# CALIFORNIA STATE SCIENCE FAIR
# 2016 PROJECT SUMMARY

**Name(s)**
Abraham E. Rachlin

**Project Number**
36324

**Project Title**
## Which Is the Best Lower Limb Prosthetic for Sports?

**Abstract**

**Objectives/Goals**
The objective of this experiment was to determine which type of lower limb prosthetic has the most efficient response.

**Methods/Materials**
3/4 inch PVC pipe, two size 10 shoe trees, a spring, aluminum rod, scale, measuring tape. Three prosthetics: one constructed with pvc and a shoe tree; one constructed with pvc, a shoe tree, and a spring installed at the "ankle" as a shock absorber; one constructed with aluminum inside of a pvc bent into a U-shape. All 3 were weighed and measured. Each one was compressed on a scale and then released with change in height measured each time. The changes in height and the force as measured by the scale were used in the efficiency equation to determine the mechanical efficiency of each one.

**Results**
Several trials were performed. The U-shaped prosthetic had a higher efficiency rating in the majority of the trials, followed by the prosthetic with the spring/shock absorber. The prosthetic with a shoe tree and no spring was rigid and had no efficiency score, but instead served as a control.

**Conclusions/Discussion**
The structure of a prosthetic greatly effects its efficiency. The U-shaped prosthetic was the most efficient as determined through various trials. The spring/shock absorber placed in the prosthetic with a shoe tree made it more efficient than the prosthetic without a spring, but not as efficient as the U-shaped prosthetic. The rigid prosthetic with no spring had no response and served more as just a support. For the purposes of sports performance, the U-shaped prosthetic is recommended.

**Summary Statement**
I found that the U-shaped prosthetic had the most efficient response and is best for sports performance.

**Help Received**
I designed the prosthetic myself using the Merck manual, but received help from handyman Miguel Castro in constructing them. Mr. William Yarberry, physics teacher at Mater Dei Catholic High School, taught me the efficiency equation.