Right Down His Alley

Edward Dougherty switches from professional bowling to pure mathematics and picks up SPIE's 2004 President's Award along the way.

If Edward Dougherty had lived out his dream, the application of his math skills might not have gone beyond keeping score at the bowling alley. Without the candor of a coach that led to Dougherty's pursuit of mathematics and science as a career, many important scientific works might never have been published.

Dougherty is the author or co-author of 12 books and hundreds of technical papers. He has chaired 25 conferences for SPIE, taught numerous short courses, and has been so integral to the Society that he is the recipient of the 2004 President's Award.

After finishing his PhD in pure mathematics at Rutgers (New Brunswick, NJ) in 1974, Dougherty took a teaching position at Rochester Institute of Technology (Rochester, NY). “I thought my research days were over before they really began,” Dougherty says. After several years he was offered the opportunity to retrain in computer science, and his interests were stimulated by artificial intelligence and imaging.

“I read Georges Matheron’s seminal work, Random Sets and Integral Geometry, recognized the great potential of the nonlinear methods of morphological image processing, and settled there,” he says.

In 1995 he was asked to work with the National Human Genome Research Institute (Bethesda, MD) by its scientific director, Jeff Trent, on the recommendation of a colleague from earlier collaborations in fluorescence imaging of cells. “I knew nothing about genomics, but he was very convincing,” Dougherty says.

Today, Dougherty is director of the Genomic Signal Processing Laboratory at Texas A&M University (College Station, TX). The lab works on expression-based phenotype classification, construction and analysis of gene regulatory networks, and therapeutic strategies based on applying the principles of optimal control to regulatory networks.

With his roots in mathematics, Dougherty enjoys solving practical problems by applying math. “My basic job is to find a way to model a problem mathematically so that the mathematics leads to a solution sufficient for the task at hand,” he says. His work in biology has led him to appreciate that the computation requirements in that field far outweigh those necessary in electrical engineering.

“The great impediment is to develop an educational structure that facilitates the mathematical development of biology,” he says. Working for years with the same colleagues, they have developed a taxonomy that works for them, but “it would be more efficient if education, beginning early, integrated the two sides,” he says.

Dougherty has a deep interest in philosophy, and he names Fyodor Dostoevsky as his favorite author. His favorite novels include Dostoevsky’s The Brothers Karamazov, Herman Hesse’s Narcissus and Goldmund, and Nikos Kazantzakis’s Zorba the Greek. “A key experience of my life was studying the conflict between David Hume and Immanuel Kant when I was an undergraduate,” Dougherty says. “Epistemology interests me very much. It has had an enormous impact in physics, but I believe it has not been taken sufficiently seriously in biology.”

His friend and colleague Jaakko Astola (Tampere University of Technology, Tampere, Finland) says that the breadth of Dougherty’s knowledge hones his problem-solving skills. “Often in our discussions, topics ranging from world history to problems in pure mathematics came up, [and] the actual image processing problem that we started to discuss ended up being much clearer and better structured,” Astola says. He and Dougherty continued on page 34
Dougherty continued from page 33

Dougherty have co-chaired numerous conferences on nonlinear image processing for SPIE.

As an author, Dougherty brings his unique interests to bear on complex problems. His Random Processes for Image and Signal Processing (SPIE Press, 1999) is “the book he was meant to write,” according to Eric Pepper, SPIE director of publications. “It’s very clear and logical in how he ties it together. He’s the best writer of any author I’ve worked with,” Pepper says.

Dougherty names the same title as his favorite of the books he’s written, which include an unpublished work on the relation between modern philosophy, science, and religion. Random Processes was intended to “provide a mathematically rigorous presentation without giving difficult proofs, so that one would not need to be a PhD-level mathematician to read it,” Dougherty says. “Had I known how much effort it would take, I never would have done it.” The book took 10 years to complete.

But his career could have taken quite a different path—or alley. Dougherty was a member of the Professional Bowlers Association while in graduate school. One day when he was at the top of his game, his coach took him aside. “After telling me how much I had achieved, he dropped a bomb by telling me I should give up on trying to make a career of bowling,” he says. “‘You just don’t hit the pins hard enough,’ he said. That was it. It took several months of sulking, but I realized he was right—so here I am.”

