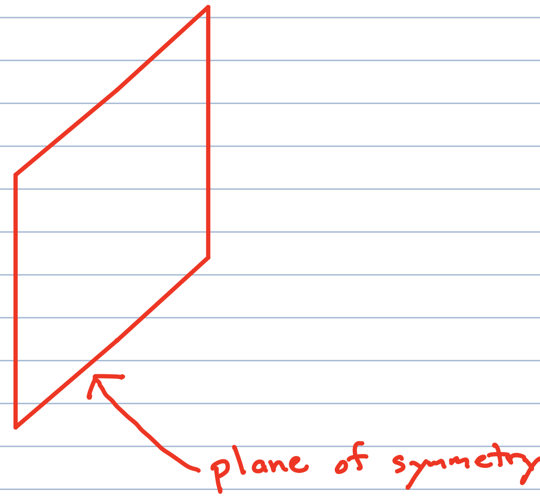
Stereoisomers → molecules with the same connectivity, but different orientations of groups in three-dimensional space

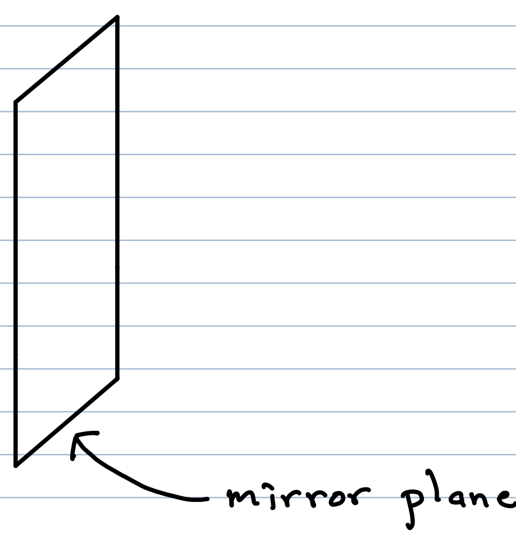
enantiomers ⇓ stereoisomers are mirror images of each other, BUT are not identical — they are not superimposable on their mirror image

diastereomers ⇓ stereoisomers that are NOT enantiomers

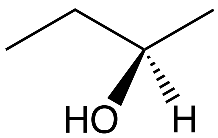
A chiral object/molecule does NOT have a plane of symmetry →

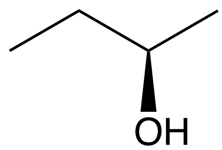


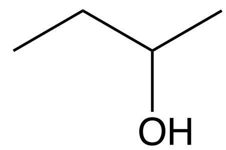

A carbon atom that is not chiral will have a plane of symmetry

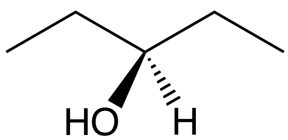


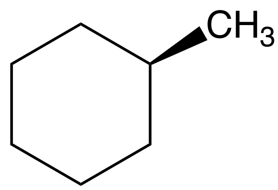
You need to be able to identify chiral centers in complex molecules →

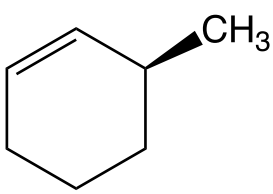


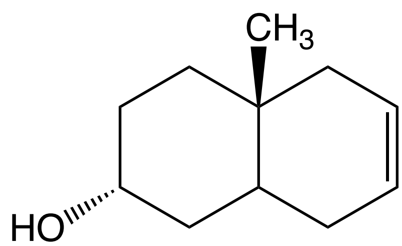



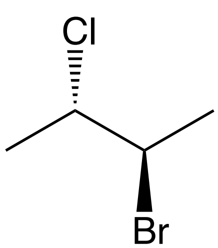



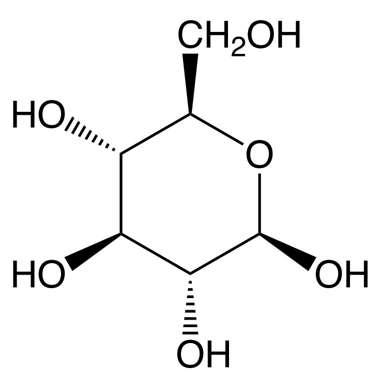



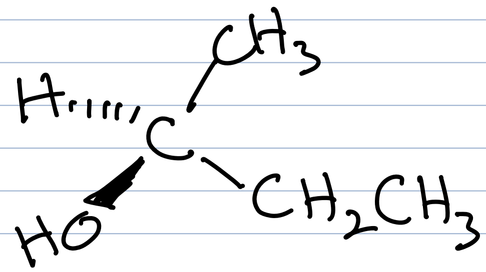



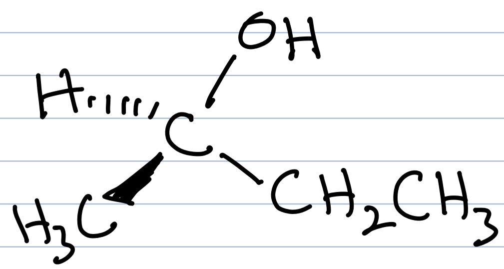
Really hard part → naming the enantiomers

