TRANSITION METAL-COMPLEXED CATENANES, ROTAXANES AND MOLECULAR MACHINES

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Catenanes represent attractive synthetic challenges in molecular chemistry. The creation of such complex molecules as well as related compounds of the **rotaxane** family demonstrates that synthetic chemistry is now powerful enough to tackle problems whose complexity is sometimes reminiscent of biology, although the elaboration of molecular ensembles displaying properties as complex as biological assemblies is still a long-term challenge.

The field of artificial molecular machines and motors has experienced a spectacular development in the course of the last fifteen years, in relation to biological motors or information storage and processing at the molecular level. A recent example consists of a fast-moving rotaxane whose ring undergoes a pirouetting motion on the millisecond time scale by oxidizing or reducing the central copper atom (Cu^{II}/Cu^{I}).

Recently, our group has also proposed a transition metal-based strategy for making two-dimensional interlocking and threaded arrays. Large cyclic assemblies containing several copper(I) centres could be prepared which open the gate to controlled dynamic two-dimensional systems and membrane-like structures consisting of multiple catenanes and rotaxanes.

In the course of the last three years, we have been much interested in endocyclic but non sterically hindering chelates. These compounds are based on carefully designed 3,3'-biisoquinoline derivatives. Some of them have even been incorporated into macrocyclic compounds. A particularly efficient and fast moving molecular "shuttle" based on such a chelate has been made and investigated as well as three-component molecular entanglements constructed by assembling three such ligands around an octahedral metal centre. These biisoquinoline-based compounds are particularly promising in relation to fast-responding controlled dynamic systems and novel topologies.