fluid milk produced and distributed by improved sanitary methods. Both appealed much more to people who liked the taste of fresh milk. Sweetened condensed milk might have shrunk to the status of a rare emergency ration. Instead, it eventually reached a market for its own sake, precisely because of qualities not found in fresh milk.

At least some consumers in the industrialized temperate-zone world came to see the powerful sweetness and viscous body of condensed milk as pleasures, not drawbacks. It could be spread on bread or toast like honey, spooned onto hotcakes or biscuits like maple syrup, or used as a ready-made, endlessly adaptable dessert sauce. See HONEY; MAPLE SYRUP; and SAUCE. As early as 1866, Jennie June's American Cookery Book suggested serving it with fresh strawberries as an alternative to cream. By the early twentieth century, both home cooks and professionals working for food manufacturers were experimenting with other uses, turning condensed milk into various kinds of puddings or pie fillings. Purists denounced such shortcuts in 1932. The food writer Sheila Hibben mocked expedients such as an uncooked filling made from "Screech Owl Condensed Milk" —a clear reference to Bonden's "Eagle" brand—mixed with lemon juice and poured into a graham cracker crust. Already, however, these shortcuts were indispensable in many kitchens. Many Florida Key lime pie recipes today are only marginally more elaborate than the "Screech Ow." version.

For generations, milk seldom reached most English or European colonies of the tropics and subtropics in anything but canned form. Sweetened condensed milk thus acquired many popular uses. In (and beyond) Latin America, cooks learned to place unopened cans in boiling water for several hours until the already thick milk condensed further into a close reproduction of dulce de leche. Condensed milk, sometimes mixed with evaporated or fresh milk, also became a popular base for fans. It usually figures in fillings for the Mexican version of American-style cheesecake, pay de queso. Throughout the Caribbean it appears in eggnog-like holiday punches, such as the Puerto Rican caquito. See DULCE DE LECHE; EGG DRINKS; and FLAN (PUDIM).

English colonists in Africa and Southeast Asia relied on condensed milk in sweet sauces (e.g., the custard sauce for trifles) and desserts resembling cornstarch puddings that involved Bird's custard powder mixed with condensed milk. See CUSTARD.

It also went into resoundingly popular versions of coffee and tea, hot or iced, in Thailand and several neighboring countries. The famous Malaysian and Singaporean teh tarik, or "pulled tea," often sold by mamak (Muslim Tamil) street vendors, is made by adding condensed milk to freshly brewed tea and rapidly pouring the combination between two containers to raise a froth.

Condensed milk was a well-known standby among the British in Hong Kong, Shanghai, and other treaty ports of the late Qing Empire. Both in China and abroad, cooks still favor it for a few uses. Condensed milk is an almost invariably sauce for some versions of mantou, small steamed or fried yeast buns that originated in northern China, and it sometimes sweetens the formerly salty egg filling in modern reworkings of luo wong bao, another kind of steamed bun. See CHINA.

The French brought sweetened condensed milk to Vietnam, along with avocado trees and yogurt. Today avocado and condensed milk are a familiar pairing, with the milk used as a sauce for avocado halves or blended in an extravagantly rich milkshake. Meanwhile, Vietnamese-style yogurt made by inoculating a combination of fresh and thinned condensed milk with yogurt cultures has come to the United States with immigrant Vietnamese communities. See YOGURT.

See also INDIA; SOUTHEAST ASIA; and THAILAND.


Anne Mendelson

sweetness preference refers to the preference for sweet tastes observed in numerous species, including humans, from infancy on. Our sense of taste is unlike any of our other senses, in that we are born with established likes and dislikes for its fundamental qualities. This fact reveals that there is something quite crucial about taste that cannot wait for the normal processes of postnatal experience.
and learning. From an evolutionary standpoint, sensitivities to sweetness (as a signal for calories), bitterness (taste), and saltiness (sodium) are likely to have important roles in regulating the intake of nutrients and avoidance of toxins. This interpretation is supported by findings in rats of strong inverse associations between degree of toxicity of taste compounds and their palatability.

Most taste qualities—sweetness, sourness, bitterness, and umami (glutamate taste)—can also be shown to elicit stereotyped hedonic responses (facial expressions, suckling responses) very shortly after birth in humans. In particular, unambiguously positive facial expressions are observed when sugar is placed on the tongue of human newborns. This contrasts with the similarly obvious dislike shown to bitter or strongly sour tastes. Moreover, the same positive facial responses to sweetness may be observed in both rodents and apes. Infants also find sweet tastes pacifying in the face of painful hospital procedures such as drawing blood. Cross-cultural studies indicate that sweetness per se evokes nearly identical patterns of largely positive responses in adults—in this case, in the form of ratings of liking over increasing sucrose concentrations—even when their diets are substantially different. All these findings strongly suggest that our responses to sweetness as a quality are innate, with minimal input from our experiences with foods.

