**Why is chirality important in drug development?**

Biological systems like that of human beings have been known to exhibit chirality. This is reflected by the existence of chirality of drug receptor areas and the requirement of chiral specificity on drugs. In order to understand the biological effect of drugs, we have to distinguish the three main phases of their action. The first phase is the initial receptor differentiation phase, where different drugs have different affinity and tissue specificity due to receptor differentiation and distribution for the parent compound formed. The second phase is the absorption, distribution, metabolism and excretion phase, where the type of bioavailability is determined. The third phase is the interaction of the drug with the molecular site of action, leading to the observed Reading to Learn Activity (4) 148 therapeutic effect. The three phases of action are based on the receptor theory, similar to the lock-and-key hypothesis. Receptor molecules in the body are proteins that exhibit high affinities for the binding of molecules with certain structures. This is completely analogous to enzyme-substrate binding. Mismatching of drug molecules with the targeted receptors may cause undesirable side effects such as requirement of higher dosage and increased toxicity. All pharmacological activity may reside in one enantiomer. The therapeutic inactive isomer is regarded as an impurity that possesses a different or undesirable pharmacological entity. This situation may become even more acute if the active enantiomer exhibits a low therapeutic value or there is clinically significant toxicity. A well-known example of therapeutic-specific pair is the R- and S-enantiomers of thalidomide .The R-enantiomer is an effective sedative, which is a medication with calming and soothing effect that relieves anxiety and promotes sleep. However, the S-enantiomer may cause teratogen formation. A teratogenic foetus is one with deficient, redundant, misplaced or grossly misshapen parts. S-Thalidomide was shown to be responsible for over 2,000 cases of serious birth defects in children born of women who took it during pregnancy.

 

What drugs in our daily life are chiral?

 Chirality is an essential dimension in pharmacology. Worldwide sales of chiral drugs in single-enantiomer forms continue to grow. The commonly used single-enantiomer drugs are grouped as follows:

 • Cardiovascular disease: Atorvastatin calcium, Simvastatin, Pravastatin sodium and Valsartan

 • Central nervous system: Paroxetine hydrochloride and Sertraline hydrochloride

• Respiratory: Fluticasone propionate and Salmeterol

 • Hematology: Clopidogrel bisulfate

• Gastrointestinal: Esomeprazole magnesium

 • Antibiotic: Amoxicillin and potassium clavulanate