

Book Reviews

Challenges in Synthetic Organic Chemistry. By Teruaki Mukaiyama. (Translation Edited by J. E. Baldwin). Clarendon Press: Oxford, 1994, 225 pp., paperback. £ 19.50. ISBN 0-19-855855-4.

In this fascinating book, Professor Mukaiyama presents, in essentially chronological order, a most engaging and useful overview of his enormous contributions to the art and science of organic synthesis. This is a reference text to one man's achievements and is certainly not the place to look for an overview of a particular topic; almost no perspectives are given regarding the relationships between Mukaiyama's discoveries and those of others active in the various areas described. However, what is so delightful about the narrative style is the very human face of research which is presented, together with the remarkable chemistry which emerges from beginnings which do not always appear especially promising. The various topics are introduced with almost casual ease until one realizes that the questions asked at the start of a particular section are of a very fundamental nature, with the result that the book is littered with examples of the definition of what are now referred to, quite rightly, as 'classical' synthetic transformations. These include such highlights as the generation of nitrile oxides from nitroalkanes using isocyanates, the development of a variety of phosphorylation methods, the esterification and lactonization procedures based upon the use of pyridinium salts and the powerful combination of triphenylphosphine and 2,2'-dipyridyl disulfide in peptide and nucleotide synthesis. All of these valuable transformations were arrived at by relatively simple considerations of the principles of dehydration together with the basic chemistry of the reactants. It is plain that the research into the phosphorylation chemistry was the stimulus for the later development by Mitsunobu, one of Mukaiyama's co-workers at the time, of the widely used method for the clean and direct S_N2 displacement of secondary alcohols. The development of the Lewis acid-catalysed aldol condensation using *O*-silyl enolates, together with the later notable contributions to methods for effecting stereocontrolled bond formation based around the aldol, Michael and related condensations constitute another area of extraordinary significance. These studies represent a major start-

ing point for the subsequent explosive growth in the development of chelation controlled synthetic methods in general. However, it is not immediately obvious from the book just how important a discovery this was and continues to be.

Throughout, the basis of the ideas is clearly and concisely rationalized. In this respect alone, the book is highly recommended reading for new graduate research students working in organic synthesis as well as for their more senior colleagues. What also comes over very clearly is that no matter how excellent and well thought out an idea may be, a great many experiments and many careful observations will usually have to be performed to bring the project to fruition. The contributions made by luck are also freely acknowledged, although one always has the feeling that often it was a case of 'making his own luck!'

The general presentation of both the text and the diagrams is of a high quality and largely error free. The translation is excellent and the narrative flows along in an easy to read but, in places, rather brisk fashion. Clearly, this will be a useful reference volume, but essentially only for Mukaiyama's own work; perhaps its more lasting significance will be as an elegant example of the application of scientific logic and as a demonstration of the art and craft which underpin the advancement of organic synthetic methodology. In these respects, it is an extremely stimulating and worthwhile volume.

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The Anomeric Effect and Associated Stereoelectronic Effects. Edited by G. R. J. Thatcher. ACS: Washington, 1993, 305 pp., paperback. \$ 74.95. ISBN 0-8412-2729-2.

Originally defined¹ as the phenomenon responsible for "the tendency of an electronegative substituent to assume the axial rather than the equatorial orientation at C(1) of a pyranoid ring", the anomeric effect has, slowly but definitely, turned into one of the most fundamental and relevant areas of study in chemistry. Indeed, probing into the nature of the anomeric effect has led to the finding and comprehension of the so-called stereoelectronic

interactions, which have been shown to influence a great number of conformational and reactivity patterns exhibited by chemical species.

The present monograph is actually the second volume within the ACS Symposium Series dedicated to the anomeric effect,² and serves as an excellent complement to other texts and reviews on the subject.³

Developed to provide a forum for competing viewpoints and interpretations surrounding the anomeric effect, this book includes also a candid, enjoyable, and important retrospective account by J.T. Edward.⁴ In addition, an excellent introductory overview by G.R.J. Thatcher emphasizes the areas of most activity, and presents concise, clear descriptions of several relevant terms and concepts.

The core of the book is formed by contributions from well-known researchers and "antagonists" in the area: (1) P. Deslongchamps reexamines the evidence supporting the participation of stereoelectronic interactions during the hydrolysis of glycosides and orthoesters, (2) A.J. Kirby discusses structural data in accord with $n \rightarrow \sigma^*$ and $\sigma \rightarrow \sigma^*$ orbital interactions as responsible for the observed changing patterns of bond lengths in systems involved in anomeric and gauche effects, (3) C. L. Perrin's iconoclastic view of anomeric effects defies the existence of the reverse anomeric effect and argues in favor of electrostatic over orbital interactions as the basis for the anomeric effect, and (4) M.L. Sinnott's "No kinetic anomeric effect in reactions of acetal derivatives" presents data backing this conclusion.

