Pass it On

Memorial scholarships honor the lives of Fairfield University alumni.

Fascination

Filmmaker Chris Campbell '74, M.A.'75 tells transformative stories for children.

Pot Luck

Rebecca Hays '92 of America's Test Kitchen *has a passion for cooking.*

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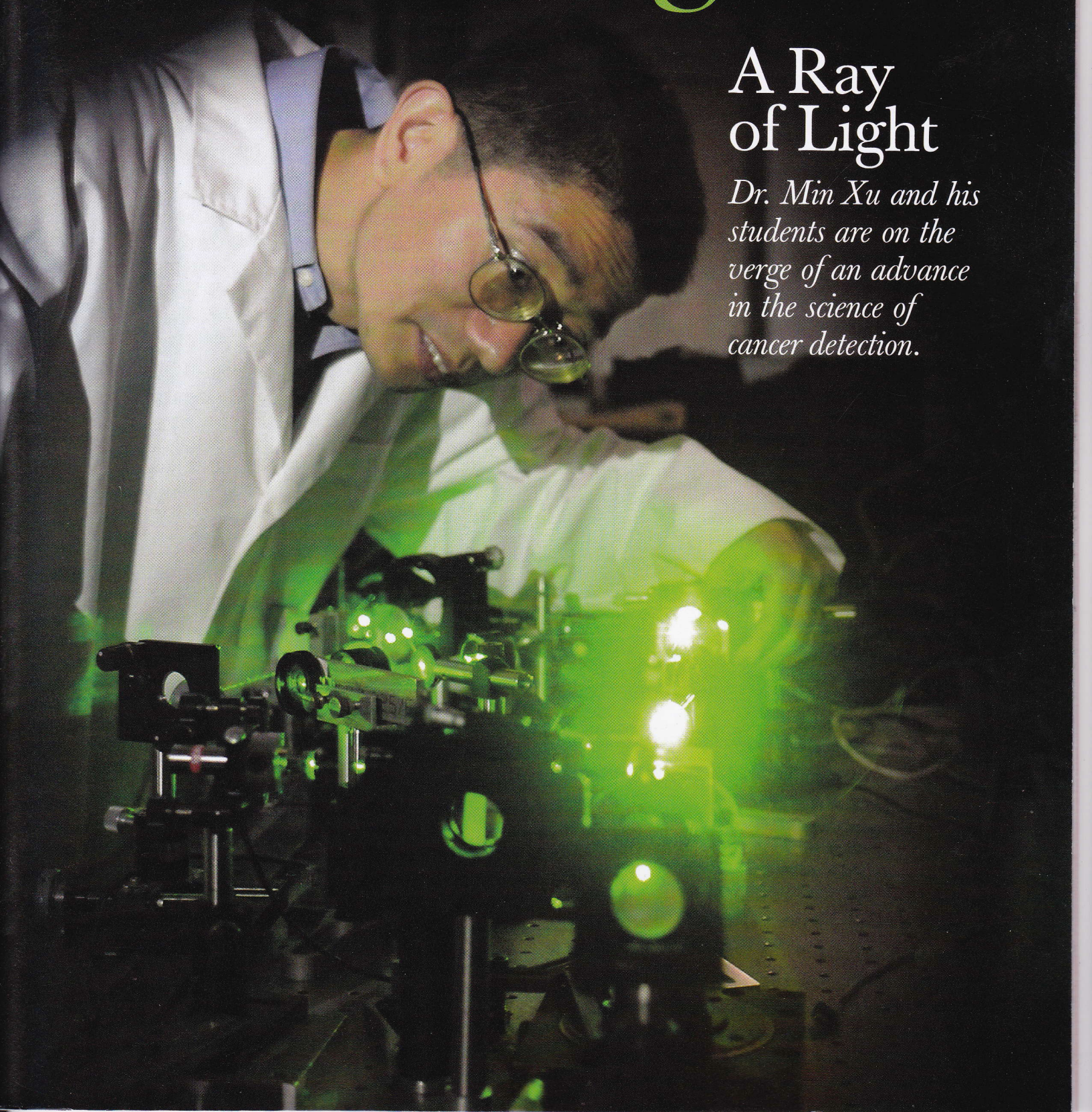

