COMPREHENSIVE ORGANIC CHEMISTRY

The Synthesis and Reactions of Organic Compounds

SIR DEREK BARTON, F.R.S.

AND

W. DAVID OLLIS, F.R.S.

Volume 5 Biological Compounds

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Volume 5 Biological Compounds

Edited by E. HASLAM

UNIVERSITY OF SHEFFIELD

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Foreword

During more than a century, the development of organic chemistry has been associated with extensive documentation. Vast numbers of textbooks, monographs, and reviews have been published with the objective of summarizing and correlating the results obtained by many thousands of organic chemists working in academic and industrial research laboratories. However, out of this colossal literature there is but a relatively small number of textbooks and multi-volumed works which have become generally accepted as representing real steps forward in the presentation of our subject.

During the classical era of organic chemistry (1820–1940), textbooks which had a profound influence on the teaching of the subject included, for example, works by Armstrong (1874), van't Hoff (1875), Roscoe–Schorlemmer (1878), Richter (1888), Gattermann (1895), van't Hoff–Werner–Eiloart (1898), Meyer–Jacobson (1902), Schmidt–Rule (1926), Karrer (1928), Freudenberg (1933), Richter–Anschütz (1935), and Gilman (1938). These texts provide an opportunity to comment on the relationship between the history of organic chemistry and its associated publications. The *Treatise on Chemistry* by Roscoe and Schorlemmer consisted of three volumes (5343 pages) published in nine parts over the period 1878–1892: the major component was Volume III (6 parts, 3516 pages) which was devoted to organic chemistry. Another instructive example is the important work *Lehrbuch der Organischen Chemie*, produced by Victor Meyer and Paul Jacobson. The increase in size from the edition (1735 pages) published during 1902–1903 to the edition (5115 pages) published over the period 1913–1924 is striking.

Many have expressed concern about the problems of maintaining effective contact with the expanding literature of organic chemistry, but few have allowed themselves to become involved with attempted solutions. The decision to publish Comprehensive Organic Chemistry was not taken lightly. The absence of a work reflecting the current rapid development of modern organic chemistry has been lamented by many eminent chemists, including the late Sir Robert Robinson (1886–1975) who played an important role in the initiation of this project shortly before his death. Comprehensive Organic Chemistry was conceived, designed, and produced in order to meet this deficiency. We realised that the current rate of growth of organic chemistry demanded speedy publication and, furthermore, that its interaction with other subjects including biochemistry, inorganic chemistry, molecular biology, medicinal chemistry, and pharmacology required the collaboration of many authors. The selection of topics to be included in order to justify the work as being comprehensive has not been easy. We recognize that some areas of organic chemistry have not been given the detailed treatment which can be justified, but we have done our best to meet the expectations of the majority of readers. In particular, we have not made a special section for Theoretical Organic Chemistry. This is not because of any lack of appreciation on our part of the importance of Theory. It is because a correct treatment of Theory cannot be made comprehensible in an abbreviated form. It is also because Theory changes with time more rapidly than the facts of the subject. Theory is better treated in our view in specialist monographs. The same arguments apply equally to the fundamental subject of Stereochemistry. Any comments regarding errors and omissions will be appreciated so that they can be dealt with in future editions.

The contents of each volume have been brought together so as to reflect what are judged to be the truly important facets of modern organic chemistry. The information is presented in a concise and logical manner with mechanistic organic chemistry being adopted to provide a constant and correlative theme. The dominating intention of the Editorial Board has been to ensure the publication of a contribution to the literature of

organic chemistry which will be genuinely useful and stimulating. Emphasis has therefore been given throughout to the properties and reactions of all the important classes of organic compounds, including the remarkable array of different compounds prepared by synthesis as well as natural products created by biosynthesis. Of course, the study of natural products provided the original foundation stones on which modern synthetic organic chemistry now firmly stands.

As a major presentation of modern organic chemistry, Comprehensive Organic Chemistry will be doubly useful because we have provided, in a separate volume, an extensive index. Not only have the contents of the work been indexed in the ordinary way, but we have also added a substantial number of additional references from the original literature. These do not appear in the text itself. Thus, the reader who wishes to obtain additional information about reactions and reagents mentioned in the text will quickly be able to consult the original literature. The Index volume has been prepared by a team from Pergamon Press.

