A first: Researchers apply efficient coding principle to sense of smell

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For the first time, researchers have demonstrated that the efficient coding principle regarding neurobiological processes applies to sense of smell. The team, comprised of researchers from the Czech Academy of Sciences and the French National Institute for Agricultural Research (INRA), displays this quantitative relationship in a study of male moths and pheromone plumes, published April 25th in the open-access journal *PLoS Computational Biology*.

The efficient coding principle – the adaptation of sensory neurons to the statistical characteristics of their natural stimulus – has previously been studied in visual and auditory neurobiology. In this new study, the researchers have extended this principle to sense of smell, studying how males locate their female mates via pheromone release. The team affirms that olfactory neurons in moths best process those stimuli that occur most frequently.

The authors selected the pheromone olfactory system because it is the only one in aerial animals for which quantitative properties of both the natural stimulus and the reception processes are known. These properties were used to determine the characteristics of the pheromone plume that are best detected by the male neuron reception system. The researchers then matched those characteristics with those from plume measurements in the field, providing quantitative evidence that this system obeys the efficient coding principle.

The researchers note that this study was confined to early detection events, most notably the interaction of pheromone molecules with membrane receptors. Exploring the quantitative relationship between the properties of biological sensory systems and their natural environment should lead not only to a better understanding of neural functions and evolutionary processes, but also to improvements in the design of artificial sensory systems.

Citation: Kostal L, Lansky P, Rospars J-P (2008) Efficient Olfactory Coding in the Pheromone Receptor Neuron of a Moth. PLoS Comput Biol 4(4): e1000053. doi:10.1371/journal.pcbi.1000053

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