# Stapler for Uretero-Intestinal Anastomosis with Absorbable Staples

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# Overview

- Background and Motivation
- Design Specifications
- Previous Work
- Semester Goals
  - Staple Fabrication
  - Stapler Design
- Future Work

# Bladder Cancer

- Client: Dr. Tracy Downs, Professor of Urology, University of Wisconsin Clinics
- 5th most common cancer in United States [1]
- Most expensive over time
- Treatment when cancer invades muscle: radical cystectomy [2]
  - Urostomy bag
  - Neobladder

# Motivation & Problem Statement

- Ureters attached to new bladder via absorbable sutures
- Lengthy procedure
- Inconsistency between surgeons
- Metal staples cause stones
- Minimize subsequent interventions

# Design Specifications - Staples

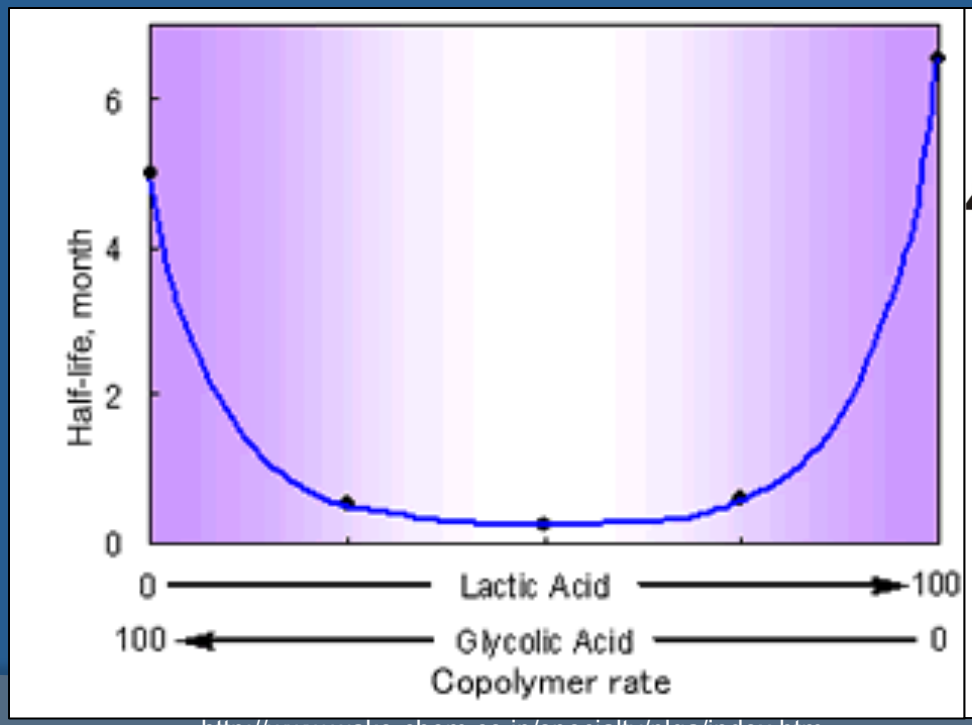
- Biocompatible
- Secures ureter to neobladder for a minimum of 30 days
- Able to create water-tight seal
- Withstands bladder environment
- Does not damage surrounding tissue
- Sterile

