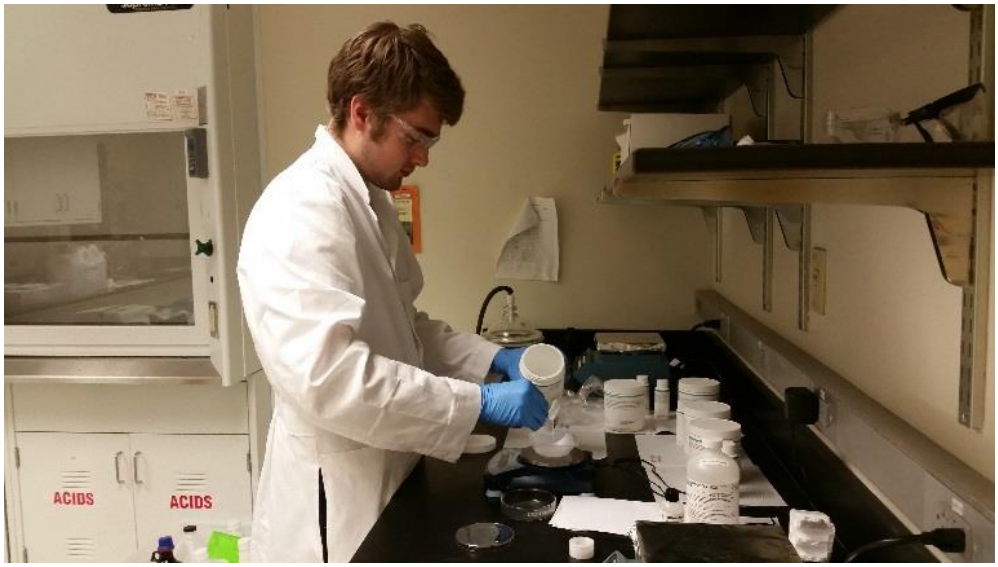


**Soft Robotic Gripper with Tunable Adhesive Surfaces**
**Ryan Draper (EAS,2018)**
**Advisor: Kevin Turner**

This summer I conducted research under the mentorship of Dr. Kevin Turner in the Department of Mechanical Engineering and Applied Mechanics through the PURM program. My research focused on designing and manufacturing a soft robotic gripping mechanism that is driven by changes in air pressure that induce local material's deformation. Soft robots are made of elastomers, meaning that they can experience extremely high strains without yielding, making them well suited to pneumatic actuation. The goal of this project was to fabricate and test a soft robotic gripper capable of picking up a diverse range of objects – such as a potato chip bag, empty tennis ball canister, padlock, and cotton ball. This group of objects was chosen in order to assess the range of the gripper's capabilities.

The first step in realizing a soft robotic gripper was designing and constructing a single "finger" of a gripper. The finger is a channeled cantilever beam made of an elastomer - PDMS (polydimethylsiloxane). The channeled beam is a solid rectangular prism with a channel running throughout its length as well as side channels on either side of this main channel. There is more material above this set of channels than there is below, creating a bending moment when pressure is applied on the walls of the channels. This bending is increased by attaching a thin layer of PET (polyester) to the top of the finger. The higher stiffness of the PET enhances the bending of the finger when actuated, which is desirable because large deformations wrap around an object and facilitate gripping. The dimensions of the main and side channels and the thickness of the PET layer were set equal to values determined from a finite element analysis study of the finger design.

The fingers are produced through the use of laser cut acrylic molds. Molds are made by stacking several layers of acrylic with different thicknesses and in-plane patterns. PDMS is poured into the mold and then cured. Early test results have produced less bending than finite element analysis, so several variations have been produced in an attempt to produce the desired amount of deformation. Future research will include detailed analysis of the test results and assembling the full gripper.

This project has enhanced my understanding of the new and emerging field of soft robotics. In addition, it has allowed my problem solving skills to grow as I have worked around the various issues that my project has encountered. The PURM program has given me valuable experience that can only be gained by doing research, allowing me to utilize the knowledge I have gained in the classroom and apply it to problems in the real world. Working in Dr. Turner's research group has allowed me to see how much a motivated and insightful group of engineers can accomplish.