



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Joshua D. Bright	Project Number J2409
Project Title Free-Range vs. Caged Chickens: Influence on Yolk Color and Size	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals I have had chickens for pets for two years, and the eggs they lay seem to have brighter, larger yolks than commercial eggs. I wondered why this was, and this is what led me to my project. I hypothesized that the yolk color and size would be dependent upon whether the egg was organic and the chicken that laid it was free-ranged or caged. Egg color matters because it is the result of two carotenoids called lutein and zeaxanthin and other beneficial xanthophylls. Lutein and zeaxanthin have been shown to aid in prevention of age-related macular degeneration (AMD), the leading cause of blindness.</p> <p>Methods/Materials I took a total of 162 RGB readings from 54 photographs of 27 eggs representing nine different types of eggs. For each I recorded the weights of the egg and the yolk and took two pictures of each yolk sample and uploaded the images to my computer. For each image, I selected three representative spots on each photograph and took the RGB readings of each one. I then averaged the data.</p> <p>Results The most significant result I obtained from my project was that commercial eggs tend to have larger yolk/egg ratios than organic eggs. This may be because commercial feed may contain different dietary nutrients. The RGB color assessments showed that redder (more orange) yolks did not always correlate with free-range chickens, and this may be clue to dietary differences among the free-range animals. I am continuing to experiment and looking for a pattern regarding yolk color.</p> <p>Conclusions/Discussion Factors that I thought would have a great impact on coloration and yolk/egg proportion did not seem to have a consistent effect. One consistent result my tests yielded was that inorganic eggs tended to have larger yolk proportion than organic eggs. I believe this may be because these eggs are laid by chickens fed a diet supplemented by hormones and antibiotics. My free-range chickens did have yolks with deeper coloration than most of the other test eggs, but other free-range egg yolks were not as deeply colored as I predicted they would be. The diet a chicken is fed influences egg yolk color. In other words, chickens fed diets higher in xanthophylls will lay eggs that are higher in xanthophylls, and the eggs will be more deeply pigmented. I would suggest more testing be done, comparing the diets of free-range chickens, to see if more consistent patterns emerge.</p>	
Summary Statement My project is about the factors that influence the color and size of the yolk of a chicken egg.	
Help Received My mother helped me acquire eggs for my testing; my science teacher helped me develop a way to analyze yolk color using RGB readings; Dr. Robert Pomeroy gave me general advice about my project.	