Frontiers in Bioorganic Chemistry

Foreword

This special issue on 'Frontiers in Bioorganic Chemistry' is organized around five themes of contemporary challenges in bioorganic chemistry. The specificity and selectivity in chemical and biochemical reactions is a consequence of non-covalent molecular forces which tune the physical interplay among the component molecules. A basic understanding of the rules which govern such interactions and the determinants of molecular recognition is essential for unravelling the chemical basis of biological complexity. The articles on supramolecular chemistry (J M Lehn), role of hydrogen bonding in molecular self assembly (A D Hamilton), and delineation of hydrophobic, contribution to molecular recognition in bio-relevant aqueous systems (D H Williams and C Wilcox) attempt to address some of these issues. The application of molecular recognition for influencing the rate and course of organic reactions is amply demonstrated in two independent contributions (J K M Sanders and A K Lala). The futuristic possibilities and practical utility of molecular cognition are exciting: control of molecular architecture through engineered molecular recognition, creation of functional materials and synthetic self organizing systems, construction of chemzymes with high turnover capability and rational design of medicinal agents.

Ever since the discovery of the famous 'double helix' by Watson and Crick almost forty-one years ago, the search for multitudes of polymorphic structures for DNA and RNA continues unabated. This has resulted in discovery of triple helical and tetrameric DNA and several 'functional' motifs for RNA. The chemistry and biology of RNA are moving centrestage after the discovery of ribozymes. The articles on slipped loop DNA structure (N Yathindra), rational design of nucleobases with improved stacking potential (S Ranganathan), recent advances in chemical synthesis and applications of RNA (M J Gait) and synthesis of complex lariats relevant to RNA splicing models (J Chattopadhyaya) illustrate some challenging aspects. The chemical degradation of DNA is as important as its chemical synthesis due to its emerging applications in antigene/antisense technology. Two separate papers (D Ranganathan and K N Ganesh) which employ copper complexes for this purpose are noteworthy.

Several naturally occurring peptides present in low amounts but with potent biological activity have been good targets for chemical synthesis in view of their potential applications in drug development. The success in peptide synthesis is a strong function of its sequence and hydrophobic-hydrophilic balance. The papers dealing with strategies for synthesis of paradaxin and δ toxins (R Nagaraj) and design of novel polymer supports (V N R Pillai) exemplify the difficulties in this area. The design of peptides with conformational restrictions in the backbone is a key aspect

of peptide engineering. This is illustrated by use of dehydro amino acids to control secondary structure in peptides (V S Chauhan).

Elucidation of biosynthetic pathways has not only led to characterization of a large number of secondary metabolites but has also contributed to identification of key steps for development of enzyme inhibitors. A number of bioactive furocoumarins have been reported from *Pimpinella monoica* (A Banerji). Using isotope-labelled D and L amino acids, stereochemical rearrangements in biosynthesis of showdomycins, tuberin and catabolism of 5-fluorouracil (D Young) and the substrate specificity of the enzyme glutamate mutase (D Gani) have been investigated. An analysis of active site chemistry of phospholipase involving Ca^{2+} coordinated catalytic water molecule (S Vishveshwara and M K Jain) and an overview on scope of lipases in transesterifications (V S Parmar) illustrate the current importance of lipase enzymology and its practical utility. A different form of biocatalysis of organic reactions is the use of microbial cultures and novel transformations of steroids and morphines by *Mucor performis* (K M Madyastha) provide good examples of this approach.

Oligosaccharides and lipids are futuristic molecules owing to their emerging potential in medicinal and material chemistry. Selective glycoside bond formation for oligosaccharide synthesis poses considerable challenge to organic chemists and in this context, α-nitrophenyl-β-thioglucosides (J H van Boom) have considerable advantages. *Myo*-inositol plays a central role in cellular signal and transduction pathways. The stereospecific mannosylation of *myo*-inositol (H B Mereyala) and a review on recent developments in synthesis of phosphosidyl lipid analogues (M Shashidhar) are representative of the emerging interest in chemical and biochemical aspects of phospholipids. The versatile aggregation properties of lipids are tunable by chemical modification and lead to creation of chiral superstructures, new immunomodulatory agents and novel drug delivery systems (S Bhattacharya).

Biology presents a myriad challenges, many of which are amenable to chemical solutions. A compelling consequence of this is an enhanced symbiosis of chemistry and biology. I hope that the articles in this issue bear evidence of this. I thank all the contributors to this volume who overwhelmingly accepted my invitation. I would like to express my appreciation to Ms Surekha Deshpande, NCL, for assistance and the Indian Academy of Sciences for giving me the opportunity to bring out this issue.

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Guest Editor