American Academy of Arts & Sciences

2010 Induction Programs

October 8–10, 2010

of the Presidential Young Investigator Award (1990 – 1995); the David and Lucille Packard Fellowship in Science & Engineering (1989 – 1994); and the 2007 Cozzarelli Prize, National Academy of Sciences.

David Nathaniel Seidman

Northwestern University, Evanston, Illinois

Walter P. Murphy Professor of Materials Science and Engineering. Researcher in the use of field-ion microscopy and 3-D atom-probe tomography to study defects, interfaces, segregation, and precipitation in metals and metallic alloy systems on atomic scale. Work advanced understanding of the behavior of vacancies and self-interstitial atoms in metals, in connection with radiation damage and dislocation interactions. Contributed to knowledge of crystal defects, small nanosize precipitates, and grain boundary segregation and how they determine material properties. Member of the Editorial Board, *MRS Bulletin*, 2006 – present. Editor, *Journal of Materials Science*, 2002 – 2004.

Mary Fanett Wheeler

University of Texas at Austin, Austin, Texas

Director, Center for Subsurface Modeling, Institute for Computational Engineering and Sciences; Ernest and Virginia Cockrell Chair in Engineering; Professor of Aerospace Engineering and Engineering Mechanics; Professor of Petroleum and Geosystems Engineering; Professor of Mathematics. Identified new computational and numerical methods to study flow through porous media, oil reservoir simulation, and CO_2 sequestration and environmental pollution remediation. Developed penalty versions of the discontinuous Galerkin method and proof of convergence for finite element approximations for parabolic equations. Created parallel computing system for modeling variety of geological applications including groundwater flow, reservoir simulations, and large-scale optimizations methods. Founding Director, Center for Subsurface Modeling, Institute for Computational Engineering and Sciences. Recipient of the 2009 SIAM Theodore von Kármán Prize.

Forman Arthur Williams

University of California, San Diego, La Jolla, California

Professor of Engineering Physics and Combustion. Contributed to combustion science and its utilization in large-scale fire research, rocket-engine stabilization, and chemical kinetics as it relates to development of a viable hydrogen economy. Analyses have expanded knowledge of combustion fundamentals and accidental destructive fires. Developed the "San Diego Mechanism," an approach for quantitative descriptions of flame phenomena. Introduced asymptotic expansions as an analytical tool in combustion. Served as Director, Center for Energy Research, University of California, San Diego (1991 – 2006). Awarded the silver medal (1978) and gold medal (1990) of the Combustion Institute and the 1999 Thermal Engineering Award for International Activity from the Japan Society of Mechanical Engineers.

Section 6: Computer Sciences (including Artificial Intelligence and Information Technologies)

Randal E. Bryant

Carnegie Mellon University, Pittsburgh, Pennsylvania

Dean, School of Computer Science; University Professor of Computer Science. Responsible for advances in simulation and verification of digital systems. Developed the "switch-level" techniques that first allowed complex integrated circuits to be simulated at practical speeds. Introduced the "ordered binary decision diagram" representation for Boolean functions, which enabled practical verification of hardware designs using symbolic model checking and resulted in benefits for the semiconductor industry. Recipient of the 1989 IEEE Baker Prize and the 1998 ACM Kanellakis Theory and Practice Award.

Nancy Ann Lynch

Massachusetts Institute of Technology, Cambridge, Massachusetts

NEC Professor of Software Science and Engineering; Professor of Electrical Engineering and Computer Science. Spearheaded the development of a comprehensive theory and practice of fault-tolerant distributed computing, from rigorous models permitting the analysis, comparison, and verification of multi-process algorithms, to algorithmic techniques spanning all fundamental problems (such as consensus, resource allocation, and synchronization), to identify-

ing the boundaries between what is possible and provably impossible to solve in a distributed setting. Awards include the 2010 IEEE Piore Award and the 2007 Association for Computing Machinery Knuth Prize.

Raymond E. Ozzie

Microsoft Corporation, Manchester, Massachusetts

Chief Software Architect. Expertise in collaboration software. Engineered Lotus Symphony and created Lotus Notes. Founded Iris Associates and Groove Networks, which specialized in productivity software that allows multiple users to work collaboratively on computer files simultaneously. In 2006, succeeded Bill Gates as Chief Software Architect, responsible for oversight of Microsoft's technical strategy and product architecture and for directing the company's next-generation software services platform.

Burton Jordan Smith

Microsoft Corporation, Redmond, Washington

Technical Fellow. Contributed to various subdisciplines within the field of parallel computation, including high-performance parallel architectures, interprocessor communication networks, and parallel programming languages. Work on hardware multithreading initiated an approach to computational concurrency that is increasingly used in the design of microprocessors. Chief architect of Tera Computer's MTA machine and Denelcor HEP. Recipient of the 1991 Eckert-Mauchly Award and the 2003 Seymour Cray Computer Engineering Award.

