100 Chemical Engineers of the Modern Era

Now in its second century, the chemical engineering profession — like the Institute — has been shaped and sustained by the achievements, leadership and imagination of thousands of engineers. This month, AIChE's Centennial Celebration Committee recognizes a few "Modern Era" chemical engineers — those who attained the equivalent of AIChE Senior Member status after World War II — most of whom are still in practice and guiding the profession into the new century.

ACHIEVEMENT

Andreas Acrivos

Recognized for key suspension mechanics developments relevant to oil production and semiconductor manufacture. Recipient of U.S. National Medal of Science.

Rutherford Aris

1929–2005

Recognized for controlling reaction runaways; oscillating reactor studies of potentially explosive chemical processes.

Albert L. Babb

Recognized for development of portable, fail-safe, single-patient dialysis machine; medical applications of nuclear energy. One of only eight living individuals elected to all three National Academies.

James E. Bailey

1944–2001

Recognized as father of modern bioprocess engineering.

Mark Barteau

Recognized for work in surface science, metal and metal-oxide catalysis; surfaces and catalyst spectroscopic characterization; computational chemistry techniques.

Alexis T. Bell

Recognized for work in catalytic phenomena, reaction mechanisms and catalytic site identification and description; applied cutting-edge spectroscopy.

R. Byron Bird

Recognized for establishing "transport phenomena" as a distinct discipline.

Michel Boudart

Recognized for fundamental catalytic research: kinetics, deactivation, olefin polymerization, dispersed metals.

Robert A. Brown

Recognized for modeling of materials (*e.g.*, semiconductor) processing phenomena. Provost, MIT. President, Boston Univ.

Nai Y. Chen

Recognized for discovering shape-selective zeolitic catalytic-cracking catalyst.

Stuart W. Churchill

Recognized as pioneer in reaction engineering and fluid dynamics fundamentals. Participant in launching of Chemical Heritage Foundation. AIChE President, 1966.

Donald A. Dahlstrom

1920–2005

Recognized for work in mineral liquid-solids separation processes for recovery and waste disposal. Founding chairman, AIChE Environmental Division. AIChE President, 1964.

Mark E. Davis

Recognized for pioneering work in new catalytic materials and chemical sensors using ceramics and electronic materials. Recipient of the National Science Foundation's Alan T. Waterman Award.

Joseph M. DeSimone

Recognized for work in liquid CO_2 for pharmaceutical extraction and groundwater remediation; imprint lithography materials for shape-specific biomaterials.

Pablo G. Debenedetti

Recognized for work on structure, thermodynamics and statistical mechanics of fluid mixtures and glasses; preservation and formulation of pharmaceutical products in water-soluble glassy matrices.

Abraham E. Dukler

1925–1994

Recognized for systematic studies of two-phase flow regimes. Sparked formation and was first chair of AIChE's Design Institute for Multi-phase Processing (DIMP).

David A. Edwards

Recognized for therapeutic aerosol drug delivery. Co-founder, Advanced Inhalation Research. Formed Medicine in Need to mitigate spread of tuberculosis and avian influenza.

Larry B. Evans

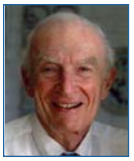
Recognized for pioneering development and application of integrated systems for chemical process modeling, simulation and optimization. Founder, Aspen Technology, Inc. AIChE President, 2007.

James R. Fair

Recognized for work on distillation contacting mechanisms; adsorbent regeneration kinetics; catalytic distillation; high-efficiency packings.

Liang S. Fan

Recognized for work in particulate reaction engineering. Invented "OSCAR" for carbonation ash reactivation, and "CARBONOX," for NOx reduction.



Sheldon Friedlander

1927–2007

Recognized for pioneering work in aerosol science, fine-particle engineering, nanoparticle aggregates, and environmental impacts.

Elmer Gaden

Recognized as a father of biochemical engineering. Established bioengineering and bioprocessing curricula at Columbia Univ.

Haren Gandhi

Recognized for pioneering research in three-way catalysts for control of automobile emissions; commercialization of Pd/Rh and Pd-only; alternative fuels catalysts; oxygen storage components.

