

Amino Acids, Peptides and Proteins

J. S. Davies, Senior Reporter, Specialist Periodical Reports, Royal Society of Chemistry, Cambridge, Volume 32, 2001, ii + xx pp., price £189.50, ISBN 0-85404-232-6

This is the latest in a long running series of specialist periodical reports published by the Royal Society of Chemistry. Volume 32 consists of the standard five chapters, dealing as the title suggests with various aspects of the chemistry, biology and biochemistry of amino acids, peptides and proteins. In addition, John Jones' very useful and accurate survey of the nomenclature and abbreviations used in peptide chemistry has been reproduced at the start of the volume. This volume predominantly covers work published in 1999, though some papers published towards the end of 1998 and a few 2000 references are also included. As such, the authors have done an excellent job in producing the volume for publication in 2001, thus ensuring that it is a timely contribution. Remarkably, the rapid publication has been achieved whilst maintaining a high standard of typographical accuracy. On reading through the volume, I found no obvious typographical errors in either the text or the diagrams, a situation which is all too rare nowadays.

The first chapter, written as always by Graham Barrett, deals with amino acids and is an incredible *tour de force* of >1100 references in 106 sides, 36 of which are taken up just listing the references. This chapter has a very wide scope, covering topics such as the occurrence and isolation of amino acids from natural sources, the chemical synthesis of amino acids (both racemic and asymmetric syntheses), resolution and racemization of amino acids, prebiotic amino acid syntheses, spectroscopic, diffraction and theoretical studies on amino acids, and analytical methods for the separation and quantification of amino acids. The term 'amino acid' is interpreted in its widest possible usage, and in addition to the proteinogenic α -amino acids, the chapter deals with other α -amino acids, α,α -disubstituted amino acids as well as β - and higher amino acids. There is one inevitable consequence of covering so much material in such a limited amount of space, namely that chemical structures are given only in the most demanding cases. This means that the chapter is by no means a light read, and on a number of occasions I found it difficult to work out exactly what the structure was of an amino acid with a complex name.

Chapter 2 of the volume deals, as always, with peptide synthesis and consists of 777 references in just 28 pages of text and 28 pages listing the references. The format of the chapter is as in previous years, with the emphasis being on methodology. Thus, new protecting groups for amines, acids and amino acid sidechains are discussed followed by methods for disulfide formation and peptide bond formation. Polymer supported peptide synthesis and enzyme catalysed peptide synthesis are also included. The final section of this chapter comprises an alphabetical listing of all of the peptides, peptide analogues and peptide fragments whose synthesis has been reported in the time frame covered by this volume.

The third chapter is entitled 'Analogue and conformational studies on peptides, hormones and other biologically active peptides' and comprises over 700 references in 90 pages. I know

from experience just what a challenging chapter this is to write, since the coverage must of necessity be highly selective and should be selected based on the biological importance of the work. Hence, the author needs an appreciation of both the chemistry and the biology of the work being reviewed. The present author (Anand Dutta) is perfectly placed to write this chapter and has done an excellent job. He is going to be difficult to replace in future volumes. There is always scope for unnecessary duplication of work in the area of cyclic peptides between this chapter and the following one. However, this year the authors seem to have ensured that any such duplication is minimised. Chapter 3 starts with a discussion of amide bond mimetics incorporated within peptides, and then discusses rigid peptide turn mimetics, and cyclic peptides. The bulk of the chapter is however, concerned with analogues of specific biologically active peptides and enzyme inhibitors. The specific peptides covered vary from year to year depending upon the relative importance of pharmaceutical targets. Twenty classes of peptides are covered this year, including peptides involved in Alzheimer's disease, angiotensin analogues, LHRH analogues and vasopressin derivatives. A 21st section is entitled 'Miscellaneous' and covers work on important targets (insulin, calcium channel blockers *etc.*) where there was insufficient material published to justify a separate section. Fourteen classes of enzymes for which inhibitors have been designed are also covered, including HIV protease inhibitors, matrix metalloproteinase inhibitors and thrombin inhibitors. Again, a 'Miscellaneous' section is included to catch important work not covered elsewhere. The chapter ends with short sections on phage library leads, protein-protein interactions, and advances in drug formulation and delivery.

Chapter 4 entitled 'Cyclic, modified and conjugated peptides' is written by John Davies and details 250 references in 45 pages. The main distinction between this chapter and the preceding one is that the peptides discussed here tend not to be biologically active. The chapter is logically organised starting with cyclic peptides and discussing in turn the reported syntheses of cyclic dipeptides, cyclic tripeptides *etc.* up to cyclic decapeptides and higher. This is followed by sections on the synthesis of peptides modified by the inclusion of thiazole and/or oxazole rings, and the synthesis of cyclodepsipeptides. The remainder of this chapter covers the synthesis of modified peptides such as phosphopeptides, glycopeptides, and lipopeptides.

