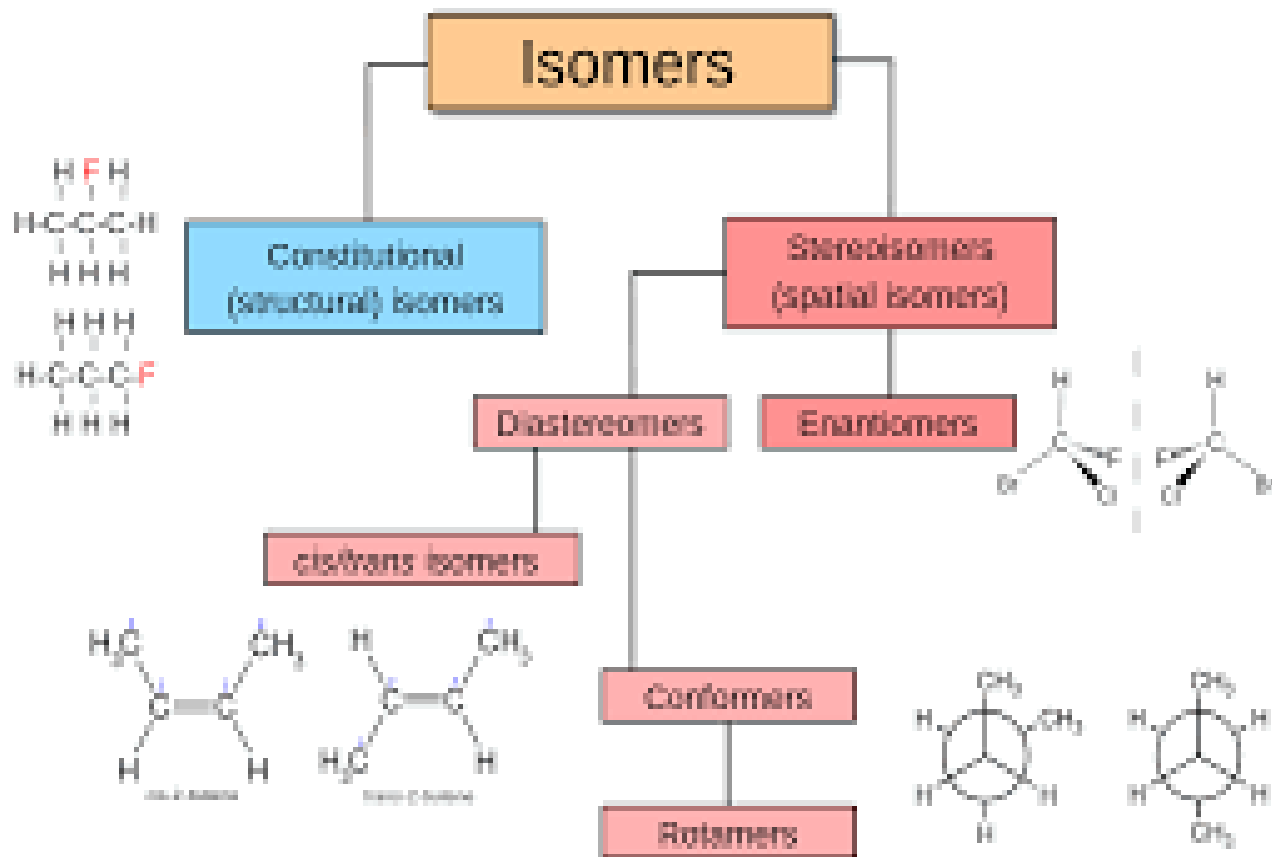


STEREO ISOMERISM

Definition

In stereochemistry, **stereoisomerism**, or spatial isomerism, is a form of isomerism in which molecules have the same molecular formula and sequence of bonded atoms (constitution), but differ in the three-dimensional orientations of their atoms in space.



