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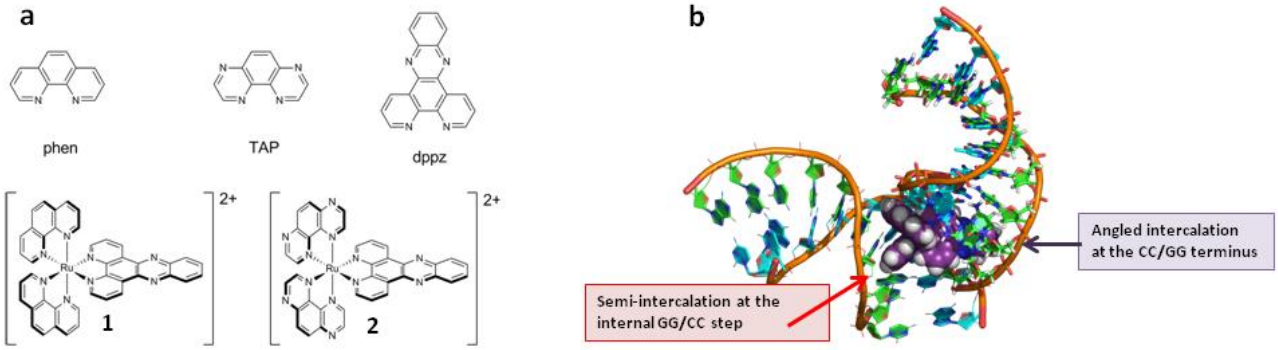
Nucleic acid crystallography
The original fibre diffraction studies of Rosalind Franklin paved the way for the later crystallographic studies of DNA oligonucleotides in laboratories around the world. My own work in this area started in the 1990's, with the first publication in 1996, the structure of the $d(ACGTACGT)_2$ octamer.
We then went on to look at ways of solving new structures, such as those typically formed by intercalation. Thus, in 1999 we demonstrated the intercalation mode of the acridine-4-carboxamide family of antitumour agents, as shown in the video.
http://youtu.be/Fk1eRZ9c2-k

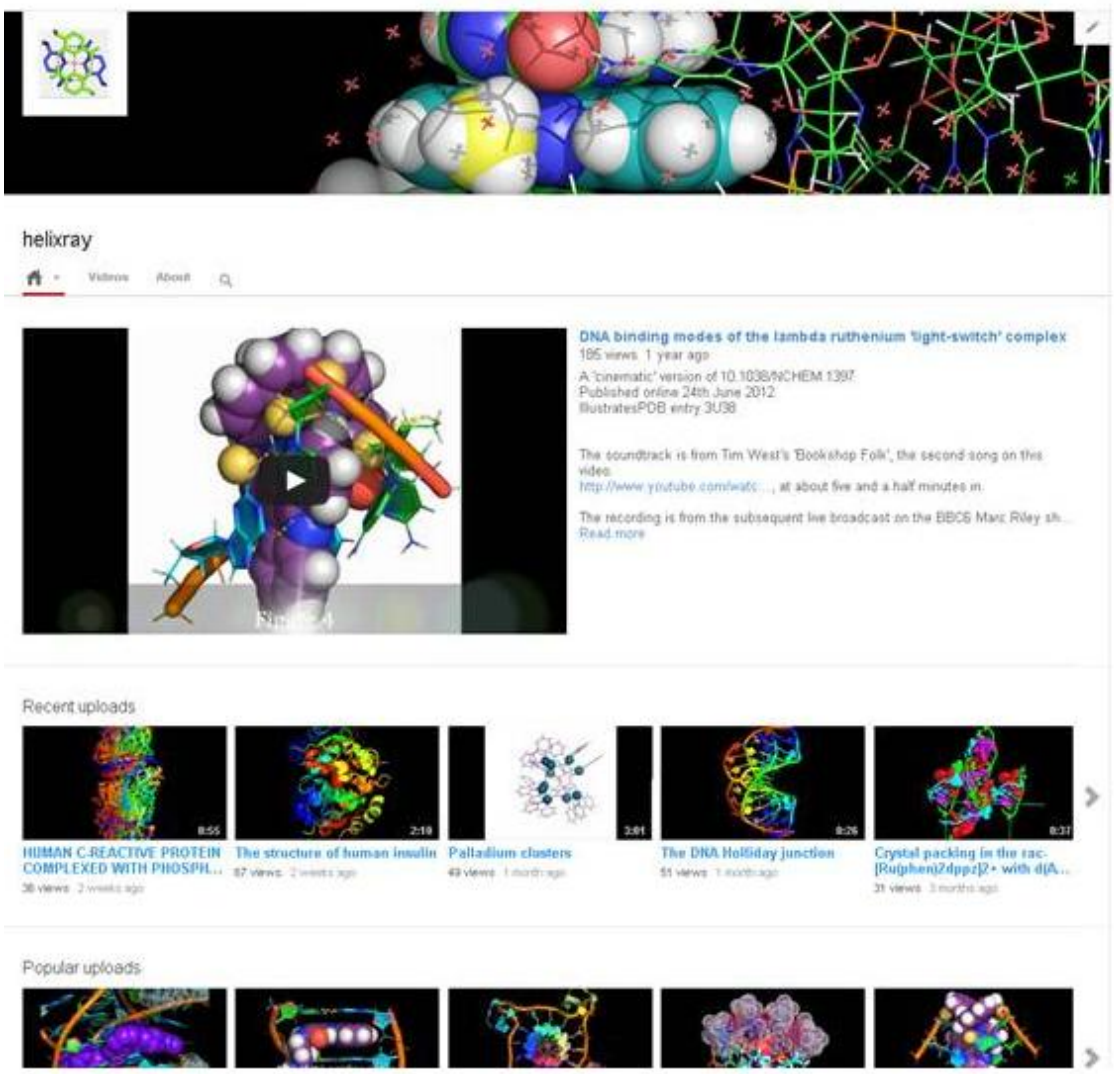
e then went on to look at the Holliday junction structure, in 2007 showing the binding mode of a bis-acridine to this structure, in which there is bridging of the ligand across the major groove face of the junction. This binding mode can be described as semi-insertion, because of the flipping out of the adenine bases at the junction, and their replacement by acridine-4-carboxamide residues.

http://youtu.be/cAMzWcZ-ry4

While working with Holliday junction forming sequences, we embarked on studies of the ruthenium 'light-switch' complexes, which happened to crystallize with some of these sequences. They did not form junctions; rather, they bound by intercalation from the minor groove, coupled with semi-intercalation (kinking) of a second DNA duplex at a different base pair step, giving a highly crystalline network.



The difficulty of conveying this family of structures to noncrystallographers led to my creation of the youtube helixray video channel, which has now had over 10,000 hits in its first year or so.



For further details of our recent work, one way in is to follow the links in the videos.

Current projects

BBSRC funding for this work will allow us to extend our ruthenium-DNA work. We are also embarking on ultrafast studies of electron transfer processes in these crystals in conjunction with the Lasers for Science facility in the Research Complex at Harwell.