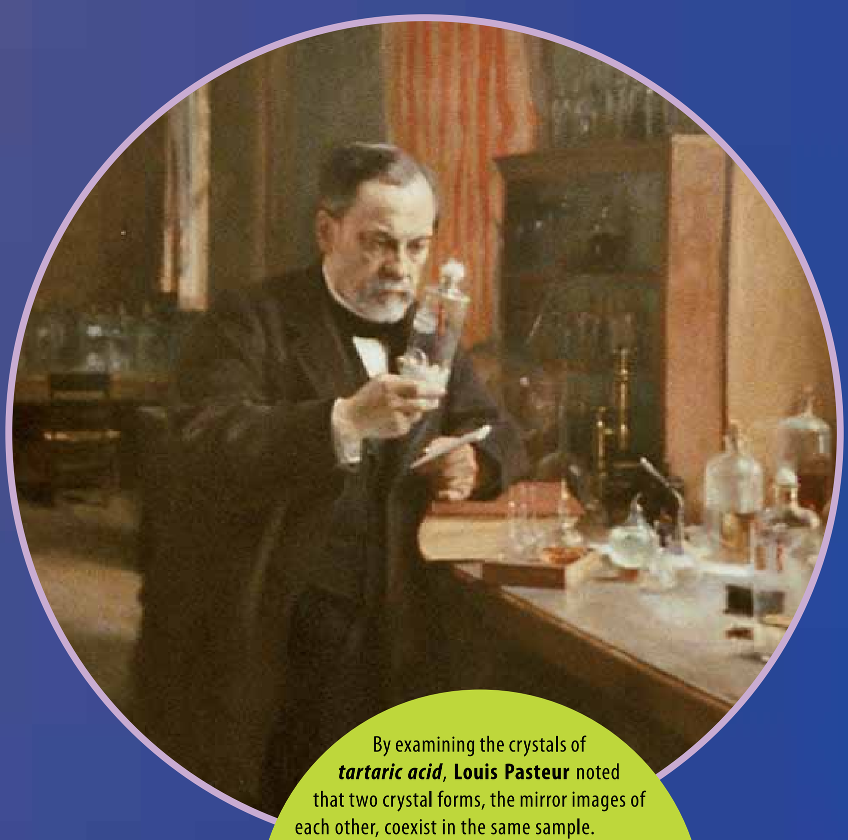
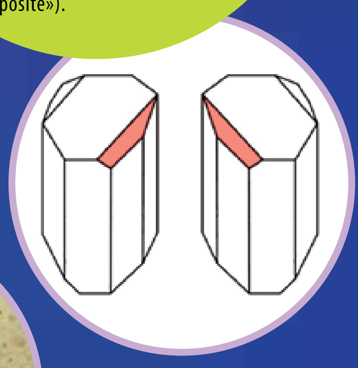
The crystal, chirality and Pasteur

Chirality is a fundamental concept in chemistry and physics. It exists in certain crystals, is a fundamental property in the chemistry of living orgasms and is an indispensable condition for certain physical properties.



By examining the crystals of ***tartaric acid***, **Louis Pasteur** noted that two crystal forms, the mirror images of each other, coexist in the same sample.

Pasteur separated these two forms of crystals manually and dissolved each of them separately in water He found that the two forms have different optical properties: one form rotates the plane of polarization of light in the opposite direction to the other. A mixture of the two solutions would not deflect the light. These two forms are called **enantiomers** (from the Greek *enantios* «opposite»).



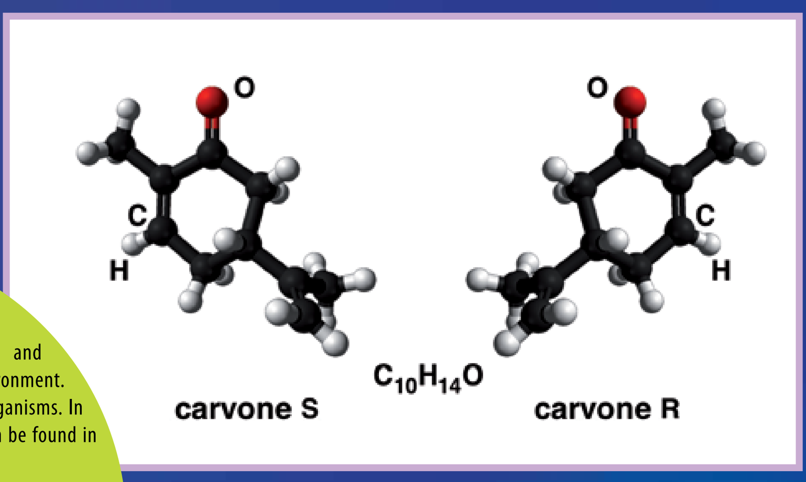
«Chiral» comes from the Greek word *chiro* which means 'hand'. When your palms are turned towards the sun, your left hand cannot be superimposed on your right hand.

The chirality of molecules

In 1848 Pasteur commented that crystals can have two identical and yet opposing forms, a mirror image of each other. He interpreted this as the existence of two chiral molecules. The chirality of crystals is primarily due to the manner in which the constituent atoms or molecules are arranged. Asymmetric molecules have two chiral forms; in nature one of these two forms is generally the dominant one.

Our bodies are made up of basic chiral structures: amino acids, sugars...

A chiral molecule in one or the other form will not have the same effect on (all) our body. This is the case with certain medicines, and for the perception of certain tastes and smells.



Enantiomers with different properties

Two **enantiomers** have identical physical and chemical properties in a symmetrical environment. However, they are perceived differently by living organisms. In other words, depending on whether the molecule can be found in one or the other form, it will not have the same effect.

- This explains why the molecule ***(R)-carvone*** **smells** of spearmint whilst ***(S)-carvone*** smells of cumin; our olfactory receptors are sensitive to chirality.

- The same apply to taste: the molecule of ***S-asparagine*** has the bitter **taste** of asparagus, whilst the ***R-asparagine*** molecule is sweet to the taste

- These differences in properties can be dramatic for **drugs**: this is the case of ***thalidomide***, one form is an analgesic and the other causes foetal malformations.