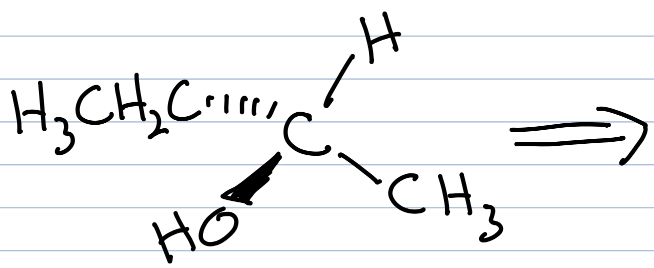
1) Assign atomic number priorities for each group, ranking them 1 → 4

2) Position the molecule so you are looking down the C → 4 bond

3) Count the remaining three groups in order



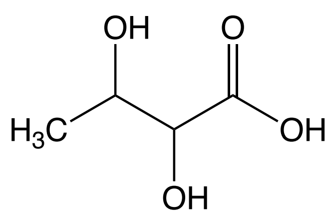

Diastereomer → stereoisomers that are not enantiomers

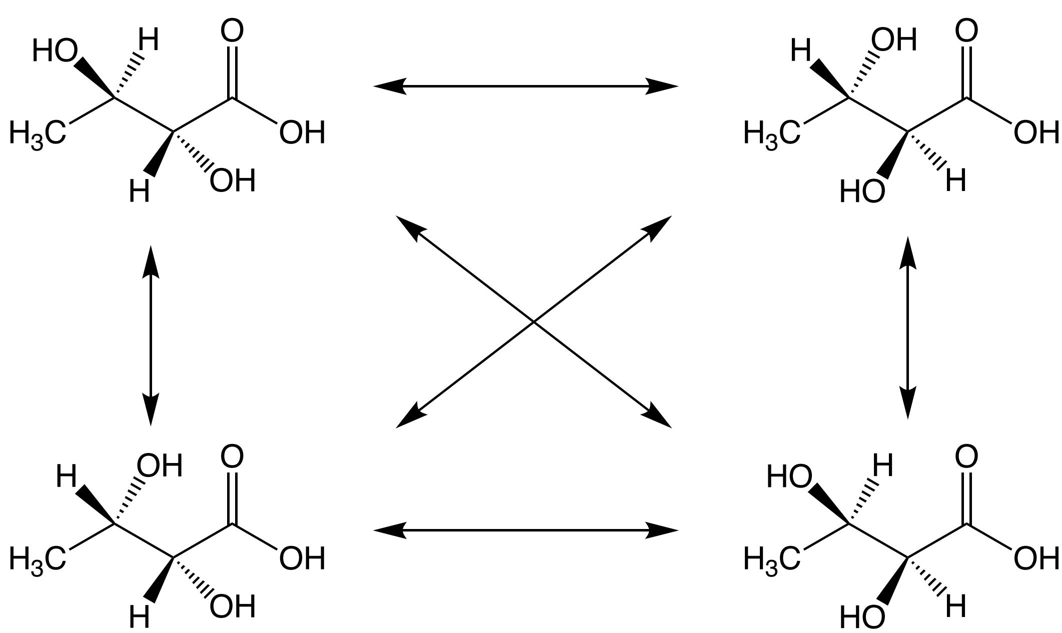
# Molecules with 2 Chiral Centers

1) If a molecule contains n chiral centers there are $2^n$ possible stereoisomers

