Consortium) and today offer about 250 full programs online (degrees and certification). Dr. Mayadas has been a keynote speaker at several distance education conferences and has testified before Congress on web-based learning. Prior to coming to the Sloan Foundation, Dr. Mayadas spent 27 years at the IBM Corporation, where his final responsibility was Vice President, Research Division, Technical Plans and Controls from 1991 to 1992. Dr. Mayadas received a Ph.D. in Applied Physics from Cornell in 1965; and a B.S. from the Colorado School of Mines in 1961. He has over 35 published papers in Systems, Devices, and Solid State Physics, and holds several patents, and awards from IBM. He is a fellow of the IEEE, a member of the American Physical Society, and a past Director of the Society of Engineering Science. He has served as a member of the National Advisory Board for Georgia Tech, and the Advisory Board of the College of Engineering, University of Illinois at Urbana-Champaign. He is currently a member of the Advisory Board for the College of Engineering, University of Florida.

THE CONGRESSIONAL PERSPECTIVE
The Honorable Rush Holt
U.S. House of Representatives

Rush Holt has represented the 12th Congressional District of New Jersey in the U.S. House of Representatives since 1999. Born in West Virginia, he inherited his interest in politics from his parents. His father was the youngest person ever to be elected to the U.S. Senate, at age 29, and his mother was the only woman ever to serve as Secretary of State of West Virginia.

Rep. Holt entered politics after a distinguished career as a physicist. From 1989 until he began his 1998 Congressional campaign, Rep. Holt was Assistant Director of the Princeton Plasma Physics Laboratory, the largest research facility of Princeton University and the largest center for research in alternative energy in New Jersey.

After receiving his B.A. in Physics from Carleton College in Minnesota and his Masters and Ph.D. from NYU, Rep. Holt served as a physics professor at Swarthmore College, a Congressional Science Fellow in the office of then-Rep. Bob Edgar (1982-83), and Acting Chief, Nuclear and Scientific Division, Office of Strategic Forces Analysis, U.S. State Department, before assuming his duties at Princeton.

Recognizing Rep. Holt's standing among his colleagues, he has been appointed to the leadership in Congress as an At-Large Democratic Whip and is a member of the New Democrat Coalition.

Rep. Holt is a tireless advocate for science, engineering and technology funding in Congress. From his positions on the House Budget Committee and the House Committee on Education and the Workforce, he has been instrumental in promoting increased federal investment in research and development, and in supporting math, science and engineering education programs. His work in support of the 21st Century Science Teachers Skills Project has been especially crucial the last two years. From his own experience, Rep. Holt is an outspoken advocate of the Congressional Fellows program, and is currently spearheading an effort to revive the Congressional Office of Technology Assessment to provide members of the House and Senate their own resource for independent analysis of the increasingly complex technical issues of the 21st century.

In addition to all his other accomplishments, Rep. Holt is a five-time winner of the game show "Jeopardy."

POSTER SESSION/DISPLAYS

Materials Societies displays:

The American Ceramic Society, Inc.

ASM International

Materials Research Society

The Minerals, Metals and Materials Society

Enhancement of Materials Science for Manufacturing Program

John M. Rusin, Edmonds Community College

Thomas G. Stoebe, University of Washington

Materials Technology and Science are topics that excite students' interest because the student has everyday, hands-on experience with materials. Thus materials topics are great motivators in any engineering, technology or science course. Materials Science activities can also be used in both academic and vocational courses and thus assist in the transition for technology students across the high school-community college boundary. Edmonds Community College in Lynnwood, WA, has been awarded a three-year, \$1.05 million grant from the National Science Foundation to conduct teacher training in materials science and to establish a materials science resource center for teachers and students.

Outreach and Educational Activities from the University of Kentucky

Janet Lumpp, University of Kentucky

UK's outreach activities include work with elementary and high-school students and teachers. Teacher workshops on electronics are part of KEEP (Kentucky Electronics Education Project) training math and science teachers grades 5-12 in basic circuit fabrication skills. KEEP uses microelectronics as a theme for math and science topics with lesson plans and activities consistent with the Core Content for Assessment and the National Science and Education Standards.

