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Benoit Mandelbrot Receives 2002 William Procter Prize

Pioneering mathematician Benoit B. Mandelbrot, known as the creator of fractal geometry, will receive Sigma Xi's 2002 William Procter Prize for Scientific Achievement and present the Procter Prize Lecture at the Society's annual meeting in November in Galveston, Texas.

The prize includes a cash award of \$5,000 plus the privilege of naming the recipient of a special \$5,000 Grant-in-Aid of Research.

It is highly appropriate, given Sigma Xi's interdisciplinary outlook, that its highest honor should go to a scientist whose work was inspired by an interdisciplinary point of view and has had such a wide-ranging impact in so many fields.



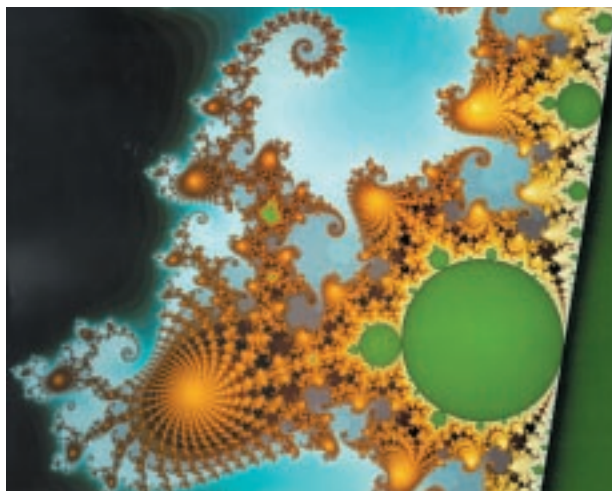
Benoit B. Mandelbrot

"Benoit Mandelbrot is one of the few living mathematicians whose originality has given birth to entire disciplines," said

physicist Philip Morrison.

"This makes him especially suited to present mathematical reasoning to a diverse group of scientists. His lectures are lively, Gallic in tinge and taste, clear to the non-mathematical, and can reach a memorable level for many who never imagined they would resonate with novel mathematics."

Benoit Mandelbrot was born in Warsaw, Poland, in 1924. At the age of 11, he and his family emigrated to France, where his uncle, a professor



The classic Mandelbrot set, a fractal that displays self-similarity at various scales. Courtesy Richard F. Voss

of mathematics, took charge of his education, introducing him to a now famous mathematical paper by Gaston Maurice Julia. Put off by it at first, Mandelbrot came back to that paper nearly thirty years later while working with his own theories.

World War II disrupted his formal education, and he was largely self-taught, which allowed him to think in unconventional ways and develop a highly geometrical approach to mathematics. His intuition and vision have given him unique insights.

In 1958, Mandelbrot moved to the United States and joined IBM, delving into processes with unusual statistical properties and geometric features. This led to his famous contributions in fractal geometry.

His 1967 article in *Science*, "How long is the coast of Britain?," is generally considered a milestone in science and mathematics whose impact has been felt in many other fields. Mandelbrot coined the word "fractal" in the mid-1970s to describe objects, shapes or behaviors

that have similar properties at all levels of magnification.

The concept has found applications in such diverse fields as physics, economics, and linguistics. The colorful symmetry of computer-generated fractal graphs has captured the imagination of artists, scientists and the public.

Mandelbrot studied at Ecole Polytechnique and the California Institute of Technology and received a Ph.D. in mathematics from the University of Paris. He joined Yale University in 1987 and is now Sterling Professor

of Mathematical Sciences. He is also IBM Fellow Emeritus in Physics at the IBM T.J. Watson Research Center.

His many honors include the Barnard Medal for Meritorious Service to Science, the Franklin Medal for Signal and Eminent Service in Science and the Wolf Prize for physics. He was inducted into Sigma Xi in 1949 and is a member of the National Academy of Sciences, the American Academy of Arts and Sciences and the European Academy. Among his books is the bestseller *The Fractal Geometry of Nature* (1982). *American Scientist* (Nov-Dec 1999) cited his 1977 monograph *Fractals* among the top 100 scientific publications of the century.

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An Interview with Sigma Xi's New Executive Director



Patrick D. Sculley

Sigma Xi's new executive director, Patrick D. Sculley, comes to the Society from the Army Office of the Surgeon General (OTSG) in Washington,

D.C., where he has served as chief of staff of the U.S. Army Medical Command (MEDCOM) and the second highest-ranking officer in the Army Medical Department.

Major General Sculley is deputy surgeon general of the Army and chief of the Army's Dental Corps. He retires from the military in May after 29 years of service and assumes his new duties at Sigma Xi on June 3.

