

Report of the Committee on Awards for the Year ending June 30, 2002

The Committee on Awards met on Thursday, 8 November 2001 during Sigma Xi's 2000 Forum and Annual Meeting in Raleigh, North Carolina.

The William Procter Prize

Following the Society's 2001 annual meeting in Raleigh, North Carolina, the Board of Directors approved the Committee's recommendation that Dr. Benoit Mandelbrot receive the 2001 William Procter Prize for Scientific Achievement.

Few scientists can claim to have started revolutions or generated new paradigms. IBM Fellow Emeritus Benoit Mandelbrot of the T.J. Watson Research Center is one of them. With a naturalist's broad view of science, he has ignored the prevailing boundaries and methods in pursuit of his vision. In the process, he has become one of the most versatile mathematicians in history. More importantly, he has created a new geometry of nature that is centered in physics but has changed our view of the universe.

Father of fractals

His creation of fractal geometry and the concept that simple rules can generate infinitely complex structures and behaviors defines a paradigm rooted in the fact that fractals "are irregular geometric shapes having identical structure at all scales." According to Mandelbrot, their irregular and complex behavior is echoed from scale to scale. Mandelbrot's multi-disciplinary explorations began with his doctoral thesis in 1952, which combined linguistics (a mathematical analysis of the distribution of words) with the tools of statistical thermodynamics. In the early 1960s, he moved to study finance, demonstrating that price fluctuations in markets are not smooth, as economists thought, but are often choppy, discontinuous and always concentrated in time. And he showed that wealth acquired on the stock market is typically acquired on a very small number of favorable periods.

Mathematics of the Nile

At IBM Research, where he joined in 1958, Mandelbrot showed that errors propagating on telephone lines used to transmit computer information were not classically random and self-similar over any chosen period of time. Not only would there always be periods of error-free transmission and of error-plagued transmission, but it was impossible to find a fine enough time scale in which that wouldn't be the case. Mandelbrot had found the same mathematical distribution to hold true in the field of water resources, and the study of floods and droughts in the Nile River Basin. He revealed the discontinuous nature of the universe, and the persistence and the tendency of droughts or floods to come in clusters.

Dimensions in nature

Mandelbrot's work came to fruition in a seminal 1967 paper in Science Magazine, titled "How long is the coast of Britain? Statistical self-similarity and fractional dimensionality?" In it, Mandelbrot pointed out that the concept of length was meaningless when trying to describe something as seemingly concrete as a natural coastline; that length is dependent on one's choice of measuring stick. To characterize this ever self-similar and yet infinite complexity, Mandelbrot introduced into science the concept of fractal dimension; if a smooth curve had a dimension of one, and a smooth surface a fractal dimension of two, a coastline, for instance, could be said to have a fractal dimension somewhere in between. The concept was stunning. When his 1977 and 1982 books provided an extraordinary list of fractal phenomena from nature -- mostly from physics, but also from the veins and arteries of anatomy to hierarchical clustering of stars and galaxies -- and he communicated them through computer-generated imagery. As Mandelbrot would later state, he "re-introduced the eye to the study of mathematics." Simplicity to define complexity

According to New Scientist, "Mandelbrot's massive....achievement has been to convert [a] abstract formalism into a flourishing branch of applied mathematics." Or in the words of the Mathematical Gazette, "Euclid is replaced as hero by a celestial committee....whose ideas have condensed into fractals under Mandelbrot's supervision." With the introduction of the Mandelbrot set in 1980, he showed that such complex phenomena could be created and described by simple rules iterated over and over again, and he set a whole generation of mathematicians, computer scientists, and even artists to generating and studying the beautiful images that resulted.

Procter Prize Grant-in-Aid Recipient

Each year the Procter Prize recipient has the privilege of naming a younger colleague to receive a \$5,000 grant-in-aid of research from the Procter Prize Fund. This year, Dr. Mandelbrot has nominated Mr. Henry Kaufman, a computer programmer who works with Dr. Mandelbrot, to receive this award.

Honorary Members

At its November 2001 meeting, the Committee on Awards recommended, and the Board of Directors subsequently approved, that Richard Harris and Malcome Browne become Honorary Members of Sigma Xi. Mr. Browne is a Senior Writer and a well-recognized member of the Science News Department for The New York Times, while Mr. Harris is a widely known Science Correspondent for National Public Radio. Due to health problems, Mr. Browne was initiated as an Honorary Member during a special ceremony at The New York Times on 3 May 2002. Richard Harris will accept his award at the November 2002 meeting in Galveston.