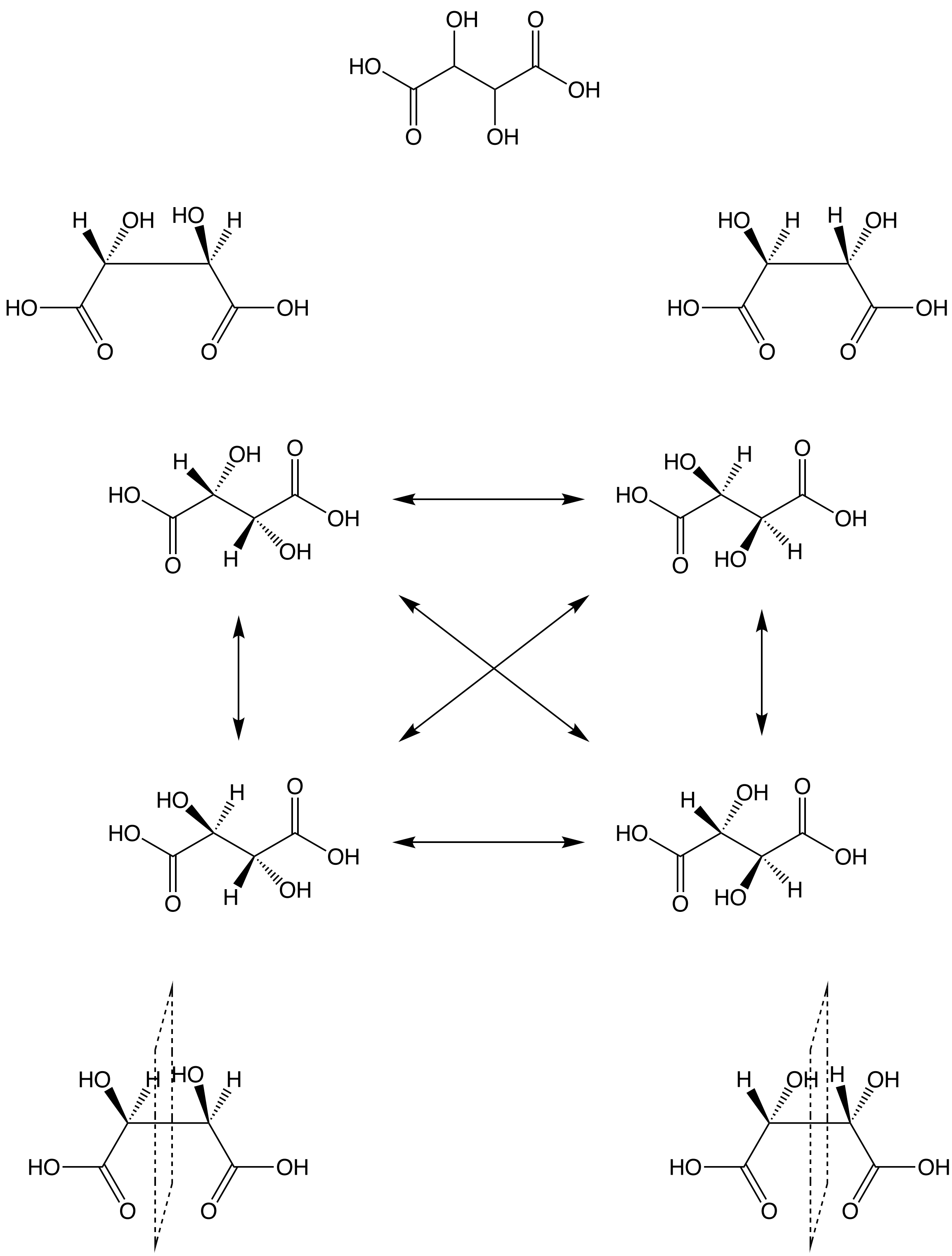
2) R,R and S,S are
R,S and S,R are
All other pairs are (Ex. R,R and R,S)

3) To identify stereoisomer relationships

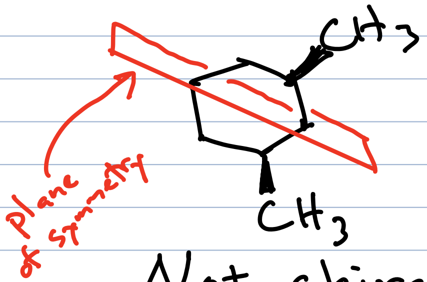




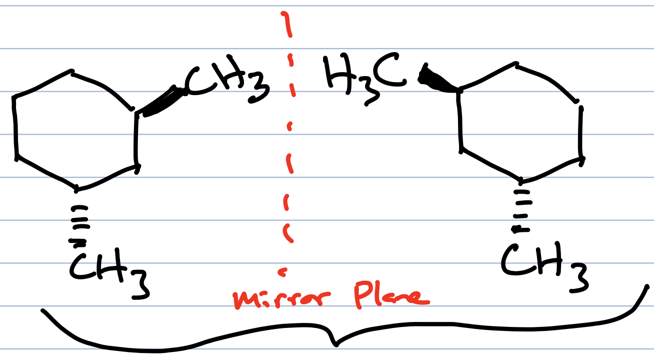
4) A meso compound has chiral centers but is not chiral due to symmetry (plane of symmetry)



Pro tip → Use flat cyclohexanes to look for planes of symmetry



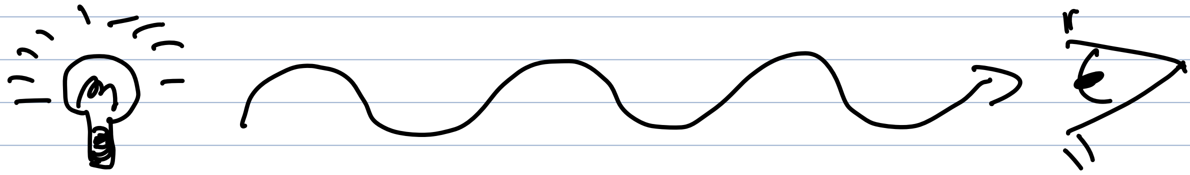

Not chiral (meso)

