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Post-mating sexual abstinence in a male moth

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In most animals, male copulation is dependent on the detection and processing of female-produced sex pheromones. In males, a refractory post-ejaculatory interval (PEI) follows copulation, allowing them to avoid direct remating until they have replenished their reproductive tracts. In the moth Agrotis ipsilon, newly mated males show a transient inhibition of behavioral and central nervous responses to sex pheromone. Using non pheromonal (plant) odors, pheromones and their mixture, we now show that the observed lack of pheromone response originates from differential post-mating odor processing in the brain. Although mated males still respond to plant odors alone, their response to mixtures depends on the added pheromone concentration. Below a specific threshold, sex pheromone is not detected at the brain level; above this threshold, it becomes inhibitory. This PEI can thus be interpreted as a «refusal to respond», which contradicts the generally accepted paradigm of sleep-like/exhaustion behavior during PEI.

In animals, sex pheromones are generally considered as attractants and play a key role in the encountering of sexual partners, ultimately leading to copulation. During mating, males transfer sperm and seminal material from their reproductive tracts, which induce drastic behavioral and physiological post-mating effects in both sexes. In males, it induces a post-ejaculatory interval (PEI), which is characterized by a sleep-like behavior, i.e., a decrease in motor activity, probably caused by exhaustion.1 In Vertebrates, this PEI lasts from a few seconds in hamsters to hours or days in some other mammals.2 In insects, the PEI is often shorter, from 5 minutes in a parasitic wasp to 24 h in moths or earwigs.3,4 This PEI allows newly mated males to “wait” until they have refilled their reproductive tracts with seminal proteins for a new potential ejaculate. By skipping unsuccessful reproduction, males might enhance their probability of surviving to the next reproductive opportunity and increase their amount of energy available to undergo a next reproductive event. Although postcoital changes in physiology are well documented in females,5 the physiology underlying the male PEI is less studied.

In the moth, Agrotis ipsilon, newly-mated males are no longer attracted to sex pheromone.4 Moreover, most newly-mated males showed the characteristic sleep-like PEI behavior (hardly any walking and no random flight).7 This is accompanied by a decrease in the sensitivity of neurons within the primary olfactory centre, the antennal lobe (AL).4 To understand the nature and origin of the PEI in A. ipsilon males, we asked the following questions: (i) is pheromone detection switched off completely? (ii) are other odors still detected? and (iii) if they do detect the pheromone: do they ignore it or does the pheromone itself inhibit their attraction? To test these possible scenarios, we chose a strategy in which the sex pheromone was tested in combination with a non-pheromonal type of attractant (flower odor) using behavioral (wind tunnel) and electrophysiological tests (intracellular recordings in ALs).8

Our results show that, during the PEI, the olfactory system is not entirely...
males might be physically exhausted from copulation, they are certainly not “sleepy”, because they still respond to plant odors alone and to mixture with an under-threshold concentration of pheromone. This is in opposition with the generally admitted paradigm of PEI being described as a sleep-like rather inactive behavior.

We are currently working on two main questions: (i) is there a specific factor (peptide, protein, hormone, neuromodulator) inducing this post-mating abstinence after mating? and (ii) how does this potential factor modulate the processing of sex pheromone in the AL?

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