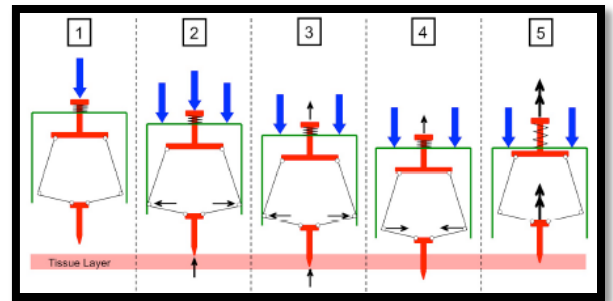


*Winner of the 2013 \$30,000 Lemelson-MIT Student Prize  
Notable Inventions*

**Puncture Access Mechanism**

**The Challenge:** “Puncture access procedures” are those in which a surgeon uses a sharply-pointed device to create a pathway into a patient’s body. Puncture access is the first step in many medical procedures including epidurals, intravenous catheter placements and bone marrow biopsies. The puncture access device must pierce through the intended tissue without penetrating so deeply that it impacts any underlying tissue or organs. Physicians often rely on techniques like stacking their fingers to form a safety stop to reduce this risk. In 2003, the FDA published a report stating that creating a puncture incision is the most dangerous step in minimally-invasive surgeries.\*

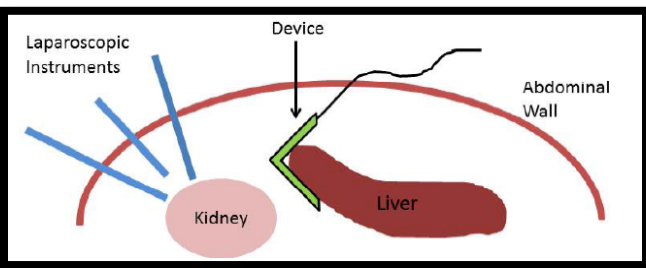
**The Solution:** Begg invented a “force-sensing” mechanism that retracts the instrument’s tip at the moment of puncture. The tip is connected to a retraction spring by a series of hinged links. When the tip is advanced and pressed against tissue, the links expand and lock the mechanism in place with friction (2). The moment the tip punctures the tissue and the force on the tip becomes zero (4), a mechanism unlocks and the spring retracts the tip (5). It takes the tip less than 1/100 of a second to retract back into the device. The device is purely mechanical, has few parts, and is scalable for almost any medical puncture access device. It is protected by two patents and has gained attention from medical device manufacturers for various applications.



During puncture access procedures, Begg’s mechanical device retracts within 1/100 of a second after puncturing the tissue.

**Laparoscopic Tissue Retractor**

**The Challenge:** While observing laparoscopic surgeries at local hospitals, Begg observed that an additional incision must be made so an assistant can hold the liver out of the way in right kidney laparoscopic surgeries.



A tissue retractor deforms while passing through an injector tool into an expanded shape suitable for engaging and retracting an organ or tissue during a minimally invasive surgical procedure.

This extra incision risks over-puncture, infection and pain.

**The Solution:** Begg developed a surgical instrument that retracts the liver, or other tissue or organs, during laparoscopy without requiring this additional incision. The organ or tissue is held by an expandable scaffold inserted through the existing incision. A suture stored within the device is passed out of the body and tensioned to temporarily re-position the organ or tissue in the surgeon’s field of vision. The incision created by the suture is nearly nonexistent and poses virtually no threat of infection or injury. This device can be made in a variety of sizes depending on the organ or tissue requiring retraction.

\*U.S. Food and Drug Administration. (November 7, 2003). Laparoscopic Trocar Injuries: A report from a U.S. Food and Drug Administration (FDA) Center for Devices and Radiological Health (CDRH) Systematic Technology Assessment of Medical Products (STAMP) Committee. Retrieved from <http://www.fda.gov/medicaldevices/safety/alertsandnotices/ucm197339.htm>