

A TREMENDOUS FOUNDATION FOR THE FUTURE

Interdisciplinary Math Institute Sparks Creative Problem-Solving

When a small group of math professors, including Robert Sharpley and his colleagues Colin Bennett and Ronald DeVore, launched USC's Industrial Math Initiative in 1991, they had no idea how large a demand there might be for their work.

Twenty years later, their initiative has blossomed into an institute where 32 faculty members, from the math department and beyond, collaborate with postdoctoral students and graduate and undergraduate assistants to solve complex mathematical issues for government agencies like the National Science Foundation, Department of Defense and National Endowment for the Humanities and for private-sector companies like Exxon-Mobil and Radiance Technologies.

With some 27 currently funded research projects in the works, the program, now known as the Interdisciplinary Mathematics Institute (IMI), makes Carolina's mathematical talent more readily available beyond the university's walls,

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where it has had significant academic and real-world applications. For those like Sharpley who have been with the program since the beginning, it has been exciting to see just how varied and extensive those contributions have been.

When he arrived at Carolina in the 1970s, Sharpley was impressed by a young, dynamic math department that was clearly on the rise. "We had a tough and energetic dean who really wanted to see the department improve," he says. "We were able to attract a lot of terrific people and to keep them here. If you want to build a strong department, nothing beats bringing in great faculty."

As the department grew, it developed particular strengths in classical analysis, which is the foundation for much of the work performed by the IMI. "A lot of people in various sectors of government and industry have problems that can be formulated mathematically," Sharpley explains. "They might, for example, want to extract information from data or optimize a particular procedure. A mathematical approach helps to break complex problems down, isolate key variables, and devise fast solution methods with guaranteed accuracy."

One early IMI project involved the Moffitt Cancer Center's efforts to optimize medical imaging to aid in early detection of breast cancer. "Radiologists look for certain microcalcification chains that can be precursors to breast cancer," Sharpley says. "But when you look at these images, even with a trained eye, the chains are still extremely difficult to detect. What we can do, through multiresolution analysis, is build a framework that decomposes the image into more discrete layers, which allows doctors to clearly see hidden features and relationships at their naturally occurring scale." This work has evolved into a budding collaboration with a chief scientist at GE Healthcare Systems to devise

information extraction methods for maintaining and assessing patient's records, particularly various 2-D and 3-D medical imagery, and automatically indicate changes that may have occurred over time.

Although Sharpley is now officially retired from teaching in the math department, he continues to be very active with the IMI, for which he has served as director and currently serves as an executive committee member. He has directed IMI projects for the Savannah River Site, the Department of Defense and the National Science Foundation.

It is, in large part, the wide-ranging applications for mathematical research that keep him involved with the IMI. "We were recently contacted by organizations working with government intelligence agencies," he notes, "and what they're charged with doing is analyzing ground-level photos to determine, as quickly as possible, a short list of candidates for the most likely world coordinates where the image was taken. Our faculty's expertise in image and geometry processing provide the foundation to help with those types of challenges."

Working on a U.S. intelligence project brings Sharpley back full circle since it was geopolitics during the time of his youth that initially sparked his interest in a mathematical career. "When the Soviets launched Sputnik, and I watched it cross the cloudless sky from my backyard on the high plains of Texas, I could see how much they were investing in math and science education," he says. "I had been thinking about a career in medicine, but that made me decide on math." Noting that math is, for many students, a difficult, even feared, subject, he credits supportive teachers with giving him the initial boost of confidence he needed to succeed in such a challenging field. "Encouragement and some initial success can make a big difference in any student's perception of themselves," he says.

Students, he adds, tend to pay back the favor of a professor's support with the energy they bring into the department. "I do miss teaching," he says. "One of the great things about being at a university is that there are always fresh ideas and fresh faces and so much enthusiasm from people who are ready to learn. That's one reason we make a point of putting undergraduates in our labs. We want to expose them as fully as possible to what a career in math can be like."

Carolina, Sharpley says, offers a particularly fertile environment from which to launch a math career, largely because of work the university and his colleagues did to build the department in his early years here. "There was such great synergy between the people who came here at that time," he notes. "That generated a lot of professional activity, and all the research coming out of the department led to a complete revamping of the graduate and undergraduate programs, so it had a long-term effect."

Now, he believes, is another pivotal moment for both the math department and the IMI. "When I arrived here,



Robert Sharpley

there were such amazing opportunities," he says, "and now there are too." In the IMI, "what we're trying to do now, with Pencho Petrushev as director, is to leverage existing collaborations and build on that and become even more multidisciplinary so that we can further expand our reach and ability to provide mathematical support to those who can benefit from it."

That, says arts and sciences dean Mary Anne Fitzpatrick, is very much in keeping with what the IMI has done all along. "Bob and his core team have laid such a tremendous foundation for the future," Fitzpatrick says. "That makes the outlook for the Interdisciplinary Mathematics Institute very promising."

UPCOMING EVENTS

Mark your calendar for these upcoming events sponsored by the College of Art and Sciences. Learn more about these and other events at www.cas.sc.edu/upcoming.html.

Exhibits

"Imaging the Invisible: Challenging Visitors to Think about Scientific Imaging": Aug. 13-Dec. 12, 2011, McKissick Museum

"Showing Your Mettle": Sept. 10-Dec. 16, 2011, McKissick Museum

"Castelli's Cabinet": Oct. 10-Nov. 23, 2011, McMaster Gallery

"Chris Ganz: Gallery": Jan. 16-Feb. 16, 2012, McMaster Gallery

College Events

National Science Foundation Conference, "New Horizons in Conflict System Analysis: Applications to the Middle East": Oct. 28-30, 2011, The Inn at USC

Joseph Cardinal Bernardin Lecture, "Souled Out: Reclaiming Faith and Politics after the Religious Right": Nov. 1, 2011, Law School Auditorium

Theatre and Dance Productions

Architects of Dance: Nov. 10-11, 2011, Koger Center for the Arts

"Polaroid Stories," by Naomi Iizuka: Nov. 11-19, 2011, Longstreet Theatre

"Romeo and Juliet," by William Shakespeare: Nov. 17-20, 2011, Lab Theatre

Future Perfect: Student Choreography Showcase and Wideman/Davis Dance in Concert: Nov. 30-Dec. 2, 2011, Drayton Hall Theatre

Go to <http://www.cas.sc.edu/calendar.html> for a complete listing of events

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with ambiguity," she notes. "There's never just one way to interpret a poem. In the diplomatic service, you never have all the information you might want, but your job is to take the information you do have and interpret it as best you can. And you have to be sensitive to the nuances of another culture. More broadly, you need to be flexible and willing to get out of the box. Those are skills you get from studying English, and they are useful in a number of professions."

That appreciation for the value of her own education has now brought Shumake back to the teaching career she initially imagined for herself when she began her graduate work. Having returned to her hometown upon her retirement, she teaches English part time at East Mississippi

Community College and is also enjoying her newfound opportunity to put down deep roots in one place. With the average diplomatic assignment lasting three years, she notes, "you get immersed in the culture of each country, but it's hard to get involved in the community in any sustained way. So, coming home, I'm able to work with organizations like our local arts council and our friends of the library and give back to the community in a way that I haven't been able to do in 25 years, and that means a lot to me."