Young Investigator Award

Also during its November 2001 meeting, the Committee recommended that Dr. Paschalis Alexandridis be awarded the 2002 Young Investigator Award in the physical sciences and engineering. The Board of Directors subsequently approved this recommendation and Dr. Paschalis Alexandridis has agreed to participate in the November 2002 Forum and Annual Meeting to accept his award and to present a lecture on his research on Saturday morning during the annual meeting. A polymer chemist, Dr. Alexandridis is at the University of Buffalo where he is Associate Professor. Among his scientific accomplishments are a variety of molecular methods with exciting potential applications in basic polymer research.

Dr. Alexandridis' areas of expertise are block copolymers, amphiphilic polymers, surfactants, resins, polymer gels (physically or chemically cross-linked), structured fluids, lyotropic liquid crystals, self-assembly, phase behavior, microstructure, micellization, solubilization, dissolution, microemulsions, emulsions, micellar kinetics, polymer-surfactant interactions, molecular recognition, controlled release, rheology, wetting, adhesion. His research aims in elucidating the interrelations between (i) the molecular characteristics of amphiphilic molecules (such as block copolymers and surfactants), (ii) the structure of organized assemblies formed by amphiphiles, and (iii) the functional properties of such assemblies. Amphiphile self-assemblies can be utilized for the development of novel materials and processes of interest to chemical, bio-, and materials engineering. Amphiphilic (i.e., containing both hydrophilic and hydrophobic parts) molecules, such as surfactants, lipids, copolymers, and proteins, find widespread use in the chemical, pharmaceutical, and food industry, because of their unique ability to self-assemble and modify the surface/interfacial properties, thus either enhancing compatibility or imposing partition. The self-assembly is governed by (tunable) molecular- and colloidal-level interactions and its control is crucial for tailoring the properties of systems where amphiphiles are present.

Regional winners of the 2002 Young Investigator Award were recognized with Certificates of Recognition for their accomplishments. The 2002 regional winners were: Dr. William E. Amatucci of the Naval Research Laboratory (Mid-Atlantic Region); Dr. Rex D. Ramsier of the University of Akron (North Central Region); Dr. Rigoberto Hernandez of the Georgia Institute of Technology (Southeast Region); Dr. David B. Fogel of Natural Selection Inc. (Southwest Region); and Dr. F. Xavier Malcata of Portugal's College of Biotechnology (Canadian/International Constituency Group).

Established by the Board of Directors in 1996, the Young Investigator Award recognizes the work of outstanding young Sigma Xi members within ten years of their highest earned degree as well as the ability to communicate their research to the general public. The Award alternates between the physical sciences and engineering and the life and social sciences. The Award includes a Certificate of Recognition, \$5,000, and the opportunity for the recipient to present their research during a lecture at the Society's Annual Meeting.

International Science and Engineering Fair

On 12-18 May 2002, Sigma Xi continued its participation in the International Science and Engineering Fair, which this year was held in Louisville, Kentucky. Participating in the "Special Awards" category, Sigma Xi awarded three prizes for the best interdisciplinary team projects at the Fair. Each team received a cash prize, and each team member received a Certificate of Recognition and a one-year subscription to *American Scientist*; the winners school library also received a one-year subscription to the magazine.

The first place award of \$1,000 was made to a team of two students from Caddo Parish Magnet High School in Shreveport, Louisiana, Benjamin Scruggs and Ryan Bienvenu for their project on bioengineering an artificial blood vessel. A second place award of \$450 was presented to two students, Austin Minnich and Milo Lin from Los Alamos High School (Los Alamos, New Mexico) for their project entitled "Algorithms for Determining Sequence-specific DNA Chips Applied on Human Mitochondria DNA." A third place award of \$300 was given to two students from Pleasant Grove High School in Pleasant Grove, Utah, Michael Judson and Nelson Radmall, for their project on the effects of artificial gravity on plants.