Creating Opportunities for Women in Materials Research

Velda Goldberg, Simmons College

This three-year collaboration between a predominantly undergraduate women's college (Simmons College) and a NSF-supported MRSEC (the Cornell Center for Materials Research (CCMR)) focuses on establishing a collaborative Simmons/Cornell research program that provides opportunities for students to work with faculty on timely research projects, have access to sophisticated instrumentation, and gain related work experience in industrial settings. The project also uses the PUI/MRSEC collaboration to enhance the undergraduate curriculum and encourage new Ph.D.s in materials-related disciplines to consider academic careers at PUIs.

Reaching Elementary School Children: Face to Face with S&T Kits

Velda Goldberg, Simmons College

Face to Face with Science and Technology Kits stress aspects of science and technology found in the everyday world. Kits such as Treating Vascular Disease, Inventing the Pen, or Designing Automobile Brakes illustrate real-world products or processes and help children to view science and technology in the context of their everyday lives. These materials grew out of the NSF-sponsored project, "Industry-School Collaboration: Products, Processes and Technology in the Elementary School Curriculum."

Center for the Science and Engineering of Materials: Education and Outreach
Bob de Groot, Caltech

The outreach efforts of the Caltech Center for the Science and Engineering of Materials (CSEM), an NSF-supported MRSEC, are: (1) the Materials Partnership with California State University at Los Angeles (82% are from underrepresented groups) which includes faculty interactions, collaborative research projects and enhancing experimental facilities; (2) Development of high school science materials and experiences designed to involve Native American students in technical fields; (3) Development of middle-school hands-on science instructional materials; (4) Development and production for public television of a 10-episode educational video series and Web-based curriculum on the role of materials in our lives.

Baby Steps: A Materials Outreach Program to the K-12 Community
Kelly P. Eaton, Lehigh University

An intensive effort at Lehigh University to develop a close relationship with surrounding K-12 schools has been initiated in the Education College in conjunction with the Institute for Metal Forming and the Materials Science Department. As a result of this work a Website "Ask the Engineer" has been constructed for middle school students. Additionally a Website promoting materials science and engineering through information, experiments, and lesson plans was prepared for high school students and teachers. Several interactive classroom presentations have already been made by a graduate student, and a network consisting of about a dozen schools has been created. Future plans include developing collaborative programs and assuring their presence in local schools.

MicroWorlds: Exploring the Structure of Materials
Elizabeth Moxon, Lawrence Berkeley National Laboratory

MicroWorlds is an electronic science magazine on the Web. Written for students in grades 7-12, their teachers, and the general public, it features information about research at the Advanced Light Source, a third-generation synchrotron at LBNL. MicroWorlds has several unique features that sets it apart from many Web educational projects: it features real science, and the scientists, engineers and support staff that make outstanding research happen; it connects key science concepts like electromagnetism and light to the way the concepts are used in everyday life, engineering, and science; the material is integrated with hands-on activities that make the student a participant in the learning process; and it is developed by ALS writers in collaboration with teachers and students. Three teaching modules guide students on a path of scientific discovery as they unravel clues that lead them on an exploration of the world of materials science.

High School Student and Teacher Programs at Penn
Andrew R. McGhie, University of Pennsylvania

The NSF-supported MRSEC at the University of Pennsylvania undertakes a variety of educational outreach programs to all sectors of the community. In this poster we describe five such programs for schools: (1) A Research Experience for Teachers program which brings five high school teachers into the materials lab for six weeks to work with a faculty member; (2) A REU program which brings 25 college juniors into our lab every summer; (3) A four week lecture/lab course for high school juniors in July; (4) A monthly lecture series for teachers; and (5) Lectures to schools via videoconferencing and cable television.

PCCM's Science Curriculum Support and Teacher Training Project

Daniel Steinberg, Princeton University

We have established a program to support hands-on inquiry based science curricula. Teams of teachers and PCCM faculty worked together on six different science kits from Foss and STC. A web site with science content help for teachers using these kits is maintained. Building on this experience, PCCM faculty have developed a unique electricity and magnetism kit for districts that have not yet adopted the commercialized kits. Four faculty conducted an all day training session recently for local lead teachers. Each lead teacher received training in our kits and was provided a kit to bring back to their schools.

