FIGHTING THE GOOD FIGHT

By Debbie Kang, journalism '06

SOME CHEMISTRY STUDENTS MAY STILL BE trying to figure out the atomic number for lithium, but not **Magdalena Mroczkowski (CHEM '06)**. She is currently working on synthesizing new antibacterial agents in the form of beta-lactams, a class of antibiotics that includes penicillin. (See Professor Profiles, page 10.) The problem with beta-lactams arises when bacteria synthesize beta-lactamase. This enzyme renders beta-lactams like penicillin inactive, resulting in resistance to that antibiotic.

Beta-lactam is a chemical structure that is versatile in use, but Mroczkowski is focusing on its capabilities to prevent microorganisms from growing.

"Personally, I am working on synthesizing one beta-lactam structure and aiming toward a certain mass so that it is enough to be used for testing in the microbiology labs that we are going to send it off to," she said.

Right now, Mroczkowski is working on making 500 mg of beta-lactam. When she's finished, she will attempt to start on a new structure that has never been made before. She believes the research will delay resistance. Since bacteria become resistant to antibiotics quickly, new antibiotic structures must be made.

Such research is time consuming. Fortunately, Mroczkowski can maintain her schedule through multitasking. She can start her experiments with chemical reactions with procedures taken from journals and simultaneously study for her other classes.

"It gets overwhelming at times, but Professor Konaklieva is very flexible, and I basically make my own hours, around my schedule," she said.

Although she never worked in a lab before, Mroczkowski was motivated to try by Professor Monika Konaklieva's Organic Chemistry class.

"Medicine always interested me," she said, "but at the same time, I prefer chemistry to biology. So I thought medicinal chemistry was a good combination of the two. And just in general, I thought the prospect of working on a potentially new antibiotic was pretty exciting."

NOT YOUR NORMAL SHIPBOARD MINE DETECTOR

By Mary Specht, journalism '08

IT'S HARD TO THINK OF SOMETHING **CHRISTY FERNANDEZ (CAP '04)** hasn't done. The physics major is a Ronald E. McNair scholar and has interned with Hillary Clinton, *Latina Style* magazine, and the National Institutes of Health, among others.

She is currently working with the Department of Defense for NAVAIR, on a naval base doing electrical engineering work (optics/physics) for the navy. More specifically, she is working to improve the method for seeing underwater by resolving reflections of backscatter from laser light. This is energy scattered back to the laser, interfering with the image quality. Reflections come from thin layers in the water column as well as underwater objects. The current technology has many applications: from mine detection to studying ecological life like phytoplankton which form thin layers in coastal waters of about 1 to 10 meters in depth. The National Aeronautics and Space Administration, among others, currently uses a LIDAR (Light Detection and Ranging) setup for possible cloud layer analysis or atmospheric analysis of CO_2 or O_2.

The system Fernandez is working on is called LOCO (Layered Organization of Coastal Oceans): Shipboard LIDAR, which is used as a range-gated LIDAR system—using modulation to chop down a pulse. This better resolves backscatter from either layers or objects underwater that are captured by the receiver.

"It's hard to use radar to analyze or better resolve anything underwater," she said. "Analysis of backscatter makes it difficult to deduce what you're looking at. But light at a particular wavelength, specifically 532 nm, which is similar to the color of water in coastal oceans so it highly absorbs, can be used. Also, a shorter pulse helps to better analyze certain things like thin layers of phytoplankton or even mines underwater."

Fernandez is helping to program a controlling unit and a laser unit for the shipboard LIDAR. Her computer programs will communicate with the hardware. She is also putting together the optics and tools necessary for chopping an 8ns pulse down to a 2ns pulse. However, she is not using the usual technique of combining light with radar. She is using a range-gated modulation system.

"It's a different technique and we're building our own prototype," she said. "If it's successful and we're able to do something that can better identify, then it will possibly be used for the fleet."

The range-gated system is different in that she is not combining light with radar. Instead, she is using a modulator which rotates the polarization of incoming light. A modulator will shorten the pulse and this is why it is called a range-gated system.

"By using a range-gated system it is possible to shorten the pulses and better resolve what you are looking at in the water," Fernandez said. "I'm trying to create a more vivid picture of what we're seeing below the water."

Editor's Note: As we went to press, we learned that Christy Fernandez had just been accepted into the electrical engineering PhD program at Duke University.