

Supramolecular chemistry anniversary

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DOI: 10.1039/b617780h

An anniversary is a time both to look forward and to look back. This year, 2007, marks two special anniversaries in the field of Supramolecular Chemistry. Firstly, it is the fortieth anniversary of the publication in the *Journal of the American Chemical Society* of the synthesis and cation binding properties of crown ethers by Charles J. Pedersen.^{1,2} This work, which arose from Pedersen's careful observations of the formation of side products during the synthesis of 'metal deactivators' for use in the stabilization of rubber, was an early landmark in the development of receptors for group 1 metal cations and provided inspiration for many working in the field.

In 1987, the trailblazing work of Donald J. Cram,³ Jean-Marie Lehn⁴ (who coined the term 'Supramolecular Chemistry') and Charles J. Pedersen was

recognised by the award of the Nobel Prize in Chemistry "for their development and use of molecules with structure-specific interactions of high selectivity" and it is the twentieth anniversary of this special event that is also marked by this issue of *Chemical Society Reviews*.

Charles Pedersen passed away in 1989 and Donald Cram in 2001. We look back on the lives of these pioneers with profiles from Reed Izatt and John Sherman.

In this issue we look forward too, with a highlight article from Jean-Marie Lehn on the evolution of supramolecular chemistry towards constitutional dynamic chemistry and the transition from design to selection.

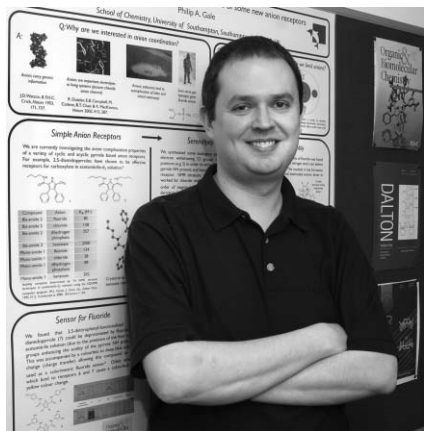
There are a number of themes running through this issue. Supramolecular chemistry at the biological interface is the topic of a number of articles. Supramolecular chemistry in membranes is discussed in a trio of reviews looking at different aspects of this area from Tom Fyles, George Gokel and Tony Davis,

David Sheppard and Bradley Smith. Base pairing as a supramolecular recognition motif is discussed by Jeff Davis and Gian Piero Spada in the context of self-assembling guanosine derivatives. Jonathan Sessler, Candace Lawrence and Janarthanan Jayawickramarajah also look at base pairing for the formation of molecular ensembles with applications in energy and electron transfer. The recognition of DNA itself is discussed by Mike Hannon in his tutorial review. Other helical systems, specifically synthetic non-peptide mimics of α -helices are discussed by Jessica Davis, Lun Tsou and Andrew Hamilton. Their review looks specifically at key-protein-protein interactions that are mediated by α -helices and how synthetic mimics may be used to inhibit these interactions. Pascal Blondeau, Margarita Segura, Ruth Pérez-Fernández and Javier de Mendoza have looked at the important role of the guanidinium group as a recognition motif for oxo-anions in biological systems as well as its use in synthetic receptors for simple inorganic anions and enantioselective carboxylate recognition through to peptide and protein surface recognition. Laura Baldini, Alessandro Casnati, Francesco Sansone and Rocco Ungaro have reviewed the use of calixarenes as scaffolds for the construction of multivalent ligands for use in a variety of biological and material applications.

The supramolecular chemistry of fullerenes is also covered in detail here with a critical review from Davide Bonifazi, Olivier Enger and François Diederich on the chemistry of C₆₀ on surfaces whilst Kentaro Tashiro and Takuzo Aida have contributed a tutorial review on the expanding area of metalloporphyrin hosts for the recognition of a variety of fullerenes.

Interlocked molecular species are an important group of compounds that without supramolecular chemistry would exist as chemical curiosities available only in miniscule yield. That of course

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Lectureship by the RSC UK Macrocycles and Supramolecular Chemistry Group. He is the recipient of a 2005 Corday-Morgan medal and prize from the Royal Society of Chemistry. He is a member of the editorial board of *Chemical Society Reviews*, the co-editor of the journal *Supramolecular Chemistry* and a member of the international editorial advisory boards of *Coordination Chemistry Reviews*, the *Encyclopaedia of Supramolecular Chemistry*, *Chemistry World* and *Chemical Communications*. He is a member of the International Scientific Committee of the International Symposium on Macrocyclic and Supramolecular Chemistry (ISMSC).

has changed, and here three aspects of this chemistry are discussed. Matthew Vickers and Paul Beer have provided a tutorial review on the new area of anion-templated interlocked structures whilst Steve Loeb has discussed the use of rotaxanes as ligands—a strategy that has led to the development of new tuneable materials. Interlocked materials are also discussed in Benoît Champin, Pierre Mobian and Jean-Pierre Sauvage's review on prototypical molecular machines based on transition metal complexes.

Two reviews look at measuring interactions in non-covalent assemblies. Scott Cockcroft and Chris Hunter have shown how double- and triple-mutant cycles may be used to study individual non-covalent interactions in molecular ensembles whilst Michael Pluth and Ken Raymond have reviewed the mechanisms of guest exchange in supramolecular systems discussing a variety of receptors and the techniques which may be used to study inclusion properties and processes.

Kimoon Kim, Narayanan Selvapalam, Young Ho Ko, Kyeng Min Park, Dongwoo Kim and Jeeyeon Kim have written a tutorial review of functionalized cucubiturils. Recent advances in the chemistry of these increasingly important systems have allowed the synthesis of tailor-made derivatives and their

use in a variety of applications. Ed Constable has reviewed the role of terpyridine in metallo-supramolecular assemblies focusing on some recent advances in the construction of metallocycles and metallodendrimers and systems going up in size to nanoscale assemblies.

Separation and extraction is an important area of application for supramolecular chemistry. Henk Dam, David Reinhoudt and Willem Verboom have reviewed recent advances in the design of multivalent ligands for lanthanide and actinide separations.

In the area of materials chemistry, Kazuki Sada, Masayuki Takeuchi, Norifumi Fujita, Munenori Numata, and Seiji Shinkai have reviewed in depth, the polymerization of preorganized assemblies in order to trap otherwise fragile nano- and microscale superstructures formed *via* non-covalent interactions. The sister field of crystal engineering and its boundary with supramolecular chemistry is explored by Scott Dalgarno, Praveen Thallapally, Len Barbour, and Jerry Atwood in their article which discusses the remarkable liquid and gas inclusion properties of crystals of calixarenes set within the broader context of metal organic frameworks and coordination networks.

It has been both a pleasure and an honour to edit this themed issue of *Chem. Soc. Rev.* In a single issue it is not possible to cover completely the breadth of Supramolecular Chemistry and I must apologise to those who might feel their work has been omitted. However I hope this issue has captured the moment of this double anniversary and the excitement and challenges that remain in the study of supramolecular systems. *Chem. Soc. Rev.* continues to publish both tutorial and critical reviews on supramolecular topics with a number of other articles scheduled to appear in 2007.

I would especially like to thank my fellow editorial board members of *Chem. Soc. Rev.* and outgoing chairman Professor David Parker in particular for supporting this themed issue. Editor Dr Robert Eagling has been extremely helpful and I would like to thank him for his guidance.

References

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