A thought for International Day of Happiness: how a square of chocolate really does make us smile!

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Today is International Day of Happiness, an apt time for it in the UK as we emerge from a wet and dreary winter. Last month saw Valentine's Day and World Chocolate Day, both reminding us of this feel-good substance.

Unlike money, chocolate really does grow on trees; the Theobroma cacao is an evergreen that is native to tropical regions of the American continent. Its seeds or beans are the source of the 4 million metric tons produced each year, much in far-away countries like the Ivory Coast and Indonesia.

Chocolate consumption goes back at least 4000 years, to the peoples of present day Mexico – the Mayans, Aztecs and their predecessors, the Olmec. Just as today, they roasted the fermented seeds from cocoa pods, grinding the roast to a powder which they used to make a chocolate beverage, a cold, foaming drink that was very different to the substance we consume today. Sometimes they added honey to sweeten it and the Aztecs also added chilli pepper to give the phrase "hot chocolate" a whole new meaning.

Two thousand years ago the Mayan people of what is now known as Guatemala even came up with the original "chocolate teapot", a ceramic vessel used to pour the foaming drink. Archaeologists have found evidence that chocolate drinks were served up at the celebrations after the interment of sacrificial victims, though I'm sure the condemned certainly would not have made their last request for a bar of chocolate!

The last Aztec emperor Montezuma II consumed a lot of this drink every day. It was hinted that this enhanced his virility. No wonder the Spaniards were interested. Of course, it was the Spaniards who brought this wonder drink back to Europe, but it had to be changed to give it more appeal, by adding sugar and spices like cinnamon to sweeten it, as well as vanilla, another import from the Americas. Chocolate drinking became the thing to do in fashionable society.

Less than 200 years ago, the invention of the chocolate press by Casparus van Houten senior made it possible to separate roasted cocoa beans into cocoa butter and a solid that could be made into cocoa powder. This powder could be recombined with sugar and cocoa butter to produce an eating chocolate; in 1847 the Bristol firm of Fry's, closely followed by Cadbury's in Birmingham, made the first chocolate bar. The Swiss came up with milk chocolate bars in the 1870s, and to this day Switzerland and Britain are two of the top nations for chocolate consumption. Chocolate Easter Eggs were invented in the 1870s, and we haven't looked back since.

The taste of chocolate comes from a mixture of chemicals, many resulting from the roasting process, in which sugars and amino acids combine, forming members of a family of molecules called pyrazines, which contribute the nutty, roasted and chocolately sensations.

But what about the "feel-good" side of chocolate? For a start, there is the world's most widely consumed psychoactive drug, 1, 3, 7-trimethylxanthine by name. You may have heard of it – we call it caffeine. It works by counteracting the natural neurotransmitter adenosine, resulting in an increase in heart-rate and muscle contraction. There is a significant presence of a similar stimulant, theobromine, in chocolate – which also happens to be the molecule that makes chocolate poisonous to dogs. Then there is serotonin, a natural neurotransmitter which controls many functions in the brain, including mood and behaviour. The body makes it from the natural amino acid tryptophan – chocolate contains both serotonin and tryptophan.

Another chocolate molecule believed to be important was discovered less than 20 years ago; anandamide binds to receptors in the brain known as cannabinoid receptors. These were originally found to be sensitive to the most important psychoactive molecule in cannabis, Δ9-THC; likewise anandamide and similar molecules found in chocolate are also thought to affect mood.

Phenylethylamine is found in chocolate in very small amounts. It is a naturally occurring substance with a structure that is closely related to the synthetic amphetamines, which of course, are also stimulants. It is often said that our brain produces phenylethylamine when we fall in love, and it acts by producing endorphins, the brain's natural "feel-good" molecules. However, eating chocolate is probably not the best way of getting our hands on phenylethylamine, as the monoamine oxidase enzymes present in our liver will degrade it before it can reach the brain.

There are other molecules in chocolate – especially dark chocolate – like flavonoids, which some scientists think may help improve cardiovascular health, but that's a story for another day!

There is one feel-good factor I've not mentioned which isn't a molecule – that's the melt-in-your mouth sensation. The fatty triglycerides in cocoa butter can stack together in six different ways, each resulting in a different melting point. Only one of these forms has the right melting point of about 34 degrees, so that it "melts in your mouth, not in your hand". Getting the chocolate to crystallise to give this form is a very skilful process, the product of very careful chocolate engineering.

All these years on, scientists still haven't truly got to the bottom of how chocolate can be so enjoyable, and maybe it's a good thing that it remains one of life's great mysteries! I wish you all a very enjoyable International Day of Happiness.

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