George Georgiou

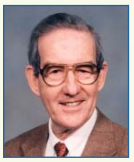
Recognized for developing protein-based inhaled anthrax therapies; discovered proteins to treat autoimmune diseases such as rheumatoid arthritis.

Ignacio E. Grossmann

Recognized for mixed integer nonlinear programming (MINLP); model formulation and solution for process design and operation.

Keith E. Gubbins

Recognized for work in modeling nano-porous material fabrication; effects of confinement on selective adsorption from mixtures, phase transitions; pioneering computer simulations.



Thomas J. Hanratty

Recognized for work on turbulence, wave generation, two-phase flow, and computer simulation of turbulence; fundamental studies of wave generation, hydrodynamic stability, and particle mixing.

L. Louis Hegedus

Recognized for work in catalysts and catalytic reactor design and performance; catalytic converter development.

Arthur E. Humphrey

Recognized for design, monitoring and control of bioprocesses. AIChE President, 1991.

James D. Idol

Recognized as inventor of ammoxidation processes and catalysts; patented process for the manufacture of acrylonitrile.

Marvin M. Johnson

Discovered metals passivation for catalytic cracking using antimony compounds; viscosity index improvers.

Frederick J. Karol

Recognized for pioneering organotransition metal catalyst chemistry for Unipol fluidized reactors; low-density polyethylene resins, polyethylene process.

George E. Keller II

Recognized for pioneering work in chemical separations, particularly for modernizing pressure swing adsorption (PSA) for use in medical oxygen generation.

Chaitan Khosla

Recognized for work on modification of genes involved in microbial production of polyketides; drugs to fight infectious diseases. Recipient of the National Science Foundation's Alan T. Waterman Award.

Sangtae Kim

Recognized for pharmaceutical radio frequency identification using fluidic self-assembly; suspension rheology computational methods.

Robert Langer

Recognized for inventing controlled drug-release systems (the "patch"); creative work in developing transdermal ultra-

sound drug delivery and growing engineered muscle tissue and engineered blood vessels. Youngest person ever elected to all three American National Academies.

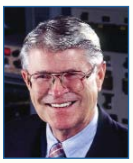
Norman N. Li

Inventor and developer of liquid membranes.

Arthur B. Metzner

1927–2006

Recognized for work in turbulent/porous media flows, mixing non-Newtonian fluids. Service to AIChE.



John J. Mooney

Recognized as co-inventor of automotive catalytic converter. President, Engelhard Industries. President, Environmental and Energy Technology Policy Institute.

Julio M. Ottino

Recognized for modeling of complex chaotic systems; mixing; three-phase dispersions; granular materials.

John Prausnitz

Recognized as pioneer in adapting molecular science to process design; pioneered molecular thermodynamics for biotechnology. Recipient of National Medal of Science.

Edward J. Rosinski

1921–2000

Recognized as co-inventor (with Charles Planck) of zeolite catalytic-cracking catalyst; 76 U.S. patents, many on zeolites.

Charles N. Satterfield

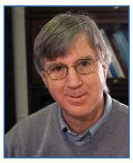
Recognized for work in chemical reaction engineering, including trickle beds, slurry reactors, heterogeneous catalysis; Fischer-Tropsch synthesis, catalytic hydrotreating.

William R. Schowalter

Recognized for modeling dynamic behavior of fluids composed of large molecules, deformable particles, or colloidal matter.

John H. Seinfeld

Recognized for developing first models describing urban air quality; one of first to describe linkage between urban ozone and global climate change.



Michael L. Shuler

Recognized as early pioneer in simulating molecular and cellular biological systems and developing bioreactor and analog cell culture systems. Co-authored "Bioprocess Engineering: Basic Concepts."

John H. Sinfelt

Recognized for work in catalyst fundamentals; invented bimetallic Pt-Ir powerforming catalyst.

Herbert L. Toor

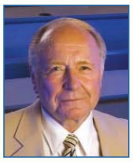
Recognized for seminal reactive multicomponent mixing research. Toor Test is industry standard for assessing relative mixing and reaction rates.

