Young innovators
and industry leaders
finding solutions to
tomorrow’s challenges.
The chemical industry faces many challenges and opportunities at the start of the 21st century, including the rapid emergence of new fields and the maturing of existing methods for research and manufacturing. Only a renewed focus on innovation will harness promising technologies and spur industry growth.

To promote early career innovation, the Chemical Heritage Foundation and the Society of Chemical Industry America International Group jointly organize an annual Innovation Day, consisting of the Warren G. Schlinger Symposium, the SCI Gordon E. Moore Medal, and the SCI Perkin Medal. The Schlinger Symposium brings together promising young scientists and technology leaders from across the chemical industries with a focus on frontiers of chemical R&D. Plenary and breakout sessions are oriented to areas where the chemical industry interfaces with other emerging business sectors. In combination with the medal ceremonies, the Schlinger Symposium offers participants the opportunity to learn about cutting-edge science and technology, exchange ideas with peer industrial researchers and entrepreneurs, and prepare to be innovation leaders.
17 September

6:00–7:00 p.m. Reception and Dinner
Jacobs Reading Room

7:00–9:00 p.m. Dinner and Address
Ullyot Meeting Hall
“Using Fabrication Technologies from the Microelectronics Industry to Address Unmet Needs in Drug Delivery”
Joseph M. DeSimone, Chancellor’s Eminent Professor of Chemistry, University of North Carolina at Chapel Hill

18 September

8:00 a.m. Continental Breakfast
Ullyot Meeting Hall

8:30–9:25 a.m. Schlinger Symposium
Opening Plenary
Ullyot Meeting Hall
“Energy Solutions for a Fossil Fuel–Deprived Future”
Rakesh Agrawal, Winthrop E. Stone Distinguished Professor of Chemical Engineering, Purdue University

9:30–10:40 a.m. Breakout Sessions: Presentations

**Sustainable Chemistry and Engineering**
Moderator: Gary Kozerski, Health and Environmental Sciences, Dow Corning Corporation
Speakers: Eric J. Beckman, Chief Scientific Officer, Cohera Medical
D. Tyler McQuade, Associate Professor, Department of Chemistry and Biochemistry, Florida State University

**Electronic Materials**
Moderator: Susan Fitzwater, Scientist, Computational Chemistry Group, Rohm and Haas Company
Speakers: Nick Pugliano, Research Scientist, Rohm and Haas Electronic Materials
Rao Varanasi, Senior Technical Staff, IBM Corporation

**Chemistry of Energy Sources**
Moderator: Thomas Upton, Research Manager, ExxonMobil Chemical Company
Speakers: Rakesh Agrawal, Winthrop E. Stone Distinguished Professor of Chemical Engineering, Purdue University
Jeffrey S. Beck, Manager, Corporate Strategic Research, ExxonMobil Research and Engineering Company
Health Materials
Moderator: William Fraser, Senior Director, Global Technology Alliances, The Dow Chemical Company
Speakers: Leonard J. Buckley, Head of Materials Chemistry Research, Naval Research Laboratory
Alan S. Rudolph, Chief Executive Officer, Adlyfe

Emerging Global Economies
Moderator: James Alder, Vice President, Operations and Technical, Celanese Corporation
Speakers: Yuguo Ma, Vice Dean, College of Chemistry and Molecular Engineering, Peking University
Zhengang Xu, Director and Research Professor, China Coal Research Institute, Beijing Research Institute of Coal Chemistry

10:45–11:40 a.m. Morning Poster Session
Moderator: Ryan R. Dirkx, Vice President of R&D, Arkema
Dow Public Square

11:45–1:45 p.m. SCI Gordon E. Moore Medal Ceremony and Luncheon
Gordon E. Moore Medal Lecture
Edmund M. Carnahan, Scientist, The Dow Chemical Company
Ullyot Meeting Hall

2:00–3:10 p.m. Breakout Sessions: Discussion
Same topics as morning breakout sessions

3:15–3:55 p.m. Afternoon Poster Session
Moderator: Ryan R. Dirkx, Vice President of R&D, Arkema
Dow Public Square