Now he stays active by playing basketball, and at age 58 can still compete with the students at the Texas A&M gym. “The wind is fine, but the legs are not always there,” he says. “I’m still fond of blocking shots.” Basketball figures into his work too, as he says he can only work efficiently when he’s physically active.

“My thesis adviser at Rutgers taught me that mathematical research is irrational and goes on in the subconscious,” he says. “When I want to solve a problem, I lie back in a large reclining chair and allow myself to enter a meditative state. Lack of physical tension is critical.”

Dougherty’s family includes his wife, Terry, a Methodist minister, and his sons Russell, John, and Sean. They’re not too far away—Russell just graduated from the University of Texas (Austin, TX), John is in graduate school in statistics at Texas A&M, and Sean is a junior in high school. Dougherty has a long history of coaching basketball and soccer. Today he and Terry travel and hike whenever they can, and the Scottish Highlands are a favorite destination.

Astola, who has known Dougherty since they met at SPIE’s Annual Meeting in San Diego more than 15 years ago, says that collaborating between Finland and Texas has become easier via the Internet, but he still values their face-to-face time so that discussions can cover a wider range of topics.

“I admire his wide knowledge, and his ability to quickly see the essence of a problem,” Astola says.

### SPIE Sponsors RIAO/OPTILAS Conference in Venezuela

SPIE is proud to sponsor and publish the proceedings for the Fifth Iberoamerican Meeting on Optics, Lasers, and Their Applications, known internationally as RIAO/OPTILAS. The joint event will take place 3–8 October in the city of Porlamar, Margarita Island, Venezuela.

Sessions at the meetings will cover a wide variety of topics, including laser and quantum optics, nonlinear optics, interferometry and metrology, optoelectronic devices, atmospheric optics, diffractive optics, education in optics, and color, vision, and radiometry, among others.

Despite the financial challenges of the region, past RIAO/OPTILAS conferences have been a success. This year will mark the third consecutive joint RIAO/OPTILAS meeting, with previous events held in Columbia and Argentina in 1998 and 2001, respectively.

Participants hail from across Latin America, Spain, and Portugal, with increasing numbers of attendees from all over the world.

Other sponsors of the event are the International Commission for Optics (ICO), Optical Society of America, Unesco/International Centre for Theoretical Physics, Latin American Center of Physics, European Optical Society, Universidad de Los Andes Mérida/Venezuela, Venezuelan Central University, Simon Bolivar University, Instituto Venezolano de Investigaciones Científicas, and the International Union of Pure and Applied Physics.

In addition to the main event, the ICO Cuban Territorial Committee will organize a satellite meeting called “Optics, Life, and Heritage,” which will be held in Havana, Cuba the week before RIAO/OPTILAS.

For more information or to register, see www.ivic.ve/Fisica/ cuantica/riao/.
Eighty-nine-year-old Charles Townes provided advice and memories for more than 60 students at the student luncheon during the Astronomical Telescopes and Instrumentation meeting this June in Glasgow, UK. Townes summarized his successful lifetime in science and invited questions in an informal setting. He urged students to pursue a career in something they enjoy and to network extensively. Townes advised students to have faith and courage in their insights and ideas, to dare to be different, and to stick with a promising new direction.

After the talk, Hua Xie from Technische Universität Braunschweig (Braunschweig, Germany) won a copy of Amazing Light: A Volume Dedicated to Charles Hard Townes on His 80th Birthday, autographed by Townes.

2004 President’s Award, Directors’ Award, and 2003 Kingslake Medal Presented at Annual Meeting

The President’s and Directors’ awards are bestowed in recognition of outstanding service to the Society. The 2004 awards were presented at the SPIE Annual Meeting, 2–6 August in Denver, CO. The 2003 Rudolf Kingslake Medal and Prize also was announced at the Annual Meeting.