Optical activity

Solutions of some organic compounds have the ability to rotate the plane of polarised light. These compounds are said to be optically active. This property of a compound is called optical activity

Optical Isomerism(enantiomerism)

- An optically active compound can exist in two isomeric forms which rotate the plane polarized light in opposite directions. These are called optical isomers or enantiomers and the phenomenon as optical isomerism or enantiomerism
- Optical isomerism occurs when substances have the same molecular formula and structural formula, but one cannot be superimposed on the other. They are **nonsuperimposable mirror images of each other**. Each isomer is known as enantiomer

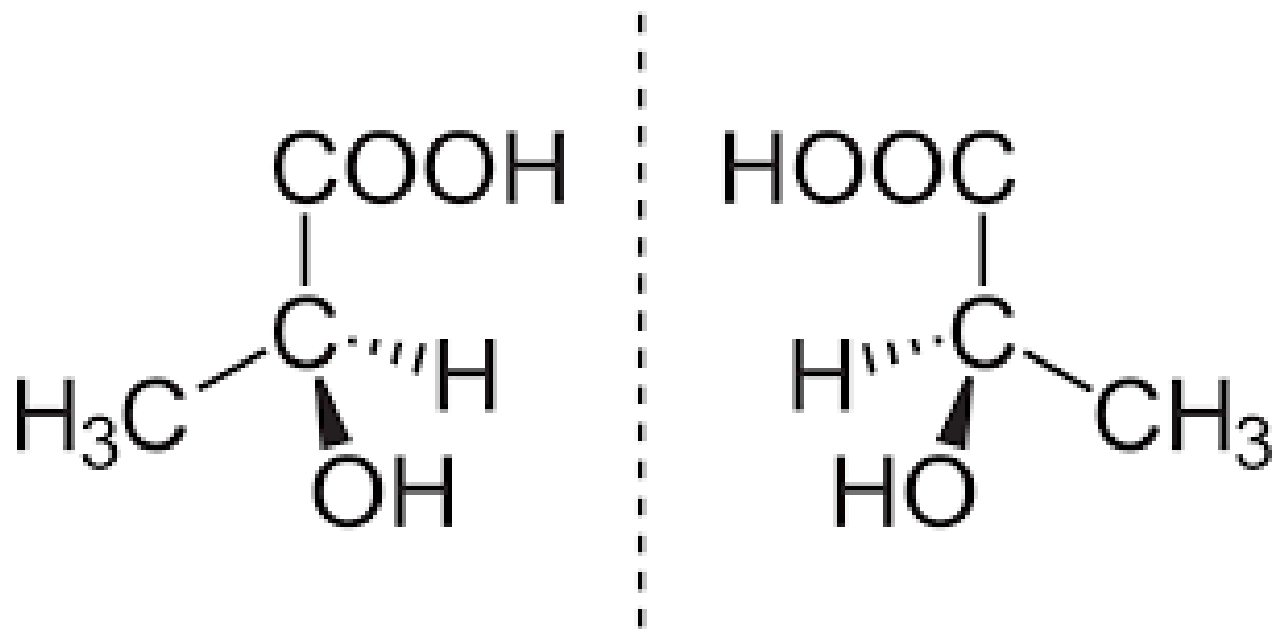
- Optical isomers can occur when there is an asymmetric or chiral carbon atom
- An optically active compound can exist in two isomeric forms which rotate the plane polarized light in opposite directions. These are called optical isomers or enantiomers and the phenomenon as optical isomerism or enantiomerism

Enantiomers

- **Enantiomers** are chiral molecules that are non-superimposable mirror images of one another. This means that the molecules cannot be placed on top of one another and give the same molecule. Enantiomers always exist in pairs
- Enantiomers differ from one another in 3-D spatial arrangements
- Enantiomers have identical properties except in their interaction with plane of polarised light

- They have same melting point, density, solubility, colour, reactivity
- A mixture of equal amounts of two enantiomers is called a **racemic mixture**.
Racemic mixture is optically inactive.

