Why bees may stop to smell the flowers: How olfactory restriction affects odor signaling in the honey bee, Apis mellifera

Author(s): Christopher M. Jernigan, Christopher M. Jernigan , Rachael Halby , Richard C. Gerkin , Irina Sinakevitch , Fernando Locatelli , Brian H. Smith

Institution(s): Social Insect Research Group, School of Life Sciences, Arizona State University, Tempe, AZ USA ; Social Insect Research Group, School of Life Sciences, Arizona State University, Tempe, AZ USA ; Social Insect Research Group, School of Life Sciences, Arizona State University, Tempe, AZ USA ; Social Insect Research Group, School of Life Sciences, Arizona State University, Tempe, AZ USA ; Instituto de Fisiología, Biología Molecular y Neurociencias (IFIBYNE-UBA-CONICET) and Departamento de Fisiología, Biología Molecular y Celular, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Buenos Aires, Argentina ; Social Insect Research Group, School of Life Sciences, Arizona State University, Tempe, AZ USA ; Social Insect Research Group, School of Life Sciences, Arizona State University, Tempe, AZ USA

Experience plays a determinant role in shaping the central nervous system of animals and allows them to adaptively change their responses to stimuli over time. In this study we explore how a chronic reduction in, post-eclosion, olfactory experience shapes olfactory processing, olfactory mixture learning, and the antennal lobe network of the honey bee, *Apis mellifera*. We placed sister honey bees into one of two olfactory conditions. In the first condition we reduced the food associated olfactory experience of foraging bees by placing them in a tent in which both sucrose and pollen resources were associated with a single odor, 1-Hexanol. In the second condition, bees were allowed to freely forage in the environment and receive a diversity of resource associated olfactory experience. We measured the antennal lobe glomerular responses to odors using calcium imaging, and found that reducing the olfactory experience of bees also reduced the natural inter-individual variation in their glomerular response profiles to odors. We next measured the impact of this treatment on a mixture variance learning assay, and found that bees with a reduced olfactory experience generalized more to mixture components even when the mixtures presented were consistent over time. We also found that bees with a reduced olfactory experience had more immature-like structural staining, suggesting sensory input post-eclosion is necessary to maintain antennal lobe maturity. Together we show that olfactory experience can affect both the primary olfactory lobe and the behavioral capacity of honey bees. This study and others highlights the potential impact of individual experience at multiple levels of olfaction.