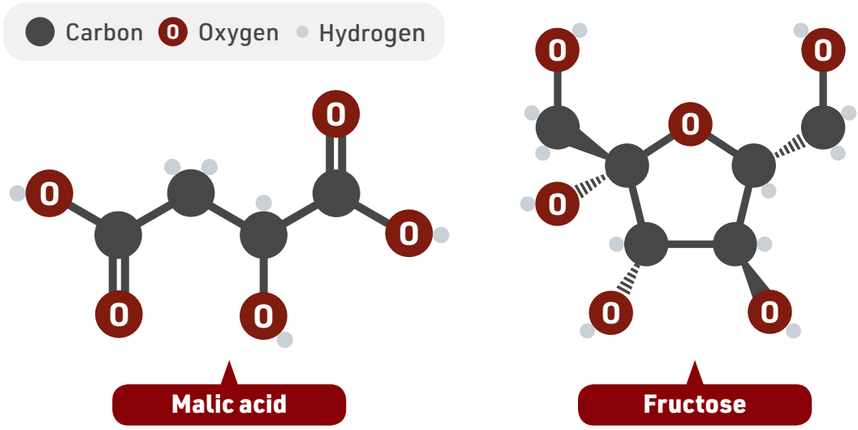
The chemistry of apple flavours

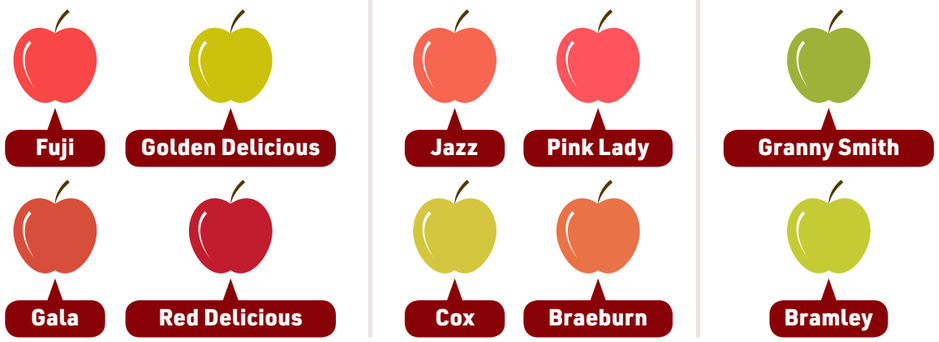
compound interest

What makes apples sweet or tart?

There are over 7,500 different cultivars, or types, of apples worldwide. Different cultivars can differ in how sweet or tart they taste. Sweetness comes from sugars, with fructose the main sugar in apples. Tartness comes from acids, such as malic acid, the dominant apple acid.

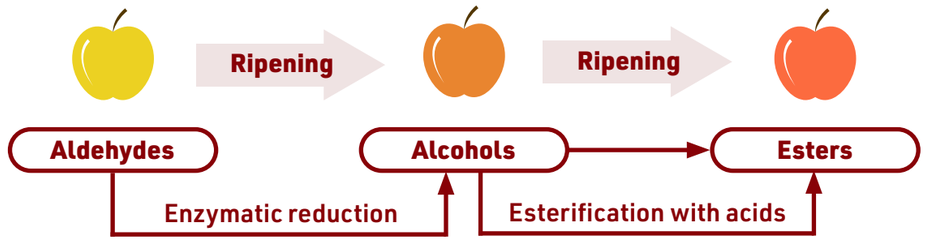


The balance of acids and sugars in an apple affects whether we perceive the apple's flavour as sweet or tart. The higher an apple's sugar/acid ratio, the sweeter the apple. Tannin compounds add bitterness or astringency.



Key apple flavour compounds

As apples ripen, the aroma and flavour compounds they contain vary. The dominant aroma compounds in unripe apples are grassy-smelling aldehydes. Aldehyde levels drop as apples ripen and levels of alcohols and esters increase, with esters the main aroma and flavour compounds in ripe apples.



Esters make up 80% or more of aroma compounds in apples. Yellow-skinned cultivars produce mainly acetic acid esters, while red-skinned cultivars produce mainly butyric acid esters. Straight chained esters are produced from alcohols and fatty acids, while branched chain esters are formed from the metabolism of the amino acid isoleucine.Some of the key ester compounds contributing to apple flavour are shown below.