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Reproductive behavior of the silkmoth is determined by a single pheromone receptor protein

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Pheromone preference, and the initiation of a complex programmed sexual behavior, is determined by the specificity of a single sex pheromone receptor protein expressed in a population of olfactory receptor neurons in the silkmoth (*Bombyx mori*). The study, which will be published on June 30th in the open-access journal *PLoS Genetics*, provides the first direct proof of the long-held belief that the control of sexual behavior in male moths originates in the chemical specificity of the pheromone receptor proteins expressed in pheromone receptor neurons.

Sex pheromones are chemical signals found in a wide range of organisms. They serve as stimuli inducing behavioral responses in conspecifics (especially opposite-sex members of the same species). In most moth species, male moths depend on sex pheromones emitted by conspecific females to recognize and locate appropriate mating partners. Thus, behavioral preference of male moths for conspecific pheromones is a critical factor for successful reproduction. Although sex pheromone receptor proteins reportedly play a central role in sex pheromone detection and discrimination, the causal relationship between sex pheromone receptor specificity and behavioral preference remained to be proven.

The researchers, from The University of Tokyo, National Institute of Agrobiological Sciences, Fukuoka University, and Keio University,

address this question using the silkmoth, which displays the simplest possible pheromone system, in which a single pheromone substance, bombykol, elicits full sexual behavior. They generated transgenic silkmoths which express a different sex pheromone receptor: PxOR1, of the diamondback moth (Plutella xylostella). Ectopic expression of PxOR1 elicited the same physiological and behavioral responses in the silkmoth when it was exposed to its specific ligand, which is a major sex pheromone component of the diamondback moth.

These results demonstrate not only that it is the specificity of the pheromone receptor proteins which controls the sexual behavior of male silkmoth, but that manipulation of the sex pheromone receptor neurons can turn silkmoths into detectors for essentially any odor for which a specific receptor can be made, due to the conspicuous orientation behavior and extremely high behavioral sensitivity of male silkmoths. The researchers note that it will now be necessary to ascertain the general validity of the results in more complex systems.

More information: Sakurai T, Mitsuno H, Haupt SS, Uchino K, Yokohari F, et al. (2011) A Single Sex Pheromone Receptor Determines Chemical Response Specificity of Sexual Behavior in the Silkmoth Bombyx mori. PLoS Genet 7(6): e1002115. doi:10.1371/journal.pgen.1002115