Chapter 9

FLAVOUR PROGRAMMING DURING BREAST-FEEDING

J.A. MENNELLA
Monell Chemical Senses Center, Philadelphia, PA USA. mennella@monell.org

1. INTRODUCTION

As omnivores, humans exploit a wide range of potential plant and animal foods. Thus, developmental processes must act to ensure that an individual is not restricted to a narrow range of foodstuffs by virtue of few preferences and strong aversions for novel foods.1 Nevertheless, a cursory view of cultural differences in cuisine serves to show that not all of the potential foods available to individuals within a culture are actually consumed. Individual experiences, which can be conceived as the mechanism by which one absorbs culture, must serve to specify acceptable and preferred foods.2

After defining the concept of flavour, this essay summarises the insights gleaned from scientific research on the sensory capabilities of the human infant and describes one of the first ways that mothers pass on to daughters and sons their gastronomic culture. This body of research reveals that, like other mammals, the foods eaten by women during pregnancy and lactation flavour amniotic fluid and mothers’ milk, respectively. Such experiences bias acceptance of particular flavours and may ‘program’ later food preferences.
2. DEFINITION OF FLAVOUR

Flavour, a powerful determinant of human consummatory behaviour throughout the lifespan, is a product of several sensory systems, most notably those of taste and smell. The perceptions arising from these two senses are often confused and misappropriated, with such sensations as vanilla, fish, chocolate and coffee being erroneously attributed to the taste system, per se. In fact, there are only a small number of primary taste qualities (e.g., sweet, salty, bitter, sour and savoury tastes) which can be perceived in all areas of the tongue. Smell sensations, on the other hand, encompass thousands of diverse qualities, some of which are noted above. The receptors for the olfactory system, located high in the nasal chambers, are stimulated not only during inhalation (orthonasal route), but during sucking in infants and deglutition in both children and adults, when molecules reach the receptors by passing from the oral cavity through the nasal pharynx (retronasal route). It is this retronasal stimulation arising from the molecules of foodstuffs that leads to the predominant flavour sensations.

3. ONTOGENY OF FLAVOUR PERCEPTION

Emerging scientific research revealed that the taste and olfactory systems are well developed before birth (see reference 4 for review). The apparatus needed to detect taste stimuli make its first appearance around the 7th or 8th week of gestation, and by 13 to 15 weeks the taste bud begins to morphologically resemble the adult bud, except for the cornification overlying the papilla. Taste buds are capable of conveying gustatory information to the central nervous system by the last trimester of pregnancy, and this information is available to systems organising changes in sucking, facial expressions, and other affective behaviours.

Likewise, the olfactory bulbs and receptor cells needed to detect olfactory stimuli have attained adult-like morphology by the 11th week of gestation. Olfactory marker protein, a biochemical correlate of olfactory receptor functioning in fetal rats, has been identified in the olfactory epithelium of human fetuses at 28 weeks of gestation. Because the epithelial plugs that obstruct the external nares resolve between gestational weeks 16-24, there is a continual turnover of amniotic fluid through the nasal passages such that by the last trimester of pregnancy, the fetus swallows significant amounts of amniotic fluid, inhaling more than twice the volume it swallows. Even in air-breathing organisms, volatile molecules must penetrate the aqueous mucus layer covering the olfactory epithelium to reach receptor