A dental surgeon with a masters in health services management, he is a student of history, a runner and a popular public speaker on leadership, management and strategic planning. He and his spouse, Peggy, have four children and two grandchildren. For a more extensive profile, visit www.sigmamaxi.org.

What appealed to you about Sigma Xi?

When I was Commanding General of the Army Center for Health Promotion and Preventive Medicine, I led an organization of scientists and health care professionals. I really enjoyed working with that team. There were environmental scientists and engineers, laboratory scientists, air, soil and water experts and a host of others. I took great pride in their contributions to my command and the Army. I developed a great appreciation for the role of scientists and, therefore, Sigma Xi's research focus is highly appealing.

I also wanted to work in an organization with a mission larger than itself and am particularly drawn to

Sigma Xi's mission of promoting science and engineering research and of encouraging the next generation of researchers.

In addition, I have enjoyed volunteer work for professional associations, including the Academy of General Dentistry and the American Dental Association, both in terms of committee service and as a delegate. I was the Academy's representative to the ADA Future of Dentistry project, which I found rewarding.

Working with young people has been an important aspect of my military career, and Sigma Xi's role as a mentoring organization also has strong appeal. It's vital that we help young people develop their potential. I saw an opportunity at Sigma Xi that matched my interests and experience.

What role do you see for non-governmental organizations (NGOs) in scientific affairs?

There is a huge role for Sigma Xi and other NGOs as advocates for ethical research and as proponents of progress in science and engineering, nationally and internationally. Science has informed much of human progress, and there is much more to be done.

The research community as a whole faces many challenges. What do you consider some top priorities?

Funding for research is a major challenge. I am concerned about the inadequacy of funding and its implications for the future of science and engineering.

At the same time, I think we need to promote public appreciation for the major role science plays in our lives. I'm afraid too many people gravitate to the more sensational sites on the Internet, for example. There's too much of a tabloid mentality in the public at large when it comes to science.

We need to overcome that and develop the next generation of scientists. The lack of emphasis on science and math in the schools is troubling, and we need to do everything we can to improve science and engineering education.

In what ways does Sigma Xi's mission address these issues?

The things we've talked about: funding, advocacy, mentoring, communication, informing the public and decision-makers, such as elected public officials and industry leaders. These are all part of Sigma Xi's role.

We need to grow the Grants-in-Aid of Research program over time, promote good, ethical science and respond to the media with reliable information. Since Sigma Xi represents all of science and engineering, it's a logical home base for media information.

We also need to inform the public in other ways and communicate with scientists.

How does Sigma Xi's chapter structure lend itself to these efforts?

It's ideal. Our more than 500 chapters are creating the next generation of researchers. Sigma Xi's greatest potential resides in its chapters. It's a real grass-roots effort. Many chapters are getting out into the schools and making an impact on students and their parents early on. We need to do more of that.

The mentoring that has traditionally gone on within Sigma Xi is becoming more formalized, and there may be some supporting roles to play, such as creating a clearinghouse to match mentors and students on a broader basis.

But our chapter structure is key. At the local level, Sigma Xi members can help budding researchers learn how to apply for grant funding. They can foster communication in their local communities. The chapters are a spawning ground for new scientists, and that's our future.

Grizzly Bear Survival May Depend on Fragile Moths

This is one in a series of articles on recent Grants-in-Aid of Research Recipients. For nearly 80 years, the Sigma Xi grants program has represented an important investment in the future of research.

For Hillary Robison, the conservation of landscapes and the species that inhabit them is not an esoteric pursuit. The survival of the grizzly bear may depend on the information she is gathering through her field work and laboratory studies.

As incongruous as it may seem, the fate of these mighty creatures, which have been both feared and revered throughout history, may hinge on something as fragile as a lowly moth, a fact that in itself speaks to the interconnectivity of life.

A graduate student at the University of Nevada, Reno, Robison is using molecular techniques to study the migratory ecology and population genetics of the army cutworm moth (ACM) on which grizzly bears feed.

"Adult ACMs migrate from the Great Plains to the Rocky Mountains," Robison says, "where they aggregate in high-elevation talus and grizzly bears consume them by the thousands."

The goal of the Endangered Species Act is to recover species and to ensure their continuation. In the case of the grizzly bear, Robison says previous studies have shown female survival and cub production to be critical factors in the natural equation. Cub production, in turn, depends on a mother's pre-hibernation energy stores.

"These moths are a rich food source," she notes. "Previous research has shown that a grizzly bear feeding on them can consume close to half of its yearly energy needs in just 30 days. Little is known about the migratory ecology of ACMs; however, this information is important to grizzly bear conservation since weather patterns, pesti-



At 11,500 feet on a spur of the Absaroka Mountain Range in Wyoming, Grant-in-Aid of Research recipient Hillary Robison collects an army cutworm moth for later genetic analysis. The moth is an important food source for endangered grizzly bears.

cide use and habitat change may affect their abundance and availability to bears."

