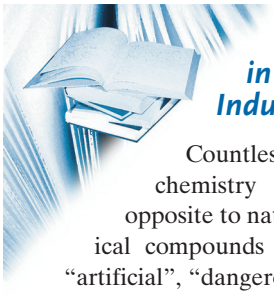


Natural Products in the Chemical Industry

Countless people probably regard chemistry as being diametrically opposite to nature, and associate chemical compounds with attributes such as "artificial", "dangerous", and "toxic". Bernd Schaefer, research director of BASF and an associate professor at Heidelberg University, illustrates with his book Natural Products in the Chemical Industry that such opinions defy reality. In fact, nature has always been the biggest driving force behind innovation in chemistry. Natural products and compounds derived from or inspired by them are helping humankind to overcome numerous global challenges. For instance, almost half of our drugs and a considerable number of agrochemical products are based on natural products!

The book is a slightly updated English translation of a textbook that was first published in German in 2007. The intended readership comprises non-specialists, students, and post-graduate students, and therefore this work does not just convey basic information, but also provides a collection of anecdotes. Unlike other textbooks on similar topics, it is not organized in terms of the structural classes of natural products or according to biosynthetic pathways, but rather by the fields of application. Since an extensive treatment of all natural products would go far beyond the scope of such a textbook, only a selected few are presented as examples for each topic. The selection is well chosen. Many of the great success stories are covered in detail, thus giving the reader a fair overview of industrial applications of natural products and their importance for human civilization.

In a short introduction, the author describes the motivations for industrial chemistry, and explains the importance of cost-efficient total syntheses. It is emphasized that the costs of substrates and the amount of waste need to be minimized for the sake of sustainability. This view is in contrast to the trend in academia, where elegant syntheses are often combinations of particular sophisticated reactions or novel types of reaction mechanisms.

The second chapter deals with colorants such as indigo, Tyrian purple, and alizarin. For all the compounds, the author gives a comprehensive survey covering aspects such as the history of their use, structure determination, and recent developments in synthesis.

Chapter 3, on flavors and fragrances, deals with damascene, ionone, jasmonoids, menthol, vanillin, muscone, and ambrox. Industrial syntheses are nicely contrasted to the biosynthesis of the compounds.

Common amino acids, the subject of Chapter 4, are not usually considered as an important part of a textbook on natural products. However, they are among the most important products of the chemical industry. As a striking example, the author describes in detail the invention of the Haber–Bosch nitrogen fixation process and its impact on the chemical industry. Other industrially important syntheses of amino acids are also discussed.

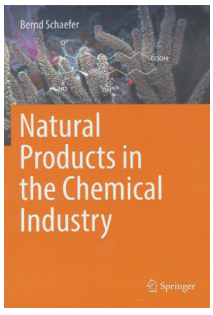
The extensive section on pharmaceuticals covers ACE inhibitors, β-lactam antibiotics, opiates, tetrahydrocannabinol, caffeine, non-steroidal anti-inflammatory drugs, prostaglandins, tetrahydrolipstatins, as well as artemisinin, taxol, statins, and nicotine. Compared to the German version of the book, the latter four sections have been newly added. As these topics are important current examples of natural products that have ultimately led to novel drugs, their addition makes a lot of sense.

Chapter 6 covers hormones, including steroidal contraceptives, thyroxin, and adrenaline, while Chapter 7 describes several important vitamins. As well as detailed descriptions of the production routes, these chapters also contain valuable information about the physiology and biochemistry of the respective compounds.

The last chapter, dealing with agrochemicals, has sections on amino acid herbicides, strobilurins, pyrethroids, neonicotinoids (newly added in the English translation), and pheromones. In describing the discovery and development of the beta-methoxy fungicides, special emphasis is given to the neck-and-neck race that occurred between BASF, developing the strobilurins, and Zeneca, starting from the oudemansins. The evaluation of these fungal metabolites has resulted in the most important innovation in crop protection in the past few decades.

The numerous schemes for the chemical syntheses were gathered from the primary literature, from patents, and from personal communications. Although a solid understanding of reaction mechanisms in organic synthesis and of the basics of pharmaceutical chemistry will be useful, undergraduate and post-graduate students of chemistry and pharmacy, and even scientists of other, related, fields can also use this book to find their way into this fascinating area of research.

Plenty of illustrations and historical background are provided in addition to the scientific information, which certainly improves the readability, even though some of the pages appear a bit crowded. Nevertheless, the use of color helps the reader to grasp essential information and, for example, to pursue important partial structures in reaction schemes.



Natural Products in the Chemical Industry
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Despite the wealth of information provided, this book is certainly not meant to be comprehensive, but instead is a rather selective collection of highlights seen from the author's perspective as a chemist. Some blockbuster drugs and agrochemicals based on natural products, for example, spinosyn and important immuno-modulatory agents such as cyclosporin and rapamycin, are not even included. Also absent are caspofungin and other "modern" anti-mycotics, the anti-parasitics avermectin and emodepside, or antibacterial antibiotics such as the macrolides, mutilins, and daptomycin. Strikingly, most of these compounds are still being produced by biotechnological processes that require little (if any) chemical modification, so they might not be attractive enough for a chemist to include. These compounds should perhaps be included in the next edition, or even covered by a second volume, because of their importance.

In summary, this book is highly recommended, and the translation from German was certainly timely, as we are not aware of a similar textbook in English. We are sure that this book will have a strong impact, considering on the one hand the revival of interest in natural products in the age of multi-resistant human and plant pathogens, and on the other hand the emphasis on bio-economy in various areas of life sciences and biotechnology.

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