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## Regional

# Ledzewicz applies math to health sciences

For many people, mathematicians live in an abstract world that can seem almost detached from reality. Yet, many mathematicians are doing work in areas that affect each of us directly – including in healthcare. That is the case of Urszula Ledzewicz, a distinguished research professor in the department of mathematics and statistics at Southern Illinois University Edwardsville. Born in Lodz, Poland, Ledzewicz obtained her master's and doctorate degrees in mathematics from the University of Lodz.

"I grew up in a very abstract world of mathematics," Ledzewicz said. "It was one of my colleagues from Poland who introduced me to models for cancer treatment. I thought this was such a great application of the tools that I had been mastering for 15 years or so. I started doing applications that have been so much more exciting, so much more fruitful and just fulfilling for me. I wish I had started earlier." Using mathematics for such real-world applications means regular interactions with professionals from outside her discipline.

"I just came back two weeks ago from a conference in Boston where my husband and I were both plenary speakers, but we were basically the only mathematicians who had affiliations in departments of mathematics or engineering," Ledzewicz said. "There were other mathematicians but they were all parts of medical schools, so they had mathematical training, but were medical doctors at the same time. The majority of people were from the medical field and I was terrified of giving a talk, but the communication was great. If you know what they want you to deliver, you leave the mathematical details aside." She noted that mathematicians today make important contributions to the health sciences.

"Doctors are noticing that giving a drug is not just the answer to the question, but also how to give the drug in



Professor Urszula Ledzewicz teaches a class.

the sense of dosage, frequency and sequence. If it is more than one drug, that can make a tremendous difference in the outcome of treating cancer, for example," Ledzewicz explained. "At the same time, they have absolutely no clue from the medical point of view other than just a gut feeling or intuition of how to do it, and here is where mathematicians come into the picture. You construct the model which somehow

mimics what is happening in the human body, and then you introduce a variable called dosage of the drug."

Another positive outcome of this type of study is that mathematicians can help save money for the already expensive healthcare system. "Some drugs are very expensive and I would tell you how to use it in the optimal way. In other cases, some drugs are not expensive, so it is not an issue of the cost

but an issue of minimizing toxicity of the drug," Ledzewicz said. "If with a lower dose you can accomplish a better outcome, why poison the patient?" One of the areas in which mathematics have been used most successfully is in the treatment of cancer.

"There is a group of researchers at the University of Washington who work very closely with medical doctors and radiologists in treating glioma, which is

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a tremendously fast growing tumor in the brain," said Ledzewicz. "They take data from specific patients to analyze and measure the growth. This data is being entered and it is like a personalized model patient. Then they can judge the progress and also make a prediction of how the life of the patient would look like, most likely, and they try to see how the treatment would affect it. So, that is where the mathematical model directly enters medicine. This is one example I know at this center, where they developed things called virtual patients. They get data from the hospital about the patients and produce potential outcomes and best treatment options using mathematical modeling."

Despite its usefulness there is always the perception that mathematics is a very difficult field. "That is the question I will not be able to answer," Ledzewicz said. "I have always found mathematics interesting and fascinating. I think this perception I see more in the U.S. than in Europe. There is a little mental blockage in the States when it comes to mathematics. You tell somebody you are a mathematician and it is, 'Oh my God! I can hardly balance my checkbook.' I never heard that comment in any of the European countries." Her own approach to her students is this regard is very simple.

"I try to explain to them that they should not fear mathematics," she said. "And I try to pass my enthusiasm to them. That's all I can do."

*Aldemaro Romero is the Dean of the College of Arts and Sciences at Southern Illinois University Edwardsville. His show, "Segue," can be heard every Sunday morning at 9 a.m. on WSIE, 88.7 FM. He can be reached at [College\\_Arts\\_Sciences@siue.edu](mailto:College_Arts_Sciences@siue.edu).*

Photo courtesy of Ana Roa