Robison finds it rewarding that the scientific information she is gathering will have direct applications to the conservation of a species.

"I have enjoyed being able to observe up to 10 bears, including females with cubs, foraging intensely on moths for hours at a time. I have also been able to observe heretofore undocumented ACM behavior. These observations reinforce the importance of my research."

In the process, she has engaged in valuable collaboration with biologists and researchers from several state and federal institutions and different universities.

"I have also been able to gain experience in the field as well as in the laboratory. The techniques I have learned and contacts I have made throughout this project have helped me grow as a scientist. I have learned a variety of ways in which I can apply my interests and experi-

ence to the conservation of species and the landscapes they inhabit."

Her Sigma Xi grant helped fund horse-pack trips to reach remote research sites that are as much 35 miles into wilderness areas.

"These funds have been instrumental in helping me conduct the necessary sampling for my research," Robison says, noting that many students embark on research projects that are not fully funded when they begin.

"Sigma Xi grants allow students like myself to reach our funding needs and, hence, to reach our scientific goals. Writing these grants also prepares us for writing grants later in our professional careers."

Grants-in-Aid of Research guidelines, an interactive application form and tips on preparing a successful application are available online at www.sigmaxi.org. Grant deadlines are October 15 and March 15 annually.

2002 Forum Focuses on Creating a Diverse Scientific Workforce

The 2002 Sigma Xi Forum will examine the health of the research enterprise by evaluating future demands for scientists, engineers and technologists in the workforce and exploring the contributions our members can make to better meet these demands.

What will the future demand in terms of scientific workforce preparation and training? How can universities and colleges attract and retain a diverse student population to meet those needs?

The 2002 Sigma Xi Forum, *Changing the Face of Science and Engineering*, will bring together scientists, labor economists, engineers, leaders in higher education, corporate representatives, researchers and policy makers to address these and other workforce issues.

To be held in conjunction with Sigma Xi's annual meeting, the forum is scheduled for November 14-15 at the Moody Gardens Hotel in Galveston, Texas.

Through a series of plenary talks, panel discussions, focused sessions and contributed presentations, the conference will contribute to the international conversation about the scientific workforce of the future.

Call For Presentations

Abstract Deadline: September 2

Sigma Xi is soliciting abstracts for poster presentations to be on display throughout the 2002 Forum November 14-15. Presentations will be reviewed by the organizing committee for relevance to the forum topic. Submissions should be made online via the Sigma Xi Web site, www.sigmaksi.org.

The successes and failures of philosophies and programs that aim to attract and retain students, faculty and researchers from underrepresented groups will be among the topics.



Possible additional topics include:

- Institutionalizing Change
- Attraction & Retention: Creating a Welcoming Environment
- International Mobility in Science and Technology
- Diversifying the Pipeline
- Pedagogical Approaches
- Graduate Education: What's Wrong and What's Right?
- The Role of the Media in Diversifying the Workforce
- The Role of Professional Societies
- Policy Aspects of Diversifying the Workforce
- How Do We Know It's Working
- The Importance of Role Models

The two-day forum will provide an opportunity for developing activities through which Sigma Xi chapters can help their institutions and communities explore and address these issues. Visit www.sigmaksi.org for program updates and registration information.

News Roundup

Minority Mentoring Online

Sigma Xi is among the sponsors of a Web site (www.justgarciahill.org) that provides a gateway to a virtual community of minority scientists and facilitates networking and mentoring online. Designed to encourage broader participation in the sciences, the site includes a minority scientist database, biographies and an electronic newspaper with information about grant opportunities and other items of interest.

Free Science News Digest

As a benefit to members, Sigma Xi offers a free daily e-mail bulletin called "Science In the News," providing a digest of science stories from major media outlets. The bulletin is an extension of Sigma Xi's Media Resource Service, which puts journalists in touch with reputable experts for context and perspective on science news. Many subscribers say "Science In the News" is also a valuable classroom aid. To subscribe, visit www.mediaresource.org.

Send Gift Subscriptions

One of the benefits of Sigma Xi membership is a special discount on gift subscriptions for *American Scientist*. Active Sigma Xi members can purchase gift subscriptions for only \$25, nearly 10 percent off the regular price. Visit the Membership link at www.sigmaksi.org or call 800-282-0444.

Nominate Members Online

Sigma Xi membership eligibility guidelines and nomination forms are available online at www.sigmaksi.org. Any dues-paying full member may submit nominations through a local Sigma Xi chapter or through the Committee on Qualifications and Membership via the Society's administrative office. Other convenient online features for Sigma Xi members include a change of address form and a secure site for dues payment.