Stevens thoracic catheter senior design team takes 1st place at regional ISPE competition

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A Senior Design team at Stevens Institute of Technology is working to alleviate pain and other complications that often arise during thoracic surgeries. Five undergraduate Biomedical Engineering students have invented a novel thoracic catheter that overcomes issues of existing catheter design and introduces a potentially profitable new product for the marketplace.

On April 21, the efforts of the Stevens Innovative Fluid Extraction System (SIFES) Senior Design Team were recognized with first prize in the undergraduate division at the regional International Society of Pharmaceutical Engineers (ISPE) Student Poster Competition. This win advances the team to the international competition at the ISPE Annual Meeting in Dallas, Texas this November.

The SIFES team is Sara Budar, Zachary Carr, Lauren Griggs, Gerald Riccardello, and Stephanie Spelman. Their faculty advisors are Dr. Vikki Hazelwood and Dr. Arthur Ritter, and their clinical consultant is Dr. David Pearlstone, Chief of the Division of Breast Surgery at Hackensack University Medical Center.

Thoracic catheters are commonly used to drain fluid from the space between the lungs and chest wall after thoracic surgeries—operations in the chest, such as for the heart, lungs, or breast cancer. These tubes remove pooling fluid—typically, blood—and then reinflate the lungs. Though their insertion is common practice, these catheters experience life-threatening complications, especially blood clotting that occludes

passage in the catheter tube, which can be life-threatening. Additionally, thoracic catheters inserted through muscle and the pleural membrane must remain in contact with this open wound for days, inflicting substantial pain.

Other alternative catheters in development partially address these complications by using anticoagulant coatings on tube materials or by adding a mechanical method for clearing blood clots. However, these approaches cannot clear clots that originate near the catheter site in the body and do not address the issue of pain.

To test their new concept, the team created a mechanical model simulating the chest wall and lungs. Clear viscous liquids, approximating human blood, were contained within the model and a dyed liquid was delivered into the system using the SIFES catheter. With this in vitro model, the team demonstrated successful dissipation of a theoretical anesthetic to the wound site, proving the concept and preparing the device for in vivo trials.

"Our design overcomes all of the current catheter problems," reports Sara. Their redesigned thoracic catheter uses proprietary modifications to the catheter tube to effectively drain fluid from the chest while also delivering saline, anesthetic, anticoagulant, and other liquids and drugs to body. The team's solution is an integrated system that fully replaces existing catheter tubes, rather than supplying an accessory. This makes the SIFES product cheaper and adaptable to future developments.

As participants in the ISPE Student Poster Competition, SIFES were judged for the quality and merit of research, as well as ability to convey their project through a poster and five minute presentation.

By the time the team got to the competition, the students felt very confident in their ability to effectively describe their research. "We've

been giving presentations on our project all year long," says Gerald. "We've come a long way in our ability to communicate."

"I think our win really demonstrates the effect of the emphasis on 'soft skills' that we get in Biomedical Engineering at Stevens," says Zachary, the team's five minute presentation representative at the competition. "We are trained to focus on the bottom line and give a description that is both thorough and accessible for the layman."

Although these seniors are going on to separate careers in industry and academia after graduation, the team holds on to their vision for the future of their invention. "We would like the project to make money, but more importantly we ultimately want to help the patients who are suffering," says Lauren.

The team has already written an invention disclosure and is currently pursuing a patent for the device. "It is an intuitive product, smart in its simplicity," Stephanie says.

Provided by Stevens Institute of Technology