

## Yale students design a new device to transport intestinal transplants to patients

April 7 2014, by Holly Lauridsen

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(Medical Xpress)—Almost 20 people die every day while waiting for an organ transplant. For patients in need of intestinal transplants, the wait is even more agonizing because countless healthy intestines are discarded due to the difficulty of transporting them. To solve this problem, five Yale students have designed a new intestinal transport unit.

Unlike hearts, lungs, or other commonly transplanted organs, intestines are very difficult to transport due to rapid tissue breakdown. Coupled with the shortage of available organs, the inability to transplant intestines contributes to the disproportionately high mortality rate for patients needing an intestinal transplant.

The [students](#)—all Yale College seniors—are are Natalie Pancer

([biomedical engineering](#)), Andrew Crouch (biomedical engineering), Brian Loeb (mechanical engineering), Raja Narayan (public health), and Kristi Oki ([mechanical engineering](#))..

They began working on their Intestinal Preservation Unit (IPU) as part of the class MENG404-"Medical Device Design and Innovation," taught by Joseph Zinter '11Ph.D., assistant director of the Center for Engineering Innovation and Design (CEID), and Richard Fan, formerly an associate research scientist at the Yale School of Medicine (now at Stanford).

MENG404 is a hands-on interdisciplinary course aimed at addressing real-world, open-ended problems. Wanting to improve upon the problem set-based classes of his undergraduate years, Zinter approached Yale physicians to find real design challenges that students could feasibly address over the 15-week course. "We wanted to provide students with projects that offered a real learning opportunity and the chance to contribute a meaningful solution to real medical problems," said Zinter.

The idea for the IPU came from John Geibel, professor of surgery and of cellular and molecular physiology, vice chair of surgery, and director of surgical research. Geibel believed that improving the intestinal transportation system could improve the tissue quality to ensure more successful transplantations.

In addition to their course lectures on medical technologies and design processes, the five students met regularly with Geibel to design the IPU. After many late nights in the CEID, the students had their first working prototype. Unlike pre-existing transportation options, this student-developed solution perfused both the main intestinal track as well as the surrounding vasculature to remove waste products and prevent tissue damage.

With the IPU prototype complete, these students continued to "push the limits of what could be done in a class," notes Narayan. Working with Manuel Rodriguez-Davalos and Roger Patron-Lozano, transplant specialists in the Yale Department of Surgery, the students conducted their first trial with a pig intestine. Although the trial was not perfect, the device did "fail perfectly," according to Pancer. With a couple of adjustments and the semester coming to a close, the team prepared for their second trial with a pig intestine. This time, the IPU ran without a hitch, and preliminary analysis of the intestines showed that the IPU significantly improved the quality of the tissue over a control specimen in a standard cooler.

"This was the most rewarding class of my Yale career," said Natalie during her group's final presentation in December. "Building a good relationship with the doctors and learning skills that we had never used before made the experience really empowering," added Kristi.

Unlike most class projects, this effort did not end with close of the semester. These students still meet regularly with Geibel to move the project forward, and Pancer and Loeb have decided to turn this into their senior project. Moving forward, they hope to complete a third trial with a pig intestine this spring and then work closely with Connecticut-based organ banks to conduct a trial with human tissue. In May, the group will present their work at 55th annual meeting of The Society for Surgery of the Alimentary Tract.

Provided by Yale University

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