**Chiral Trivalent Chromium Complexes: Synthesis, Separation, Photophysics and Reactivities**

1. **Introduction**
2. **Synthesis strategies to obtain chiral Cr(III) complexes and their application**
   1. ***Cr(III) as a chiral center in octahedral complexes***

***- Homoleptic:*** *CrA6 (Oh, monodentate) is achiral, Cr(A∩A)3 (D3, didentate) is chiral, Cr(A∩A’)3 exists as facial (C3) and meridional (C1) and are both chiral. Cr(A∩A∩A)2 exists as facial (S6, tridentate) and meridional (D2d), which are both achiral is achiral.*

***- Heteroleptic:*** *CrA5B (C4v), CrA4B2 (cis = C2v and trans = D4h), CrA3B3 (fac = C3v and mer = C2v) with monodentate ligands are all achiral. Cr(A∩A)2(B∩B)(C2) is chiral (didentate). fac-Cr(A∩A∩A)(B∩B∩B) (C3v, tridentate) is achiral, so is mer-Cr(A∩A∩A)(B∩B∩B) (C2v)*.

Due to the inertness of Cr(III), separation of the pairs of enantiomers are possible by chromatography with chiral support/eluant or by resolution with enantiopure counter-ions

Classical Δ and Λ with bidentate ligands en= ethylenediamine, pn = 1,2-propanediamine, ox = oxalate, phen, segmental ligand for self-assembled CrEuL3, etc), for which P and M enantiomers could be separated and characterized (enantiomeric excess)

* 1. ***Starting from preorganized chiral ligands***

*Describe the combination of a rigid and not interconvertible chiral ligand with the Cr(III) center. For non-chiral Cr(III) environments, the only source of chirality is brought by the ligands and the complex exists as a single enantiomer dictated by the chirality of the ligand (for instance CrAR6). Upon combining an inherent chiral ligands with a chiral coordination sphere, we have the formation of diasteromers. For instance with didentate ligand in homoleptic complexes Cr(A∩AR)3 leads to a pair of diastereomer -R and -R which can be separated by normal chromatography or crystallization. A systematic review on inherent chiral ligands that have been used for preparing such diastereomeric chiral Cr(III) complexes would be welcome. When describing the synthesis and separation of the compounds I would add the application when there is one (DNA probe, catalysis, or magnetism).*

* 1. ***Starting from fast interconverting chiral ligands***

*Mainly observed (to the best of my knowledge) for tridentate ddpd and dqp in Crddpd2 and Crdqp2 where The (helical) chirality of the ligand is only fixed after its complexation to Cr(III) due to sterical constraints (note that the Cr-center is achiral in mer-Cr(tridentate)2 complexes). In this cas, only a pair of enantiomer is observed PP/MM due to the two ligands whereas MP may exist, but was too high in energy to be detected. separation: sephadex, electrophoresis and chiral HPLC*

*As before, when describing the synthesis and separation I would add the application if there is one (DNA probe, catalysis, or magnetism).*

1. **Circularly Polarized Luminescence** 
   1. ***Physical basis of CPL (brief description)***

*equations and the success of lanthanides (few words)*

* 1. ***Luminescence properties of Cr(III)***

*Tanabe Sugano of d3, spin-flip transitions as promising candidates for strong CPL and alternative to lanthanides*

* 1. ***Examples of chiral Cr(III) complexes showing CPL***

*Systematic review of Cr(III) complexes with CPL since the 60s. Structure, CPL spectrum and glum.*