

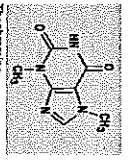
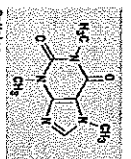
Here is a word for you: "chocoloholic." When you *roast* chocolate, nothing else will do. Just thinking about hot fudge drizzling over the cream raises your spirits. You crave a truffle, a Kit-Kat, a mug of velvety hot cocoa. Few, if any, other foods evoke such passion.

So what is unique about chocolate? Recent scientific findings are providing new evidence that chocolate may be healthier than is usually assumed.

So many good chemicals ...

One of the reasons chocolate is unique is the temperature at which it melts: between 94 °F and 97 °F. A morsel of chocolate slides across your tongue and liquefies into a perfect puddle of taste sensation. The human body, at 98.6 °F is just above the chocolate's melting temperature. "Melts in your mouth?" Delightfully true.

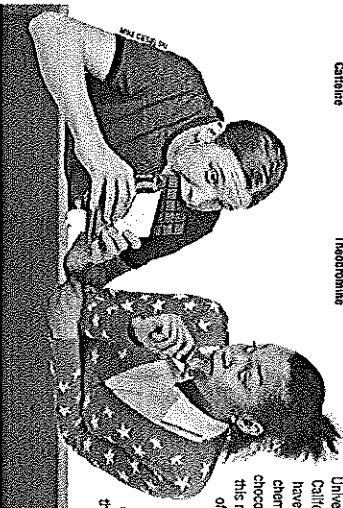
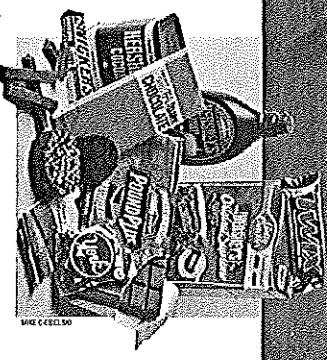
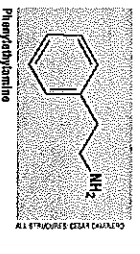
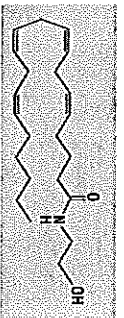
Chocolate contains more than 300 chemicals. Caffeine, a stimulant, is the most well known, but it's present only in small amounts. Another stimulant is theobromine, found in amounts slightly higher than caffeine. The two molecules are identical except for one methyl group (CH₃), but it is not yet clear how they add together in chocolate.



Another chemical known to make us happy when we eat chocolate is anandamide, so named because it means "bliss" in Sanskrit. Not only is it present in chocolate, but it is also produced by the brain and blocks out pain and depression.

But when anandamide is produced quickly, so its effects don't last.

Emmanuel DiFonzo, an assistant biologist at Massachusetts General Hospital, Boston, Mass., and Daniele Piemelli, professor of pharmacology at the University of California-Irvine, have shown that chemicals in chocolate may inhibit this natural breakdown of anandamide. This means that when you eat chocolate, anandamide molecules from chocolate stay in the body longer.



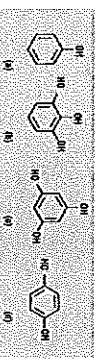
ChemMatters, APRIL 2009 13

Then, there is phenylethylamine (PEA), a natural brain chemical which stimulates the parts of the brain that keep you alert and mimic the brain chemistry of a person in love.

Is chocolate healthy?

Recent studies have explored chemicals in chocolate called polyphenols, which belong to a larger group of chemicals called antioxidants. These chemicals protect cells against damage from free radicals—atoms, molecules, or ions with unpaired electrons. Inside cells, free radicals damage DNA, and have been associated with Alzheimer's disease, heart disease, and cancer. Antioxidants prevent this damage from happening by blocking the action of free radicals and may therefore reduce the risk of being affected by these diseases.

Antioxidants work by slowing or preventing a chemical reaction called oxidation, which can produce free radicals. Antioxidants terminate this reaction by preventing free radicals from being formed. Examples of antioxidants include flavols, which are organic compounds that contain a functional group composed of a sulfur atom and a hydrogen atom (-SH) and polyphenols, which are organic compounds that contain OH groups attached to six-membered benzene rings.



The health benefits of some polyphenols—such as quercetin, which is found in citrus fruit, buckwheat, and onions—are well established, while other polyphenols' health effects are still being investigated. The largest and best studied group of polyphenols are the flavonoids, a group of several thousand compounds present in various fruits, vegetables, and chocolate.

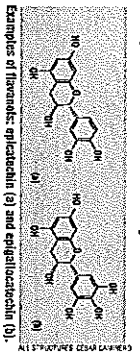
Joe Vinson, professor of chemistry at the University of Scranton, Pa., and his research students have found that polyphenols in chocolate have

beneficial effects against heart disease. The scientists showed that cocoa polyphenols acted as antioxidants in the body, compared with coconut butter and sugar alone. Also, the scientists discovered that in hamsters, cocoa powder at a dose equivalent to two dark chocolate bars per day significantly inhibited atherosclerosis, a type of heart disease in which fat clogs up arteries, and raised the levels of good cholesterol.

Cocoa is especially rich in chemicals called flavonols, which are flavonoids also found in tea, wine, and nuts. Ian McDonald, professor of metabolic physiology at The University of Nottingham, and colleagues have shown that people who consumed a flavanol-rich cocoa beverage had increased blood flow in their brains. This result suggests that cocoa flavonols could be used to prevent vascular impairments in the brain resulting from, say, a stroke.

Norman Hollenberg, professor of medicine at the Harvard Medical School and Brigham and Women's Hospital, and colleagues have observed that the consumption of a flavanol-rich cocoa beverage also increases the amount of nitric oxide in the blood vessels, allowing them to dilate and stay pliable. This result suggests that cocoa flavonols could also be used to improve heart health.

Also, Juan Carlos Espin de Juan, a senior research scientist at the Spanish Research Council in Murcia, Spain, and colleagues are working on processing the cocoa beans differently to usually lost in the processing of the beans. They asked six volunteers to consume a milk beverage made with flavanol-enriched cocoa and later to drink chocolate milk made from traditional cocoa. When they drank the flavanol-enriched cocoa, these volunteers had eight times more of



How chocolate is made

The cacao beans used to make chocolate come from a tree called *Theobroma cacao* (food of the Gods) that is cultivated in the tropics. They flies called midges pollinate the