Our debt to the Authors and to the Volume Editors is considerable. We are very grateful to all our colleagues for the efficient way in which they have tried to meet the challenges (and the deadlines!) which have been presented to them. We hope that the Authors have enjoyed their association with this venture. In a lighter vein, we also trust that their feelings are different from the statement 'this task put system into my soul but not much money into my purse' attributed to Henry Edward Armstrong (1848–1937) after he had written his *Introduction to Organic Chemistry* in 1874.

We are delighted to acknowledge the masterly way in which Robert Maxwell, the Publisher, and the staff at Pergamon Press have supported the Volume Editors and the Authors in our endeavour to produce a work which correctly portrays the relevance and achievements of organic chemists and their contributions to knowledge by research.

D. H. R. Barton
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Preface to Volume 5

"History is not just a catalogue of events put in the right order like a railway timetable. History is a version of events. Between the events and the historian there is a constant interplay. The historian tries to impose on events some kind of a rational pattern: how they happened and even why they happened".

A. J. P. Taylor, *Essays in English History.*

So it is that citric acid (von Scheele, 1784), quinic acid (Hofmann, 1790), morphine (Seturner, 1805), glycine (von Braconnet, 1820), geraniol (Jacobsen, 1871), peltogynol (Robinson, 1935), cephalosporin C (Abraham, 1955), and mevalolactone (Folkers, 1956) is not merely a record of the discovery and isolation of particular organic compounds from natural sources arranged in the right chronological order, but in a different context it portrays a constant theme and influence on the way, over the past two centuries, organic chemistry has developed as a scientific discipline. The investigations of the chemistry of natural products have not only been an essential element in man's endeavours to unravel the mysteries of the living world, but at the same time these studies have constantly refreshed and enriched the very fabric of organic chemistry itself, imparting new ideas and stimulating new directions in which the subject may grow. The strength of organic chemistry lies in its rich diversity. For those for whom it is above all an enabling science, to be used rather than admired for its own intrinsic elegance, the greatest excitements derive from looking outside its conventional boundaries. For many these interests take them within the compass of biology, where a multitude of properties and problems await an explanation and description at the molecular level. It is entirely appropriate therefore that a volume devoted to the organic chemistry of biological compounds should be included in the series Comprehensive Organic Chemistry.

Despite the series' collective title, Volume 5 is not primarily intended to be a comprehensive text embodying data on the structure and chemistry of all natural products as they are known. Rather its intention is to present, with sufficient background information and perspective, topics of major interest and importance in contemporary biological organic chemistry and so to give the reader some of the style and flavour of current developments in these areas of research. It is clear that within the past two decades new horizons have appeared in the study of natural products which strengthen its kinship and its ties to biochemistry. Increasingly, attention is drawn to the fundamental relationships which are seen to exist between structure, the keystone of organic chemistry, and biological function.

The present text sets out to reflect these ideas and relationships. In so far that we may have succeeded in this task the volume editor's thanks are due almost entirely to the many contributors not only for the chapters which they have composed but also for their helpful ideas and suggestions to improve the format and content of the volume. No less significantly, deadlines were met and friendships preserved.

The editors's thanks are also due to the other members of the editorial board for their comments and criticisms and to Dr. Colin Drayton of Pergamon Press for his considerable help and advice during the production of this text.

Sheffield

E. Haslam

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Contents of Other Volumes

Volume 1

Part 1 Nomenclature and Stereochemistry
Part 2 Hydrocarbons
Part 3 Halo Compounds
Part 4 Alcohols, Phenols, Ethers, and Related Compounds
Part 5 Aldehydes and Ketones

Volume 2

Part 6 Amines and Related Compounds
Part 7 Nitro and Nitroso Compounds
Part 8 Imines, Nitrones, Nitriles, and Isocyanides
Part 9 Carboxylic Acids and Related Compounds
Part 10 Phosphorus Compounds

Volume 3

Part 11 Organic Sulphur Compounds
Part 12 Organic Selenium and Tellurium Compounds
Part 13 Organic Silicon Compounds
Part 14 Organic Boron Compounds
Part 15 Organometallic Compounds

Volume 4

Part 16 Nitrogen Systems: The Azines
Part 17 Nitrogen Systems: The Azoles and Other Systems
Part 18 Oxygen Systems
Part 19 Sulphur and Other Heteroatom Systems
Part 20 Mixed Heteroatom Systems