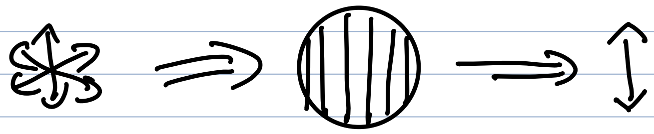



enantiomers → no plane of symmetry

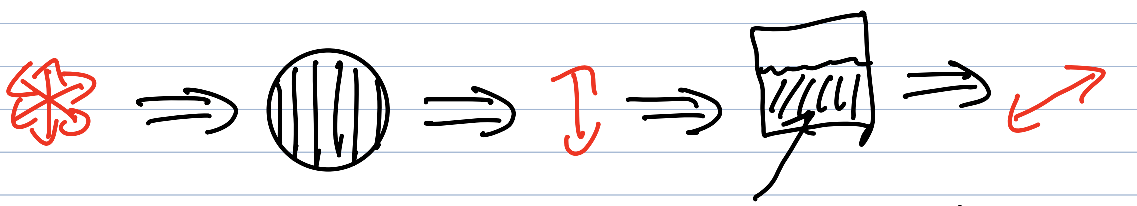
Enantiomers →

Diastereomers →

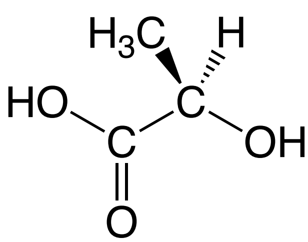


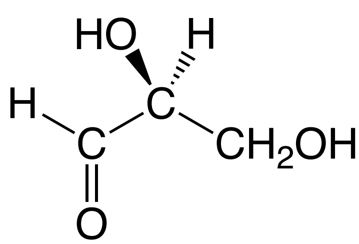


A sample of a chiral molecule will rotate the plane of plane polarized light

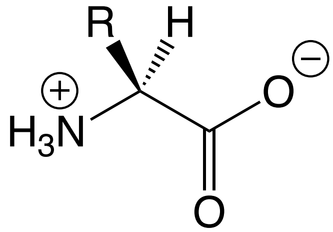


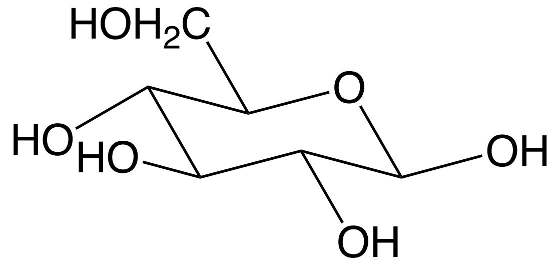
There is no direct connection between R and S and "+" and "−".

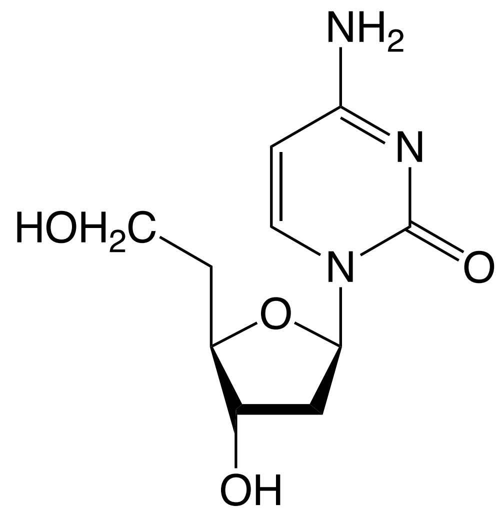


New definition → Racemic Mixture

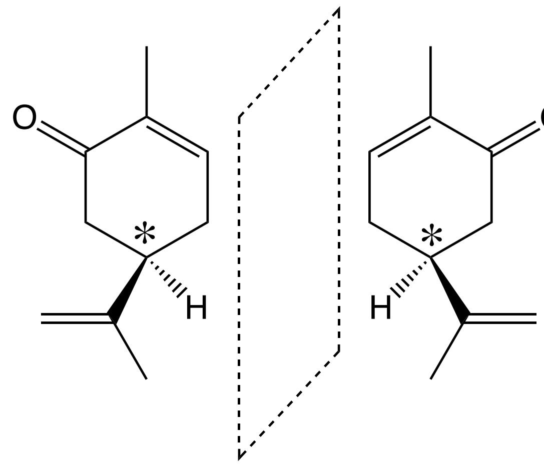




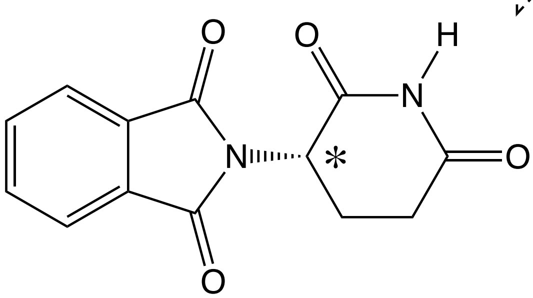


These are our molecular building blocks →

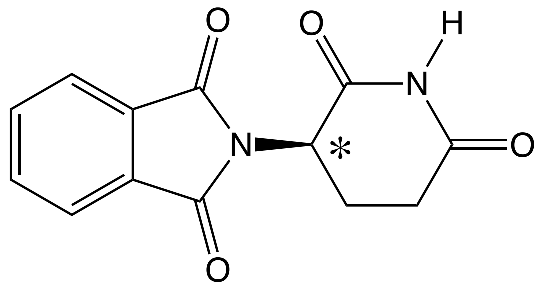
*R*-Carvone
Spearmint



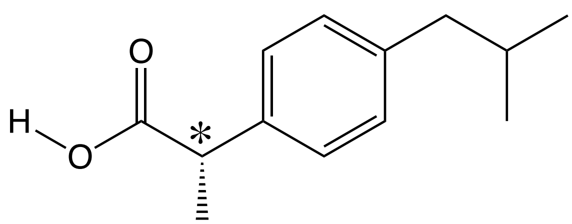
*S*-Carvone
Major component
of caraway seeds



