Tastes differ: How taste preferences develop

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Very few of our taste preferences are biologically preset. Much rather they are linked with some sort of experience. Although there are some genetic factors that cause differences in taste perception, similarities in taste preferences much more commonly reflect similar experiences with types of flavours and foods. The shaping of taste preferences begins in the womb and continues throughout the rest of our lives.

Prenatal shaping

All human senses are established in the embryonic phase (weeks 1-8 of gestation) and at the start of the foetal phase, and mature at varying rates. Development and maturation of the sensory organs is tightly linked with that of the central nervous system. Organ formation begins at the head, which is why the sensory organs of this area (eyes, ears, nose, tongue) are also established very early. The taste sense, too, forms and matures at an early stage, with the first taste buds appearing at eight weeks of gestation. Aroma compounds in the amniotic fluid stimulate the foetal taste receptors as soon as the foetus starts swallowing (around 12th week of gestation). The taste impulses are transmitted to various nuclei (clusters of neurons) of the brain stem where they induce - amongst other things - the reflexes for saliva flow and tongue movements.

Amniotic fluid composition changes along the development of the foetus, especially when it starts to urinate. The foetus swallows 200-760 ml of amniotic fluid daily (depending on the development stage) and is exposed to a large number of taste compounds, including various sugars (e.g., glucose, fructose), fatty acids, amino acids, proteins and salts. Flavours from the maternal diet reach the amniotic fluid. In this way, babies already experience cultural taste patterns long before directly getting in contact with foods itself.

During weeks 26 to 28 of gestation, links between the stimulation of taste receptors and reflex-type changes in facial expression can be detected. This is especially evident with bitter taste stimuli. At 32 weeks of gestation, the foetus responds to a change in amniotic fluid taste by changing its drinking behaviour. Depending on whether the amniotic fluid tastes sweet or bitter, the foetus adjusts its swallowing pattern to a higher or lower frequency, respectively.

Innate taste preferences

For newborns, the taste sense is the most important and most developed of all senses. Numerous experiments with newborns show a high culturally transcending acceptance for sweet taste. They even react to a highly diluted sugar solution with a comfortable and satisfied facial expression. In contrast, the sour taste of citric acid is rejected with pursed lips. No response is seen with diluted bitter our salty solutions, but bitter flavours are rejected in high concentration. A change in accepting bitter tastes is seen at the age of 14-180 days. The evolutionarily sensible preference for sweetness (“safety taste”) can be explained by the fact that the sweet taste indicates a source of energy (carbohydrates) which is non-
poisonous and thus safe to eat. A bitter taste in turn warns us of toxic foods. Similar evolutionary programming is assumed for the other tastes; an acidic taste may for example warn against spoiled food, whereas a salty taste may hint at minerals. The taste quality “umami” (= savoury) indicates a good protein source as it naturally occurs in animal foods.\(^5\)

**Breast milk shapes preferences**

Human breast milk contains numerous aroma compounds the mother takes in through her diet. Natural flavours from foods (garlic or vanilla) are detectable in breast milk 1-2 hours after consumption.\(^2\) The taste of breast milk may also impact on the later preferences of the newborn. American researchers, for example, showed that neonates whose mothers had consumed carrot juice during pregnancy and weaning, preferred a carrot-flavoured cereal during infancy when compared to a control group whose mothers had not consumed carrot juice.\(^2\)

### Table 1: Innate reactions to taste compounds\(^6\)

<table>
<thead>
<tr>
<th>Basic taste</th>
<th>Innate reaction</th>
<th>Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>sweet</td>
<td>positive</td>
<td>prenatally</td>
</tr>
<tr>
<td>sour</td>
<td>negative/rejecting, uncertain</td>
<td>prenatally</td>
</tr>
<tr>
<td>salty</td>
<td>positive</td>
<td>at the age of 4-6 months</td>
</tr>
<tr>
<td>bitter</td>
<td>negative/rejecting</td>
<td>prenatally</td>
</tr>
<tr>
<td>umami</td>
<td>uncertain</td>
<td>unknown</td>
</tr>
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</table>

Babies who are formula-fed also make „taste experiences“ that impact on later preferences. It was shown that adolescents and adults who had been formula-fed during infancy, preferred a ketchup sample that was flavoured with vanillin.\(^7\) In contrast, subjects who had been breastfed as babies preferred the non-flavoured sample. Infant formula was commonly flavoured with vanillin to increase acceptance of this food by the infants.\(^7\) This type of taste formation applies to all aroma compounds. Once acquired, a preference for a specific flavour is also elicited by other foods containing this flavour.\(^8\)

**Conditioning of preferences and aversions**

Once a flavour or food is accepted, this can also influence the preference for and acceptance of new flavours or foods. This so-called flavour-flavour-learning means that new foods are more likely to be accepted when combined with known dishes rather than eaten on their own. However, this effect is more pronounced with regard to negative taste stimuli.\(^8\)

If the sensory properties of a food are linked with negative sensations or reactions (nausea, vomiting during or after consumption), an aversion against this food develops that may remain for the rest of one’s life (so-called “sauce béarnaise phenomenon”). Often it does not matter whether that food was the actual cause of the reaction or just consumed around the same time. This phenomenon can also be observed in cancer patients suffering from nausea and vomiting due to chemotherapy. In many cases these patients develop a strong aversion against foods consumed during chemotherapy, although the foods did not
contribute causally to the nausea.

