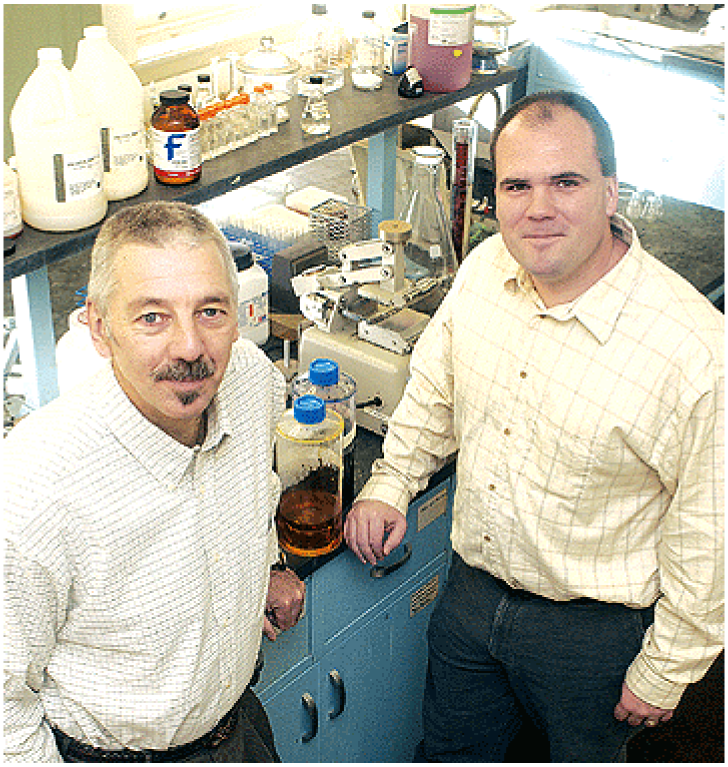

Photo Courtesy URI News Bureau/Michael Salerno

Martin Bide, left, professor of textiles, fashion merchandising and design at the University of Rhode Island and Matthew Phaneuf, president of BioSurfaces of Ashland in Bide's lab at URI. Along with Philip J. Brown, assistant professor of Materials Science and Engineering at Clemson University, they have developed small diameter artifical arteries to be used in bypass surgery.

BioSurface building better bandage, artificial arteries

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By Patricia Resende

Coronary heart disease is the single leading cause of death in the United States today, according to the American Heart Association, causing more than 500,000 deaths each year. More than 70 million Americans have one or more forms of cardiovascular disease.

Those staggering numbers have led a trio of scientists from academia and business to develop a new, small-diameter artificial artery graft for cardiac patients.

Matthew Phaneuf, a biochemist and assistant lab director at Beth Israel Deaconess Medical Center's Vascular Surgery Research Lab, has spent more than a decade researching artificial arteries and their failures.

Nearly 15 years ago Phaneuf, who had no knowledge of composite materials, tapped his wife's old college professor, Martin Bide, to assist him in finding the right material to use in artificial artery grafts.

Bide, professor of textiles, fashion merchandising and design at the University of Rhode Island, and Phaneuf have been collaborating on the project ever since.

In 2003 Bide brought in Philip Brown, an expert in polymers and an assistant professor of materials science and engineering at Clemson University in South Carolina, to collaborate on the research.

What they have developed is a nanofibrous biocomposite prosthetic vascular graft, or an artificial artery.

Large artificial arteries, 10 to 15 millimeters in diameter, have been used for more than 50 years in replacing large blood vessels. The artificial arteries are made of Dacron.

But no small diameter — 5 millimeters and below — artificial artery exists today that can imitate the biological and physical properties of real arteries.

Blockages in arteries below the groin and in the knee, calf or foot are more difficult to repair because the vessels are so small. That is one of the team's focus areas.

Normally, the first choice for procedure is a patient's own veins, according to Bide, but if those veins have been damaged as a result of a chronic illness such as diabetes, surgeons need an alternative.

The team says they have that alternative.

"What we are looking to do is go below the knee with the artificial artery and closer to the heart," Phaneuf said. "There are no artificial arteries used (currently) for bypass at the heart."

"Some haven't been able to develop the technology to make them this small because the materials aren't durable enough," Phaneuf said. "And they will clot very quickly."

To eliminate that issue, the group is using the polyester and collagen materials and is manufacturing the materials using electrospinning.

Electrospinning creates nano-scale fibers that will allow the body to heal the artificial artery in a better fashion.

“The nanotechnology allows you to create a surface that is very different than currently accepted materials,” Phaneuf said.

Nearly three years ago Phaneuf decided it was time to take the technology off the research bench and develop a business around it. Thus was born BioSurfaces, a biotech company based in Ashland.

“I originally started in this area in the academic setting, and we felt there was a niche to get into. So we took a lot of the technology we were developing and figured, ‘Why don’t we try to move this to product development?’” Phaneuf said.

The scientist formed BioSurfaces to get away from the academic bureaucracy and to help get funding.

“Forming this company allowed us to apply for small business grants,” he said.

And his plan worked. In August 2003, the National Institutes of Health’s National Heart, Lung and Blood Institute awarded BioSurfaces a Phase I SBIR grant for $200,000.

The NIH invests only 7 percent of its budget in heart research, according to the organization.

BioSurface’s Phase I grant expired in January, and the team is in the midst of receiving a Phase II grant to get to the next level.

“We are either looking to have someone to jump in or looking for funding to do large-scale trials to prove the system is effective, and then we’d be in a stronger position to look for a commercial partner,” Bide said. “There is a big jump for us from proving some of this in the lab and testing it in real life.”

The team has already developed a prototype, and the next step is testing it in animals. Phaneuf and his team are hopeful that they will secure a partner and Bide said they are already in talks with interested parties.

Artificial arteries are at the heart of the business and research, but the team has used the core technology for other uses. In January, the group announced that it had developed a bioactive wound dressing to be used by wounded soldiers, police and firefighters.

The wound dressing surface is based on polyester that combines both infection resistance and blood clotting properties to prevent a patient from bleeding. The dressing is made with Ciproflaxin, an antibiotic, to help treat infection. It also incorporates thrombin, a protein-cutting enzyme that promotes clotting.

BioSurfaces has presented the U.S. Army Soldier System Center in

Natick with a prototype sock that helps prevent foot infections.

“That kind of product would be easier to commercialize because you are looking at a topical application,” Phaneuf said. “An implantable device is much more regulated — you have to have safety aspects and you need to get a lot of device approval from the FDA.”

Patricia Resende is a freelance writer based in Bristol, R.I.