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Research Interests: ligand design, molecular recognition, bio-inorganic chemistry, self-assembled monolayers, catalysis, nanomaterials and electrochemistry

We have research projects in bioinorganic, supramolecular and materials chemistry. In bioinorganic chemistry we are interested in synthetic modeling chemistry, biocatalysis, biological imaging and medicinal chemistry. In supramolecular/materials chemistry our work is concerned with molecular recognition via hydrogen bonding, self-assembled monolayers (SAMs) and semiconductor nanoparticles (quantum dots). Current projects include.

1) *Artificial phosphate ester binding and cleavage*. We have prepared Zn^{II} complexes of ligands with H-bonding groups that are exceptionally effective for recognizing and cleaving phosphate esters. These complexes open now the possibility of creating agents for effective and selective cleavage of DNA/RNA under mild physiological conditions with the potential for applications in biotechnology and medicinal chemistry.
2) *Catalytic and sensing SAMs.* We are using SAMs on electrodes for redox-mediated catalysis and sensing. Some of the chemistry involves reduction/oxidation of small molecules e.g. O_2, N_2, NO_x, ClO_x etc., and sensing toxic or important molecules and ions e.g. metals, cyanide, phosphates, proteins, nucleic acids etc.
3) *Quantum dots interacting with metal complexes.* We are preparing fluorescent nanoparticles in which the interaction with metals or complexes is exploited for *in vivo* and *in vitro* biological imaging and generation of photocurrents.

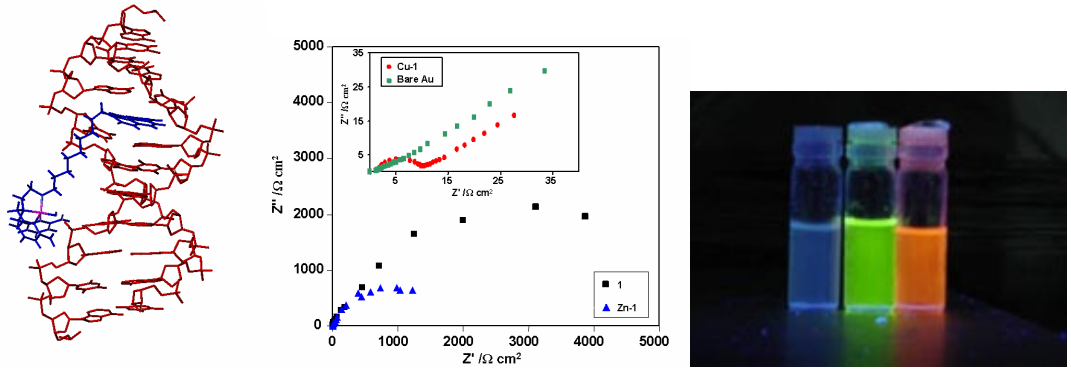

Figure 1. DNA cleaving agent (left), measuring the rate of ET across SAMs (middle), fluorescent nanoparticles (right).

SELECTED RECENT PUBLICATIONS

1. Relative importance of H-bonding and co-ordinating groups in modulating the zinc-water acidity J. C. Mareque-Rivas, R. Prabaharan, R. Torres Martin de Rosales, *Chem. Commun.* **2004**, 76.
2. Structures and reactivity of synthetic zinc(II) complexes resembling the active sites and reaction intermediates of aminopeptidases" J. C. Mareque-Rivas, E. Salvagni, S. Parsons, *Chem. Commun.* **2004**, 460.
3. The affinity of phosphates to zinc(II) complexes can be improved with H-bond donors J. C. Mareque-Rivas, R. Torres Martin de Rosales, S. Parsons, *Chem. Commun*, **2004**, 610.
4. A Highly Reactive Mononuclear Zn(II) Complex for Phosphodiester Cleavage G. Feng, J. C. Mareque-Rivas, R. Torres Martin de Rosales, N. H. Williams, *J. Am. Chem. Soc,* **2005,** *127(39)*,13470.
5. A comparison between mononuclear Zn(II) complexes with H-bond donors and dinuclear Zn(II) complexes for catalyzing phosphate ester cleavage G. Feng, J. C. Mareque-Rivas, N.H. Williams, *Chem. Commun*. **2006,** 1845.
6. H-Bonding Cavities Regulating Redox Behaviour and Binding of Metal-Bound Ligands L. Metteau, S. Parsons, J. C. Mareque-Rivas, *Inorg. Chem.* 2006**, 45**, 6601.
7. The strength of H-bonding interactions to metal bound ligand can contribute to changes in the redox behavior of metal centres J. C. Mareque-Rivas, S. L. Hinchley, L. Metteau, S. Parsons, *Dalton Trans*. **2006,** 2316.
8. Efficient phosphodiester binding and cleavage by a Zn^{II} complex combining H-bonding interactions and double Lewis acid activation G. Feng, J. C. Mareque-Rivas, D. Natale, R. Prabaharan, N. H. Williams, *Angew Chem. Int. Ed.* 2006, **45**, 7056.
9. Metal-mediated transport of electrons across molecular films V. Ganesh, P. Calatayud, J. C. Mareque-Rivas, *Chem. Commun.* **2007**, 804.