



**CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY**

Name(s) Benjamin J. Hewitt	Project Number J2206
Project Title Retention of Larval Stage Conditioning in Post-Metamorphic Pieris rapae Butterflies	
<div style="display: flex; justify-content: space-between;"><div style="width: 40%;">Objectives/Goals My objective was to determine whether Pieris rapae butterflies can retain memories of experiences from their larval stage.</div><div style="width: 40%;">Abstract</div><div style="width: 20%;"></div></div> <div style="padding-left: 5px;">Methods/Materials Pieris rapae eggs were obtained and hatched on home-grown radish sprouts. At their 4th instar, they were separated into control and conditioned groups, and were moved into different habitats with organic brussels sprouts. The conditioned group was placed on electrically conductive agarose gel in a container through which the scent of ethyl acetate (EA) was pumped while a mild electric current went through the agarose gel. Following 3 rounds of conditioning, the groups were labeled #A# and #B# so that this would be a blind study for me. The groups were tested (1) to see if the caterpillars had an instinctive aversion to the scent of EA and (2) if not, whether the conditioning had worked such that one group tended to avoid the EA scent. The caterpillars were then allowed to go through metamorphosis. 24 hours after hatching as butterflies, each insect was tested for aversion to the EA scent and then released. The study was repeated three times, each time as a blind study. Group identities were revealed to me only after the completion of the 3rd study.</div> <div style="padding-left: 5px;">Results Based on my study, Pieris rapae butterflies do not have any instinctive aversion to the scent of EA, but when conditioned to have a negative experience with it, they can and do retain those memories through metamorphosis.</div> <div style="padding-left: 5px;">Conclusions/Discussion Studies have shown that almost all of a caterpillar's brain is liquefied during metamorphosis, other than the parts that control certain muscle movement. My study shows that even if the brain matter is liquefied, it has a way of storing memories. Recent studies have also shown that memories are stored not in the synapses, but inside individual neurons. The results of my study are consistent with this recent scientific learning, which could explain how butterflies can recall memories learned prior to metamorphosis.</div>	
Summary Statement My project was testing whether Pieris rapae butterflies can retain memories of conditioning from their larval (caterpillar) stage.	
Help Received My parents (driving, supplies); family friend (cutting pipes and windows in the butterfly testing apparatus); Cory Tobin (supervision with agarose gel).	