# Design Specifications - Stapler

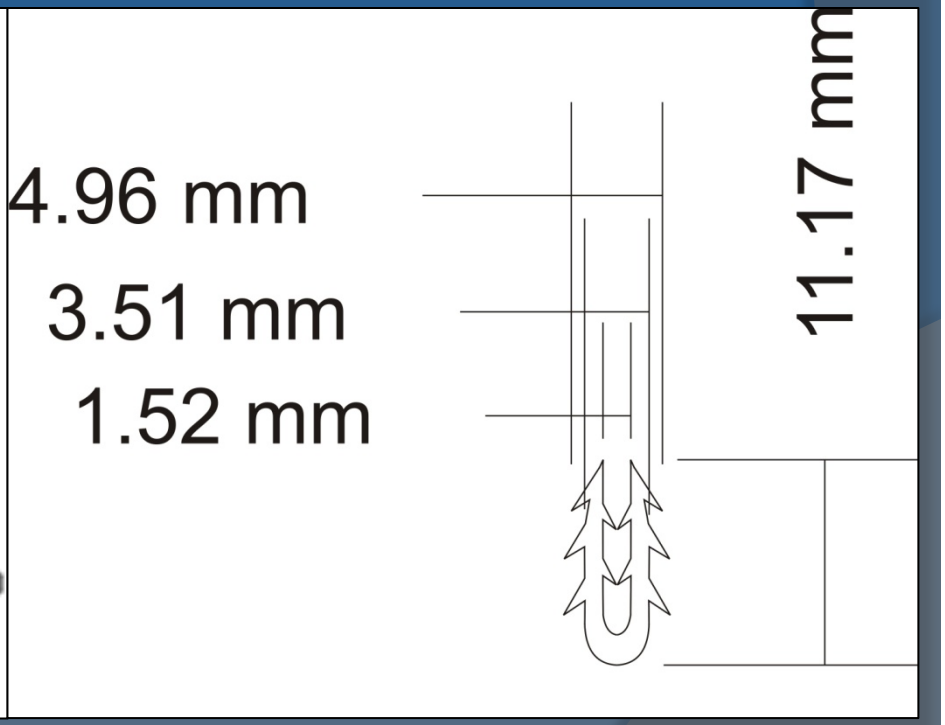
- Must be faster and more consistent compared to sutures
- Sterile
- Firing mechanism must be simple to operate
- Must form water-tight seal of ureter to neobladder

# Previous Work - Staples

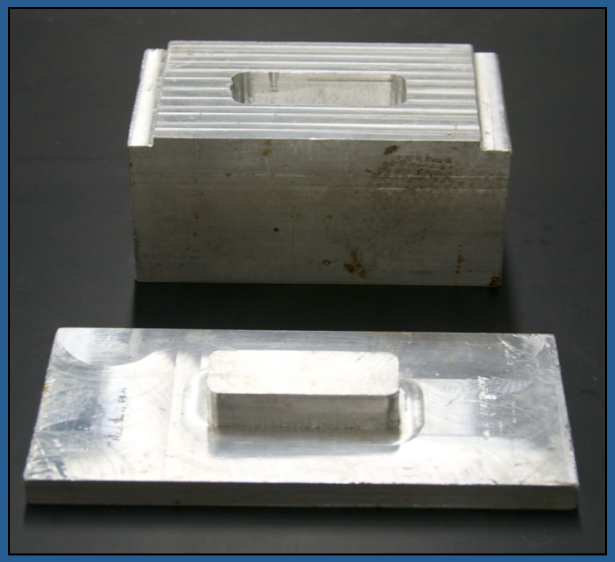
- 85:15 poly(lactide-co-glycolide)
- Biocompatible and absorbable
- Barbs for gripping tissue

