Ruthenium polypyridyl complexes binding to helix DNA structures

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Recent crystallographic successes have allowed us to define three modes of binding of ruthenium polypyridyl 'light-switch' and related photooxidising complexes to DNA. This family of complexes is under development for applications in DNA sensing, photodynamic therapy and possibly for direct therapeutic applications. We have subsequently used CD spectroscopy to probe these binding modes in solutions.

Ruthenium polypyridyl complexes have been extensively studied because they are coloured, chiral, stable metal complexes with useful redox and photochemical properties. They bind strongly to DNA, and in principle can target specific sequences, conformations and mismatches. They have long lived excited states, and can be good sensitisers for singlet oxygen. The complex cation shows no photoluminescence in aqueous solution at ambient temperatures, but displays intense photoluminescence when added to solutions of calf thymus and synthetic DNAs.

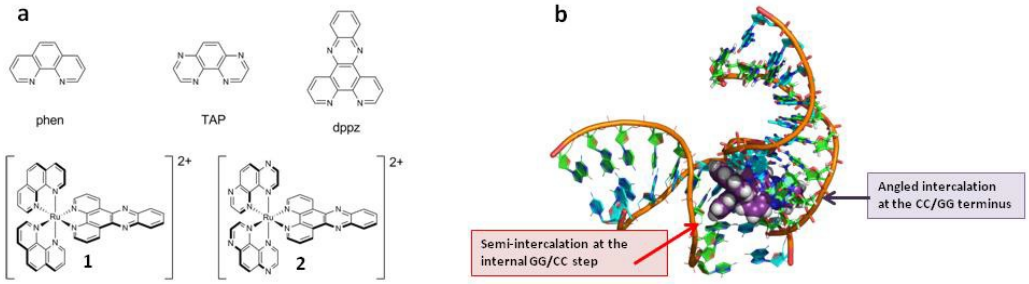

Figure 1 *(a) Ruthenium complexes and ligands. (b) The combination of intercalation and semi- intercalation by a single complex of* ***(1)*** *which generates the crystal self-assembly.*

No structural data to decisively confirm any binding mode were available before our work. Both intercalative and semi-intercalative binding modes were discovered in a recently published study.[1] In a second high profile paper[2] we reported the first crystal structure of **1** bound to DNA, in which the dppz ligand intercalates symmetrically from the minor groove of the $d(CCGGTACCGG)_2$ duplex at the central TA/TA step. Experiments carried out during our B23 beamtime have demonstrated that a CD signal at 190 nm, that is associated with the DNA duplex, can be used to probe the binding of enantiomerically pure ruthenium complexes. This is an important finding, as other areas of the CD spectrum are complicated by containing a signal for both the DNA and the complex. Interestingly the different enantiomers give rise to different effects within this region of the CD spectrum.

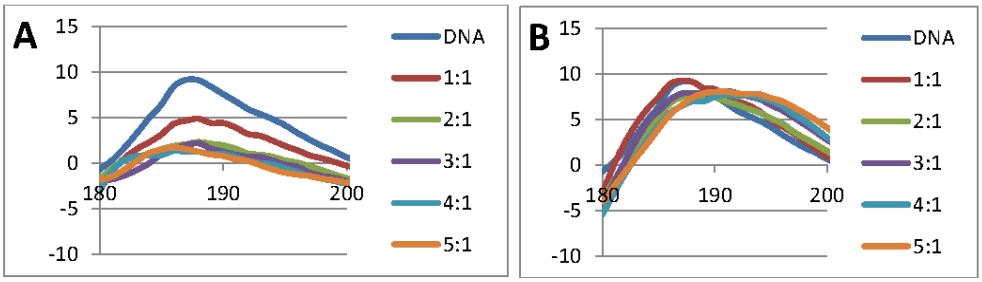

Figure 2 *SCRD spectra of TCGGCGCCGA with different ratios of (A) Λ[Ru(phen)$_2$(dppz)]$^{2+}$ and (B) Δ [Ru(phen)$_2$(dppz)]$^{2+}$, measured on B23.*

References

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2. Niyazi H., Hall J. P., O'Sullivan K., Winter G. *et al. Nat. Chem.*, **4**, 621 (2012).

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