Color Vision: From Behavior to Genes

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*Color Science Building 18, Franc Grum Learning Center

Abstract

In this talk I will be discussing one study from my dissertation and one from my post-doctoral fellowship, followed by a miniature version of a lecture from the Interdisciplinary Color Course I have taught and would love to teach again someday. The first study looks at how the ratio of red to green cones (which vision scientists call L and M, for long-wavelength-sensitive and medium-wavelength-sensitive) in the retina affects perception. Amongst people with normal color vision, there is surprising variability in cone ratio, ranging from close to 1:1 to nearly 20:1 L:M cones. Do these differences affect our perceptions? And what does this say about neural wiring? For the second study, I will discuss two novel genetic mutations that we have identified that appear to be disrupting the S-cone (short-wavelength-sensitive, or "blue" cone) vision of these subjects, leading to a form of colorblindness known as tritanopia. I will also present our hypothesis, and supporting data, that tritanopia is degenerative. Then I will shift gears and present the Mauve Story from my Interdisciplinary Color Course – mauve was the first synthetic dye, and its discovery revolutionized not only the dye industry, but all of chemistry, especially organic chemistry.

Biography

When I was little, I thought I would be an artist when I grew up. In junior high school that changed to scientist or mathematician. In the end, I was able to combine my interests, with a PhD in Color Vision. I began academically combining behavior and biology at Oberlin College through a major in biopsychology. In graduate school at UC San Diego, I continued with an interdisciplinary PhD in Cognitive Science, with psychology as my primary specialization and neuroscience as secondary; my dissertation was a psychophysical study of color vision. The intersection of behavior and biology fascinates me, that we can identify specific neural structures or even genes and amino acids that are responsible for how we perceive features of our world such as colors. In an NIH-funded post-doctoral fellowship at the Medical College of Wisconsin, I studied the molecular genetics of color vision, combining that with the behavior of our subjects through psychophysical measurements. The genetics underlying color vision have turned out to be more complicated than was originally expected, providing a rich environment in which to launch my own career. I have also greatly enjoyed sharing this knowledge with students, both research associates and in courses I've taught on Sensation & Perception, Sensory Neuroscience, and Interdisciplinary Color.