Posted By: Marie French on Friday, December 13th, 2013

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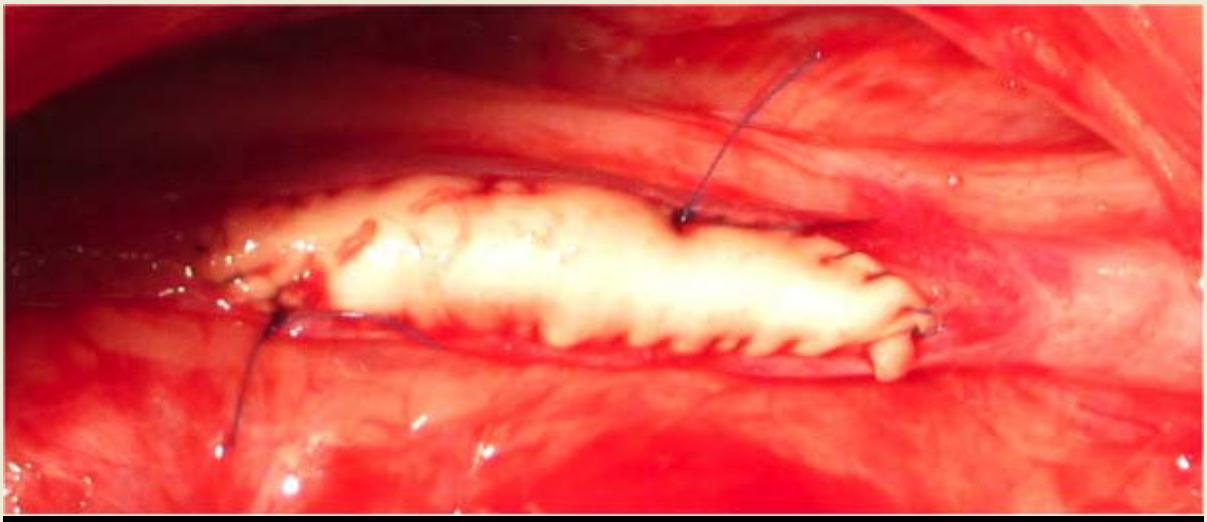

Biological patches are sewn into the vascular tissue of pigs with help from Raja Gopaldas, an assistant professor in the division of cardiothoracic surgery, who performed the surgery. The patches are designed to integrate into the tissue better than artificial patches currently utilized.

Modified vascular tissue patches developed in a bioengineering lab at Mizzou and implanted into pigs showed better integration than existing commercially available biological patches. The results have potential to improve such material currently being used in human surgical procedures.

The biological patches, constructed from arterial tissue, were “decellularized,” removing the DNA components but leaving behind the cellular framework. Gold nanoparticles, which have been shown to have such positive effects as encouraging cell growth, reducing bacterial growth and preventing inflammation, are then added.

Biological patches developed in Baker’s lab are made from tissues voided of DNA components and infused with gold nanoparticles.

“Everyone wants to create implants that the body can move into and remodel,” said Allison Ostdiek, a D.V.M. who’s pursuing her doctorate in area veterinary pathobiology and works on the project in Sheila Grant’s lab. “But it has to be something that maintains

strength long enough for the integration to happen."

Sheila Grant discusses the project following the 2013 Coulter Awards ceremony.

Grant, a professor in the bioengineering department, said the promising results from the initial testing have possibilities for improved biological implants in other areas. The two researchers worked closely with Raja Gopaldas, an assistant professor in the division of cardiothoracic surgery, who performed the delicate surgery to implant the patches in the pig.

This patch is specifically designed for carotid endarterectomy, a surgical procedure to treat stenosis of a carotid artery, which is a narrowing of the artery usually caused by a buildup of calcium and other materials. There are only about 100,000 cases each year in the United States. However, a similar process could be used with heart valve tissue to create better implants for those needing replacements.

"Many projects can come out of the use of these nanoparticles and natural scaffolds," Grant said. But the focus for now is in reaching a better understanding of why the patches were so well integrated, Grant and Ostdiek said.

Grant attributes the smoothness and success of the project, which Ostdiek picked up in July 2011 and reached testing in January 2013, to the interdisciplinary team working on the project as well as the quality of Ostdiek's work.

"Allison is a non-traditional student in my lab," Grant said, meaning she's not an engineer, but rather a veterinarian and doctoral student. . "It's really been an interdisciplinary study with us and having this interdisciplinary research has made it progress a lot faster."

Ostdiek is in the final research stage of her work for the veterinary pathobiology program. She already completed two years of work and one year of clinical residency but said when she gets her doctorate will depend on the progress of this research. The University of Missouri's College of Veterinary Medicine is one of the few in the country that has a federal grant for postdoctoral research programs, which is why Ostdiek came here after completing her doctor of veterinary medicine at the University of Illinois.

College of Veterinary Medicine doctoral

She said she's enjoyed the experience of getting to work in an engineering lab, despite some of her unfamiliarity with the way engineers characterize materials and the methods used.

candidate Allison Ostdiek is working with grant to develop the biological patches. *Photo courtesy of the College of Veterinary Medicine*

“There’s been a large learning curve for both me and my engineering PI,” Ostdiek said. “That’s been a little challenging.”

The research has resulted in Ostdiek winning an honorable mention for a poster at Life Sciences Week 2013 and she currently has one paper being reviewed and a second paper being drafted.

The project progressed more quickly than expected, when an opportunity to begin the in vivo testing stage came up, we took it. Now we want to look at the processes behind the results.

“The science will be very strong. Allison and I really want to take a step back and do the basic science, Grant said. This can help researchers reach a better understanding of why the patches were so well integrated.

“For example, what is a cell seeing when it approaches a nanoparticle and how can we manipulate the growth?”

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