Larry F. Thompson

Recognized for inventing polymeric resist materials for making chromium masks. Managed development of 193-nm deep UV lithography.

Klaus D. Timmerhaus

Recognized for cryogenics science and practice. AIChE President, 1976.



Walter J. Weber

Recognized for water resource management; membrane separations; free-radical oxidation; organic macromolecules in aquatic systems; supercritical water.

Vern Weekman

Recognized for chemical reaction engineering modeling, particularly catalytic cracking. AIChE President, 1998.

Fred Zenz

Recognized for pioneering fluidization work. Founder, Particulate Solids Research Institute. Book: "Fluidization and Fluid-Particle Systems."

LEADERSHIP

Thomas Baron

1921–1985

Recognized for leadership at Shell Emeryville — extractive technologies, basic chemical and engineering exploratory work, and process R&D.

Barry C. Buckland

Recognized for microbial fermentation research on vaccine quality; developed processes for chickenpox, Haemophilus influenzae type b (HIB) and hepatitis.

Paul M. Cook

Founder, Raychem, Diva Systems. Established SRI International Radiation Engineering Laboratory. Chairman, Sarnoff Board.

Michael F. Doherty

Recognized for work on synthesis of non-ideal separations; crystallization of organic materials. President, CACHE Corp.

Elisabeth Drake

Recognized for leadership of MIT Energy Lab; environmental sustainability and research competition.

Ed Ekholm

1925–2006

Recognized for work at Bechtel and Fisher Tropsch; butyl rubber, ethylene. Founder, Pace Engineering.

Alice Gast

President, Lehigh Univ.; Vice President, Associate Provost, MIT Research. Work in colloid and surface phenomena.

Sheldon Isakoff

Recognized for industrial chemical engineering research; unsteady-state operations control. Early Chemical Heritage Foundation Board Chairman. AIChE President, 1990.

Klavs Jensen

Recognized for work in chemical and biological microsystems; materials synthesis and processing; multi-scale simulation.

William H. Joyce

Chairman, CEO, Union Carbide; CEO, Nalco. Recipient of National Medal of Technology and Plastics Academy's Industry Achievement Award.

C. Judson King

Recognized for work in reversible chemical complexation for polar organics recovery solution. Vice Provost, Univ. of California, Berkeley. Founder, AIChE Separations Division.

Gerald D. Laubach

Recognized for developing and commercializing anti-arthritic and anti-diabetic drugs. President, Pfizer.

Henry Linden

Recognized for work on global climate change; industrial ecology; energy resource assessment; clean coal technologies. Director, IIT Energy Power Center.

James Mathis

Recognized for chemical research. Vice President, Exxon Science and Technology. Founder, AIChE Management Division.

John R. McWhirter

Responsible for the invention, development and commercialization of the Unox System for secondary wastewater treatment by Union Carbide.

Thomas O. Mensah

Recognized for fiber optics development and applications; high-vacuum radio frequency sputtering. Founder, Superconductivity Technology.

James Y. Oldshue

1925–2007

Recognized for work in fluid mixing technology. Chair, AIChE North American Mixing Forum. AIChE President, 1979.

Stanley I. Proctor

Director, Engineering Technology and Services at Monsanto; President, ABET; Chair of AIChE Foundation Board of Trustees; Chair, U.S. Council for International Engineering Practice. AIChE President, 1987.

Kenneth J. Richards

1923–2008

Recognized for contributions to developing advanced copper smelting technology. President, Kerr-McGee.

Alfred D. Saffer

President, Chief Technical Officer, Oxirane. Vice Chairman, Halcon International. Petrochemical R&D and commercialization.

Martin B. Sherwin

Recognized for technical leadership in developing artificial organs, environmentally friendly insecticides, gas-separation membranes. Director, W. R. Grace.

James A. Trainham III

Recognized for work in chemical industry sustainability. Vice President for Science and Technology, PPG.

James Wei

Recognized for pioneering industrial catalysis and reaction engineering research. Editor-in-Chief, "Advances in Chemical Engineering." Dean of Engineering and Applied Science, Princeton Univ. AIChE President, 1988.