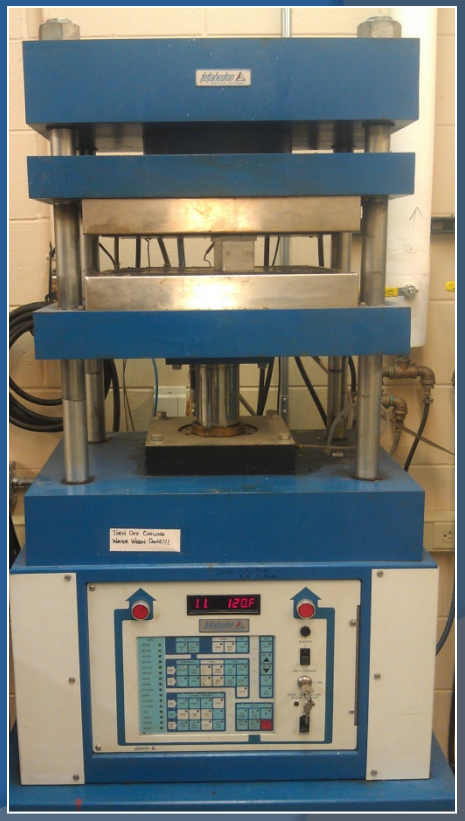


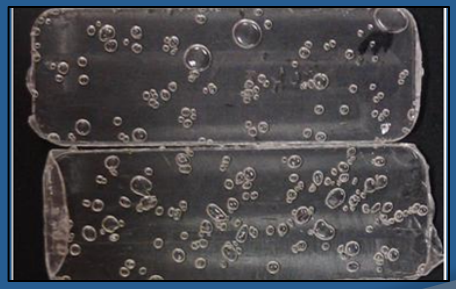

http://www.wako-chem.co.jp/specialty/plga/index.htm

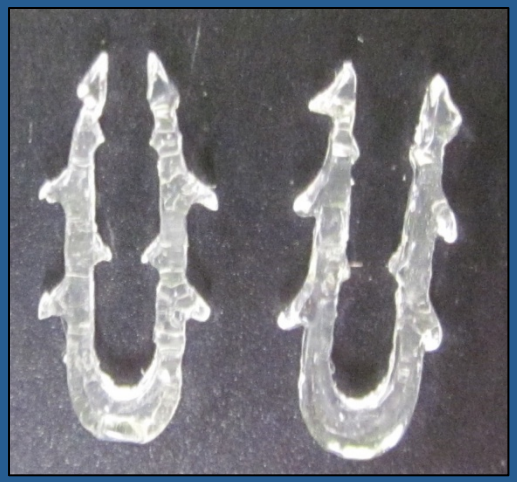


# Previous Work - Fabrication



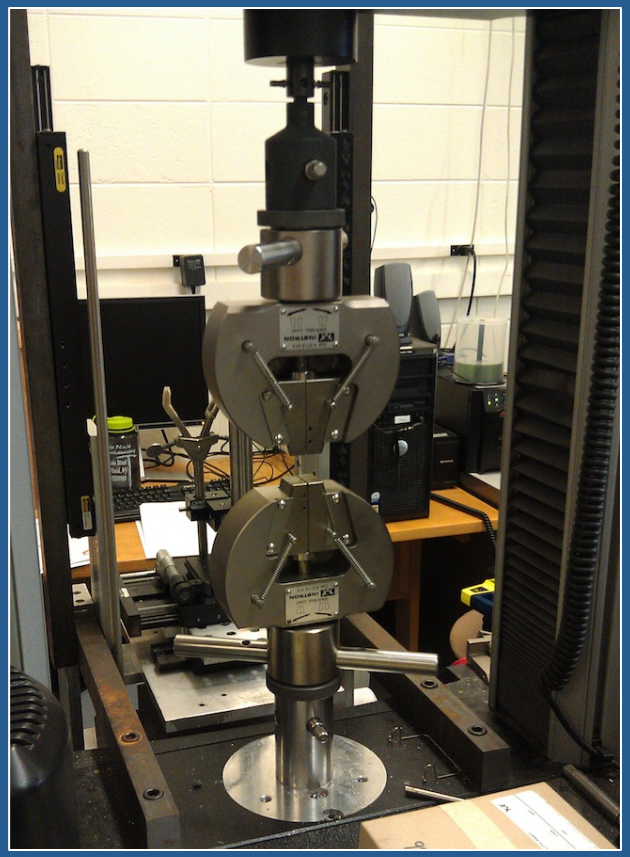






**Problem: bubbles in material plate and staples**

# Previous Work - Testing




**Problem: bubbles in test specimens, non-physiologically relevant tissue model**

# Previous Work - Stapler

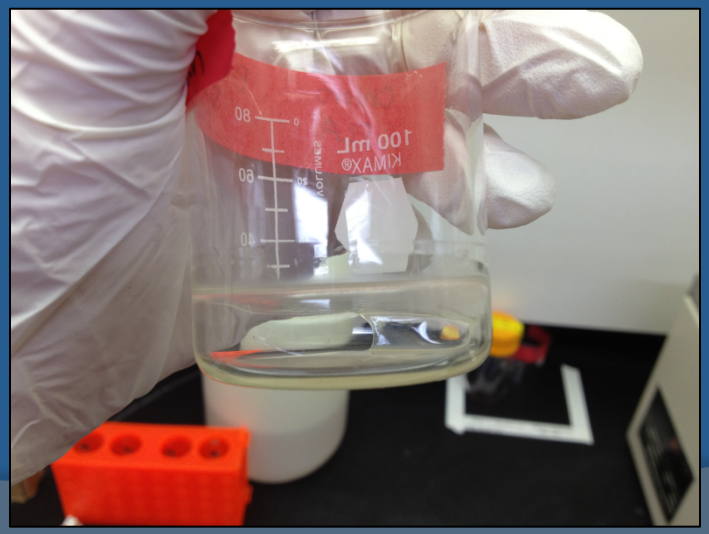