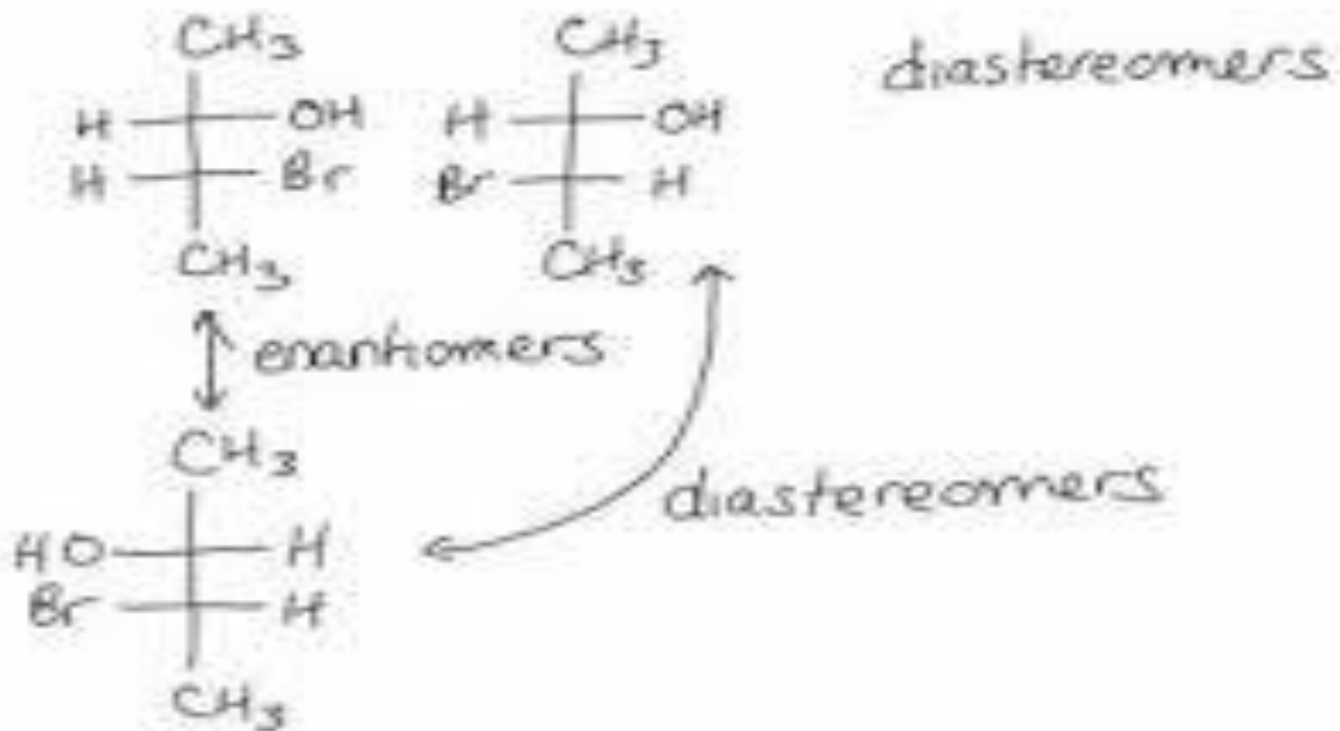
Example - 2-hydroxy propanoic acid



Diastereoisomers

- Stereoisomers that are nonsuperimposable and nonmirror images of each other are called diastereoisomers.
- For a molecule to have diastereomer it must have more than one chiral centre

Eg. isomers of 3-bromo-2-butanol



properties

- Diastereomers have different properties
- Two diastereomers have different melting points,boiling points and solubilities
- They will have different chemical reactivities toward most reagents

Racemic modification

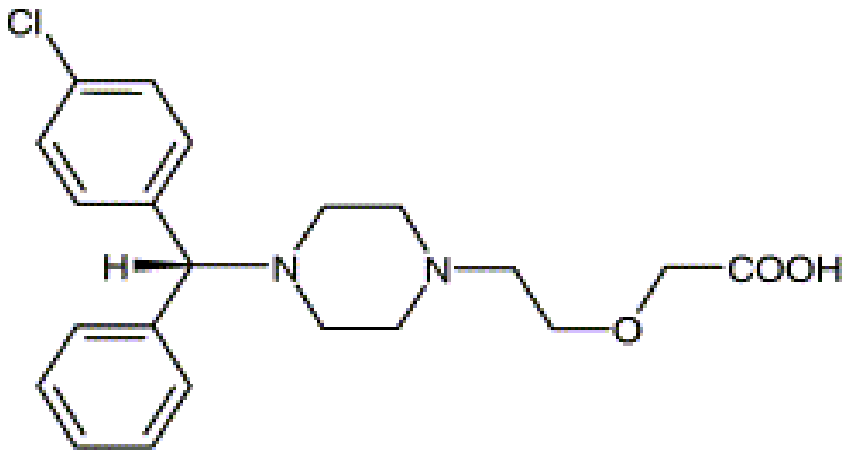
A mixture of equal parts of enantiomers is called a **racemic modification**. **A racemic modification is optically inactive**: When enantiomers are mixed together, the rotation caused by a molecule of one isomer is exactly cancelled by an equal and opposite rotation caused by a molecule of its enantiomer. Hence the overall optical rotation of racemate is **zero**. Thus a racemic modification is optically inactive.

