



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) David F. McCleary	Project Number S0419
Project Title Efficiency of ATP Production of Mitochondria in Different Body Segments of Drosophila melanogaster	
Objectives/Goals The goal of my experiment was to determine the relative efficiencies of ATP production of mitochondria in different body segments of Drosophila melanogaster.	
Abstract Methods/Materials I extracted and purified by centrifugation mitochondria from the head, thorax, and abdomen of 200 one week-old Drosophila. The samples were first standardized for protein concentration and thus mitochondria concentration using the Bio-Rad protein concentration assay protocol (Bradford assay). I inserted an oxygen sensor connected to a biological oxygen monitor and rolling grapher into a fluid chamber to measure the change in oxygen concentration in the fluid. I measured the rate of oxygen consumption of the samples in this chamber both when all substrates of respiration were present and when substrates were exhausted in four different trials. By dividing the former value by the latter value I constructed a Respiration Control Ratio (RCR) for all trials of the three samples, which gives the relative efficiency of oxygen consumption directly as a result of oxidative phosphorylation in mitochondria.	
Results I found the average RCR of head mitochondria to be 1.532, the average RCR of thorax mitochondria to be 6.986, and the average RCR of abdomen mitochondria to be 1.348. A high RCR means that large amounts of oxygen were consumed when substrates were present and low amounts of oxygen were consumed when substrates had already been used up, which is a sign of efficient ATP production.	
Conclusions/Discussion My data seems to show that my hypothesis was correct and thorax mitochondria are much more efficient in the production of ATP. Head and abdomen mitochondria RCR values are too close to show which is more efficient. If after further research I determine the cause of these differing values to truly be variable efficiency of mitochondria in different tissues, there are two hypotheses I wish to explore. The first being that mitochondria with different features function as egg polarity factors (cytoplasmic determinants) in the early embryo, and the second being that different nuclear genes that control mitochondria function are transcribed in different tissues causing different efficiencies of mitochondria in these tissues.	
Summary Statement I determined the relative efficiencies of ATP production of mitochondria in the head, thorax, and abdomen of Drosophila melanogaster by measuring oxygen consumed by oxidative phosphorylation in the mitochondria of these segments.	
Help Received I used lab equipment at the University of California, Irvine in the laboratory of Dr. Douglas Wallace under the supervision of Dr. James Tong.	