

Sensing food and pheromones

Heinz Breer

Institute of Physiology

University Hohenheim

The chemical senses, olfaction and taste, play an important role in acquiring chemical information from the external world and in regulating fundamental physiological processes, such as feeding and reproductive behavior. Indeed, what we eat and drink is guided largely by food and beverage flavor, a combination of smell and taste. Thus, both sensory modalities in concert are essential for food choice and for the assessment of palatable and nutritious food. Research over the last decade has unraveled the molecular basis for the recognition of chemical compounds by the nose and the tongue. Volatile compounds are recognized by olfactory sensory neurons, which express one receptor type out of a large array of receptors and which respond relatively unspecific to odorants. Taste compounds are recognized by gustatory sensory cells in the lingual papillae, which are specifically tuned to the distinct taste modalities. A third possibility for an assessment of food is based on the chemosensory capacity of the gut, where specialized cells in the intestinal mucosa sense nutrient components and release signaling molecules which regulate digestive activities and multiple metabolic processes.

The initiation and regulation of complex reproductive behavior strongly depends on chemosensory perception of specific chemical cues. The underlying molecular mechanisms have been explored in great detail for pheromone signaling in insects. Pheromones, molecules released from individuals of the same species that convey social or sexual cues, are recognized by highly specialized chemosensory cells in the antennae. Binding proteins in the sensillar lymph are supposed to transfer the highly hydrophobic compounds to the sensory cells which are equipped with receptors specifically tuned to the species specific pheromones. Upon interaction with adequate pheromones the sensory cells elicit electrical signals which are conveyed to pheromone information processing centers in the brain, thus triggering distinct behavioral and neuroendocrinological reactions.