

# 23 Billion

DOLLARS ARE SPENT ANNUALLY ON  
DIRECT CARE FOR DIABETES

# Aiding the Diabetic Heart

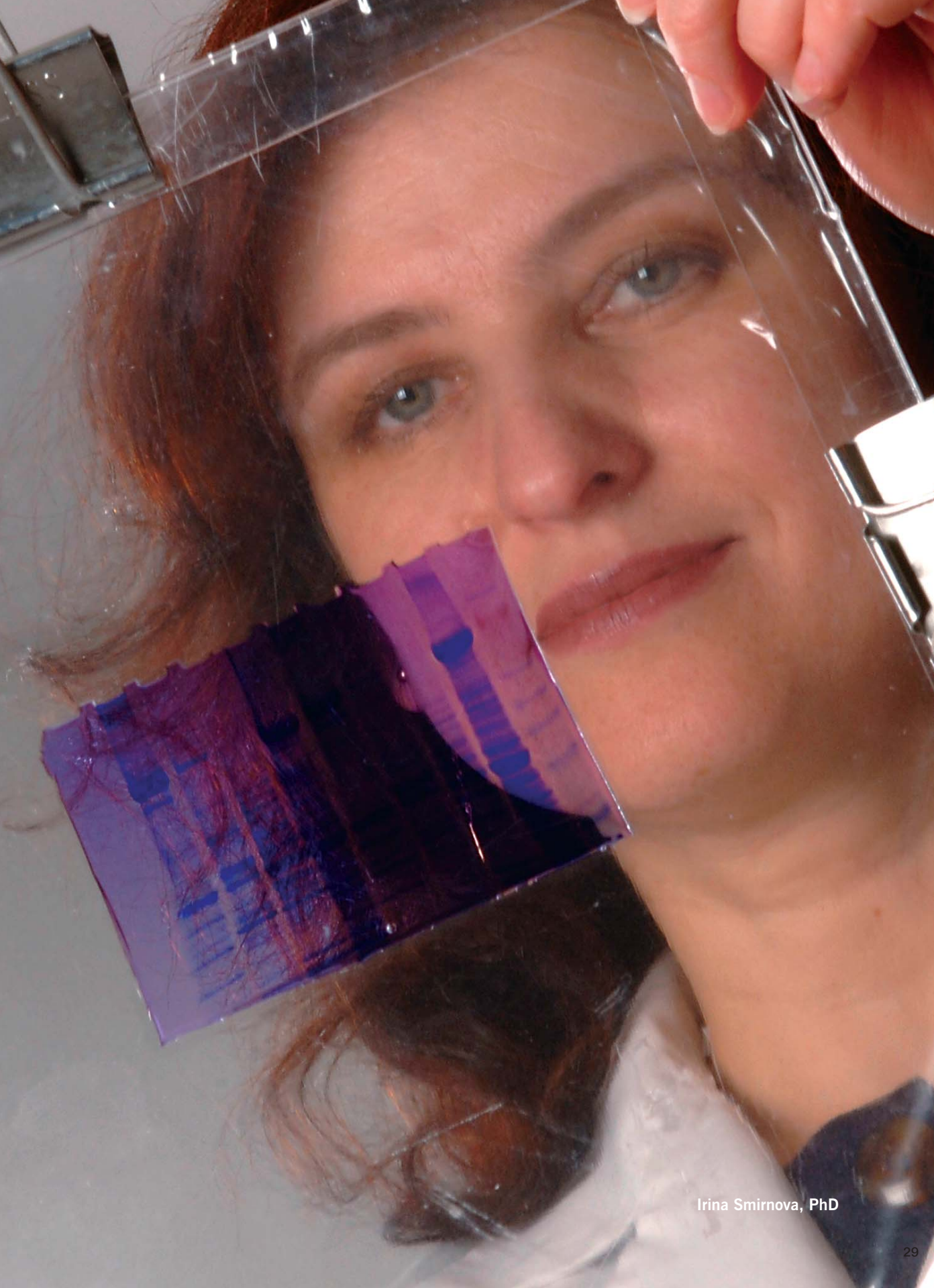
**O**f the 20.8 million adults and children in the United States who currently suffer from diabetes, two-thirds will die from heart disease or stroke, according to the American Diabetes Association. Yet most diabetics do not recognize heart disease as a complication of diabetes.

With training in both biochemistry and protein chemistry, Irina Smirnova, PhD, wanted to dig deeper to learn more about the molecular mechanism underlying exercise's positive effect on the heart in diabetics.

Smirnova is an assistant professor in the Department of Physical Therapy and Rehabilitation Science. She has focused much of her research on the cellular signaling involved in pathological cardiac processes associated with diabetes and how physical training can protect the damaged heart.