A Ray of Light

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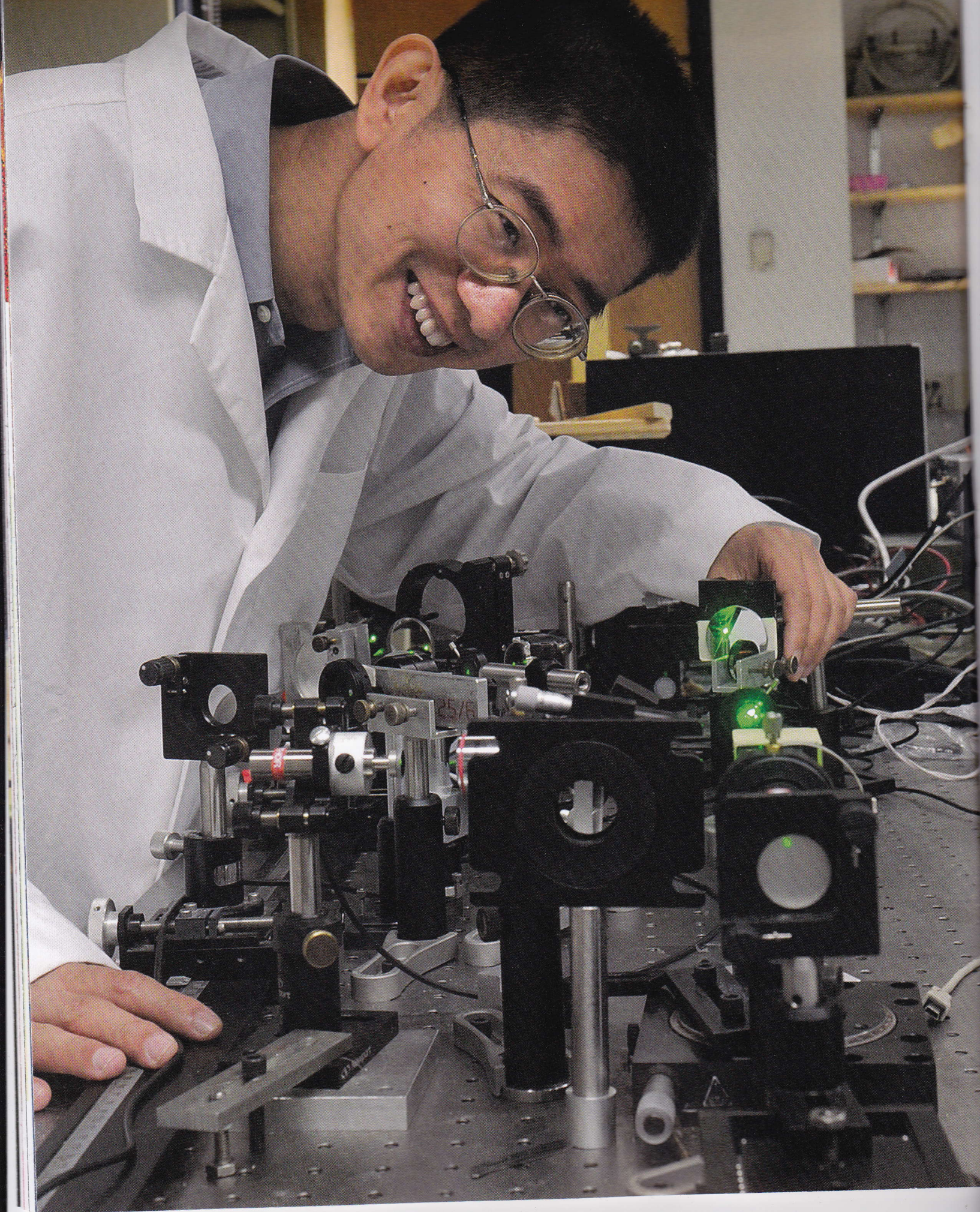


A Ray of Light

BY MEREDITH GUINNESS

Dr. Min Xu is on the verge of an advance in the science of cancer detection

Dr. Min Xu, associate professor of physics, and his team of gifted student researchers have been in the lab all summer at Fairfield, working toward a new cancer detection and classification technique that could revolutionize the way doctors diagnose and treat the disease.

