



(l-r) Matt Raab, Dr. Gharib, Steve Neuman, Kevin Shah, Desiree Wagner and Rick Hoover

Engineering students help MD design a tool for the operating room

Professor Nadine Barrie Smith's senior bioengineering class has 15 weeks to divide up into teams and complete their senior projects. One team is using funding provided by the I-99 Corridor project to help an anesthesiologist at Altoona Hospital make his job of preparing patients for surgery safer and easier.

Morteza Gharib, MD, has some ideas he believes will make intubation – the process of sliding an airway tube into patients' tracheae to help them breathe – a less risky procedure. As patients in the operating room are prepped for surgery, an oxygen mask pumps air and a measured amount of anesthesia into their lungs. When the patient is sedated, a muscle relaxant is given that allows the air tube to get past the patient's vocal chords. This also relaxes the diaphragm and the patient can no longer breathe on his own. As the relaxant takes affect, the anesthesiologist gently squeezes a bag filled with air, breathing for the patient. At the proper moment, the anesthesiologist removes the oxygen mask



Dr. Gharib demonstrates intubation

and inserts the tube past the vocal cords and into the trachea. The procedure must be done quickly, but without mistakes. The result could be damaged vocal cords, or a puncture, or perhaps worst of all, the insertion of the tube into the stomach rather than the lungs. Although the procedure is straightforward in 95 percent of cases, at times the procedure is made difficult by obstructions or the unusual anatomy of the patient's air passage.

The four pre-med bioengineering students in Prof. Smith's class were first given a chance to handle the intubation tools and watch a demonstration on a medical dummy. This gave them a feeling for the scope of the project. However, the demonstration was held in a quiet conference room in the Penn State Tech Center with no time constraints and no risk. They found a different situation when they were invited to watch the intubation procedure in an operating

room on a live patient. In the OR, there were beeping monitors, limited space to move, and the time constraints of a patient without oxygen.

Dr. Gharib spent time with the students during his off-duty hours, explaining his ideas and what he envisioned, an intubation tool that would allow him to see past obstructions in the windpipe on a monitor. He wanted the device to be well balanced and light, so it could be used with one hand, and it must allow him freedom to move about and observe all the other monitoring devices. The students' goal is to have a prototype to Dr. Gharib by the end of the semester.

The advantage of these young engineering students is that they don't know what won't work, says Rick Hoover, a researcher for the Materials Research Institute who is working with the students. They will try things that more experienced engineers might have given up on. "Just because it didn't work in the past doesn't mean it wasn't a good idea. Maybe the implementation was wrong, or the technology of the time didn't allow it," he speculated. "Students don't have all that baggage of failure."

An in-depth briefing by Matthew Smith of Penn State's Intellectual Property Office on issues of confidentiality and intellectual property gave the students more real world experience. The students were advised to keep detailed research notebooks and warned of liability issues. Then they split up into smaller teams to design and integrate the components.

If the students complete their project as planned, Dr. Gharib will have a prototype device and documentation, along with recommendations for further improvement. The students will have the real world experience of translating a client's ideas into an engineering problem, estimating costs, developing a deadline, and designing and implementing a useful, functioning device. For Penn State and members of the I-99 Corridor Alliance, it is a model of cooperation between knowledge-based University programs and economic development partners.