A team of 13 judges from the Louisville Chapter and one judge from the Northern Kentucky University Chapter of Sigma Xi evaluated the 172-team projects at the Fair for the Sigma Xi awards. Dr. Kunwar Bhatnagar of the Louisville Chapter assembled the judging team and Dr. Bhatnagar served as Chair of the judging team. The Committee would like to express its gratitude to Dr. Bhatnagar and all of the Sigma Xi judges for their efforts in assisting in the Society's participation in the 2002 International Science and Engineering Fair.

Monie A. Ferst Award

Chemistry professor Robert G. Bergman at the University of California at Berkeley was selected to receive the 2002 Monie A. Ferst Award. Administered by the Georgia Institute of Technology Chapter, this Sigma Xi honor recognizes those who have made major contributions to the motivation and encouragement of research through education.

The award will be presented in New Orleans next spring at the national meeting of the American Chemical Society during a symposium of research presentations by several of Bergman's former students in tribute to the lasting influence of a distinguished teacher and scientist.

Bergman's many honors include the Caltech Student Government Award for Excellence in Teaching, the Edward Leete Award for Teaching and Research in Organic Chemistry from the American Chemical Society and the University of California Department of Chemistry Teaching Award.

Trained as an organic chemist, Bergman spent the first part of his career at Caltech investigating the mechanisms of organic reactions. He also developed methods for the generation and study of unusually reactive molecules. In

1972 he discovered what was later identified as a crucial DNA-cleaving reaction in several antibiotics that bind to nucleic acids, a reaction that came to be known as the "Bergman cyclization." In the mid-1970s his research broadened to include organo-metallic chemistry. Since moving to Berkeley he has made contributions to the synthesis and chemistry of several types of organo-transition metal complexes and to improving our understanding of the mechanisms of their reactions.

A member of the National Academy of Sciences and the American Academy of Arts and Sciences, the Berkeley chemist has received many research accolades in his career, including the Dreyfus Foundation Teacher-Scholar Award and the John Bailar Medal from the University of Illinois. The American Chemical Society has given him its Award in Organo-metallic Chemistry, the Arthur C. Cope Award and the James Flack Norris Award in Physical Organic Chemistry.

This Sigma Xi award is given annually to a scientist who has made "notable contributions to the motivation and encouragement of research through education." The award is given under the auspices of the Georgia Institute of Technology Chapter and the Chair of the Committee on Awards and the Southeast Regional Director participate in the selection of the recipient.

John P. McGovern Science and Society Award and Lecturer

An additional Committee meeting was held by email. In early April 2002, the Committee agreed with a recommendation of the Forum Steering Committee that Dr. Mario Molina, Nobel Laureate at MIT, be invited to be the November 2002 John P. McGovern Science & Society Lecturer. Dr. Molina accepted this invitation and will deliver the McGovern Lecture at the November 2002 forum and annual meeting.

Sigma Xi Awards

Details for all Sigma Xi awards can be found on the Sigma Xi web page (<http://www.sigmaxi.org/programs/prizes/index.shtml>) or from local Sigma Xi chapters.

Nominations for Sigma Xi awards are welcomed by the Committee on Awards and can be forwarded to the Committee at the Society's administrative offices. The Committee urges that chapter leadership and regional directors take a stronger role in the coming years in nominating potential awardees, particularly for the Proctor Prize. Dr. Evan Ferguson can be contacted at the Society's administrative offices for additional information about Sigma Xi's awards and nomination procedures.

Committee on Awards

On 1 July 2001 the structure of the Committee on Awards changed as part of the Society's transition to its new governance. Formerly, the Committee was composed of the 6 Directors-at-Large, but with the new governance the Directors-at-Large will no longer be members of the Board. Thus, on 1 July 2001, the Committee included the last two Directors-at-Large (Geraldine Twitty and Robert Zand) to serve one year terms, two members of the Board (Cliff Chancey and Ron Weinberg) elected by the Board for two-year terms, and a member of the Board (Tony Whitehead) elected by the Board for a three-year term.

As Chair of the Committee on Awards, I would like to thank the Directors -at-large who worked with me on the Committee and guided the Chair with wit and humour, and the new members who also suffered my Chairing. It has been a pleasure working with them and I thank them for their willingness to serve the Society as a member of the Committee. The members of the Committee on Awards for the year ending 30 June 2002 were:

M.A. (Tony) Whitehead, Chair
Cliff Chancey
Geraldine Twitty
Robert Zand
Ronald Weinberg