Whilst chapters 1-4 remain constant in each volume of this Specialist Periodical Report, the final chapter varies from year to year and this year is entitled 'Current trends in protein research' written by Jennifer Littlechild. This chapter surveys 90 references in just 15 pages, and inevitably has to be extremely selective. The intention is not to cover all aspects of protein research, or even protein chemistry, but rather to highlight the most important developments and bring them together in a volume that will be read by non-protein chemists. Hence, the chapter covers topics such as protein folding, enzymes and evolution, enzyme pathways, calcium containing proteins, and protein-nucleic acid interactions.

Overall, whilst no volume of this size can hope to be fully comprehensive, the authors have used their considerable experience to select and highlight the most important areas of amino

acid, peptide and protein chemistry. The book has continued the excellence of previous volumes in this series and deserves a place in all chemistry libraries, and within all research groups interested in any aspect of amino acid, peptide, or protein chemistry.

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Functional Group Chemistry

J. R. Hanson, Royal Society of Chemistry, Cambridge, 2001, vi + 165 pp., price £9.95, ISBN 0-85404-627-5

This text belongs to the new RSC Tutorial Chemistry Texts series, which aims to cover in a concise manner the essential chemistry taught during the first two years of undergraduate degree courses. The properties of functional groups, described over 165 pages, clearly fall into this category. The text is divided into four chapters, describing firstly general principles followed by the chemistry of the σ -bond, the π -bond and of aromatic compounds.

With such a broad scope of material, encompassing everything from structure and bonding through to enolate and heteroaromatic chemistry, it is not surprising that the author has had to choose his examples carefully and to be extremely concise throughout. Considering the constraints on the length of these texts, the author has done an excellent job at summarising the salient points of each functional group. The text is packed with information, yet is laid out in an attractive and clear style, with good use of subdivisions and appropriate use of two colours to highlight particular words, figures or exercises.

Each of the four chapters starts with a list of the aims and concludes with a summary of the key points. One of the strengths of the text is that a selection of worked problems with answers is provided at the end of each chapter. This is then followed by a number of problems for which answers are provided at the end of the text. The student therefore has the opportunity to work through some questions with answers on the same page before tackling the remaining problems. These problems are not trivial and will certainly test the understanding of the underlying principles. Indeed, the problems are often somewhat advanced for a first year undergraduate.

In more detail, Chapter 1 gives a good summary of the fundamental principles of structure, bonding and nomenclature of organic compounds, before describing reagents and reaction types. This progresses logically and provides the basis for the forthcoming material.

Chapter 2 describes the preparation and reactions of alkanes, alkyl halides, alcohols, epoxides and ethers, organosulfur compounds and amines. Only a few pages are devoted to each of these functional groups, yet the important chemistry of each is described clearly. The content is not limited to the basic reactions such as S_N2 reactions or oxidation of alcohols, but incorporates more advanced transformations such as the Mitsunobu reaction, a radical cyclization, the Barton reaction, the Beckmann rearrangement (the mechanism for this

rearrangement depicts both HO^- and H^+ in the same scheme). Unfortunately, the desire to be concise has meant that diagrams are sometimes lacking and written descriptions, such as for the Barton reaction, will be lost on many undergraduates. It would have been beneficial to have made more use of the wide margin to explain terms written in the text, or to draw the structures of compounds that are not included in any scheme, such as, for example, 'racemization', 'bromonium ion', 'potassium *tert*-butoxide' or 'tetrahydrofuran'.

Chapter 3 covers the preparation and reactions of alkenes, alkynes, carbonyl compounds, nitriles, imines and nitro compounds. Many of the most common reactions are described briefly, including addition and substitution reactions with carbonyl compounds and enolates. Good coverage of the reactions of alkenes is provided and there are useful exercises, involving the completion of reaction charts, which will aid student learning and summarise key transformations. The first reactions described under the section on carbonyl compounds deal with enolate chemistry and the Felkin-Anh model, although further enolate chemistry is provided later, after a discussion of the addition reactions of aldehydes, ketones and carboxylic acid derivatives. The problems at the end of the chapter are difficult and include some chemistry (for example the Favorskii reaction) not discussed in the text, although answers are provided.

Chapter 4 describes aromatic substitution reactions and the chemistry of substituted aromatic compounds. This includes electrophilic and nucleophilic substitution, benzyne chemistry, reactions of aryl halides, phenols and derivatives, aromatic amines and diazonium salts. The content concludes with six sides on heteroaromatic compounds, particularly some chemistry of pyridines and pyrroles.

The text is presented in an attractive format and it is easy to dip in to a relevant section. The exercises, worked problems and more advanced problems will be very useful for student learning. There are very few errors that have crept in, such as 'the enolate ... is acidic' on page 81, and more crucially, the mechanism of the Wittig reaction is portrayed as progressing through an intermediate betaine on page 88, rather than the more commonly accepted direct $2 + 2$ mechanism.

Overall, this is an excellent short text aimed at early undergraduates. The essential chemistry is described clearly and logically. In addition, the text includes much chemistry that goes beyond first year undergraduate level. Most chemistry students purchase one of the large general organic chemistry texts and would therefore have access to the material covered here. The text would, however, suit those who want an account of functional group chemistry at low cost and which is convenient, well-written and concise. The wealth of information and the brevity of each point results in a text that will be hard going for many first year undergraduates, but those that persevere will benefit enormously.

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