**Problem: not compatible with our staple design**

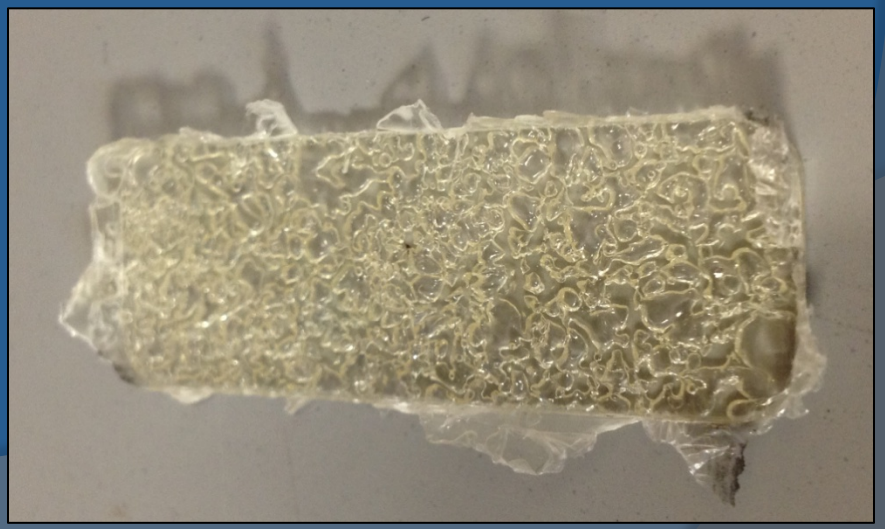
# Semester Goals

- Improve staple fabrication – remove bubbles
- Develop stapler prototype
- Integrate staples with stapler
- Functional testing of staples and stapler with physiologically relevant model

# Staple Fabrication

- PLGA film deposition via chloroform evaporation
  - Film is too flimsy
  - Cannot be compression molded
  - Possible degradation or increased porosity