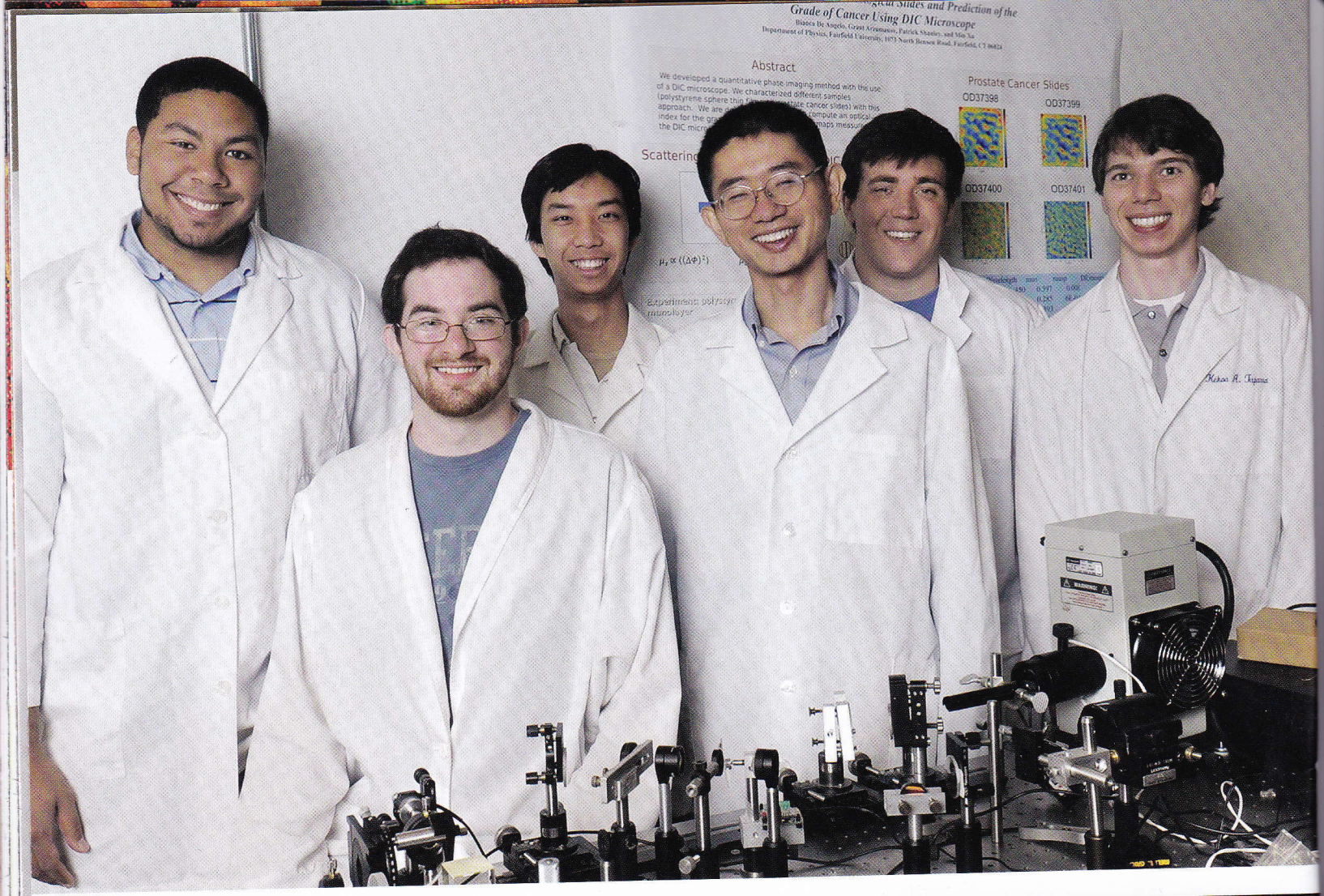
The idea seems almost simplistic: Dr. Xu and his team are trying to use light and state-of-the-art microscope technology to detect and grade cancers, about 90 percent of which begin at the most superficial layers of organs, layers that light can penetrate.

