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Vibration processing and olfactory locomotion related to honeybee communication

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Honeybees (*Apis mellifera* L.) display sophisticated behaviors including learning and communication. Honeybee foragers learn different types of flower-related information and transfer such information to their hive mates by species-specific stereotyped in-hive behaviors. For information receivers, vectors pointing to profitable flower patches and associated floral odors are key informations to locate the indicated flowers. We have studied mechanisms to decode these informations using an interdisciplinary approach. The distance and direction of vectors are encoded in the number of pulses of air-borne vibration and in the body axis during the waggle dance, respectively. We have identified the primary center of these informations and the candidates for interneurons related to distance coding. We are now collaborating with a group of computational neuroscientists at LMU Munich to evaluate the morphological and physiological changes of the critical identified interneurons, depending on the age and labor-state of the bee, to clarify the development of the candidates for interneurons related to distance coding (http://projects.g-node.org/ginjang/). Honeybees also communicate plant odors by unique behavior, trophallactic contact in which the recipients learn plant odors associated with nectar rewards and then orientate toward corresponding odor sources. We investigated the locomotion pattern toward the reward-associated odor (CS+), compared with those toward a reward un-associated odor (CS-). Stimulation with CS- induced exploratory walks that had no clear relation to the stimulus position. In contrast, stimulation with CS+ induced localized search walks around the initial position at which the stimulus was received. This locomotor pattern consists of typical alternation of left/right turns less than 180 degrees. We will propose the possible mechanism for integrating the reward-associated odor and vector informations in the brain. This research was supported by the Ministry of Education, Science, Technology, Sports and Culture of Japan; Grant Number: 22570079 and Strategic International Cooperative Program, Japan Science and Technology Agency (JST).