Facets of the evolution of vision: insights from the water flea, Daphnia

Christopher S Brandon
PhD Candidate, Department of Biological Sciences

Eyes have attracted the attention of evolutionary biologist since the field’s infancy. In *On the Origin of Species*, in fact, Darwin famously remarked on the proposition that natural selection could engineer the eye, saying “[it is] absurd in the highest possible degree.” Though, he goes on to explain, beautifully and simply, how his theory of evolution by natural selection could produce such an organ. Indeed, eyes are remarkable examples of complex information acquisition systems that have evolved from simple beginnings. Eyes allow animals to extract environmental information from light, which informs physiological and behavioral responses to resources, predation, and mates. The morphological and physiological features of eyes define the absolute bounds of visual capabilities. These characteristics of eyes highlight why they are particularly interesting from an evolutionary perspective: variation affects what and how environmental information can be collected and processed, thereby potentially altering many of the animal’s ecological interactions. While a rich literature has documented myriad facets of eye evolution, there remain many areas that merit more investigation. The aim of my thesis is to broaden our understanding of the evolution of vision by exploring three related, yet different, aspects using the ecological model organism, *Daphnia*. I present a study that examines the ecological factors that potentially influence eye morphology. Second, I present a study that demonstrates fitness variation associated with eye diameter, and pair these observations with information on genetic variation of eye diameter. Lastly, I present a study evaluating the evolution of opsins—the gene largely responsible for vision—in *Daphnia*. 