**Racemization of Tris Chelate Complexes**

The tris chelate metal complexes exist in two enantiomeric forms, called as Λ and Δ configurations.

![Enantiomeric forms of octahedral tris chelate complexes.](image)

Figure 18. Enantiomeric forms of octahedral tris chelate complexes.

The point group symmetry for the above system D₃. There are also geometrical isomers when the bidentate ligands are unsymmetrical in nature like glycinato. The total number isomer, in that case, is four as:

![Enantiomeric forms of octahedral tris chelate complexes with the unsymmetrical ligand.](image)

Figure 19. Enantiomeric forms of octahedral tris chelate complexes with the unsymmetrical ligand.

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The interconversion or the racemization of tris chelate complexes in case symmetrical ligands can take place via with or without the rupturing of the metal-ligand bond.

1. Racemization without the breakage of metal-ligand bond: The two most common processes suggested for the interconversion of the two enantiomeric forms are the trigonal or Bailar twist and the rhombic or Ray-Dutt twist. Both of the processes can be visualized from the following mechanism.

![Diagram of Racemization](image)

(a)

Figure 20. Racemization of tris chelate complexes through (a) trigonal or Bailar twist (b) rhombic or Ray-Dutt twist.

The Bailar twist mechanism proposes that the racemization of octahedral metal complexes with three bidentate rings normally occurs via the formation of an intermediate of trigonal prismatic symmetry ($D_{3h}$ point group). In honor of John C. Bailar, Jr., the inventor of the process, the pathway is called as Bailar twist. The second route is called the Ray-Dutt twist, a mechanism proposed also for the racemization of octahedral metal complexes with three bidentate chelate rings. These complexes usually adopt an octahedral geometry in their ground states and are therefore optically active. The Ray-Dutt pathway includes the formation of an intermediate species with $C_2v$ point group symmetry. The name Ray-Dutt twist is in the honor of P. C. Ray and N. K. Dutt, the inorganic chemists who suggested this mechanism.

2. Racemization with the breakage of metal-ligand bond: There are four different possible pathways suggested for the interconversion of the two enantiomeric forms of tris chelate complexes through the dissociative mechanism. After the detachment of one of the atoms of the bidentate ligand, a five-coordinated intermediate with trigonal-bipyramidal or square-pyramidal geometry is formed which converts into another enantiomer afterward. The whole process can be visualized as follows. However, it is also observed that the square-pyramidal intermediate may have a weakly bonded solvent molecule at the sixth site in some cases.
Figure 21. Racemization of tris chelate complexes through ring-opening mechanism via (a,b) trigonal-bipyramidal and (c,d) square-pyramidal intermediate.
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