President’s Award
The SPIE President’s Award recognizes unique and meritorious service of outstanding benefit to the Society and to the optics community. The 2004 President’s Award is presented to Edward R. Dougherty for his distinguished service as a conference chair, course instructor, book author, journal editor, and Society leader.

Dougherty's contributions as editor-in-chief of the Journal of Electronic Imaging from 1995 to 2000, and as author or editor of nine books published by SPIE Press, have made him an invaluable contributor to the Society.

He has chaired more than 20 conferences on nonlinear image processing and image algebra and morphological image processing during a time of rapid development in electronic imaging technology. He also has taught more than 40 SPIE short courses on various topics in electronic image processing to hundreds of course attendees.

On behalf of the entire Society, the President’s Award recognizes and thanks Dougherty for his exemplary service to the SPIE community; his dedication to excellence and quality in conferences, education, and publications; and his important technical contributions to the field of image processing.

Directors’ Award
The SPIE Directors’ Award is presented in recognition of significant services of outstanding benefit to the Society. As such, the 2004 Directors’ Award is presented to Donald C. O’Shea for his exceptional service to the Society as a past president of the Society, a member of the SPIE Board of Directors, chair and member of many SPIE committees, short course instructor, and editor of Optical Engineering.

Because of his tireless commitment and dedication, the Board would like to recognize his continued leadership and applaud the commitment O’Shea has shown SPIE, as well as his many contributions to the education of the optical engineering community at large. On behalf of the entire Society, the Board of Directors recognizes O’Shea for his outstanding service to SPIE.

Rudolf Kingslake Medal and Prize
The 2003 Rudolf Kingslake Medal and Prize is presented to John A. Hoffnagle and C. Michael Jeffress of IBM Almaden Research Center (San Jose, CA) for their paper “Beam shaping with a plano-aspheric lens pair,” published in the November 2003 issue of SPIE’s journal Optical Engineering. This paper selected by the Kingslake Award Committee is recognized for its innovative creation of a refractive beam shaper using two aspheric lenses to generate a flat-top beam substantially superior to a Gaussian beam for illumination applications. Look for a profile on the winners in the November/December issue of oemagazine.

Nobel Laureate Townes Lunches with Students

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When I began my fellowship, there were suspicions that some of the 2.7 million U.S. manufacturing jobs lost since 2000 were going offshore. As the year progressed we began to see evidence of services, software, engineering, and even R&D jobs leaving the United States. Naturally, the offshoring phenomenon became a hot election-year topic, instantly polarizing the response to it on Capitol Hill.

In hopes of changing the terms of the debate, Senator Joseph Lieberman (Democrat-CT) released a comprehensive 40-page white paper. As the senator put it, the response to offshoring has ranged from the "Do Nothings" to the "Do Anythings." The "Do Nothings" believe that the loss of jobs is a natural phenomenon and that it will be good for the economy, whereas the "Do Anythings" will do anything to stop the flow of jobs, including building protectionist walls that serve as trade barriers.

The white paper I helped prepare investigates the causes for this migration and presents a five-part strategy to address offshoring, including developing policies that encourage greater investments in federal and industrial R&D, improving K–16 education and lifelong training, empowering businesses, and promoting technological infrastructures such as broadband.

A copy of the white paper can be found at lieberman.senate.gov/newsroom/whitepapers/Offshoring.pdf.

In addressing the offshoring challenge, we first are working to find ways to collect and track the volume and nature of jobs moving offshore. We are also planning to introduce a bill that would set up a bipartisan commission to study the future of the U.S. economy as it grapples with this new wave of globalization.

I am also currently working on legislation that sets the framework to encourage more collaboration between local businesses, universities, and secondary schools within communities to improve student participation in science- and math-related fields.

Although I have spent a good part of my time working on the offshoring phenomenon, all of the staffers here juggle a multitude of issues. Consequently, I have been exposed to various interesting topics touching on education, economy, nanotechnology, manufacturing, broadband, and defense. The fellowship has so far been an incredibly enriching experience. I am looking forward to being involved in public policy and outreach work both in my local community and in scientific organizations when my fellowship ends.