**Sweetness Preferences and Evolution**

The evolutionary explanation is that our survival depends on our ability to take in energy from our diet, and one of the major sources of such energy is carbohydrates, which include sugars. See SWEETS IN HUMAN EVOLUTION. Sweetness, therefore, is an excellent signal for the presence of energy. In order to maximize energy intake, preferences generally rise with sweetness intensity. Human newborns not only respond positively to sugars, they also discriminate among different sugars, consuming more if given free access to those that are more sweet (sucrose and fructose), as compared to less sweet glucose and lactose. Moreover, the fact that sweetness preferences can be observed in very many species across diverse animal classes argues strongly for the importance of sweetness as a nutritive signal. In mammals, the only species that do not respond positively to sweetness are obligate carnivores such as cats. See ANIMALS AND SWEETNESS. Any mammal species that consumes plants is thought to show sweet preferences—signaling the adaptive importance of plant-derived carbohydrates.

**Food Preferences Determined by Sweetness**

One reason why both children and adults prefer so many sweet foods is that sweetness is a major factor in the development of food preferences. Thus, repeatedly experiencing a novel food flavor with a sweet taste leads to an increase in liking for that flavor, over and above pairing the flavor with just water. This observation remains true even when the flavor is tasted afterward without the sweet taste being present. The interpretation of this effect is that sweetness in intrinsically positive, and the flavor becomes—by association—also positive. In addition, though, a sensation of sweetness may be a signal to the body that energy is being provided, something most clearly shown when flavors are paired with a caloric sweetener. Again, liking for the flavor
increases, but only when the sweetener provides energy—that is, the increase does not occur with nonnutritive sweeteners such as aspartame or saccharin. Similarly, such conditioned flavor preferences do not operate in the absence of hunger, so that need for energy determines whether or not additional energy from a sweetener is sufficiently positive to generate a preference for an associated flavor. For the same reason, the reverse is also true: the pleasantness of a sweet taste relies on our metabolic needs, and ingesting calories to meet those needs reduces the pleasantness of a subsequently experienced sweet taste.

Sweetness remains generally positive into adulthood, even in the form of sugar dissolved in water. On average, we tend to prefer sucrose in water at 10–12 percent (by weight), which corresponds to approximately the concentration of sugar in many ripe fruits. This equivalence has fed the argument for the evolutionary significance of sweet preferences. However, it is clear that this average preference value hides considerable person-to-person variation. The scientific data actually support the existence of a “sweet tooth” in perhaps half of the population, as well as of substantial numbers of people who increasingly reject sweetness as it becomes more and more intense, even if weaker levels remain liked.

How such differences arise out of the newborn’s universal acceptance of sweet tastes is not known. Evidence exists that greater liking for sweetness is linked to the higher consumption of both added sugars and sweet foods, suggesting the importance of experience and learning. Thus, among African Americans, higher rates of sweet liking have been reported, and one interesting habit in such populations is for mothers to feed their infants sweetened water. In both adults and children, the experience of a highly sweet version of a product produces an increased preference for that version. Variations in sweet liking act to influence the degree to which we develop liking for foods. For sweet likers, the pairing of a flavor with a sweet taste will result in a liking for that flavor; for those who show relative sweetness dislike, the result may be no increased liking or even a learned dislike for the flavor.

Sweetness plays an important role, too, in aiding the acceptance of foods or drinks that are initially too sour or bitter or spicy to consume. Adding cream or milk, plus sugar, a common combination for novice coffee drinkers, not only reduces the bitterness, but also provides the necessary positive tastes to produce liking for the coffee flavor itself. This is why, even if you drink your coffee white and sweetened, the smell of black coffee brewing is so appealing. This also explains why the transition in coffee drinking is overwhelmingly from sweetened coffee to unsweetened coffee, rather than vice versa. Other prominent examples of this kind of positive association are beer and wine, where consumers typically commence drinking sweeter versions and then graduate to drier (less sweet) wines or more bitter ales.