Resolution

chiral compounds synthesized from achiral starting materials and reagents are generally racemic (i.e. a 50:50 mixture of enantiomers).

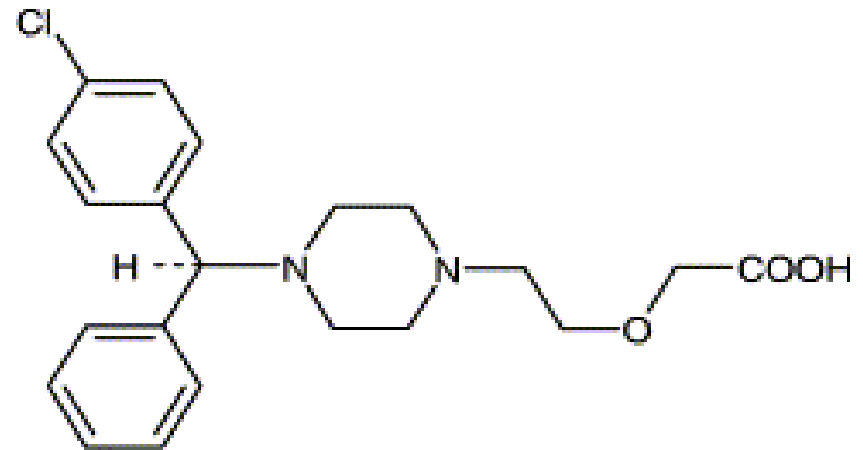
Separation of racemates into their component enantiomers is a process called resolution.

Why enantioseparation?



(*R*)-levocetirizine

(the eutomer)