Get the Show on the Road

The University of Southampton’s Light Express Roadshow introduces photonics to UK students of all ages.

In a world where seeing is believing, Pearl John and the Light Express Roadshow are making sure young men and women across the southern United Kingdom are getting an eyeful.

Using energetic, entertaining displays of laser light, the roadshow aims to bring free photonics education to students and kindle an interest in physics and photonics.

“We try to make the whole presentation have the highest visual impact, as well as demonstrate a lot of the properties of light, lasers, and fibers that the students may have heard about but are relatively unlikely to have seen, and definitely not on this scale,” says Keith Wilcox, the laserist of the roadshow.

The show uses popular technology ubiquitous in students’ lives, such as cell phones and the Internet, as a jumping-off point for discussion. For example, in one of the most striking demonstrations—a Tyndall/Colladon demo—a laser-light-illuminated curved stream of water flows from a tank (see photo on top of p. 37). This is used to teach students about total internal reflection and light guiding employed in fiber optics.
“The talk needs to be adapted on the spot to appeal to the audience,” says John, coordinator of the program. “The lecturer has to be very aware of how the audience is responding—to know how to pitch the level of the lecture—and this is very difficult in low-lighting conditions. Every show is different because of the audience.”

The presentations cover national curriculum requirements and regularly change in response to teacher and student evaluations. “This year we added a demonstration that appealed to all of us,” says John. “If you take a red balloon and blow it up inside a green balloon, then select a green wavelength for the laser and aim the beam at the balloons, only the inside balloon bursts. It doesn’t work every time, but when it does it gets a superb reaction.”

Light Express was created by the University of Southampton (Southampton, U.K.) in 2000 as a way to generate interest in science and the university among teenage students. Since then the show has visited dozens of schools, a church, and even Albert Hall in London. More than 3,000 students have participated in the program, and with its success the program’s scope has also widened.

John explains that she would like to see more in-house activities at the University of Southampton to bring students into the university setting for demonstrations. They have already begun holography workshops with students from schools the roadshow previously visited, and these “Light Express Extra” activities are offered to younger schoolchildren as well.1

The roadshow is partly funded by the University of Southampton’s “Widening Participation” program—an initiative of the Higher Education Funding Council for England, which hopes to encourage students unlikely to attend university to do so.

“One teacher told us that he would not expect any of his students to think of going to university,” says John. “So it was fantastic to get them in through the doors to see what student life was like while they were doing an exciting hands-on activity.”

She says the key to a successful program such as Light Express is plenty of technical and administrative support, excellent funding, and sensitivity to teachers’ and schools’ needs. “Sending a show on the road is a real team effort,” she says. “It is exhausting for all of us, but a lot of fun and very rewarding.”

John, an SPIE member, is herself an accomplished holographic artist with an M.A. in holography from the Royal College of Art (London, U.K.).

“I was inspired by holography at the age of about 15 when I saw my first hologram,” she says. “I knew instantly that I wanted to make a career out of making holograms. So I set about building myself a holography table and setting up a studio in my parents’ garage.”

She’s come a long way since then. In addition to many holographic art exhibitions, last year she won the Shearwater Foundation Holography Award, which is given to artists in recognition of outstanding activities in the field of creative holography. “I was delighted because it was something that I’d always hoped that I’d get at some point in my career,” she says.

John also taught laser technology to high school students from 1998 to 2003 at the Columbia Career Center (Columbia, MO) and helped establish an SPIE student chapter while there.2

Now at the University of Southampton, in addition to her duties as coordinator of the Light Express Roadshow, John continues her artwork at the university’s School of Physics and Astronomy.

“I’m very grateful for my job ... I work with research scientists—both staff and postgraduate students—who are an inspiration,” she says. “I feel very lucky to enjoy my job so thoroughly.”

References
1. For detailed information on holography demonstrations, see the article John co-wrote for oemagazine in April 2002, p. 38.
2. See this article at www.oemagazine.com for free access to the SPIE paper “Making holograms: an education CD-ROM,” which John co-wrote with Elaine Poché.