



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

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Project Title Differences in Gene Expression Underlie Convergence in Bioluminescent Squid Photophores	
Abstract Objectives/Goals A fundamental problem in zoology is how convergent evolution works at the molecular level. <i>Euprymna scolopes</i> and <i>Uroteuthis edulis</i> are distantly related species of bioluminescent squid that have very similar photophores (light organs) that demonstrate structural convergence. The goal of this work is to determine whether the species use the same kinds of genes or use different combinations of genes to regulate their photophores. Methods/Materials I extracted RNA from ten <i>E. scolopes</i> and nine <i>U. edulis</i> individuals, converted RNA to DNA and used qPCR to determine the amount of expression for eight different genes in the photophores. I used the delta-delta CT method to determine gene expression levels in one species relative to another and used the Mann-Whitney U-test, a nonparametric alternative to the t-test, to determine whether the levels of gene expression for each gene are significantly different for the two species. Results <i>E. scolopes</i> and <i>U. edulis</i> had significantly different levels of expression ($p < 0.05$) for six of the eight genes. Expression levels of opsin (light perception), cryptochromes (blue-light receptors), and crystallin (lens) genes were significantly different. There was too much variance in the expression of the two immunity genes (NFkappaB and peroxidase). Conclusions/Discussion Differences in gene expression in the photophores demonstrate that the two species use different combinations of genes to regulate their photophores. Bioluminescence is useful in biomarkers and other forms of bioimaging. Another application is simply a better understanding of Earth's history. Convergent evolution is a major part of Earth's history, and observing genomic and functional similarities and differences in the two squid species can help us better understand how evolution occurred on Earth.	
Summary Statement This project compared gene expression levels in two convergent species of bioluminescent squid to determine the molecular basis of convergent evolution.	
Help Received Used lab equipment at UCSB under the supervision of Sabrina Pankey.	