Eight additional chapters by various authors present the results of current research (experimental as well as theoretical) being done on topics such as glycoside cleavage, second-row effects, modelling of the anomeric effect by different *ab initio* methods, manifestations in organometallic chemistry as well as in derivatives of sulfur and phosphorus, and early studies of the O-C-N anomeric effect in nucleosides.

Some important topics that are treated in this book only briefly or not at all are: the anomeric effect in radicals, the enthalpic anomeric effect, endo/exo anomeric interactions, and, importantly, applications of the anomeric effect in organic synthesis. Similarly, the absence of contributions by R.U. Lemieux, H. Booth, P.v.R. Schleyer, and others, is disappointing. Nevertheless, the wealth of information and other thought-provoking data available in this monograph constitutes essential material for most students and practitioners of chemistry.

References and Notes

1. Lemieux, R.U.; Chü, N.J. *Abstracts of Papers*; 133rd National Meeting of the American

Chemical Society; American Chemical Society: Washington, D.C., 1958; 31 N.

2. Cf. Szarek, W.A.; Horton, D., Eds. *Anomeric Effect: Origin and Consequences*; ACS Symposium Series No. 87, American Chemical Society: Washington, D.C., 1979.

3. (a) Kirby, A.J. *The Anomeric Effect and Related Stereoelectronic Effects at Oxygen*; Springer Verlag: Berlin, 1983. (b) Deslongchamps, P. *Stereoelectronic Effects in Organic Chemistry*; Pergamon Press: New York, 1983. (c) Juaristi, E.; Cuevas, G., *Tetrahedron*, 1992, 48, 5019. (d) Graczyk, P.P.; Mikolajczyk, M. *Anomeric Effect: Origin and Consequences In Topics Stereochem.* 1994, 21, 159. (e) Juaristi, E.; Cuevas, G. *The Anomeric Effect*; CRC Press: Boca Raton, Fl., 1995.

4. Readers fond of quotations will find two amusing ones cited here: "It pays to speculate as widely and wildly as possible: people remember only when you are right", and "Luck counts far more than virtue in this unfair world".

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The Organometallic Chemistry of Transition Metals. Second Edition. By Robert H. Crabtree. Wiley: New York; 1994, 487 pp., hardback. £ 49.50. ISBN 0-471-59240-4.

Transition metal organometallic chemistry is so exciting today and every new issue of our favourite journals brings news - new structures and new reactions. From this point of view it becomes time not only to look for new molecules - it is time to understand the intricate, beautiful patterns in which they move - and what is easy and what is difficult for them to do. In this connection the revised second edition of the book by Robert H. Crabtree will be welcomed by all organic and inorganic chemists, but will be most useful to advanced undergraduate students of chemistry and those involved in research of organometallic chemistry.

Highlights of the textbook include an attractive balance between more theoretical aspects (chapter 1-6), analytical methods of characterisation of organometallic compounds (chapter 10) and applied aspects of organometallic chemistry as given in the chapters 11-16 including the activation of small molecules (Chapter 7, 8 and especially 12) or problems of homogeneous catalysis are discussed in Chapter 9. But also the chemistry of transition metal clusters or of bioorganometallic chemistry is pointed out in chapter 13 and 16, respectively. Chapter 10, "Characterisation of Organometallic Compounds" is an excellent over-

view of analytical methods which can be used by students and young researchers in this field. Questions at the end of each chapter in connection with the answers at the end of the book, are helpful to solve the problems studied before.

The experience of the author in research and teaching in the field of organometallic chemistry and mechanisms of reactions of transition metal complexes has resulted in a well-balanced and well-presented textbook. In many cases new aspects of coordination and organometallic chemistry are involved in the book, like the problem of distortional isomers or the reactivity of monomer $[\text{Cp}^*_2\text{Zr}=\text{O}]$ -fragment (page 305).

It is very helpful to find a lot and also new references at the end of all chapters. From time to time it takes some months to print a paper, but not longer than 3 years as in the case of reference [14] on page 69.

To summarise, the publication of this textbook has fulfilled the long-standing need for such an updated book in the general area of organometallic reaction mechanisms and applications in organic chemistry. The presentation is mostly of a high technical quality, except some graphical figures which are not printed in such a clear manner as the text around it (e. g. compare figure 14.26 / 14.27 etc.). But however, I can recommend it without reservation.

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