



Investigating Invertase

How are fondant centres in chocolates created?

Stock items	Consumables
Bin bags	Lindt Lindor truffles
Plastic tubs with lids	Rowntree After Eight mints
Sample vial (or small, clear bottle)	Invertase
Glucose molecular model	
Fructose molecular model	
Sucrose molecular model	

Presenting ideas

Fill the small, clear bottle with invertase. Put the two different chocolates into two separate plastic tubs. Try and buy similar numbers of each. Show your *edible explorer* both types of chocolate.

- What characteristics do they have in common?

Ask your *edible explorer* to take them out of their wrappers.

- What is the visible difference between the two?
- Can you offer any ingenious ways as to how a gooey centre could be made without injecting it?
- Do you know how the chemical in the bottle helps to make one of these chocolates?
- Have you heard of enzymes? What do they do?

They can eat the chocolate whilst you explain the chemistry!

What's the chemistry?

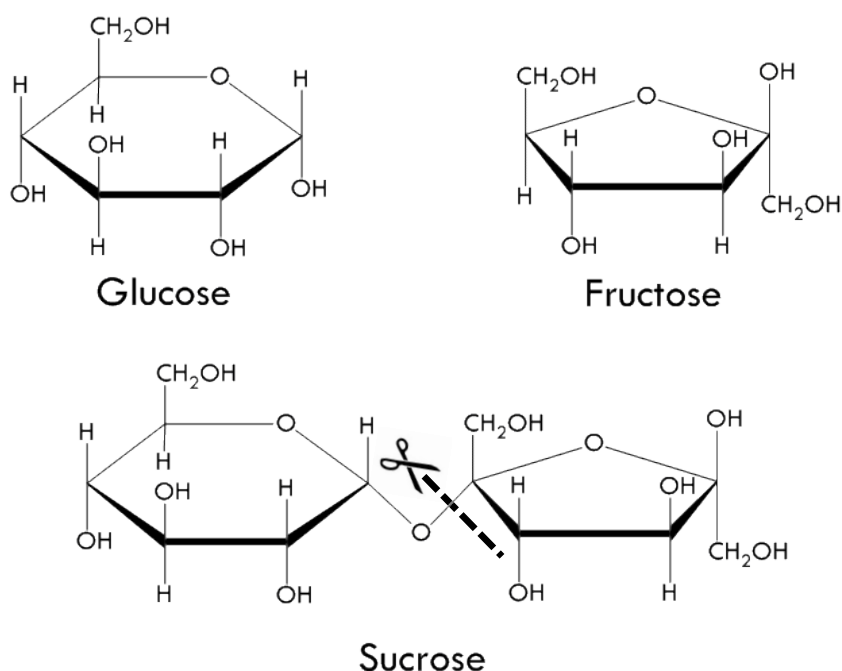
Some gooey centres in chocolates owe everything to enzymes. Enzymes are biological catalysts that speed up metabolic processes and keep us alive. Like catalysts, they increase the rate of reaction by lowering the activation energy of a reaction, remaining chemically unchanged. Because of their specific nature, enzymes can differentiate between chemicals with similar structures and can catalyse reactions over a wide range of temperatures (0–110 °C) and pH ranges (2–14).

The enzyme responsible for creating a gooey centre is invertase. It's usually derived from yeast and is sold either as a clear liquid or as a powder that can be dissolved in water. The centre of a Rowntree After Eight mint contains water, sucrose (sugar), mint flavourings and invertase. When this minty centre is made, it's a solid which can be easily dipped in dark



chocolate and left to harden before being popped into its wrapper and boxed. After roughly 3 days stored at 18 °C, the enzyme invertase works its magic.

Invertase's job is to hydrolyse sucrose, cleaving the O-C bond (shown below). Sucrose, the ordinary sugar you use in baking, is a double sugar called a disaccharide and invertase splits this into its component parts - glucose and fructose. Glucose and fructose are smaller monosaccharides (single sugars) and have a more liquid-like consistency. So the minty interior of a Rowntree After Eight has liquefied itself inside the chocolate coating all thanks to an enzyme.



In the Lindt Lindor truffles, the centre is poured into a hard chocolate shell and you can clearly see the little ridge on the surface where this is performed. Their centres have a smooth and dense consistency because they contain roughly a 3:1 mixture of chocolate and heavy cream, called a ganache. The more chocolate in the ganache, the thicker it will be. When warm it's very glossy but when cooled and whipped it becomes more opaque.

Have you noticed the ganache centre of a Lindt Lindor truffle is cooler than its exterior? The types of cocoa butter crystals in the chocolate play an important role. Specific crystals which have a low melting point and high heat of crystallisation are generated. This means when you add heat from your mouth to melt the crystals, they absorb more heat than would normally happen in simple heat transfer and you therefore perceive the centre as being slightly cooler.

Jo's Top Tips

Invertase is quite tricky to get hold of but you can buy some made by LorAnn Oils in the UK. You'll only need it for reference, so it'll be a one-off purchase.

If money is tight, don't buy Lindt Lindor truffles, just have a picture of them. You can buy non-branded versions of fondant-filled mint chocolates too.

Always make sure you know the allergy advice on the chocolates you're using. I make them visible by writing allergens on chalk boards but you could print them out.

Food enzymes are amazing but this isn't an experiment for the faint-hearted. Chop up some pineapple slices into half-moon shapes and ask some 'friends' to wear them like gum shields. The pain will be pretty intense for them within a few seconds. The enzyme found in pineapple is called bromelain and is usually used to tenderise meat. It's starting to break up the proteins in your mouth and your gums are particularly sensitive. So when you eat pineapple, it eats you back!



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