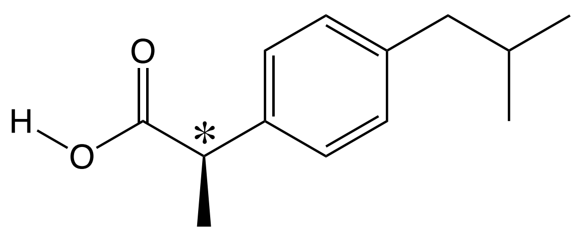
*S*-Thalidomide (Relieves morning sickness)



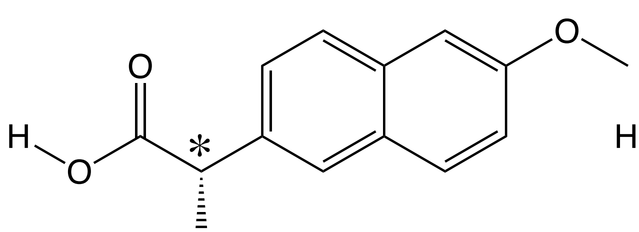
*R*-Thalidomide (Causes birth defects)



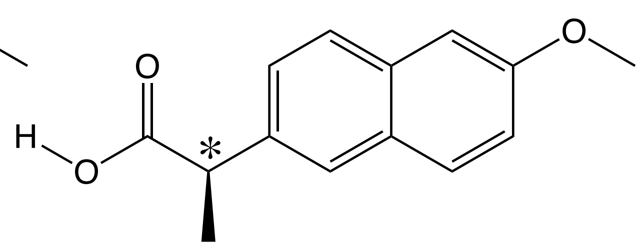
*S*-Ibuprofen (Advil, Motrin)



*R*-Ibuprofen (Inactive and relatively harmless)

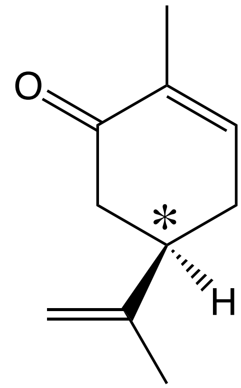


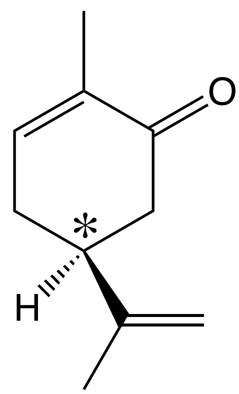
*S*-Naproxen (Aleve)



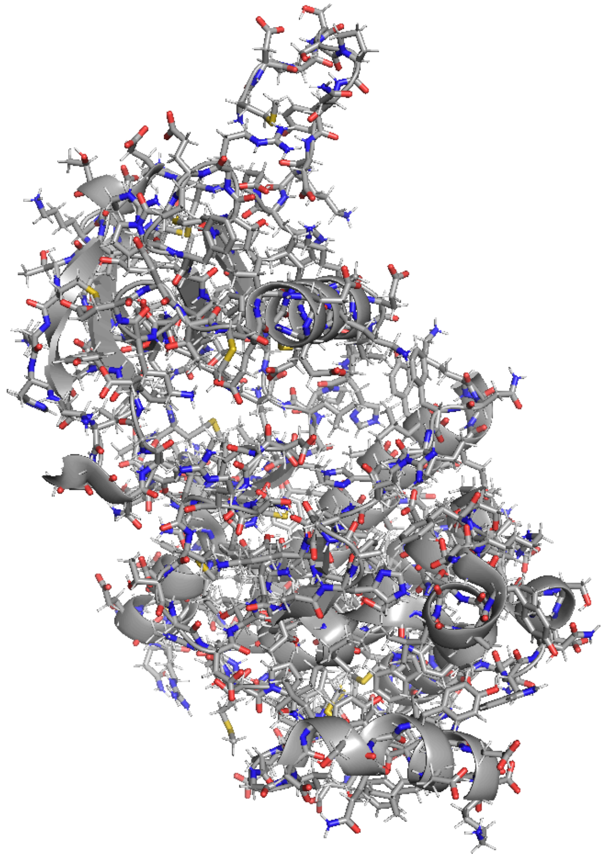
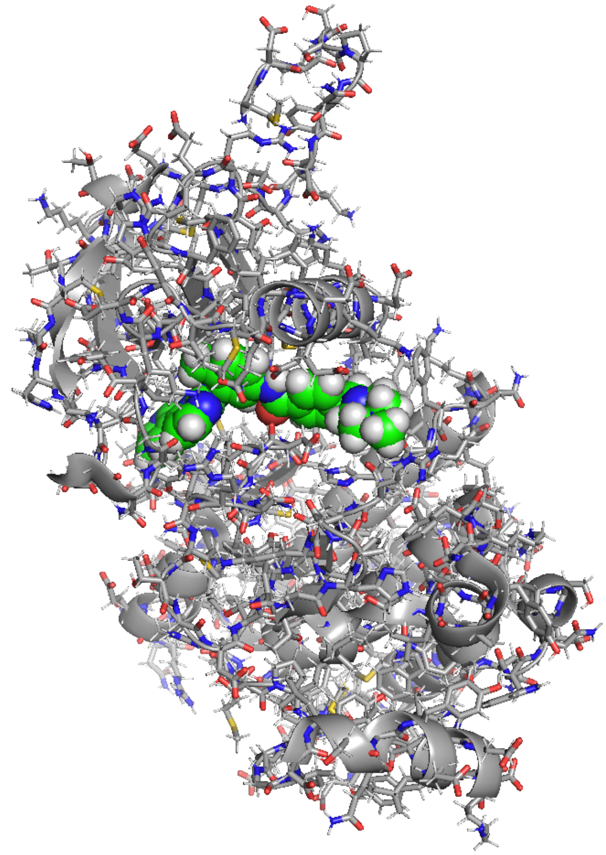
*R*-Naproxen (liver toxin)