Nonetheless, positive sensations may also shape the preference for a food. For example, animal studies have shown that rats after a while preferred the more calorific versions of specific foods to lower-calorie counterparts. They had learnt that they experienced positive reactions with the higher but not the lower energy density. This effect is referred to as “flavour-nutrient-learning” and can be observed in humans, too. The preference for energy- and fat-rich dishes is also shaped by the social context. Children often like foods they have eaten in pleasant situations and reject dishes linked to something negative. This is further enhanced by the selection of foods for specific occasions. Tasty foods (high energy density, high fat and sugar content; e.g., desserts) are commonly served on pleasant occasions such as celebrations or when guests are visiting. In contrast, foods considered less tasty, e.g. vegetables, are often consumed under pressure: “Eat your veggies or you won’t get any dessert.” This results in doubly negative coupling and at the same time increases the popularity of energy-dense, tasty dishes and the aversion against less savoury foods.

Favouring the well-known

Coffee is a drink that is only liked upon repeated consumption. Often one approaches the bitter taste very carefully with the help of milk and sugar. Repeated exposure is usually required to actually enjoy coffee, and the development of such a taste preference has been coined “mere exposure effect”. This means that only foods or drinks are liked which one consumes on a regular basis and which therefore have become an acquired taste. It is assumed that there is a direct link between taste experiences and preferences. A biological safety principle builds the basis for this effect: through careful tasting and waiting for any negative consequences (intolerance), our ancestors have gathered taste experiences. However, our own food behaviour is rarely mere intake, but rather coupled with emotions, social aspects and digestive processes that may influence the mere exposure effect. One biological principle opposing the mere exposure effect is the fear of new foods, termed neophobia.

Fearing the new

In young infants, especially at the age of 4-6 months, when solid foods are being introduced, food neophobia appears to be minimal. Already after a single feeding of a new food, the babies show a significant increase in acceptance. On the other hand, in infants aged 18-24 months food neophobia is very pronounced. In this sensitive phase, even children who used to be non-picky eaters often begin to reject new foods and new flavours. The neophobia protects infants at this age from eating harmful or poisonous foods. At an age when children start walking and become more independent in choosing their foods, such a neophobia may have a certain survival value.

Acceptance of a new flavour in children up to the age of five years is often only seen after exposing them at least five to ten times. Older children and adults possess successful means to overcome their innate neophobia. Through the use of taste principles, new flavours and foods are compared to known ones and added to the existing flavour repertoire (e.g., “reminds me of apple”). Although the rejection of new foods appears innate, there are individual and gender-specific differences to the neophobia, with women
seemingly less affected than men. Furthermore, similarities within families hint at a genetic component.

Neophobias in children can be attenuated or overcome. For example, children learn very efficiently from role models and icons. These may be the parents, siblings, friends or heroes from stories. If the model creates a positive impression, the child may adopt a complete behavioural pattern.

Favourite dish not every day

On the one hand, it is not helpful to approach new flavours uncritically. On the other hand, it is not very sensible from a nutritional perspective to always eat the same foods. For this reason a biological mechanism called sensory-specific satiety keeps us from a highly monotonous diet. Although especially children would love to eat their favourite dish every day, from one day to another they demand something new and reject their previously favoured dish. The sensory-specific satiety may also be observed when eating a several course menu. Only limited quantities can be eaten of the individual courses, leading to quick satiety and the rejection of second helpings. However, the next course or a dessert may still fit in. Experiments show that the preference for a dish or a specific flavour just consumed is diminished, whereas this does not hold for other flavours. In adults the rule applies that the wider the choice of foods during a meal, the more food is consumed.

Family taste

Why we like or dislike certain foods is a complex interplay of taste conditioning - which starts in the womb and continues into old age -, adaptation (mere exposure effect) and biological factors (such as sensory-specific satiety). Therefore, children and their parents deserve special attention in the process of “taste education”. It has been shown that the context in which family meals take place has a fundamental influence on later taste preferences, thus playing an important role in shaping eating behaviour. Preferences and aversions are highly individual, but may display clear familial and social links. From the very beginning, parents assume a vital role and may contribute substantially to the development of taste preferences and aversions. Since taste preferences are very stable and may last a lifetime, special care should always be dedicated to the meal setting. Negative influences such as arguments during meals should be avoided. Leaving children some room in their food choices and showing a certain calmness towards temporary food aversions can be key in the development of taste preferences.

Further information

Article slightly modified from “Geschmäcker sind verschieden - Wie sich Geschmacks-präferenzen prägen und entwickeln“, published in Fakten, Trends und Meinungen, Dr Rainer Wild Stiftung, Issue 3, 2008, p. 1-5. (German only)

References