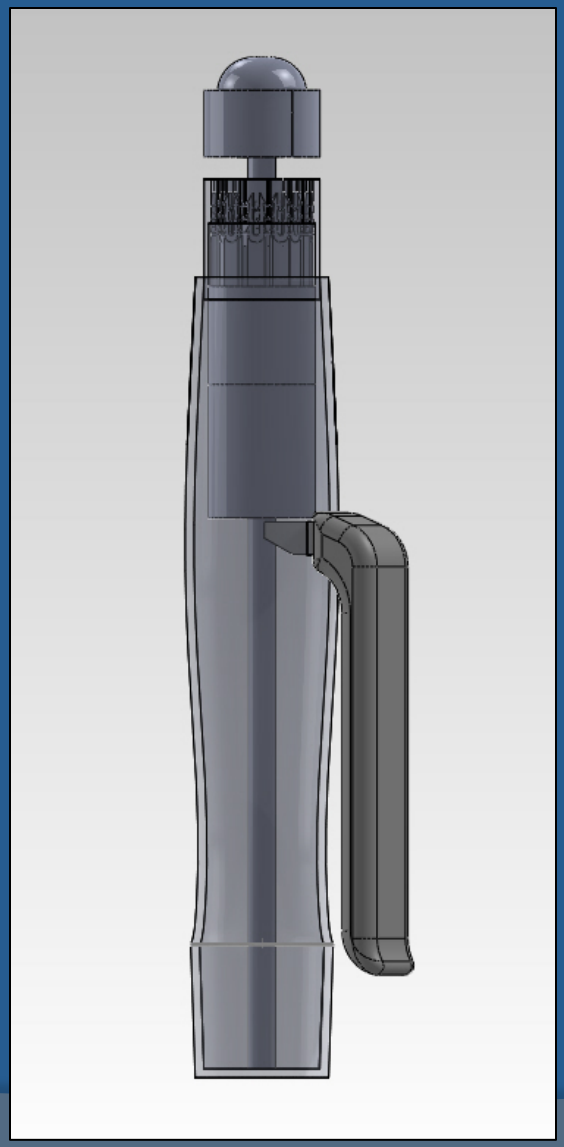




# Staple Fabrication

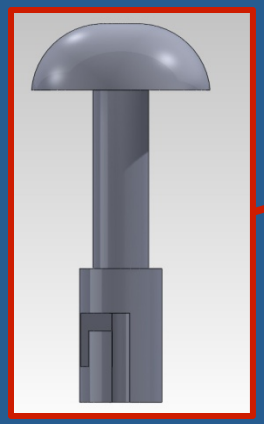
- Possible approaches
  - Compression molding in a vacuum
  - Injection molding
  - New aluminum mold
    - Shallow enough so we can squeeze out bubbles
  - Plastic mold (PMMA)
  - PMMA staples for functional testing and validation of staple design