Charles F. Zukoski

Recognized for work in nanoparticle suspension manipulation; properties of partially saturated granular materials. Vice Chancellor for Research, Univ. of Illinois, Urbana-Champaign.

NEW FRONTIERS

Kristi S. Anseth

Recognized for developing new materials to replace diseased or damaged body parts. Recipient of the National Science Foundation's Alan T. Waterman Award.

Frances H. Arnold

Recognized for research on engineering biological systems, particularly proteins and genetic regulatory networks (*e.g.*, using novel enzymes to catalyze cellulose hydrolysis). Only female elected to all three National Academies.

Georges Belfort

Recognized for research on the behavior of biological molecules at solid interfaces and the use of membrane technology to selectively recover medicinals from complex mixtures. Co-founder of the North American Membrane Society.

Harvey W. Blanch

Recognized for work on protein interactions; DNA electrophoresis; mammalian cell metabolism.

Andrea Chow

Recognized for developing technology to miniaturize chemical, biological and biochemical analyses. Developed Caliper Tech LabChip microchip to control DNA, RNA and protein purification in the Aligent 2100 bioanalyzer.

Clark K. Colton

Recognized for work on continuous-flow membrane filtration of plasma from whole blood; continuous-flow membrane plasmapheresis: theoretical models for flux and hemolysis; artificial pancreas.

John C. Crittenden

Director, National Center for Clean Industrial and Treatment Technologies.

Gerald G. Fuller

Recognized for work on orientation dynamics in complex liquids; deformation of fluid-fluid interfaces; development of rheo-optical techniques.

Carol K. Hall

Recognized for work in generalized Flory dimer theory and Hall-Helfand correlation function; simulation of amyloid fibrils formation.

Jacob N. Israelachvili

Created first bio-mimetic on-off switchable adhesive mobile sensor; complex intersurface biological fluid and materials systems.

Keith P. Johnston

Developed controlled-release bioerodible drug-delivery system; synthesized nanocrystal optoelectronic devices; nanoscale water-insoluble bioavailability.

Julia A. Kornfield

Recognized for work on polymer blend dynamics; flow alignment of liquid-crystalline and block polymers; physical aspects of new biomedical materials.

Michael R. Ladisch

Recognized for developing and scaling up new approaches and materials for process chromatography, absorptive bioseparations, and biocatalysis.

Cato T. Laurencin

Recognized for novel polymer-synthesized ceramic-composite-based system for bone repair and *in vitro* evaluation.

Stephen L. Matson

Recognized for work on multiphase membrane reactors; liquid-liquid extractive membrane reactors; enzymatic membranes for synthesis and separation of peptides.

Edward W. Merrill

Founder of biomedical engineering. Pioneered use of films and surfaces in biomedical applications — rheological and clotting properties of human blood; polyethylene oxide as a biomaterial; molecular transport across membranes; artificial kidneys, blood oxygenation and accompanying CO_2 removal during open heart surgery.

Nicholas A. Peppas

Recognized for work in drug delivery systems, including better ways of delivering insulin for diabetics; skin scaffolds.

Buddy D. Ratner

Recognized for work in engineered biomaterial surfaces to control biological surface interactions; synthesized biostable radio frequency plasma films and polymer scaffolds.

Jerome S. Schultz

Recognized for work with biorecognition and bioreceptor sensors, synthetic membranes; transport in tissues; immobilized enzymes; pharmacokinetics.

Arnold F. Stancell

Recognized for work in polymer and petrochemical processes; microelectronics processing plasma reactions; rapid laser bonding of plastics.

George Stephanopoulos

Recognized for work on statistics and stochastics in computer science and artificial intelligence.

James R. Swartz

Recognized for work on design and yield improvements of recombinant protein production; cell-free methods in developing patient-specific cancer vaccines, having so produced active complex hydrogenases enzymes; improved water filters based on the protein Aquaporin Z's ability to pass only water, possibly leading to highly selective biosensors

Jackie Y. Ying

Recognized for work on nanostructure manipulations; nanoporous materials as membranes and molecular sieving sensors; host matrices for quantum dots and wires.

For more reasons to celebrate, visit www.aiche.org/100/