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Light-inducible transcriptomic and epigenomic changes underlying brain plasticity in honeybees

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Honeybee workers perform different tasks in the colony throughout their adult life span. This is accomplished via division of labor, whereby young bees progress through a series of tasks inside the hive (cleaning, nursing), and older bees start foraging at ~3 weeks of age. However, division of labor is not exclusively age-regulated, but also context-dependent. Nurses may start precocious foraging when the colony is in need of foragers, and foragers can revert back to nurses in case of shortage of nurses. The honeybee, therefore, is an ideal model to investigate neuronal mechanisms of environmentally induced behavioral plasticity. The shift from in-hive to outside tasks involves adaptations to different environments. One major difference in the outside world is exposure to light as bees leave the dark pheromone-filled hive. Light plays an essential role for foragers, particularly for visual navigation and spotting food sources. Therefore, foragers need to be optimally prepared by adaptive changes in the neuronal circuitry. Transition to foraging is associated with remarkable changes in brain structure and associated synaptic plasticity (Groh et al. 2012, *J Comp Neurol*). Ongoing work shows that light exposure of adult workers is sufficient to induce structural synaptic plasticity in visual subcompartments of the mushroom bodies (Scholl et al. 2013, *Front Behav Neurosci*). Our aim is to study how light-inducible neuronal plasticity in visual centers of the brain is controlled at both transcriptional and epigenomic levels. In a broader context we wish to understand how light contributes to the genome-environment interplay that generates strikingly different phenotypes and behaviors with no conventional genetic changes. We will describe our experimental set-up designed to integrate environmental exposure with molecular changes in the brain and present some preliminary data on gene expression in optic lobes. Funded by the Graduate School of Life Sciences (GSLs), University of Würzburg.