Faculty physicists Robert Szoszkiewicz (left), Jeremy Schmit (center), and Bret Flanders (standing)

BIG-PICTURE PHYSICS

The potentially life-changing (and utterly cool) work of three K-State physicists

It reads like the plot of a mind-bending movie: Scientists studying and manipulating cells and molecules invisible to the naked eye…while the health of the world's population hangs in the balance.

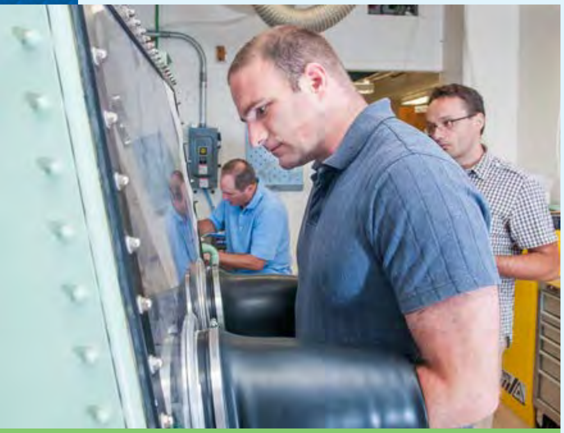
But this scenario is far from a movie. It's real life for three faculty phenoms in Kansas State University's biological physics group, which uses physics methods to study living organisms. Assistant professors Jeremy Schmit, Ph.D., and Robert Szoszkiewicz, Ph.D., and associate professor Bret Flanders, Ph.D., look at matter so tiny that it's measured in nanometers — or *billionths* of a meter. Yet no matter how small a scale they work in, the results could lead to an impact of the biggest kind. These three are taking aim at diseases we're all touched by in one way or another: cancer, Alzheimer's, and Parkinson's, to name a few.

Cause and Treatment

A theoretical physicist, Jeremy Schmit researches protein aggregation — or how proteins stick together.

"Diseases like Alzheimer's, Huntington's, Parkinson's — these are all caused by proteins that clump together in your brain," Schmit said. "So I'm trying to figure out from a physical point of view: What is it that causes them to clump together? What can we do to mitigate that?"

While trying to figure out what causes problems on the biological side, Schmit also partners with biotechnology company Amgen to address the treatment end of things. His charge is to figure out how



to transport delicate, disease-treating proteins from the manufacturing plant to the patient…without having them fall apart.

Nature's Mistakes

Like Schmit, Robert Szoszkiewicz's work concentrates on proteins. Instead of looking at how proteins group together, though, Szoszkiewicz studies how they fold, which determines how they behave. He and some colleagues have developed a new tool that sheds light on the process.

"Proteins sometimes make mistakes; they do not fold in the way they should. If we know the intermediate steps, we can say what happened during each step, and maybe we can apply some molecular agents which will correct the steps," said Szoszkiewicz, who has also collaborated with biochemistry faculty to observe proteins linked specifically to breast cancer.

"There are many diseases associated with protein folding: many cancers and many neurodegenerative diseases, like Alzheimer's, Huntington's, mad cow disease. We can maybe contribute to understanding some parts of this puzzle."

Small-Scale Surgery

Much like his colleagues, Bret Flanders is taking on some of health's biggest challenges. He and his team spent the last five years creating nanomaterials that let them work on an extremely small scale. And now Flanders has an ambitious plan to revolutionize surgery — for cancer, in vitro fertilization, and even root canals.

"One area that we're keenly interested in is developing the tools to do surgical procedures on a single-cellular or few-cellular level. That's probably 10 years down the road," Flanders said.

"The idea is that if you can work on this small of a scale, you can impact fewer cells in the body. Theoretically, you could remove just the cancerous cells without affecting the healthy ones. Or you could treat an infected area without disturbing the area around it."

Students in the Mix

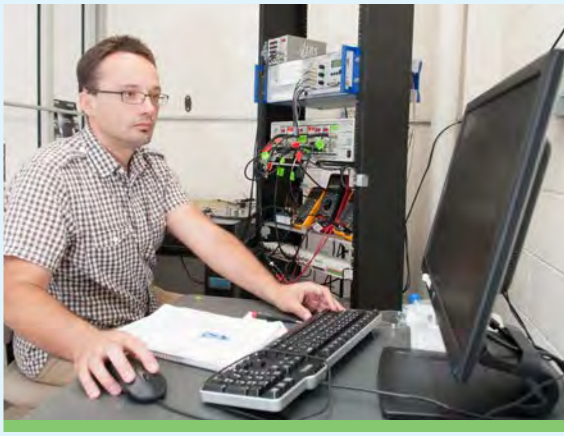
To date, this faculty trio has earned grants from the National Science Foundation (Flanders, Szoszkiewicz), the Johnson Center for Basic Cancer Research (Szoszkiewicz), and biotechnology company Amgen (Schmit). And while funding is always limited, their ideas are not. For that reason, each of them heads up a research team of postdoctoral fellows, graduate students, and undergraduates to help bring their many notions to life.

All three faculty members characterize the students — in particular the grad students — as absolutely crucial to the success of the Department and its research.

"Far and away, hands-on lab work on a common project is the most rewarding because the student develops quicker, I learn something, and the project advances," Flanders said.

K-State 2025

The ultimate goal for these teachers and researchers is simple: use science to change the world for the better. It's a goal that dovetails nicely with the University's K-State 2025 goal of becoming a top 50



public research institution, Schmit says.

"We're all in this trying to do the most influential research possible, and to try to have the biggest impact on the field as possible. And there's a big feedback loop there: The better the research you're doing, the more students want to come and work in your department, and the more people pay attention to the work that comes out of your department. You can come at this with an entirely self-serving point of view, but it feeds back into those big-picture goals."

PROPEL PHYSICS

THE NEED:
Scholarship funding for graduate students, who are invaluable to the Department's research and national reputation

TO HELP:
Sheila Walker, director of development, sheilaw@found.ksu.edu, 800-432-1578