*R*-Carvone
Spearmint

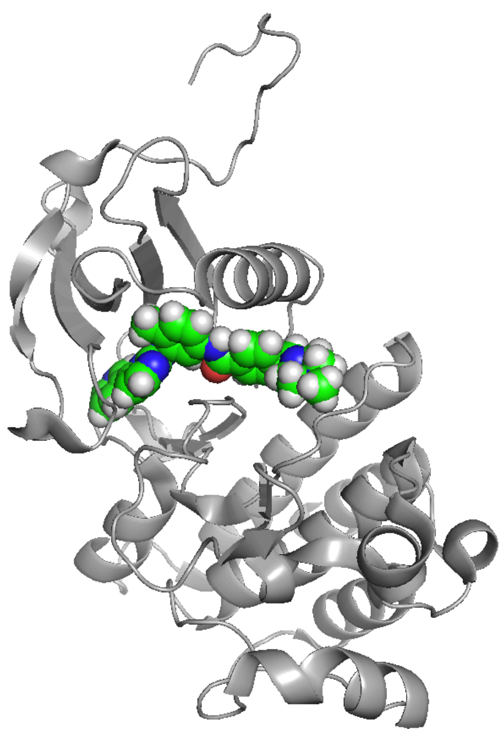
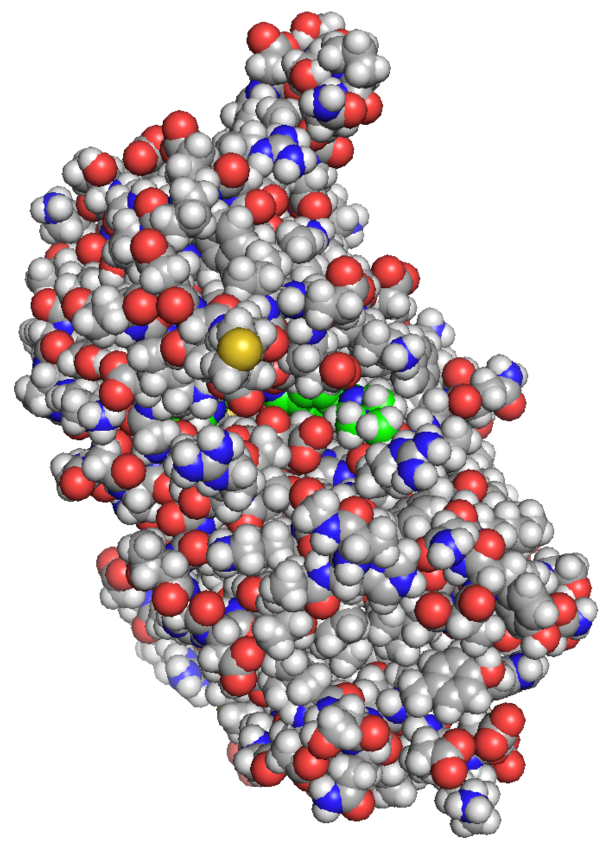