4:00–5:00 p.m. Schlinger Symposium Closing Plenary: Executive Roundtable
Ullyot Meeting Hall
Moderator: Arthur Daemmrich, Assistant Professor, Harvard Business School
Speakers: Bill Greggs, Retired Director of Global Sustainability, Procter and Gamble Company
Catherine T. Hunt, Leader, Technology Partnerships, Rohm and Haas Company
Scott A. Mobley, Research Fellow, Sustainability and Environment R&D, The Clorox Company
Anne Wallin, Director of Sustainable Chemistry, The Dow Chemical Company

6:00 p.m. SCI Perkin Medal Ceremony & Dinner
Hyatt Regency Hotel, Penn’s Landing
William Henry Perkin Medal Lecture
Ian Shankland, Director of Technology, Fluorine Products, Honeywell International
17 September

**After-Dinner Talk**

“Using Fabrication Technologies from the Microelectronics Industry to Address Unmet Needs in Drug Delivery”

**Speaker:** Joseph M. DeSimone  
Chancellor’s Eminent Professor of Chemistry, University of North Carolina at Chapel Hill

As they develop the next generation of drug-delivery systems with programmable multifunctional capability, scientists strive to translate promising molecular discoveries into benefits for patients. This presentation will describe PRINT (particle replication in non-wetting templates), a remarkable method of top-down particle fabrication that has its roots in the microelectronics industry. PRINT is a high-resolution molding technique that allows the fabrication of precisely defined nanoparticles with control over size, shape, deformability, and surface chemistry.

18 September

**Opening Plenary**

“Energy Solutions for a Fossil Fuel–Deprived Future”

**Speaker:** Rakesh Agrawal  
Winthrop E. Stone Distinguished Professor of Chemical Engineering, Purdue University

The recent rise in oil prices reminds us that the world’s supply of fossil fuels is finite. Alternate primary energy sources must be identified and developed to ensure the stability of the future world economy. This presentation will describe the current landscape of solar, wind, nuclear, and biomass power. It will also review the particular challenges and solutions needed for various end uses of energy. Finally, some novel solutions to sustain the current transportation sector will be presented. These solutions provide a feasible framework for a fossil fuel–free world and offer exciting opportunities for chemists and chemical engineers to contribute to the grand challenge of energy.

**Closing Plenary**

**Executive Roundtable**

**Moderator:** Arthur Daemmrich  
Assistant Professor, Harvard Business School

**Panelists:** Bill Greggs, Retired Director of Global Sustainability, Procter and Gamble Company  
Catherine T. Hunt, Leader, Technology Partnerships, Rohm and Haas Company  
Scott A. Mobley, Research Fellow, Sustainability and Environment R&D, The Clorox Company  
Anne Wallin, Director of Sustainable Chemistry, The Dow Chemical Company

The environmental regulatory picture is shifting dramatically from the aggressive federal rulemaking in the 1980s and 1990s to “de facto regulation” by consumers and major marketers. Big Box retailers have implemented their own sustainability initiatives, putting pressure on the chemical supply chain to develop environmentally friendly products. Executives along that supply chain will offer insights into future trends and suggest innovative solutions.
About the Breakout Sessions

Each breakout will explore real-world challenges that can be solved through new materials, processes, or products from R&D labs in the chemical industry. The breakouts will seek to connect industry’s innovation push to global market pull. Each will focus on a specific problem, with speakers presenting solutions based on their expertise and discussion groups dividing up to explore interdisciplinary methods for solving problems. Attendees can participate in one of these sessions.