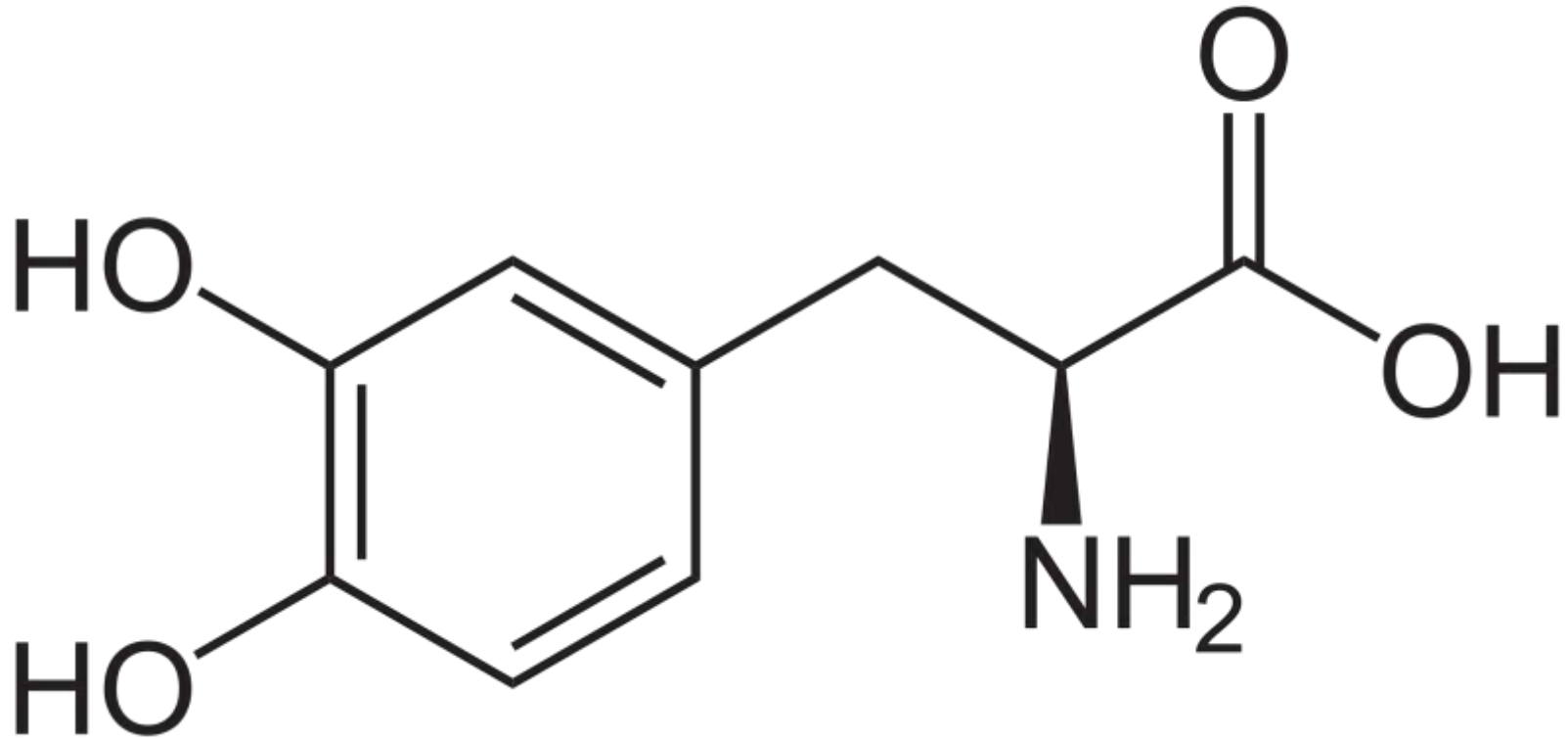


(*S*)-dextrocetirizine

(the distomer)

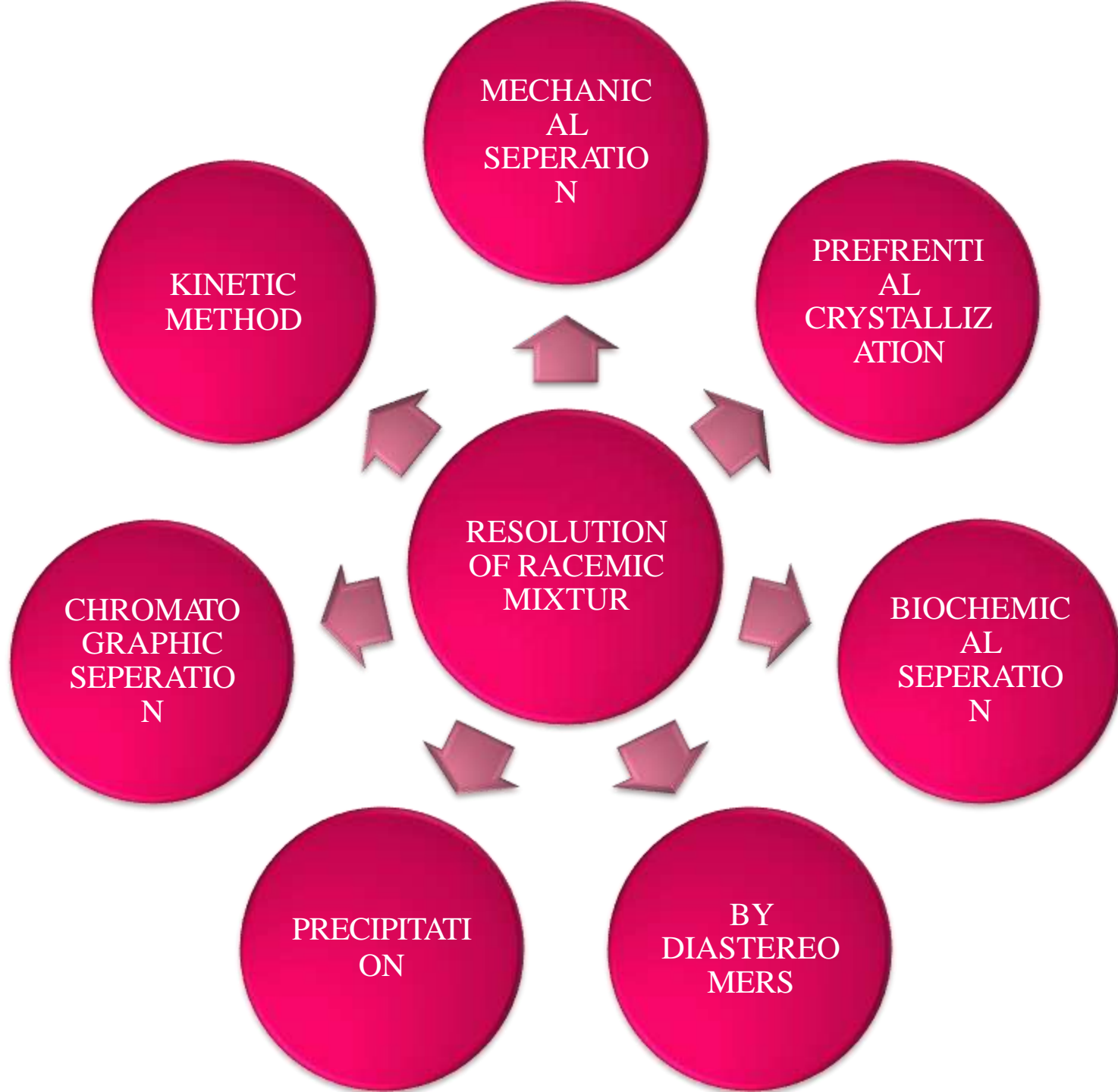
levocetirizine has been found to be
less sedative than cetirizine