*S*-Carvone
Major component
of caraway seeds

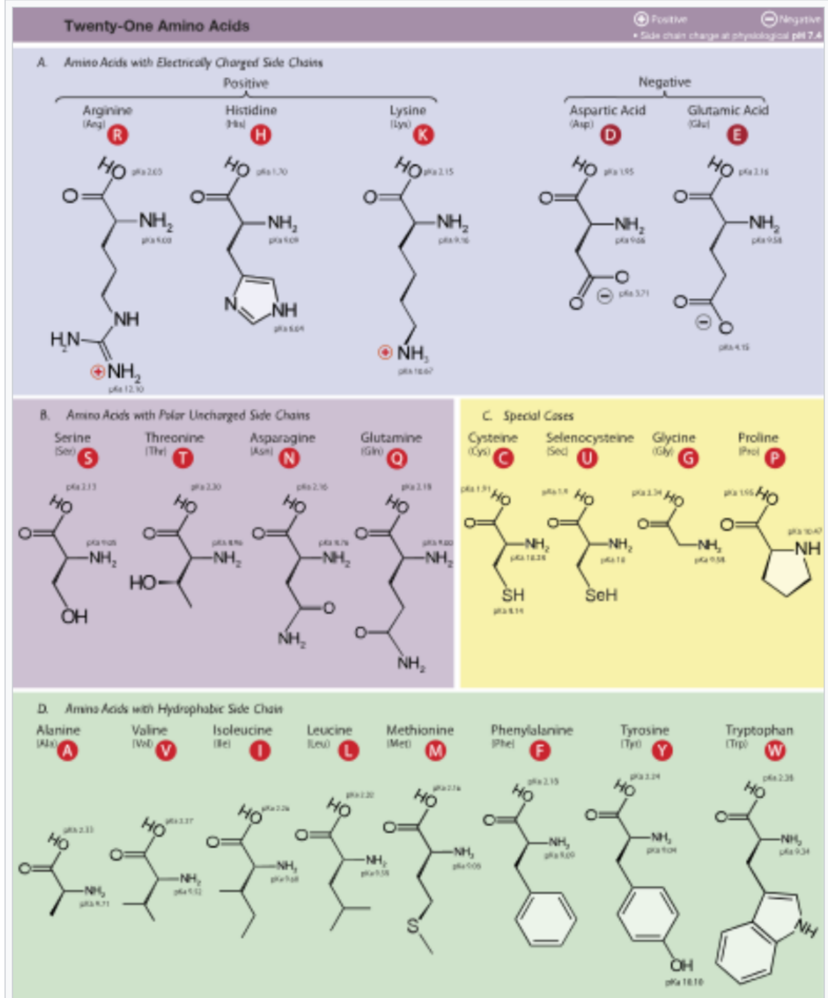



The drug Gleevec (green) bound to its target protein, the ABL kinase.

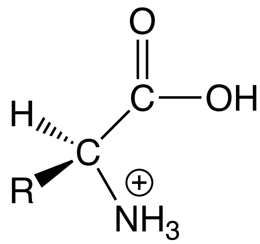
## General structure [ edit ]

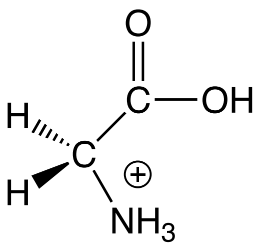
In the structure shown at the top of the page, **R** represents a side chain specific to each amino acid. The carbon atom next to the carboxyl group (which is therefore numbered 2 in the carbon chain starting from that functional group) is called the α–carbon. Amino acids containing an amino group bonded directly to the alpha carbon are referred to as *alpha amino acids*.[34] These include amino acids such as proline which contain secondary amines, which used to be often referred to as "imino acids".[35][36][37]



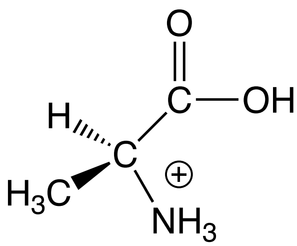

### Isomerism [ edit ]

The alpha amino acids are the most common form found in nature, but only when occurring in the L-isomer. The alpha carbon is a chiral carbon atom, with the exception of glycine which has two indistinguishable hydrogen atoms on the alpha carbon.[38] Therefore, all alpha amino acids but glycine can exist in either of two enantiomers, called L or D amino acids, which are mirror images of each other (*see also Chirality*). While L-amino acids represent all of the amino acids found in proteins during translation in the ribosome, D-amino acids are found in some proteins produced by enzyme posttranslational modifications after translation and translocation to the endoplasmic reticulum, as in exotic sea-dwelling organisms such as cone snails.[39] They are also abundant components of the peptidoglycan cell walls of bacteria,[40] and D-serine may act as a neurotransmitter in the brain.[41] D-amino acids are used in racemic crystallography to create centrosymmetric crystals, which (depending on the protein) may allow for easier and more robust protein structure determination.[42]