Genetic factors are also important in determining to what extent we prefer sweet tastes. Sensitivity to sweetness, as measured by the threshold at which we can detect it, shows unremarkable variation across individuals for either sucrose or saccharin. However, the pleasantness of very sweet solutions of sugar has been found to be partly heritable, as have the pleasantness and frequency of consumption of selected sweet foods. This finding is consistent with the fact that the sweet liker/dislik er distinction is not associated with different degrees of sensitivity to sweetness, but rather seems to be confined to how much we liked increasing sweetness. Craving for sweet foods such as chocolates, while apparently not related to bodily needs, does, however, also seem to be partly heritable.

Sweetness in Food Contexts

Although overall most people highly like foods that are dominated by sweetness, our diets do not consist of foods that are overly and predominantly sweet. Nor do we like unlimited amounts of sweetness—for each food, there is a “just right” level. From infancy onward, our experience of sweetness is usually within foods or drinks that have a characteristic sweetness level. Hence, our response to sweetness in foods becomes highly context-dependent. We are less likely to hear the complaint from children that a food is too sweet, but as we become more familiar with a particular level of sweetness within a food or drink, that level becomes the preferred one. Most tea or coffee drinkers will have an opinion about how much sweetener to add. If you take no sweetener, then any is too much. If you take two spoonsful, then any variation up or down will leave you dissatisfied. In other words, “appropriate” sweetness levels are learned.

More generally, preferred sweetness in foods is often linked to other food ingredients, such as the acids in fruit and the fat in desserts, cakes, and all
things creamy. We tend to prefer our sweetness in balance with these other qualities. Indeed, there appears to be a genetic determinant to whether or not a particular degree of combined sweetness and creaminess is preferred. Whereas sweet, creamy sensations are generally liked, how much sugar or fat is required for greatest preferences varies, due to genetic markers of overall taste intensity.

As noted above, when sweet tastes are paired with odors and flavors, they become more liked, at least if you are not someone who dislikes sweets. This process of association also produces the interesting, commonplace phenomenon of odors that smell sweet, such as caramel, vanilla, and strawberry. See AROMA. It is thought that sniffing an odor that has been previously paired with a sweet taste evokes that taste from memory, thus providing the experience of sweetness. The relevance of this phenomenon is twofold. First, it demonstrates that the sweetness experience consists of more than just “sugar on the tongue”—our past experiences are also crucial. Second, these odors can work in much the same way as “real” sweetness by, for example, making a sweet beverage or food more sweet, or a sour one less sour.

**Sweet Preferences and Overall Diet**

What effects do our preferences for sweetness have on our diet? When asked to eat until they are comfortably full, most people will consume much greater quantities of sweet foods than savory or salty ones. This phenomenon appears to have more to do with the taste, rather than a need for the energy that a sweetener might provide, since it occurs even if we use sweeteners that do not provide calories. In fact, in modern Western diets, sweet taste and energy consumption have been increasingly decoupled. Because it is so innately rewarding, sweetness does not always need to be accompanied by calories for it to be pleasurable or influence food consumption. It is the quality of sweetness itself that our bodies respond to, since its meaning has previously been unambiguous. Hence, sweet tastes can exert effects on palatability and consumption in the absence of any effect sweetness has on our metabolism. This fact has an upside in terms of its effects on calories consumed. Dieters who eat foods that are sweet—but without calories (for example, sweetened with aspartame)—are better able to comply with their diets and lose weight.

It is not difficult to think about the universal pleasure derived from sweetness in terms of drug-like properties. It is known that sweetness palatability is mediated by the same opioid (morphine-like) biochemical systems in the brain that are believed to be the basis for all highly rewarding activities. Drugs that block the activity in brain opioid systems to eliminate the effects of heroin and other opioid drugs will also reduce food palatability and intake, especially of sweet foods.

Such parallels, however, merely illustrate that sweet tastes are rewarding. That the majority of foods self-selected by children in Western societies are primarily sweet reflects the innate pleasure that sweetness provides; of course, this choice may also indicate just how available and promoted sweet foods are. In terms of the body’s needs, a high preference for sugars makes sense when energy needs are high. However, very little evidence exists that strong preferences for sweet foods in childhood necessarily lead to adult obesity, or even to continued high consumption of sweet foods beyond puberty, as they often are consumed (or at least traditionally have been) in childhood.

See also ADDICTION and SUGAR AND HEALTH.


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sweets in human evolution are a subject of considerable study among scientists ranging from molecular biologists to cultural anthropologists. Our mammalian and primate heritage predisposes us to liking sweet taste for a number of reasons. See SWEETNESS PREFERENCE. Mammalian milk contains the sweet-tasting disaccharide lactose (glucose linked