



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Jeremy J. Blalock	Project Number S1904
Project Title The Potential for Electroactive Polymers as Actuators in a Reflected Light Display Based on Cuttlefish Skin Behavior	
Objectives/Goals The project's goal was aimed to show the feasibility and potential for a digital display that relied solely upon an electrically actuated or induced change in area of some kind. In a cuttlefish's skin, micro-scale pigment cells are expanded and contracted by string-like muscle tissues, and by this change in surface area are more or less visible.	
Abstract Methods/Materials While at first the method through which this could be achieved was not clear, electroactive polymers (EAPs) were found to fit the mold very well, and so two types of EAPs were investigated to be used as actuators in such a system. Dielectric EAPs work as compliant capacitors, and produce a force in the X & Y directions when a sizable electrical force is applied in the Z direction. The tests devised to test changes in sample width, used rods instead of plates to come in contact with the sample. The material used was a commercially available tape product known for its exceptional ability to be deformed in similar ways in other applications. The first of the two physical tests used a mechanical force, applied to the sample, and visually recorded the resulting sample width using a precise manually focused camera. The second test applied an electrical force of proportional magnitude to the sample using a van de graaf generator, and visually recorded as in the first.	
Results The resulting sample width of the dielectric EAPs was shown in the experiment to increase dimensionally by ~30% when a 2N force was applied, and to closely follow a square root function, with force. Furthermore, it was shown that accordingly the change in sample width as a function of voltage followed a linear graph. Factoring in the possible sources of error that include, but are not limited to generalizations in equations and low significant digit count for actual width of sample measured in photoshop, the estimated voltage requirement would be ~40kV, which is very high, but this is being addressed.	
Conclusions/Discussion While the change in surface area from the test was only a maximum of 40%, this still makes the application of dielectric EAP materials in a reflected light display as directly expanding pixels very plausible, given initial experimental data the further experimentation will show the efficiency of the design. More research on smaller sample-sizes will continue to be done, and hopefully a more ideal voltage will be able to be used.	
Summary Statement This project investigated a new approach to digital display technology, that in the same way cuttlefish skin does, relies on expansion and contraction or pigmented areas.	
Help Received Some help was received from Prof. Gamani Karunasiri, in creating a test that did not require the use of gold powdered contacts, and fabricating an acrylic casing in which to conduct the high voltage test.	