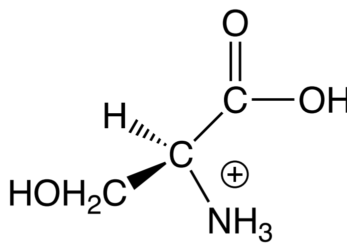




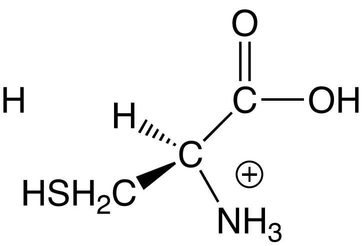
Glycine



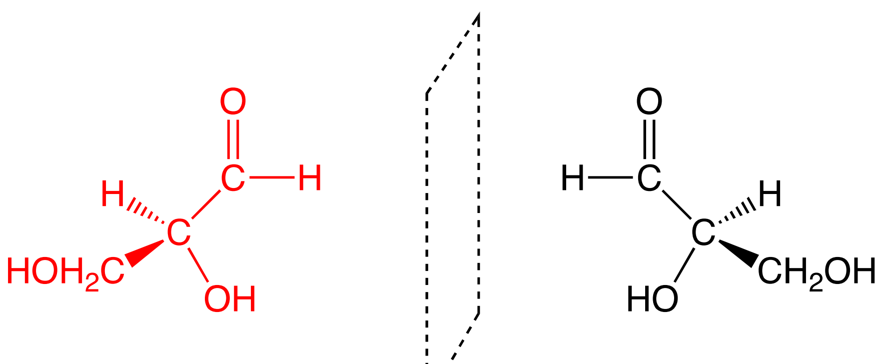
Alanine



Serine



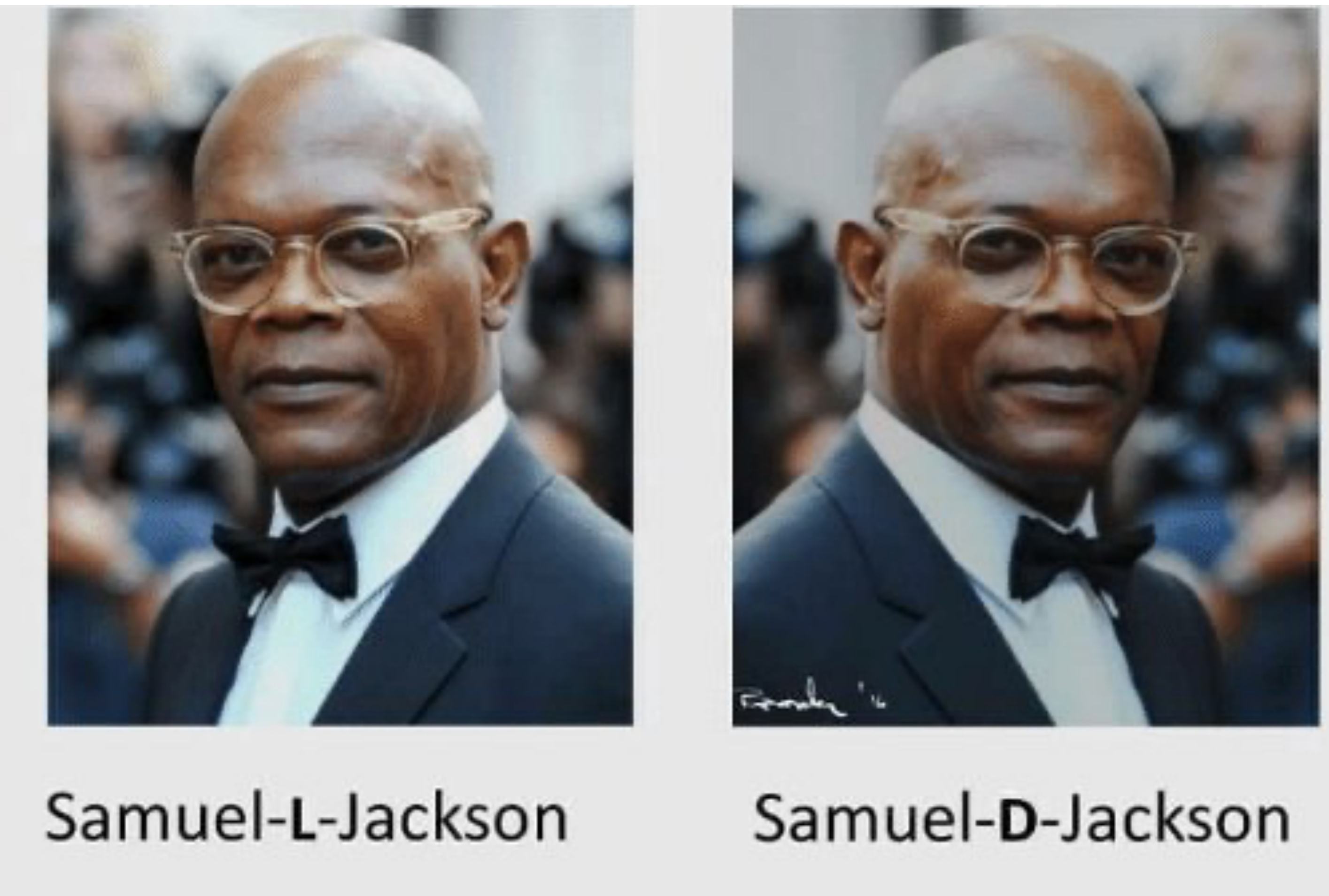
Cysteine



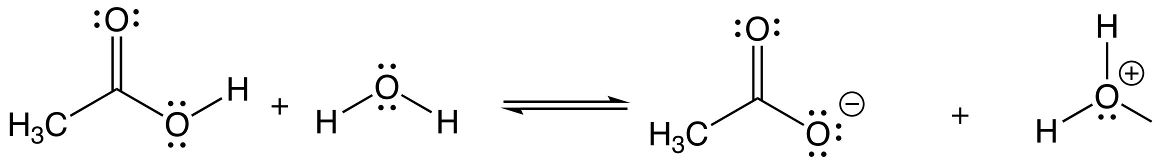
(L)-(-)-Glyceraldehyde

(D)-(+)-Glyceraldehyde

The 19 chiral common amino acids are all "L" amino acids (even cysteine!)




I hope this goes chiral



Acid (H-A) Base (B:) Conjugate Base ($A^{\ominus}$) Conjugate Acid ($B\text{-}H^{\oplus}$)

At equilibrium: $$K_{equilibrium} = \frac{[\text{Products}]}{[\text{Reactants}]} = \frac{[CH_3CO_2^{\ominus}]\,[H_3O^{\oplus}]}{[CH_3CO_2H]\,[H_2O]}$$

Assume: $[H_2O]$ = 55 M and does not change

$$K_a = K_{equilibrium}\,[H_2O] = K_{equilibrium}\,[55\text{ M}]$$

$$K_a = \frac{[CH_3CO_2^{\ominus}]\,[H_3O^{\oplus}]}{[CH_3CO_2H]} \qquad pK_a = -\log K_a$$

A stronger acid has a _________________ value of $pK_a$

A weaker acid has a _________________ value of $pK_a$