Part Two - Perception of Flavor Compounds

P. Duchamp-Viret, Marie-Christine Lacroix, Nicola Kuszewski, Christine Baly

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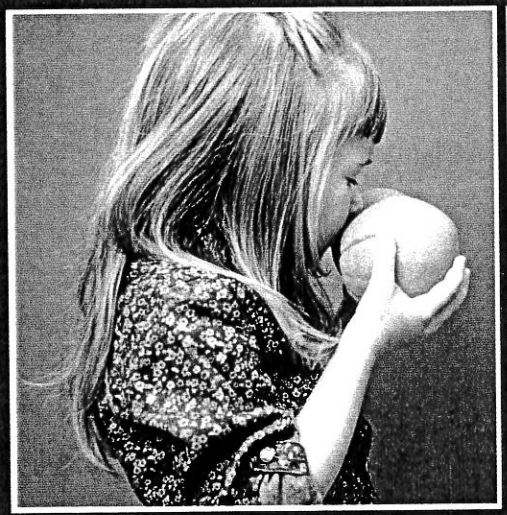

Flavor

From Food to Behaviors, Wellbeing and Health

Edited by Patrick Etiévant, Elisabeth Guichard, Christian Salles and Andrée Voilley

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Olfactory perception and integration

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3.1 Introduction

Odors are very complex stimuli which are mainly raised by mixtures of odorant chemical compounds displaying different degrees of volatility. The volatility is directly related to a substance's vapor pressure[a] at a given temperature; substances with higher vapor pressure vaporizing more readily than a substance with a lower vapor pressure. Thus, for a given combination of odorant molecules, the compounds compete with each other for constituting the gaseous phase, this competition depending on both individual volatility properties and ratios in which the compounds are present. Altogether, this will result in a unique and precise fragrance of an odor item. The quasi infinite variety of odorant compounds and their combinations, combined with the wide range of their volatility properties, imply that the olfactory system must be thus highly adaptable to new items, and highly sensitive.

In addition to having to face limitless and constantly moving stimuli, the peripheral olfactory system needs to regenerate. Indeed, in the nose, the sensory neurons are directly in contact with the exterior, and can be damaged by thermal or chemical aggressions. Such an exposure is compensated by the fact that these neurons are continuously and cyclically renewed during the course of life (Graziadei, 1973). Lastly, the olfactory system must be operating very early in the organism's life, since it intervenes in numerous survival behaviors like predator avoidance, the bounding of the young to the mother, and foraging behavior which starts at birth by the nipple search.

The olfactory system per se comprises three main levels, namely the olfactory epithelium (OE, peripheral level), the olfactory bulb (OB, first central relay), and the piriform cortex (PC, main cortical level). As a phylogenetically very ancient system, the olfactory system developed various and adaptive strategies to face the world of odors, and it can analyze and encode them as either juxtapositions of odorant elements (elemental coding), or as constructions (olfactory gestalts = synthetic coding), or both, as a function of the physiological needs or motivational events.

In this chapter, the peripheral odor processing steps will be not described according to their chronological order. Indeed, the normal time frame for the operational steps, for

[a] Vapor pressure. In a closed container, molecules from a volatile liquid escape the liquid phase and become vapor. These gaseous molecules strike the wall of the container, exerting what's known as vapor pressure. Vapor pressure is directly proportional to temperature. Increasing temperature will increase the ratio of gas:liquid molecules, thereby increasing vapor pressure.

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