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PER conditioning of monochromatic light stimuli in bumblebee drones

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Learning visual cues constitutes a vital ability of bees to orientate in space and to recognize nest sites, food sources and mating partners. To study learning and memory in bees under controlled environmental conditions, the proboscis extension reaction (PER) assay provides a well-established behavioral approach. While many studies exist about olfactory learning, only little is known about PER conditioning of visual stimuli in bumblebees. Moreover, research using the PER method has primarily focused on workers, whereas males were largely neglected. In the present study, intact *Bombus terrestris* drones were tested in different color learning tasks using classical PER conditioning. Different monochromatic light stimuli (435nm, 455nm, 488nm, 528nm) in combination with different grey filters (transmission: 13%, 51%, 100%) were used to ensure that the bumblebees can only use chromatic but not achromatic (e.g. brightness) information. Drones were trained with absolute (A+) and differential (A+ vs. B-) conditioning and tested for memory recall after two hours (mid-term memory). Furthermore, drones were tested after differential conditioning for information transfer to a novel discrimination task in a Y-maze. The results indicate that drones are capable of discriminating between monochromatic light stimuli and retrieve the learned stimulus after two hours. Drones reach performance levels similar to that of workers. However, in contrast to workers, drones are not able to transfer the learned information to a novel context (Y-maze). The PER approach provides a useful tool to investigate color learning and discrimination abilities of bees and reveal potential differences between sexes under controlled conditions.