The inventive research relies on back-scatter tomography technology – similar to the body scanning machines at airport security checkpoints – and complicated algorithms to detect abnormalities in cell nucleae, early markers of cancer.

Unlike conventional biopsy, which requires removal of tissue and the eventual death of the cells, Dr. Xu's method would allow for non-invasive, safe, and inexpensive detection by viewing the way light interacts with tissue. It would also allow doctors to determine the grade of the disease – how far it has progressed – plan appropriate treatment, and track the cancer's progress or decline in living cells, Dr. Xu said.

Photography by Jean Santopatre

LEFT: Dr. Min Xu adjusts his tomography technology invention in his physics research lab in the Bannow Science Center.



"Treatment is awfully different for different grades," he said. "We are trying to define the grades so you can have better treatment. It's a kind of optical biopsy or the sensing of structural change when cancer starts. We're looking at the physical 'signature,' the way, say, the nuclei changes with cancer cells."

Dr. Xu, who holds a Ph.D. from City College and Graduate Center of City University of New York and bachelor's and master's degrees from Fudan University in Shanghai, China, has been working on aspects of biomedical optics for several years. Since coming to Fairfield in 2006, he has had a share in several prestigious grants toward his research, including $542,960 from the U.S. Army Medical Research and Material Command, $298,600 from the Department of Defense, $219,396 from the National Institutes of Health, and two Research Corporation grants for his current work.

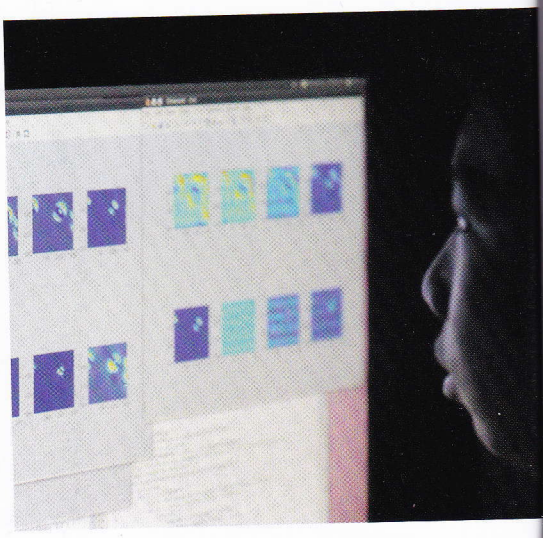
Biomedical optics poses a real opportunity for the medical field, he said, and the competition is fierce to make a breakthrough. The reason? While ultrasound is good for penetrating tissue, the images produced are poor. Other methods, such as X-rays, give good images, but can be harmful and are inappropriate for use on some individuals, including infants. As a result, researchers are looking for safe, effective alternatives. "The field is expanding very rapidly," said Dr. Xu. "People always want to see better, to see smaller. With light you can see things you couldn't before."

It's easy to pass by Dr. Xu's lab in Bannow Science Center, assuming it is closed. His team often works in the dark, shining beams of light on both the polystyrene spheres they use as a control and slides of cancer cells they magnify under a Zeiss microscope they have modified for their purposes.

Dr. Xu's work offers a unique opportunity for his students. Some, like Patrick Shanley '12, a physics major from Wantagh, New York, and Bianca De Angelo '12, a physics major from Warwick, R.I., have been working in Dr. Xu's lab for three summers. They spend their days running algorithms and studying the optical signature of cancer cells, looking for trends in the light-scattering spectrum they see to firm up their theories.

Jared Buckley '12 is also part of the research

continued on page 30



TOP: Joining Dr. Xu, from left to right: Braulio Rodriguez '12 (Lawrence, Mass.), Jared Buckley '12, (Easton, Mass), Htet Aung '13 (Myanmar), Patrick Shanley '13 (Wantagh, N.Y.), Piotr Kostyk '12 (Bethel,Conn.).

