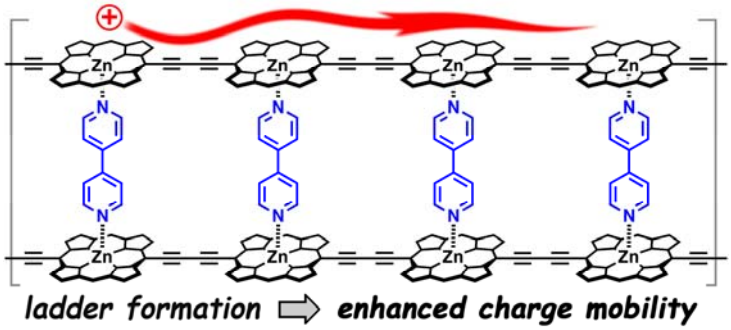
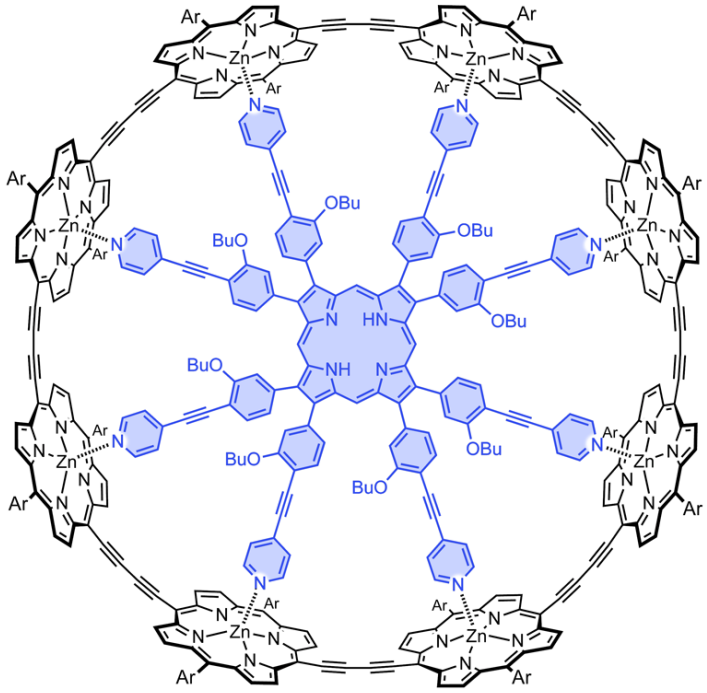
8.5 Prof Harry L Anderson, Oxford University,
Porphyrin-Based Optoelectronic Materials

Porphyrins are known as *"the pigments of life"* because they make blood red and grass green. The porphyrins that we make are completely synthetic, and we design them for optoelectronic and nonlinear optical applications with no precedent in biology, and yet we are often inspired by Nature. We are particularly interested in using non-covalent self-assembly for controlling the shape of conjugated porphyrin oligomers. Changing the shape of these molecular wires changes the strength of electronic coupling, changing the optoelectronic behaviour. For example we demonstrated recently that the assembly of double-strand ladders of the type illustrated below increases the mobility of charges along the molecular wire, which is relevant to the design of light-harvesting devices.[1] Current projects are focused on measuring the conductance of single porphyrin wires, and measuring the rates of electron transfer through porphyrin wires using photoinduced electron transfer.[2]



In another example of the use of non-covalent self-assembly for changing the shapes of molecular wires, we have used an octadentate template to bend a linear porphyrin octamer into a ring (shown below bound to the template).[3] Remarkable features of this cyclic octamer include its high symmetry (D_{8h}), its template-directed synthesis by bending a 'rigid-rod' linear oligomer, its amazingly high affinity for the template ($K_f = 10^{37}$ M^{-1}) and its cylindrical belt-shaped structure, which resembles some natural light harvesting chlorophyll arrays. We are currently investigating the magnetic properties of these molecular wire nanorings.



The availability of high quality MALDI and FAB mass spectra of conjugated porphyrin oligomers from the EPSRC National Mass Spectrometry Service Centre at Swansea helped to make this work possible.

[1] "Supramolecular Control of Charge Transport in Molecular Wires", F. C. Grozema, C. Houarner-Rassin, P. Prins, L. D. A. Siebbeles and H. L. Anderson, *J. Am. Chem. Soc.* **2007**, *129*, 13370–13371.

[2] "Probing the efficiency of electron transfer through porphyrin-based molecular wires", M. U. Winters, E. Dahlstedt, H. E. Blades, C. J. Wilson, M. J. Frampton, H. L. Anderson and B. Albinsson, *J. Am. Chem. Soc.* **2007**, *129*, 4291–4297.

[3] "Template-Directed Synthesis of a π-Conjugated Porphyrin Nanoring", M. Hoffmann, C. J. Wilson, B. Odell and H. L. Anderson, *Angew. Chem. Int. Ed.* **2007**, *46*, 3122–3125.