Michael Stonebraker

Massachusetts Institute of Technology, Cambridge, Massachusetts

Professor, Department of Electrical Engineering and Computer Science and Professor, Computer Science and Artificial Intelligence Laboratory. Cofounder, Vertica Systems. Led the database-research and industrial communities with a series of technical innovations that were integral to the INGRES, Postgres, Aurora/Borealis, and C-Store projects at the University of California, Berkeley, and the Massachusetts Institute of Technology. Helped launch new research directions in the implementation of relational systems, object-relational systems offering type extensibility, database systems for managing streaming data, and database systems employing a column store storage model. Honors include the 1992 SIGMOD Innovations Award and the 2005 IEEE von Neumann Medal.

Madhu Sudan

Massachusetts Institute of Technology, Cambridge, Massachusetts

Fujitsu Professor of Electrical Engineering; Principal Researcher, Microsoft Research New England. In the "PCP theorem," showed, with others, how to encode a proof so that its correctness could be verified with high probability by sampling a constant number of bits. Result implies the hardness of approximation for many combinatorial problems and led to the invention of locally testable error-correcting codes, the field of algorithmic property testing, and classification of the intractability of large classes of optimization problems. Demonstrated how to list-decode the Reed-Solomon code, which launched new research directions and became a proof technique used in the study of average case versus worst case complexity. Awarded the Rolf Nevanlinna Prize in 2002 and the Gödel Prize in theoretical computer science in 2000.

Robert E. Tarjan (elected in 1985)

Princeton University, Princeton, New Jersey; Hewlett-Packard Corporation, Palo Alto, California

James S. McDonnell Distinguished University Professor of Computer Science; Senior Fellow. Known for pioneering work on the design and analysis of data structures and graph algorithms. Co-inventor of important graph algorithms based on depth-first search, including finding strong components, testing planarity, and finding dominators. Co-inventor of splay trees and Fibonacci heaps. Member of the National Academy of Sciences, the National Academy of Engineering, and the Association for Computing Machinery. Winner of the Turing Award and the Nevanlinna Prize.

Moshe Y. Vardi

Rice University, Houston, Texas

Karen Ostrum George Professor in Computational Engineering. Developed logic as a fundamental tool in computer science, providing both a unifying foundational framework and a tool for modeling computational systems, particularly in the areas of artificial intelligence, automata theory, computational complexity, database systems, distributed

computing, and design specification and verification. Work in the logical theory of databases, extensive theory of reasoning about knowledge, finite-model theory, and other areas has been applied in diverse fields, including economics, linguistics, and computer science.

Jeannette M. Wing

Carnegie Mellon University, Pittsburgh, Pennsylvania

President's Professor of Computer Science. Former Assistant Director, Computer and Information Science and Engineering Directorate, National Science Foundation. Research on formal methods and on the application of mathematical models and logics to building and reasoning about computing systems led to novel contributions to abstract data types, object-oriented programming, concurrent and fault-tolerant distributed systems, and computing and communications security. At Carnegie Mellon University and the National Science Foundation, helped establish new research directions for computer science. Formulated concept of "computational thinking," which set a new tone for the role of computer science in the research community.

Class II: Biological Sciences

Section 1: Biochemistry and Molecular Biology

G. Marius Clore

National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, Maryland

Chief, Protein Nuclear Magnetic Resonance Section, Laboratory of Chemical Physics. Developed nuclear magnetic resonance spectroscopy for studying proteins and their complexes in solution; experimental and computational approaches have been widely adopted. Discovery of paramagnetic relaxation enhancement to detect and visualize low population intermediates in macromolecular association represents a paradigm shift in understanding macromolecular interactions, and elucidates highly dynamic processes, including the search for specific binding sites by transcription factors diffusing along DNA and the formation of transient encounter complexes in weak protein-protein association.

Carlo M. Croce

Ohio State University, Columbus, Ohio

Director, Institute of Genetics; The John W. Wolfe Chair in Human Cancer Genetics; Professor and Chairman, Department of Molecular Virology, Immunology and Medical Genetics. Instrumental in establishing the linkage between the abnormal karyotypes observed in cancer and the carcinogenic process. Determined the direct and causative association of chromosomal translocations with the molecular mechanism of oncogene activation, and discovered the involvement of microRNAs in cancer. Demonstrated that breakpoints in chromosomal translocations mark genes important in the causation of cancer and that translocations are guideposts for finding novel cancer genes. Showed that translocations are caused by errors in the recombinational mechanisms of the immune system.

Daniel E. Gottschling

Fred Hutchinson Cancer Research Center, Seattle, Washington

Full Member. Discovered that telomeres exert a position effect on nearby genes, and elucidated unexpected relationships among telomeres, chromatin structure, and epigenetics. Discovered the RNA component of yeast telomerase. Contributed to the understanding of chromatin regulation through research on novel enzymatic activities for histone modification, and provided insight into their contributions to nucleosome core regulated silencing. Recipient of the National Academy of Sciences Award in Molecular Biology in 1995 and the Glenn Award for Research in Biological Mechanisms of Aging in 2009.

Benjamin D. Hall

University of Washington, Seattle, Washington

Professor Emeritus of Biology and Genome Sciences. First to discover unequivocal evidence for the existence of messenger RNA by showing that pulse-labeled RNA extracted from T2-infected *E. coli* cells forms RNA-DNA hybrids with T2 DNA. First to demonstrate linkages between DNA polymorphism and a phenotype trait. First to sequence a mutant