# PrecisionCAT Experimental Protocol

**Defining the Relationship Between Stress from**

**Graspers and Bowel Injury in Humans to Establish**

**Intraoperative Force Boundaries**

Khan, Amanda; University of Toronto - Institute of Biomaterials and Biomedical Engineering

MacDonald, Matthew; CIGITI – Hospital for Sick Children, Toronto, ON

Doshi, Sachin; CIGITI – Hospital for Sick Children, Toronto, ON

Streutker, Catherine; University of Toronto Department of Laboratory Medicine and Pathobiology

Rowsell, Corwyn; University of Toronto Department of Laboratory Medicine and Pathobiology

Drake, James; Hospital For Sick Children, Surgery, Neurosurgery, Toronto, ON

Grantcharov, Teodor; University of Toronto Department of Surgery

\* Materials and correspondence to: Amanda Farah Khan, [amy.khan@mail.utoronto.ca](mailto:amy.khan@mail.utoronto.ca)

# Python Code

1. Install Anaconda
2. Open Anaconda prompt
3. Type in “ipython”, hit enter
4. Change the loading directory to the folder where your python code is located (via the cd change directory command if necessary); home is autoset to C:\Users\UserID, but set it to the subdirectory where crush.py is located
5. Make sure no tissue is loaded on the tissue loading base and there is nothing obstructing the upper pin plate
6. Type “run crush” then hit enter, the upper crush pin plate will fall to the base then rise back up to home position. This is to calculate distance and zeroing of the plate is important for accurate tissue measurements
7. Choose 0 and hit enter for COM3 serial port (assuming non-Apple PC)
8. Wait for “successfully connected” message to be displayed
9. Type “crush(rig)” then enter
10. Select a protocol by typing in the appropriate number and then hit enter:

**0 – stop:** crush plate lowers at 5mm/s, then slows to 1mm/s on first contact, continues to slow down if needed to maintain a minimum force resolution, when it hits target force it stops at that position for 10s then goes back to home

**1 – hold:** same as “stop” but when it hits the target force, it will increase position to maintain that force for a period of 10s, then goes back to home

**2 –multi\_stop:** same as “stop” but repeats for 5 cycles (duty cycle 50%)

**3 – multi\_hold:** same as “hold” but repeats for 5 cycles (duty cycle 50%)

**4 – long\_stop:** same as “stop” but stops in position for 60s instead of 10s

**5 – no\_stop:** same as “stop” but returns to home immediately once target force is reached

1. Input the target load in grams, from 200-1200g = 0 to 11.8 N or 0 to 600 kPa (specifically with our system and pin surface area, 0g, 200g, 400g, 600g, 800g, 1000g and 1200g is approximately equivalent to 2 N, 3.9 N, 5.9 N, 7.8 N, 9.8 N and 11.8 N or 0 kPa, 100 kPa, 200 kPa, 300 kPa, 400 kPa, 500 kPa and 600 kPa)
2. Press enter to run the protocol or x to exit if you made a mistake
3. Messages will display as follows:

Tissue contact made … Target force achieved … Crush complete

1. Once finished type “disconnect(rig)”, crush plate will slowly return to bottom base before depowering

# Experimental Condition 1: Single Load Pressure, “Stop” Protocol

This protocol is “0” or the “stop” protocol. Tissue is compressed for 10 s.

1. Obtain six 1 cm x 1 cm tissue samples. Each sample is loaded onto the grasper plate of the PrecisionCAT serosal side up on a small cellulose-fiber sheet to avoid tissue slippage or curling, one at a time. The grasper pin then needs to be painted with a small precision paintbrush in tissue marking dye (#1003-5 Blue, Davidson Marking System, Minnesota, USA)
2. Once a sample is loaded and is ready to be compressed, enter the force required in grams and run the protocol. Please see above for conversion between grams, Newtons and kPa
3. **Load forces to achieve**: 0, 200g, 400g, 600g, 800g, 1000g, 1200g
4. Once the tissue is compressed and the grasp pin plate has returned home, cut the sample in half, with the line of symmetry directly in center of the circle of dye on the tissue. Lay tissue on foam within slide cartridge for orientation.
5. Process tissue samples for hematoxylin and eosin H&E staining.