Volume 6

Author Index
Formula Index
Subject Index
Reagent Index
Reaction Index

Contents

Part 21 Biological Chemistry: Introduction 1

21.1 Biological Chemistry: Introduction 3
E. HASLAM, *University of Sheffield*

Part 22 Nucleic Acids 21

22.1 Introduction 23
G. M. BLACKBURN, *University of Sheffield*

22.2 Nucleosides 53
R. T. WALKER, *University of Birmingham*

22.3 Nucleotides and Related Organic Phosphates 105
D. W. HUTCHINSON, *University of Warwick*

22.4 Nucleic acids: Structure Determination and Synthesis 147
G. M. BLACKBURN, *University of Sheffield*

22.5 Nucleic acids: Structure and Function 163
G. M. BLACKBURN, *University of Sheffield*

Part 23 Proteins: Amino-acids and Peptides 177

23.1 Introduction 179
E. HASLAM, *University of Sheffield*

23.2 Amino-acids Found in Proteins 187
P. M. HARDY, *University of Exeter*

23.3 Peptides and the Primary Structure of Proteins 215
D. T. ELMORE, *The Queen's University of Belfast*

23.4 Naturally Occurring Low Molecular Weight Peptides 241
B. W. BYCROFT, *University of Nottingham*

23.5 β-Lactam Antibiotics 289
G. LOWE, *University of Oxford*

23.6 Peptide Synthesis 321
R. C. SHEPPARD, *M.R.C. Laboratory of Molecular Biology, Cambridge*

23.7 Conformations of Polypeptides 367
G. C. BARRETT, *Oxford Polytechnic*

Part 24 Proteins: Enzyme Catalysis and Functional Proteins 387

24.1 Enzyme Catalysis 389
A. J. KIRBY, *University of Cambridge*

24.2 Chemistry of Other Proteins 461
D. T. ELMORE, *The Queen's University of Belfast*

24.3 Coenzymes 489
H. C. S. WOOD, *University of Strathclyde*

24.4 Vitamin B_{12} 549
B. T. GOLDING, *University of Warwick*

Part 25 Lipid Chemistry and Biochemistry 585

25.1 Fatty Acids 587
F. D. GUNSTONE, *University of St. Andrews*

25.2 Lipids 633
F. D. GUNSTONE, *University of St. Andrews*

25.3 Membranes and Lipoproteins 665
P. F. KNOWLES, *University of Leeds*

Part 26 Carbohydrate Chemistry 685

26.1 Monosaccharide Chemistry 687
L. HOUGH and A. C. RICHARDSON, *Queen Elizabeth College, University of London*

26.2 Oligosaccharide Chemistry 749
L. HOUGH and A. C. RICHARDSON, *Queen Elizabeth College, University of London*

26.3 Polysaccharides 755
J. F. KENNEDY, *University of Birmingham* and C. A. WHITE, *Lea Castle Hospital, Kidderminster*

26.4 Polysaccharides: Conformational Properties in Solution 817
D. A. REES, *Unilever Research, Bedford*

Part 27 Synthesis of Organic Macromolecules and their Uses in Organic Chemistry 831

27 Synthesis of Organic Macromolecules and their Uses in Organic Chemistry 833
P. HODGE, *University of Lancaster*

Part 28 Bio-organic Chemistry **867**

28.1 Biosynthesis 869
R. THOMAS, *University of Surrey*

28.2 Photosynthesis, Nitrogen Fixation, and Intermediary Metabolism 915
E. HASLAM, *University of Sheffield*

Part 29 Biosynthetic Pathways from Acetate **925**

29.1 Polyketide Biosynthesis 927
J. D. BU'LOCK, *University of Manchester*

29.2 Terpenoid Biosynthesis 989
J. R. HANSON, *University of Sussex*

29.3 Carotenoid Biosynthesis and Vitamin A 1025
G. BRITTON, *University of Liverpool*

Part 30 Biosynthesis: A General Survey **1043**

30.1 Alkaloid Biosynthesis 1045
R. B. HERBERT, *University of Leeds*

30.2 Porphyrin, Chlorophyll, and Corrin Biosynthesis 1121
M. AKHTAR and P. M. JORDAN, *University of Southampton*

30.3 Shikimic Acid Metabolites 1167
E. HASLAM

Contents of Other Volumes

Volume 1

Part 1 Nomenclature and Stereochemistry
Part 2 Hydrocarbons
Part 3 Halo Compounds
Part 4 Alcohols, Phenols, Ethers, and Related Compounds
Part 5 Aldehydes and Ketones

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Part 18 Oxygen Systems
Part 19 Sulphur and Other Heteroatom Systems
Part 20 Mixed Heteroatom Systems

Volume 6

Author Index
Formula Index
Subject Index
Reagent Index
Reaction Index

PART 21

BIOLOGICAL CHEMISTRY: INTRODUCTION