Sustainable Chemistry and Engineering

As sustainability becomes an economic necessity, fundamentally new chemical transformations must be developed to minimize environmental impact, using green and sustainable chemistry and engineering. Following the principle of “better to prevent waste than to clean up after it,” researchers need to replace harmful solvents and improve catalytic selectivity and efficiency in chemical reactions that also provide cost savings. Presentations and discussion in this session will focus on such topics as removing sulfur from fuels, CO2 sequestration, cleaner aqueous processes, new membranes for separation and filtration, and fluorocarbon chemistry.
Electronic Materials

In some parts of the electronics sector, technical limits on materials engineering threaten to impede the development of new, faster, cheaper, more efficient products; while in other parts of the sector, novel materials are making possible dramatic new applications for untapped markets. Topics at the forefront of discussion include using miniaturized fuel cells to replace lithium-ion batteries; new alternatives or supplements to silicon; novel ceramics for heat management; and the use of techniques from micro-electronics manufacturing for biomedical applications. Presentations and discussion in this session will focus on new developments in semiconductor processing and the challenges of innovating into new markets.

Chemistry of Energy Sources

With fossil fuel production at or near its peak, the chemical industry is intensifying its search for alternative energy sources that are abundant, renewable, and environmentally friendly. Methods that show promise include fuel cells, hydrogen fuel, conventional and nanotechnology-enhanced solar systems, wind turbines, methane hydrate from the sea floor, and safer, less wasteful nuclear power. Meanwhile innovations that minimize waste from generation to transmission to consumption lead to more efficient energy use. Presentations and discussion in this session will focus on the innovative materials essential for new energy sources, especially solar energy, as well as business changes needed to alter our current energy infrastructure.
Health Materials

Recent innovations in biomedicine and hybrid inorganic and organic materials offer great potential for new markets for the chemical industry. But very old innovations, developed by biological organisms themselves, are often still superior to commercial products. As they learn more about how biochemistry works, chemical firms are beginning to understand how to mimic and even improve on biology. Bio-inspired materials depend on advanced characterization of biological materials, novel synthesis based on that biology, and sophisticated understanding of an extraordinarily complex health-care market. Presentations and discussion in this session will explore ways in which chemical firms can use their manufacturing and R&D expertise to develop advanced health materials.

Emerging Global Economies

Globalization and the rapid growth of emerging economies, such as China and India, present dramatic prospects for growth and diversification into new markets and new sites of innovation. As chemical companies seek to take advantage of this growth, they also struggle with such issues as industry consolidation, changing supply chain patterns, regulatory compliance, and environmental concerns that present different challenges in different regional settings. Presentations and discussion in this session will focus on obstacles and opportunities in setting up an R&D operation in emerging economies and managing a transnational research and manufacturing base.
**About the Speakers and Moderators**

**Rakesh Agrawal** is the Winthrop E. Stone Distinguished Professor of Chemical Engineering at Purdue University. Previously Agrawal was Air Products Fellow at Air Products and Chemicals. The holder or coholder of 116 U.S. patents and nearly 500 non-U.S. patents, Agrawal has made many contributions to the development of gas liquefaction and cryogenic separation technologies. He also has 64 published papers in the areas of gas separations, membranes, distillation and other separation and liquefaction processes. Agrawal has received numerous awards, including the Presidential Citation for Outstanding Achievement Award from the University of Delaware, the American Institute of Chemical Engineers’s award for Excellence in Industrial Gases Technology and its Separations Division’s Clarence G. Gerhold Award, and the Institute of Refrigeration’s J & E Hall Gold Medal. He was elected to the National Academy of Engineering in 2002. Agrawal holds three degrees in chemical engineering: a bachelor’s degree from the Indian Institute of Technology at Kanpur, a master’s from the University of Delaware, and a doctorate from the Massachusetts Institute of Technology.

**James Alder** began his career at Celanese as a process engineer. In 1981 he was promoted to R&D group leader in economics and design, and in 1984 he became R&D manager for chemical engineering. Alder was named project manager for the start-up biotechnology company Codon in 1988, president of BHC Company (a joint venture with Boots Pharmaceuticals) in 1994, and business director for Celanese generic pharmaceuticals in 1997. He became vice president of operations and technology at Celanese in 2000. Alder is currently responsible for Celanese’s sixteen global chemical and emulsion sites; a start-up site in Nanjing, China; and a joint venture in Saudi Arabia. Alder received a B.S. in chemical engineering from the Massachusetts Institute of Technology.

