

## SUGAR AND OTHER SWEETENERS

The sweetness of a substance results from physical contact between that substance and the many thousand taste buds of the tongue. The taste buds are clustered around several hundred small, fleshy protrusions called *taste papilla* which provide a large surface area for the taste buds and ensure maximum contact with a substance.

Although there are many millions of *olfactory cells* in the nose, taste is a more intense experience than smell; food technologists believe this is because of the strong pleasure relationship between the brain and food. And it is universally acknowledged that sweetness is the ultimate pleasurable taste sensation. For example, the French writer Marcel Proust is famous for using this idea in his work: eating a particular cake by chance one day brings back extremely vivid memories of childhood for the narrator of his epic *In Search of Past Time*. The words 'sugar', 'honey' and 'sweetie' are used by lovers as terms of endearment. Pregnant women can often ward off morning sickness by eating something sweet. In Tudor times\*, to have teeth blackened by decay from eating too much sugar was seen as a desirable characteristic open only to the rich and aristocratic upper class. Even recently, with the harm sugar can do much more widely known, advertisers have managed to create demand for sweet-tasting cakes with the catch-phrase '*naughty but nice*'. Despite the attraction of all things sugary, however, no-one is sure what exactly makes a substance sweet.

Nature is abundant with sweet foodstuffs, the most common naturally occurring substance being *fructose*, which is found in almost all fruits and berries and is the main component of honey. Of course, once eaten, all foods provide one or

more of the three basic food components - *protein, fat and carbohydrate* - which eventually break down (if and when required) to supply the body with the essential sugar *glucose*. Nature also supplies us with sucrose, a naturally occurring sugar within the sugar cane plant, which was discovered and exploited many centuries BC. Sucrose breaks down into glucose within the body. Nowadays, this white sugar is the food industry standard taste for sugar - the benchmark against which all other sweet tastes are measured. In the U.S.A. a number of foods, and especially soft drinks, are commonly sweetened with *High Fructose Corn Syrup (HFCS)*, derived from corn starch by a process developed in the late 1960s. And man has further added to nature's repertoire by developing a dozen or so artificial sweetening agents that are considered harmless, non-active chemicals with the additional property of sweetness (see *Figure 1*), to cater for his sweet tooth.

There is, indeed, an innate desire in humans (and some animals) to seek out and enjoy sweet-tasting foods. Since sweet substances provide energy and sustain life, they have always been highly prized. All food manufacturers capitalise on this craving for sweetness by flavouring most processed foods with carefully measured amounts of sugar in one form or another. The maximum level of sweetness that can be attained before the intrinsic taste of the original foodstuff is lost or unacceptably diminished is, in each case, determined by trial and error.

Furthermore, the most acceptable level of sweetness for every product -that which produces the optimum amount of pleasure for most people - is surprisingly constant, even across completely different cultures. This probably goes a long way towards explaining the almost universal appeal of Coca-Cola. (*Although the type of sugar used in soft drinks differs from group to group, the intensity and,*

*therefore, pleasure invoked by such drinks remains fixed within a fairly narrow range of agreement.)*

Artificial sweeteners cannot match the luxurious smoothness and mouth-feel of white sugar. Even corn syrup has a slightly lingering after-taste. The reason why food technologists have not yet been able to create a perfect alternative to sucrose (*presumably a non-kilojoule-producing substitute*) is simple. There is no molecular structure yet known that predisposes towards sweetness. In fact, there is no way to know for certain if a substance will taste sweet or even taste of anything at all. Our currently available artificial sweeteners were all discovered to be sweet purely by accident.

*\* The Tudor time is the period between 1485 and 1603 in England and Wales and includes the Elizabethan period during the reign of Elizabeth I until 1603.*

Sweetener	Strength	Taste	When Discovered	
Sorbitol	0.6	slightly oily	1872	(France)
Sucrose	1.0	standard	pre – 400 BC	(India)
High Fructose Corn Syrup	1.0	slight after-taste	1960s	(USA)
Cyclamate	30	sickly	1937	(USA)
Aspartame (NutraSweet)	200	close to sucrose but softer, thinner	1965	(USA)
Saccharin	300	slightly bitter after-taste	1878	(Germany)

**Figure 1. Commercial Sweeteners. Relative to sucrose - base 1.0.**

Refer to Reading Passage 334 "*Sugar and Other Sweeteners*", and look at Questions 1 - 5 below.

Write your answers in boxes 1-5 on your Answer Sheet.

*The first one has been done for you as an example.*

**Example:** What do the letters HFCS stand for?

**Answer:** .....*High Fructose Corn Syrup*.....

1 & 2. There are TWO naturally occurring sugar substances mentioned in the article other than sucrose. What are they?

3. What does the food industry consider to be the perfect sweetener?

4. & 5. Name the TWO most recent artificial sweeteners listed in Figure 1.

Questions 6-15

The following paragraphs summarise the reading passage. Choose the ONE most appropriate word from the box below the paragraphs to complete each blank space.

Write your answers in boxes 6- 15 on your answer sheet.

The first one has been done for you as an example.

***NB. NO WORD CAN BE USED MORE THAN ONCE.***

Sugar tastes sweet because of thousands of receptors on the tongue which connect the substance with the brain. The taste of sweetness is universally .....(Ex:) *accepted*..... as the most pleasurable known, although it is a .....(6)..... why a substance tastes sweet. ....(7)..... is the most naturally occurring sugar, sources of which include .....(8)..... and honey. Sucrose, which supplies .....(9)..... to the body, is extracted from the sugar-cane plant, and white sugar (pure sucrose) is used by food .....(10)..... to measure sweetness in other .....(11)..... . Approximately a dozen artificial sweeteners have been .....(12).....; one of the earliest was Sorbitol from France.

Manufacturers often add large amounts of sugar to foodstuffs but never more than the .....(13)..... required to produce the optimum pleasurable taste. Surprisingly, this amount is .....(14)..... for different people and in different cultures. No-one has yet discovered a way to predict whether a substance will taste sweet, and it was by chance alone that all the man-made .....(15)..... sweeteners were found to be sweet.

glucose    sweetened    different    technology    fructose

mystery    artificially    technologists    maximum    commonly

chemical    best    substances    discovered    accepted

fruit    chemist    similar

## ANSWER

1. & 2. fructose, glucose [ in either order]
3. white sugar/ sucrose.
4. & 5. Aspartame (NutraSweet), Cyclamate.
6. mystery
7. fructose
8. fruit
9. glucose
10. technologists
11. substances
12. discovered
13. maximum
14. similar
15. chemical