# Stapler Approach

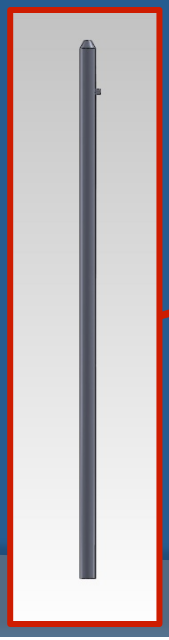


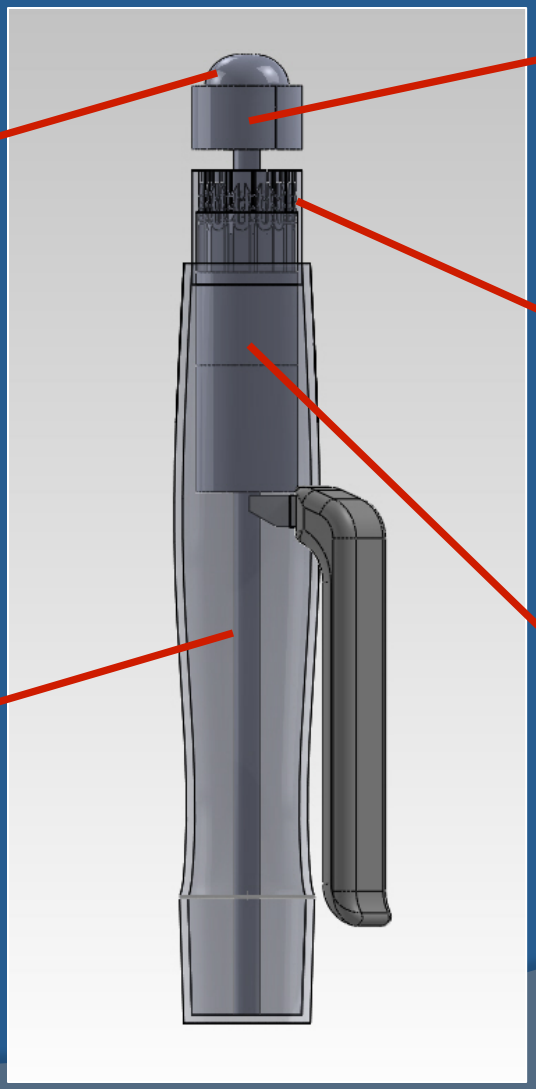
# Stapler Approach

Anvil

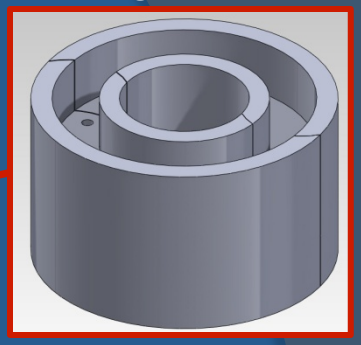


Center Bar

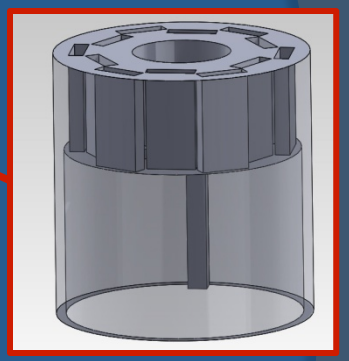




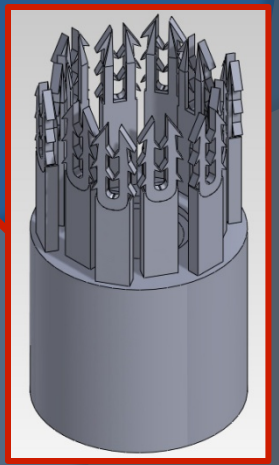
Ring Clamp



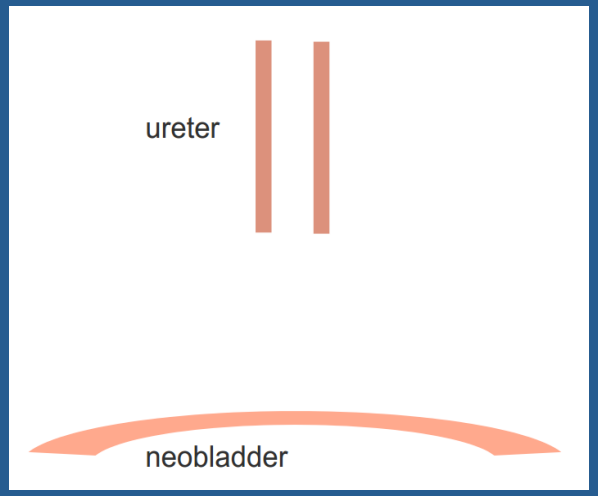
Sheath

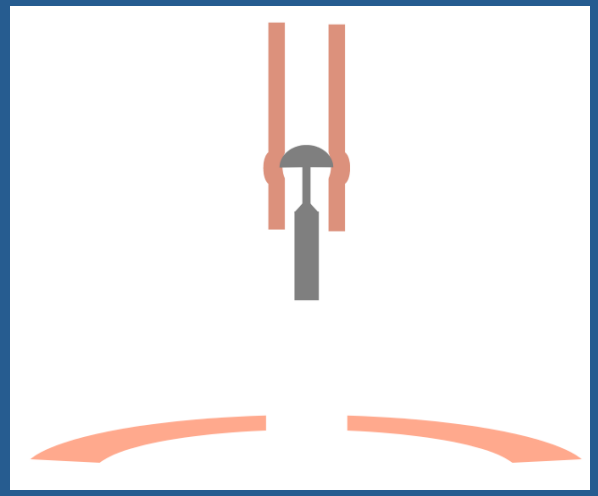


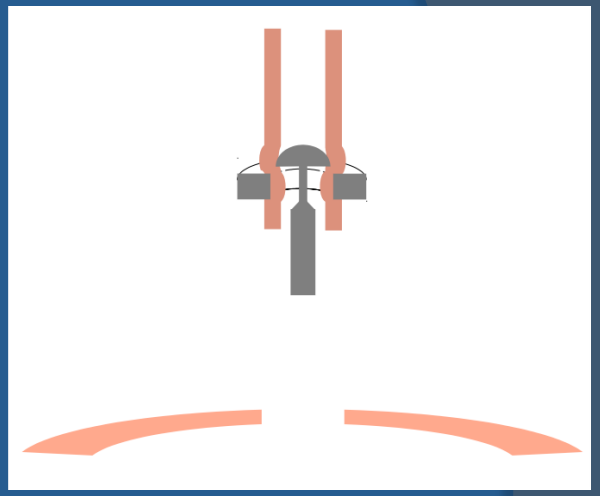