**Jeffrey S. Beck** is manager, corporate strategic research, ExxonMobil Research & Engineering Company. In the early 1990s his research focused on catalytic applications of zeolite catalysts. Since 2000 Beck has held various positions in both refining operations and R&D management. Beck has received numerous awards for his work including the 1994 Donald W. Breck Award, the 2003 Thomas Alva Edison Award, the 2007 American Chemical Society Heroes of Chemistry Award, and the 2009 Eugene S. Houdry Award in Applied Catalysis. He holds 59 U.S. patents and has published nearly 50 scientific articles. Beck received a B.S. in chemistry from the State University of New York at Binghamton in 1984 and a Ph.D. in chemistry from the University of Pennsylvania in 1989.
Leonard J. Buckley is manager of the Materials Chemistry Branch at the Naval Research Laboratory, where he directs and manages research scientists and engineers performing innovative R&D in chemistry and physics for the U.S. Department of Defense. Buckley has championed efforts in bio-inspired optics, self-decontaminating and self-cleaning surfaces, chemical sensing, high-temperature polymers, and photovoltaic paints. He has also provided technical expertise and analysis for the Smithsonian Institution on the restoration of the Star-Spangled Banner, the flag that inspired the American national anthem.

Buckley has authored more than 150 publications and reports and holds 9 patents. Buckley’s awards and honors include a Navy-sponsored Award for Scientific Achievement, an Alan Berman Outstanding Publication Award from the Naval Research Laboratory, and the Secretary of Defense Medal for Exceptional Civilian Service. He earned a bachelor’s degree in materials engineering from Drexel University. He holds a master’s degree in polymer science and a doctorate in materials science and engineering from the Massachusetts Institute of Technology.

Arthur Daemmrich is an assistant professor in business, government, and international economy at Harvard Business School and a senior research fellow at the Chemical Heritage Foundation. His research and teaching focus on business in regulated environments and international comparative analysis of risk and regulation. At Harvard Business School he also plays an active role in the interdisciplinary Healthcare Initiative, advancing scholarship and developing applied lessons for the business of creating and delivering health services and health-related technologies.

Daemmrich was previously the director of the Center for Contemporary History and Policy at the Chemical Heritage Foundation. He earned a Ph.D. in science and technology studies from Cornell University and has held fellowships at the Social Science Research Council/Berlin Program for Advanced German and European Studies, the Kennedy School of Government at Harvard University, and the Chemical Heritage Foundation. He has published widely on pharmaceutical and chemical regulation, biotechnology business and policy, innovation, and history of science.

Joseph M. DeSimone is the William R. Kenan, Jr., Distinguished Professor of Chemistry and director of the Institute for Advanced Materials, Nanoscience, and Technology at the University of North Carolina. He is also director of the National Science Foundation Science and Technology Center for Environmentally Responsible Solvents and Processes. In addition DeSimone serves as a professor of chemical engineering at North Carolina State University.

Cofounder of MICELL Technologies and Bioabsorbable Vascular Solutions, DeSimone is listed as inventor on 83 patents. He has authored or contributed to over 180 publications. DeSimone’s numerous awards include the Wallace H. Carothers Award, the Ernst and Young Entrepreneur of the Year in Technology Award, and the Esselen Award. He earned a B.S. in chemistry from Ursinus College and a Ph.D. in chemistry from Virginia Polytechnic Institute and State University.
Ryan R. Dirkx is the vice president of R&D at Arkema. A 20-year veteran of Arkema and its predecessor companies, Dirkx has directed global R&D organizations for several Arkema businesses, most recently those within the Technical Polymers and Altuglas International divisions. He has also held business and market management positions within the Specialty Chemicals Division.

Dirkx has a Ph.D. in solid state science from the Pennsylvania State University and a B.S. in ceramic engineering from the New York State College of Ceramics at Alfred University. He holds a number of patents worldwide, and he is active within the Industrial Research Institute.

Susan Fitzwater is a senior research fellow at Rohm and Haas Company. Her specialty is mathematical modeling of chemistry, physical properties, and chemical processes. Other areas of interest and expertise include chemistry of radical polymerization, polymer solubility and miscibility, light scattering by small particles, optical properties, and color.