Materials Molding Civilization

David Richerson, University of Utah

This class stimulates a greater interest and literacy in science for university students who normally would not have any exposure to science by presenting science through materials and history. The poster will address the content of the course and how other educators might adapt the concept to their own needs, and will address the challenges of getting students to sign up for a class listed under Materials Science and Engineering.

National Educators' Workshop — NEW:Updates

Jim Jacobs, Norfolk State University

As a report of the Organizing Committee for NEW:Update 2002 to be hosted in Silicon Valley, October 13-17, 2002, this poster and display will provide information and useful resources from 17 years of past NEW:Updates including a CD ROM, "Experiments in Materials Science, Engineering and Technology."

Sold State Physics and Materials Science at Augsburg College

J. Ambrose Wolf, Augsburg College

In Fall 2001, Augsburg College approved a new concentration in Solid State Physics. In addition there is also the possibility for students to get hands-on experimental research experience in Augsburg's Solid State Physics Research Laboratory. There also are plans to introduce a bachelor's degree in Materials Science. The new programs go hand-in-hand with interest from both the industrial and the academic side.

Materials Science and Engineering at the University of Maryland

Isabel Lloyd and Kathleen Hart, University of Maryland

We will feature information both from the Department and our ASM/TMS and ACeRS student branch. The student display will emphasize professional development activities (local society meetings, annual meetings, guest speaker service (outreach and service to the department and university). The Department display will feature outreach materials and activities and our undergraduate laboratory activities including both our laboratory sequence and "studios" in other classes. It will also highlight the variety of undergraduate research activities and options.

Teaching Undergraduates Results from Recent Research as Part of a Lab

Luz J. Martinez-Miranda, University of Maryland

We have integrated recent results in research in the curriculum of the University of Maryland, while leaving the basics untouched. This allows us to teach the fundamental laws and to show the students how these help us to answer questions that are of importance today. This can be done as part of a laboratory class and as part

of a class. In the laboratory classes, we emphasize what is measured (the main topic), then measure samples recently in the literature. These are then related to the manner the samples have been grown, and how they have been processed. Occasionally, we give students a five-point question that aims at relating their results and methodology with a recent problem in the literature.

The University of Maryland's MRSEC's Education Outreach

Jennifer Stott, University of Maryland

The Maryland MRSEC is committed to introducing, stimulating interest in, and teaching materials science to students and the community in an effort to inspire appreciation for science and to help shape the talent pool for the high tech workforce. Of equal importance, the Center's education outreach activities address national concerns about science learning. Current outreach activities include the Maryland MRSEC Research Experience for Undergraduates; coordination with local homeschooling groups to provide labs, lectures, and science fairs; development and implementation of materials science activities including lab tours, demonstrations and hands-on labs at pre-college institutions; coordination with the MRSEC K-12 Fellowship Program; participation in community events such as Physics Day at 6-Flags Amusement Park and Maryland Day; and augmentation of existing Maryland programs including Physics is Phun Program and the Department of Physics Summer Girls' Program.

The Federation of Materials Societies (FMS) is an umbrella organization whose members represent the professional societies, universities and National Research Council organizations which are involved with materials science, engineering, and technology. FMS constituent societies have nearly one million members. FMS serves as a clearinghouse where materials professionals can share best practices, current activities, and the opportunities and problems cutting across specific materials concerns and materials societies. Through meetings and its Biennial Conferences on National Materials Policy — of which “Materials Education: Opportunities Over a Lifetime” is the 17th — FMS provides a forum where policy makers and the materials community meet to discuss issues, develop policy and recommend actions.

The University Materials Council (UMC) is composed of Department Heads, Chairpersons, Directors and group leaders from academic programs in the materials field in U.S. and Canadian universities. It serves as a forum to share best practices in areas such as student recruitment, and discuss issues such as emerging research areas, ideas for curricular improvements, ABET accreditation, patent right policies in universities, implications of the latest material related studies, and the health of research funding for Materials Science and Engineering.