



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Rae J. Holcomb	Project Number S0312
Project Title A Study of Fluid Resistance in Shear-Thickening Non-Newtonian Fluids	
Abstract Objectives/Goals This project compared the properties of two types of non-Newtonian fluids, colloidal and polymeric, and searched for and found a mechanism causing those properties at a molecular level. Methods/Materials Seven fluids were tested in this experiment: water and glycerin (Newtonian fluids used as controls), two polymeric fluids (polyvinyl acetate and guar gum), and three colloidal fluids (two cornstarch mixtures and a dilution of clay). These fluids were subjected to four tests that measured their viscosity, how much they exhibit the Weissenberg effect, and their behavior when drawn through a syringe. The initial experimental design to test for viscosity failed, so the experimenter designed and constructed an original apparatus. Over five hundred measurements were taken with it. Results When testing for the Weissenberg effect, it was found that fluids with similar molecular structures (polymeric vs. colloidal) responded similarly to each other but distinctly from those with different structures. It was also found that when sucked into a syringe, the colloidal fluids separated into fluids with different densities. When testing viscosity, it was found that the viscosity of guar gum fluid (a polymer) decreased in response to mechanical motion slicing through the fluid. Conclusions/Discussion The results of the experiments indicated that the properties of each fluid were closely tied to its molecular structure. The sheer thickening properties of the colloids stem from the difference in the relative mobility of the small water molecules compared to the larger solid colloid particles. The polymer fluids derive their properties from the matrix of long chains of molecules that can be rearranged by applying mechanical energy to the fluid.	
Summary Statement This project investigated the properties of colloidal and polymeric non-Newtonian fluids and found a probable mechanism causing these behaviors.	
Help Received Equipment borrowed from teacher; parents helped acquire materials; mother proofread report; neighbor helped construct apparatus; friend helped during data collection.	