Cartridge

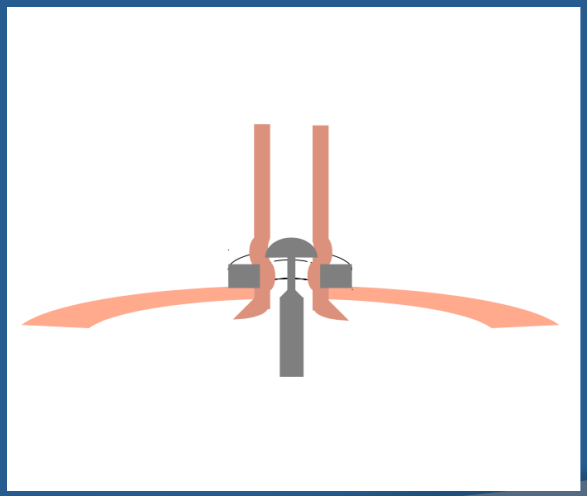


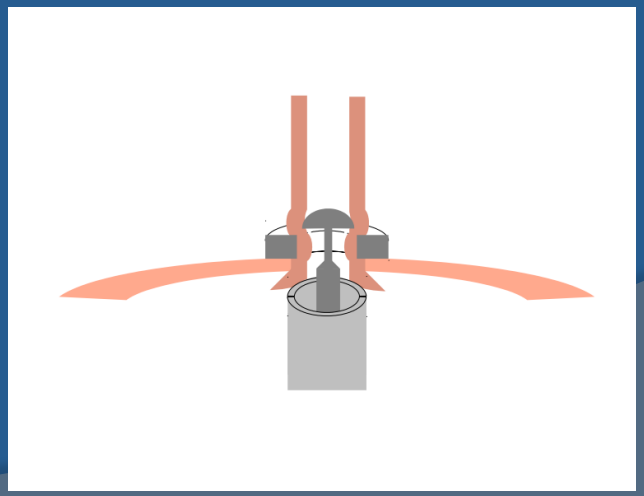
# Stapler Approach



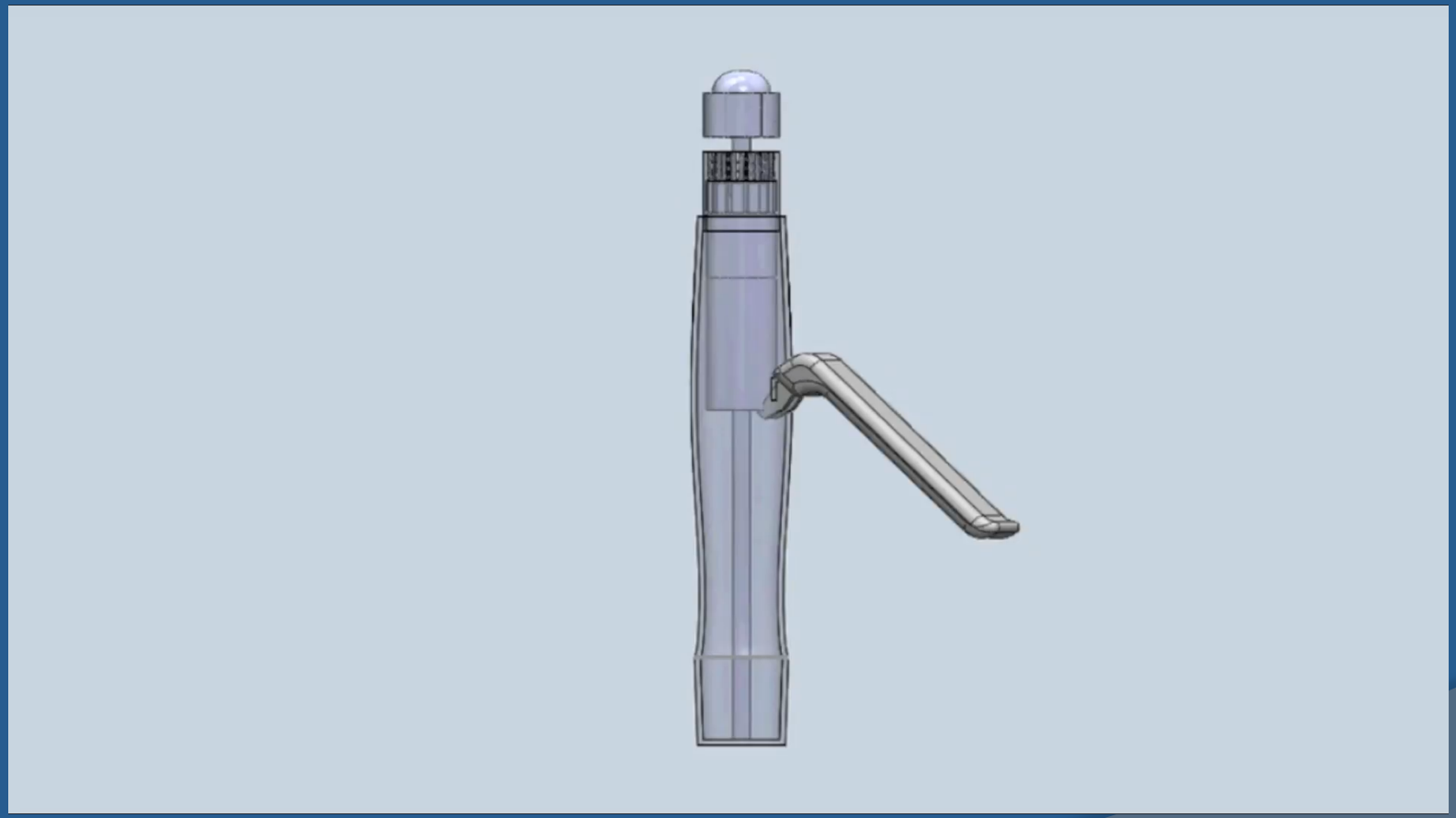









# Stapler Video



# Future Work

- Attempt other suggested methods to get rid of bubbles in material
- Fabricate rapid prototype of stapler
- Integrate staples with stapler
- Functional testing

# Acknowledgments


- Dr. Tracy Downs
- Professor Tompkins
- Professor Puccinelli
- Professor Murphy
- Polymers Lab

# References

[1] Bladder Cancer. *National Cancer Institute*. Retrieved October 17, 2011, from http://www.cancer.gov/cancertopics/types/bladder

[2] Bladder Cancer. *U.S. National Library of Medicine*. Retrieved October 17, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001517/

# Questions?