Vertebrates deploy a suite of external sensory organs to detect changes in the environment. However in recent years, it has become clear that in addition, central neurons in lower vertebrates may directly respond to sensory cues. In zebrafish, multiple non-classical sensory mechanisms initiate behavioral responses including several distinct populations of deep brain photoreceptors. Light sensitive neurons in the hypothalamus of larval zebrafish trigger hyperactivity during darkness. Using psychophysical tests and genetic manipulations, we show that these photoreceptive guide a navigational strategy that allows larvae to systematically explore their three dimensional environment for light. Moreover, retinal signaling and deep brain photoreceptors activate complementary light-search strategies that are temporally offset. Our findings show how genetically hard-wired circuits can control sophisticated motor responses that result from the integration of acute sensory information with long lasting behavioral states.

Friday, November 20, 2015
10:15am, Room 1103 Bioscience Research Building