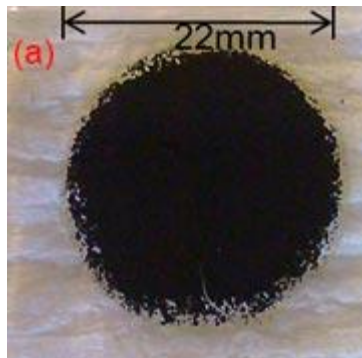


# Brown, IIT Kanpur work on heart patch

By JEN RICHMAN



**Brown University researcher David Stout, above, is collaborating with IIT Kanpur. A nano fiber patch, shown below, is being developed and studied to help heal heart attacks. Photos courtesy David Stout**

Researchers at Brown University recently teamed up with the Indian Institute of Technology, Kanpur, to develop a patch made of a Food and Drug Administration-approved polymer and carbon nano fibers — tiny tubes a fraction the circumference of a human hair — that may revolutionize healing in heart attack patients.

According to Brown University doctoral student and 2011 Indo-U.S. Science and Technology Forum Research Fellow David Stout, the patch holds promise of repairing the damaged areas from a heart attack so that patients can regain a healthy heart.

The patch, which mimics the rough surface of the bodily tissue of the heart, is round and resembles a black Band-aid about 22 millimeters in diameter, or the size of a quarter, said Stout. The flexibility and durability of the patch, thanks to its nano fibers, allows for cardiac cells known as cardiomyocytes to be regenerated on the surface of the patch and begin to heal damages to the heart. Cardiomyocytes are responsible for keeping a heartbeat's rhythm steady and typically die during a heart attack.

According to Stout, the polymer used in the construction of the patch begins to degrade in as few as four weeks once applied to the heart. The body can metabolize the polymer, preventing the need for patients to undergo a second surgery in order to remove the patch.

Stout worked with Indian researcher Bikramjit Basu from the Institute of Technology, Kanpur, on the research about the patch.

Some of the results of their research were published in a recent issue of science journal "Acta Biomaterialia."

Previous research has investigated the use of similar polymer patches, however, what is unique about the research Stout and Basu are doing is the use of nano fibers, which serves to strengthen the polymer and give the patch conductivity — essential for

working within the heart's electrically-charged environment, according to Stout.

Indo-U.S. Science and Technology Forum, through which Stout conducts research, was started in 2000 as a joint effort between Brown and the Indian Institute of Technology, Kanpur, to collaborate on scientific and technological endeavors — including biomaterials.

A graduate of the California State University at Long Beach, with a degree in aerospace engineering and chemistry, Stout came to Providence and Brown to pursue a doctorate in engineering. Stout has traveled to India and spent several weeks performing material analysis there during the course of his research.

According to him, a conversation with fellow researcher, U.S.-Indo investigator and mentor Thomas Webster last May prompted his investigation into the feasibility of using a nano-fiber patch on the heart. "I said, "Wouldn't it be great if we could create a Band-aid for the heart?" he said.

In order to carry out his research, Stout used a machine to simulate the exact timing and voltage of the human heart to see whether cardiomyocytes cells would attach to the patch, which they did. In late July, Stout completed testing in a constructed environment that mimics the human body and the tests yielded even more promising results than the laboratory environment.

Stout's research partner Basu has collaborated from India. He has worked for the last decade in nano materials, looking for structural and biomedical applications.

In collaborating with Stout, Basu contributed to the cell culture study of neural cells, as well as characterizing the way in which various elements in the patch come together through the use of spectroscopic chemical analysis.

The most exciting aspect of working on the patch is that it bridges the gap between materials science and biological sciences in the development of new biomaterials, said Basu. That bridge between different fields of science has led to the nano-fiber material used in the patch, he added.

Basu is currently an associate professor at Indian Institute of Science, Bangalore, on leave from Indian Institute of Technology, Kanpur. He earned a bachelor's degree and master's degree in metallurgical engineering from National Institute of Technology, Durgapur, and Indian Institute of Science, Bangalore, respectively. He earned a doctorate degree in ceramics at Belgium's Katholieke University Leuven in 2001.

Though the preliminary results look promising, the approval process for use of the patch in humans is a long one that begins with the Food and Drug Administration. Stout estimates it will likely take approximately 10 years before human trials on the patch will be approved.

Researchers must first finish in vitro testing that will mimic the environment of the heart. In the next several years, tests will begin to be administered outside the body, beginning with testing on pigs, according to Stout.

The Indo-U.S. Science and Technology Forum, the Hermann Foundation, the Indian Institute of Technology, Kanpur, the government of India and California State University has funded Stout's research so far.

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