SPIRALING INTO CHIRALITY

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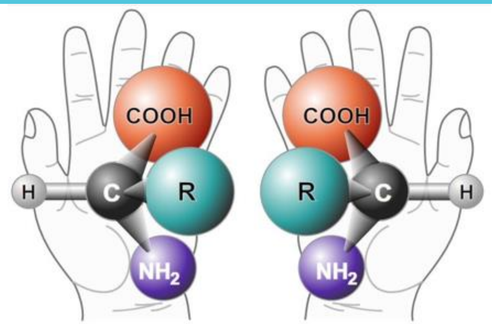
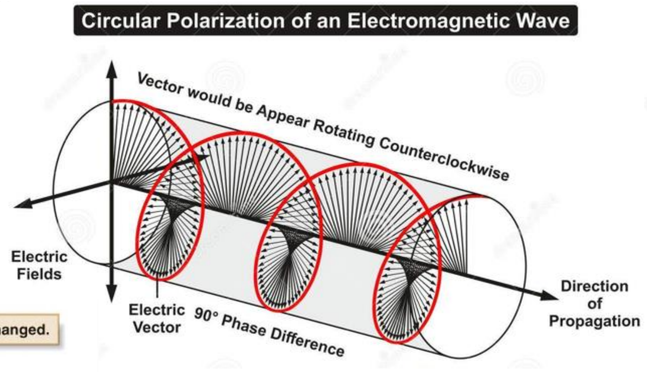
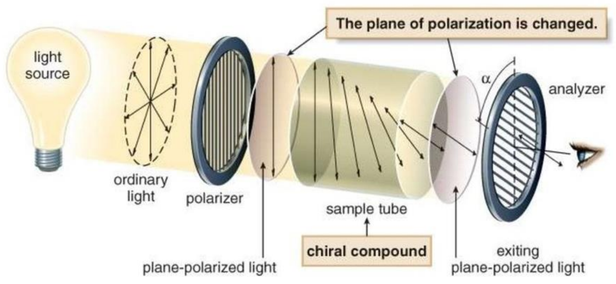
What is chirality and optical activity



Superpositions of linearly polarized light can create circularly or elliptically polarized light. Clockwise and counterclockwise circularly polarized light are chiral.

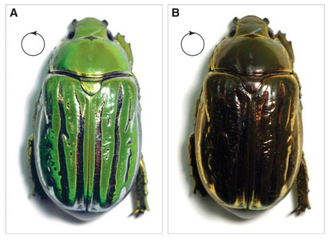
Chirality is the "handedness" of molecules representing non identical mirror image of molecules.



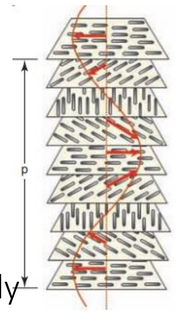


Chiral molecules have “optical activity” and can rotate the polarization of light. Each handedness will rotate the polarization differently.

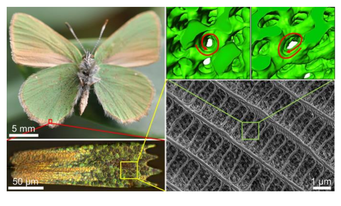
Examples in nature



Jeweled beetles selectively reflect left polarized light.



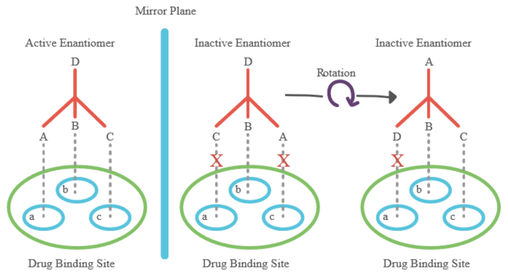
The spiraling structure of the beetle’s exoskeleton contributes to the polarization of light



The chiral nanostructure of the butterfly wings (photonic crystals) leads to coloration effects.

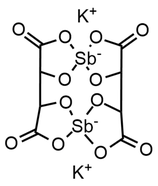
Properties of enantiomers and separation techniques

Enantiomers have identical physical properties, but they have different chemical interactions. This is particularly important in drug development involving chiral molecules because different enantiomers of a drug can cause different effects in the body and need to be separated.



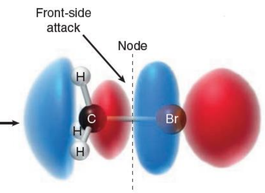
Only one enantiomer of chiral drugs can bind to the drug receptor.
The right enantiomer of thalidomide can reduce the symptoms of morning sickness, while the left causes birth defects.

To remove the undesirable enantiomer, chiral reagents that reacts differently with enantiomers and can be used



Antimony potassium tartrate is an example of a chiral reagent.

Certain chiral molecules crystalize with the same type of enantiomer crystalizing together forming a racemic conglomerate, which can then be separated.



S_n2 reactions occur through a back side attack which inverts the chirality at a chiral center. This reaction can produce the desired chirality of a molecule.

References and Acknowledgments

Chirality is all around us, from our technologies to the beginnings of life. Understanding what chirality is useful for many reasons including creating medications and analyzing materials.

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