Fitzwater received a B.A. in chemistry from Oberlin College and a Ph.D. in physical chemistry from the University of Michigan.

William Fraser is senior director of global technology alliances for The Dow Chemical Company’s Core R&D operations. He joined Dow in 2001 through the Dow–Union Carbide merger. At Union Carbide Fraser was executive vice president of R&D and engineering for Univation Technologies, a joint venture with ExxonMobil Chemicals. Univation Technologies serves as a discovery, development, and licensing company for world-scale polyethylene manufacturing.

Fraser was involved with Carbide’s development of UNIPOL Process Technology for linear low-density polyethylene (LLDPE) and the launch and building of the UNIPOL licensing franchise and the commercialization of LLDPE film technology. In Carbide’s silicones business, he led R&D efforts in the leveraging of Si technologies in plastics applications and directed a business initiative in plastics additives systems. Fraser earned a B.S. in chemical engineering from Tufts University and a Ph.D. in chemical engineering from Princeton University.

Yuguo Ma is vice dean of the College of Chemistry and Molecular Engineering, Peking University. His research interests include supramolecular chemistry, molecular recognition and self-assembly, organic functional materials based on dendrimers, organometallic chemistry, and catalytic polymerization of olefins.

Ma received bachelor’s and master’s degrees from the College of Chemistry at Peking University. He received a Ph.D. in organic/polymer chemistry from the University of Illinois at Urbana Champaign.

D. Tyler McQuade is an associate professor of chemistry and biochemistry at Florida State University, where he leads a team of researchers striving to create more efficient chemistry using multicatalyst systems.

McQuade's honors include the Dreyfus, 3M, Rohm and Haas, Beckman, and NYSTAR young investigator awards. In 2004 he was selected as one of 100 remarkable innovators under the age of 35 by the Massachusetts Institute of Technology's Technology Review. McQuade received a B.S. in chemistry and a B.S. in biology from the University of California, Irvine, and a Ph.D. in chemistry from the University of Wisconsin-Madison.
Thomas Upton is manager of research for ExxonMobil Chemical Company. In this position he is responsible for new technology development, including breakthrough research, for each of the company’s 11 businesses. Upton was part of the technical staff in the Exxon Research and Engineering Corporate Research Sciences Laboratory from 1980 to 1991. His research was on catalysis by metal surfaces and small particles, and he published more than 40 papers in this area.

From 1991 to 1996 Upton was North American product development Manager for aviation and distillate fuels and motor gasoline. In 1996 he became downstream laboratory director and led longer-range research in fuels, lubes, and refinery processes. In 1999 he moved to Exxon Chemical Company, where he was technology planning manager and butyl technology manager. Upton obtained a B.S. in chemistry from Stanford and a Ph.D. in theoretical chemistry from the California Institute of Technology.

Anne Wallin is the director of sustainable chemistry for The Dow Chemical Company. In this role, she leads the 2015 Sustainable Chemistry Goal project team, which is integrating sustainable chemistry across all disciplines, functions, and businesses in Dow. She also leads the company’s Life Cycle Assessment Expert Group. Wallin began her career at Dow in R&D as a process chemist in the Agricultural Chemicals department. After several years, she moved to Environment, Health, and Safety, where she held a variety of roles in both R&D and manufacturing. She joined Dow Public Affairs in 1999.

A coauthor of several publications and patents, Wallin is a member of the External Advisory Board for the Graham Environmental Sustainability Institute at the University of Michigan. She holds a bachelor’s degree in chemistry from Carleton College and a doctorate in organic chemistry from the University of Illinois at Urbana-Champaign.

Zhengang Xu is a research professor and the director of the Beijing Research Institute of Coal Chemistry, China Coal Research Institute. In this position he is in charge of engineering R&D and technical consultation of clean coal technologies such as coal gasification and poly-generation of fuels, power, and chemical products.

Xu received a Ph.D. in chemical technology from the China Coal Research Institute. His area of academic specialization is coal chemistry and coal conversion.