Currently, she is engaged in a four-year study funded by the American Heart Association that is testing the effect of a drug

## CAN A DRUG ENHANCE THE IMPACT OF EXERCISE ON DIABETES?



Irina Smirnova, PhD

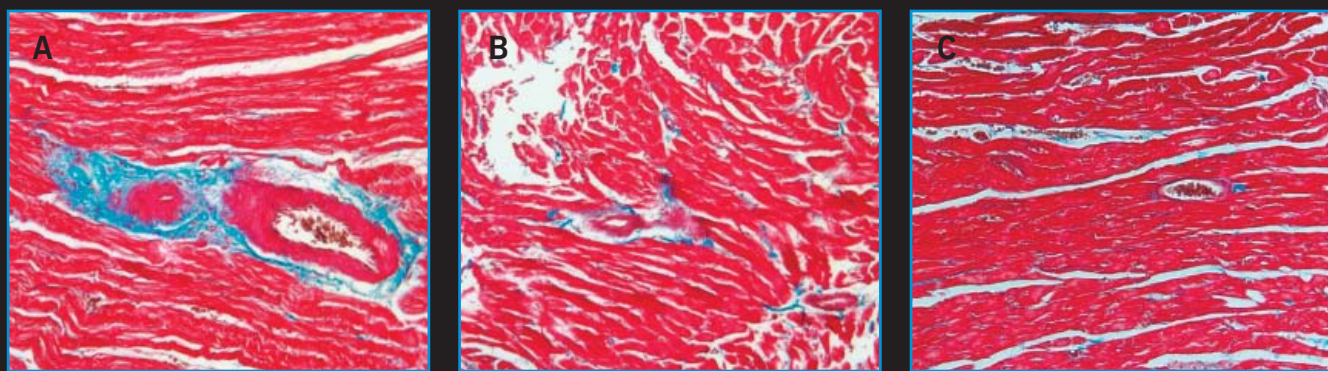
**7** PERCENT OF THE U.S. POPULATION HAS DIABETES (20.8 MILLION PEOPLE)

designed to inhibit Protein Kinase C, a molecule that induces stiffening of the heart muscles in people with diabetes causing the heart to pump blood less efficiently and eventually to fail. The goal of the study

nor exercise. A second group exercises only. The third group receives the drug but does not exercise.

“So far the data show the drug helps the animals be more tolerant of an exercise stress test, and

place, she is ready to move on to another. In the next phase of her study, she will use Magnetic Resonance Imaging (MRI) technology to evaluate the cardiac performance of the three groups of rats during the



#### **A SERIOUS THREAT** to patients with

diabetes is heart fibrosis – undermining the organ’s ability to pump blood as scar tissue overtakes healthy muscle cells. Above, the heart tissue of a diabetic rat (A) is significantly improved with exercise (B), as evidenced by the reduction in scar tissue (blue areas). Image (C) is the control sample.

is to see if the drug can replace exercise to improve the heart so that those who are physically unable to exercise, due to other complications of diabetes, can receive the same health benefits.

In Smirnova’s animal study, rats with type 1 diabetes are divided into three groups. One group receives neither the drug

their general appearance is better,” Smirnova reported. “They are doing better than the plain diabetic rats, but not as well as the exercised diabetic rats – but they are close, which is what we had hoped.”

Now that Smirnova has one piece of the puzzle in

entire course of the disease.

“We would like to have data showing when you can implement exercise and at what phase of the disease is exercise most efficient. Is it better to exercise at the beginning of the disease or later? We are trying to determine when the inter-

# SEND IN THE NANOPARTICLES!

In a study funded by the Juvenile Diabetes Research Foundation, Irina Smirnova is investigating how to promote wound healing in diabetic patients. Wound healing is critical to managing diabetes because of the rate of amputations as a complication from the disease. National Institute of Diabetes and Digestive and Kidney Diseases statistics show that more than 60 percent of non-traumatic, lower-limb amputations occur among people with diabetes.

Smirnova's research team will be filling Magnetic Resonance Imaging-traceable nanoparticles – tiny, chemically produced receptacles – with molecules that they hope will help promote blood vessel development.

“We pack the nanoparticles with vascular endothelial growth factor and inject them into rats' blood, and they spread throughout the body,” she explained. “The nanoparticles are formulated so that they are attracted to the wound site, and when they reach the site, they release the medication.” This medication (growth factor) theoretically should enhance blood vessel formation to the wound, thus speeding the time of recovery.

Smirnova's team just finished testing the nanoparticles and will now begin to introduce them in rats to see if they form new blood vessels and increase blood supply to the wound site, which is expected to promote healing.



Irina Smirnova, PhD

vention would be most beneficial,” she explained.

To collect the MRI data, Smirnova is collaborating with Mehmet Bilgen, PhD, director of high-field MRI at the Hogle Brain Imaging Center at The University of Kansas Medical Center.

In another study of the diabetic heart, Smirnova is trying to shed

light on the underlying causes of diabetic cardiac muscle disease or cardiomyopathy. Her National Institutes of Health-funded study hypothesizes that diabetes causes increased acetylation, a type of chemical modification, of cardiac proteins, which may result in altered protein function. During the two-year

study, she hopes to identify the acetylated proteins and localize the acetylation sites, then explore the mechanism for increasing protein acetylation in the diabetic heart. Her goal is to find out how this modification affects cardiac proteins' function in the diabetic heart pathology. ■