Structural studies of DNA binding modes of ruthenium polypyridyl complexes with DNA

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Ruthenium polypyridyl complexes are of interest for their possible applications as cellular probes, in anticancer therapeutics and most recently for their antibacterial properties. For many years there was no crystallographic evidence showing how any of these complexes bound to duplex or higher order DNA, but since 2011 a series of structural studies have shown aspects of sequence, enantiomeric, substituent and structural specificity. The principal binding mode to duplex DNA of complexes typified by [Ru(phen)₂dppz]²⁺ (where dppz = dipyridophenanthrene) is by angled (canted) intercalation from the minor groove, with a distinct symmetric binding mode so far only known for lambda enantiomers at the TA/TA steps. Kinking (semi-intercalation) has also been characterised, so far only at CC/GG steps, e.g. for phen ligands within these complexes. Delta enantiomers are capable of mismatch recognition, so far structurally characterised for the A-A mismatch. This binding mode, insertion is characterised by the flipping out of the adenine, with the base stacking on the ancillary ligand of the complex. For binding to higher order DNA, sequences with loops, such as the unimolecular G-quadruplex, have so far resisted attempts at crystallisation, although an nmr structure of a diruthenium complex has been reported. This talk will illustrate these binding modes and their possible significance.