Edmund M. Carnahan will receive the 2008 SCI Gordon E. Moore Medal for his pioneering contributions and leadership in the breakthrough discovery of a route for the catalytic synthesis of olefin-block copolymers. This platform technology employs the ingenious use of multiple-catalyst moieties and companion chain-shuttling reagents to modulate the transfer of growing polymer chains from one active catalyst site to another. This elegant chemistry allows, for the first time, production of unique polyolefin-block copolymers at commercial scale and practical economics.

Carnahan is a scientist at The Dow Chemical Company in Freeport, Texas. He joined Dow in 1996, and his initial research focused on aspects of polyolefin catalysis for solution, slurry, and gas-phase processes. In 2006 he became the scientific leader for the Catalyst and Chemistry group and is responsible for setting the overall technical strategy and vision within the group.

Catalytic chain-shuttling polymerization has been scaled-up and commercially implemented at Dow in record time to produce a highly versatile new product line that will be sold as INFUSE Olefin Block Copolymers. These innovative polymers are comprised of high-crystallinity (hard-segment) blocks connected to near-amorphous (soft-segment) blocks. The copolymers exhibit a very broad range of properties and heretofore unseen profiles of end-use functionality. This unique polymerization process enables INFUSE to retain its elasticity in high-temperature conditions for applications such as injection molding and bottle-cap lining. Recently Dow has announced the commercial availability of INFUSE for liquid packaging, adhesives, health and hygiene, and soft-touch applications.

Carnahan is the author of numerous articles in leading journals and holds 12 patents, with 19 additional patents pending. He holds a B.A. in chemistry from Cornell University and a Ph.D. in inorganic chemistry from the Massachusetts Institute of Technology.
The Society of Chemical Industry established the SCI Gordon E. Moore Medal as the premier recognition for early career success in innovation, as reflected in both market impact and improvement to the quality of life. By highlighting extraordinary individuals and their work, the SCI aims to promote public understanding of research and development in the modern chemical industries, enhance the interest of students in applied chemistry by providing role models, and emphasize the role of creative research in the global economy.

The award recognizes a significant innovation made by an industrial scientist early in his or her career and is given annually during Innovation Day.

**Past SCI Gordon E. Moore Medalists:**
- George Barclay (2004)
- Jeffrey John Hale (2005)
- Jonathan M. McConnachie (2006)
- Paul A. Sagel (2007)

**About the SCI Gordon E. Moore Medal**

The symposium is named in honor of Warren G. Schlinger, a Ph.D. graduate of Caltech with a distinguished career in industrial innovation. In Schlinger’s 35 years at Texaco, he was a pioneer in gasification technologies now widely used for production of hydrogen, other chemicals, and power. Among other benchmarks, Schlinger had over 60 U.S. patents issued during his career. He has been honored with the AIChE Technical Achievement Award, the Chemical Engineering Practice Award, and by the National Academy of Engineering.
The Chemical Heritage Foundation serves the community of the chemical and molecular sciences, and the wider public, by treasuring the past, educating the present, and inspiring the future. CHF carries out a program of outreach and interpretation in order to advance an understanding of the role of the chemical and molecular sciences, technologies, and industries in shaping society; maintains a world-class collection of materials that document the history and heritage of the chemical and molecular sciences, technologies, and industries; and encourages research in its collections. CHF’s Center for Contemporary History and Policy conducts research and holds conferences in order to bring long-range perspectives to bear on innovation, risk, and industrial research.

The Society of Chemical Industry is an international association that seeks to further the application of chemistry and related sciences for the public benefit. Headquartered in London since its founding in 1881, SCI has sections in the United States, Canada, Australia, and Ireland. Established in 1894, the American Section was the first society in the United States to bring together scientists and business leaders in industrial chemistry. The Perkin Medal was established in 1906 to commemorate the 50th anniversary of the discovery of mauveine. Past recipients include Nobel laureates Glenn T. Seaborg, Carl S. Marvel, and Herbert C. Brown; Donald F. Othmer, chemical engineer; Stephanie Kwolek, inventor of Kevlar; Paul S. Anderson, medicinal chemist, and Gordon E. Moore, the founder of Intel.