LEVODOPA



levodopa (L-dopa) is used in treatment of Parkinson's disease, its

D-form causes serious side effects, such as granulocytopenia



1. Mechanical Separation

- This involved mechanical separation of the crystal of one enantiomers from the other in racemic mixture based on difference in their shapes
- Crystal of the two forms have different shapes separated by magnifying lens and forceps
- This method first used by pasteur for he resolution of sodium ammonium tartarate which crystallise out in the form of racemic mixture below 27 degree
- This methods is time consuming and every compound can not be crystallized at room temperature

2.By Crystallisation

- This method involve seeding of a saturated solution of the racemic mixture with a pure crystal of one of the two enantiomers.
- The solution now become supersaturated with respect to the added enantiomers
- It begins to crystallise out
- Eg. Harada obtained free from amino acid by adding corresponding d/l isomers of amino acid

3. Biochemical Separation

- It was introduced by PASTEUR in 1858.
- This method is based on fact that when certain micro organisms like bacteria, fungi, yeast, moulds, etc are grown in dilute solution of racemic mixture, they eat up one enantiomer rapidly than other.
- Example: the mould *penicillium glaucum* preferentially destroys the (+) isomer of racemic ammonium tartarate leaving (-) ammonium tartarate in solution.

4. Chromatographic Separation

- The racemic mixture can be separated by chromatography on an optically active support.
- The diastereomeric adsorbates which are formed have different stabilities.
- Thus one enantiomer will be held more tightly than the other and would be eluted first.

5. Resolution by conversion into diastereoisomer

- When racemic mixture is allowed to interact with optically active material, it give a diastereomeric derivatives.
- Diastereomer have different physical properties and hence can easily separated into two component by fractional crystallisation