ABOVE: Htet Aung '13 studies samples from microscope findings on his computer.

"You want them to compete in the market and to get experience in how to do the work, how to solve a problem. It's only by having your hands dirty."

Dr. Min Xu, *associate professor of physics*

and graduate schools. Brimley said, "The whole program goads us into becoming a mini-expert in a specific facet of mathematics, and it is empowering to have a professor truly valuing your ideas and perspectives."

Dr. Rafalski said, "It's not always easy, but very often it's fun and a worthwhile challenge. I've found that my students have digested their research topic so well toward the program's conclusion that they often are posing questions that stump me, which I love because it keeps me on my research toes."

At the end of the REU program, each research group will prepare a written report on their work and present the results to all of the program participants. Some will be asked to present the results of their work at conferences, including the National Joint Meeting of the American Mathematical Society (AMS) and the Mathematical Association of America (MAA) in Boston.

The students and teachers have made lasting friendships and networks with the inaugural group. Brimley said, "I am really enjoying the Fairfield REU. At Fairfield, I am constantly interacting with the same group of people in my math classes, as we are all math majors following the same mapped-out curriculum. This has given me an opportunity to meet and interact with new people who are equally as interested in this scientific area."

Despite the hard work, the program has been a one-of-a-kind experience. "Doing mathematical research is a very creative process," Dr. Rafalski said. "No artist would ever tell you that it was easy to create something. Creativity requires the courage to try new things, the judgment to realize when something you try isn't working the way you thought it would, and the perseverance to push through difficulty. Mathematics research is the same way, and conveying this awareness to the students is one of the program goals."

team: "I have an algorithm that runs for 15 minutes and some days I would run it eight or nine times a day and just sit there waiting for it to give me an answer," said Buckley, a physics major from Easton, Mass.

Tedious? Yes. But these undergraduates realize that working with Dr. Xu on such cutting-edge research is invaluable, especially at a relatively small, liberal arts university.

"It's very beneficial to students," Dr. Xu said of student research. "You want them to compete in the market and to get experience in how to do the work, how to solve a problem. It's only by having your hands dirty. I tell them, "Okay, you did it. Now do it again' and then 'Okay, do it again.' And they are amazed. They say, Oh! I get it now!' It's about persistence."

Dr. Xu is also forming crucial partnerships with some of Fairfield's most high-profile researchers. He's working with Dr. Shelley Phelan, professor of biology and Elizabeth DeCamp McInerny Chair of Health Sciences, on a joint project to develop a new type of microscopy to detect and distinguish cancer cells. Dr. Phelan, a molecular cell biologist, specializes in the study of regulation and function of cancer cells. She and her student researchers are using well-tested methods – dye-based assays – to view cells dividing or going through cell death. Down the hall, Dr. Xu's students are using the optical tools to see if they can mirror her results, ideally showing light-based detection methods are just as effective, she said.

Piotr Kostyk '12, a biology major from Bethel, Conn.

"It's really a perfect synergy between his expertise and mine," said Dr. Phelan, whose students bounce between the two labs. "The research experience the students have gained in both culturing cancer cells and using those cells to test the new microscopy method has provided them with a truly unique set of skills that neither Min nor I individually have."

The University is keeping its eye on the potential commercial opportunities created as a biproduct of Dr. Xu's pursuits. Ben Muskin, the University's technology transfer consultant, said Fairfield has filed patents to protect the intellectual property related to the optical biopsy work. Muskin said Dr. Xu's research may lead to a license with an outside company or a start-up business venture for Fairfield. "We have had discussions with potential corporate partners," he said. "He is on the verge of providing proof of concept data that would make it very attractive to companies."

Though it often takes years of hard work and many setbacks to reach a goal in science, Dr. Xu said his fascination with his field and the possibility of helping others through his technology never dims. "There are so many unknowns for light," he said. "It's a fascinating field to work on. And I am fascinated also by the prospect of not only doing research, but doing good."