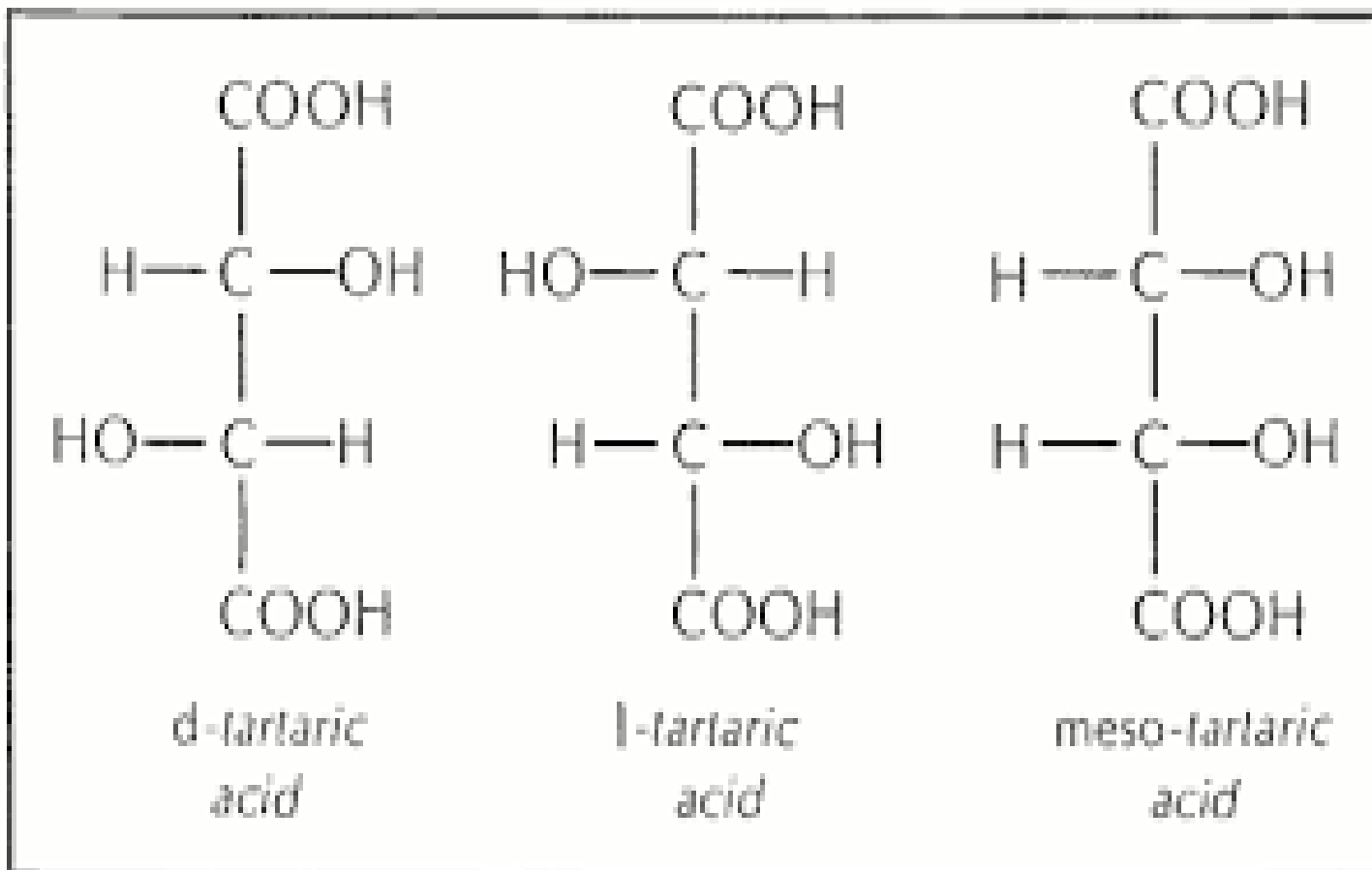
Eg.

if a racemic mixture of a chiral alcohol is reacted with a enantiomerically pure carboxylic acid, the result is a mixture of diastereomers: in this case, because the pure (R) enantiomer of the acid was used, the product is a mixture of (R-R) and (R-S) diastereomeric esters, which can be separated by their different physical properties. Subsequent hydrolysis of each separated ester will yield the 'resolved' (enantiomerically pure) alcohols.

Mesocompounds

- A meso compound is a molecule that contains a chiral centre but is achiral as a result of having a plane of symmetry in the molecule
- Mesocompound is a non-optically active member of a set of stereoisomers at least two of which are optically active
- Example-in case of tartaric acid two stereoisomers are enantiomers and the third is an achiral diastereomer called mesocompound

Example of mesocompound



THANK YOU