

**A Programmed Study**

# **INTRODUCTORY STEREOCHEMISTRY**

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### About this textbook

“Introductory Stereochemistry (A Programmed Approach)” was originally written in Japanese and was published in 1980 as one of the Programmed Approach series published by Kodansha Scientific. Rather surprisingly, this small textbook has gone through fifteen printings, and the newest printing was made in the summer of 2005. Clearly, this book has been accepted as one of the best textbooks in Japan for introductory stereochemistry.



The original version consists in thirteen chapters. Chapters 1~6 are the basic part while the rest is a little advanced.

When (it was around 2000) Prof. Masato M. Ito (Soka University), the late Prof. Hiroshi Yoshida (Hiroshima University) and I discussed our plan to develop a project, under the banner of IUPAC Committee on Chemistry Education (CCE), by which we could distribute, for free, good chemistry textbooks *via* the web site of IUPAC CCE, we chose this book as the initial attempt for several reasons.

One reason is that the problem of copyright could be solved. The publisher, Kodansha Scientific, was kind enough to allow us to translate and distribute the book free if the translated book should be used only for educational purposes.

The other reason is the style of the book. We expected that the potential readers of the book distributed *via* the Internet would use the book for self-study. The programmed approach would be most suitable for self-study.

It must be added that we did change the scope of the book to some extent. In the printed form, the readers of the book would mostly be students who were learning stereochemistry, or at least organic chemistry at colleges/universities, and they would use the book as supplementary readings. We thought that we should widen the scope of the book to wider range of readers including those who are not chemistry major. We thought we might include citizens as well as potential readers.

With this in mind, we decided to translate and distribute only first half of the book, *i.e.*, from Ch. 1 to Ch. 6 that is the basic part of stereochemistry. We prepared the Internet version in two styles. One is the www (or html) version that strengthens the drill-book feature of the Programmed Approach. The other style is made in the text-book style in pdf files. In fact the second style is the literal translation of the original Japanese book. Those readers who have already some background may find the www version more practical. Those readers who feel like to study step by step may better choose the text-book version.

The text-book (pdf) version is slightly different from the www version in that the former has Ch. 7 which is essentially Ch.9 of the original book. The reason for this inclusion is given in the

next section, “*Why stereochemistry?*” Furthermore, some examples of chirality of axis and chirality of plane in Ch. 7 of the original book was included in Ch. 5 of the text-book version.

### **Why stereochemistry?**

Stereochemistry is a basic part of the physical and biological sciences and thus one of the most important fields of chemistry, so it is quite reasonable to expect all students of chemistry to understand at least its fundamentals. In fact, the author would contend that stereochemistry should be an essential part of the scientific knowledge expected of all citizens, to be basic to the framework of their scientific literacy.

The author well understand that many oppose that idea, for example, those who would say “Stereochemistry is not an appropriate part of scientific literacy because it is an advanced subject and thus would require a great deal of background information in order to understand it properly. Far better to restrict stereochemistry to scientists.”

But the author contend that the need for background information in order to understand stereochemistry, nay, even to appreciate it, is minimal. Yes, it would be easier for you to understand stereochemistry if you knew the names of many compounds, many reagents, and the mechanisms of many reactions, but these are not essential.

Suppose you are going to learn a new card game. What you have to do is to learn a few rules and to have some experience playing the game. No background information is usually required. That is why card games are enjoyed by everyone regardless of previous experiences. To understand basic stereochemistry also requires you only to master just a few rules such as the sequence rule and various methods for drawing molecules, as you shall soon learn.

Mind you, that does not mean that the author recommend stereochemistry for all citizens because it is easy to understand! Definitely not! However, the author believe that stereochemistry is the best subject through which citizens can appreciate the most important, and often least appreciated aspect of chemistry, that it is a significant intellectual activity of humanity. This aspect, unfortunately, tends to be hidden amidst the piles of compounds and reactions one learns. Stereochemistry is relatively independent of all these complexities.

Emphasizing the intellectual aspect of chemistry will gain for chemistry both attention and support from society, and stereochemistry strikes me to be just right to play that role. It clearly demonstrates that the microscopic structure of molecules governs the macroscopic properties of materials that contain them.

For example, there is only a slight difference in the microscopic structure of  $\alpha$ -D(+)-glucose and that of  $\beta$ -D(+)-glucose: the only difference is the direction of one hydroxy group, the remaining structures of the molecules are identical. Nevertheless polymerization will produce starch with the one and cellulose with the other. What a difference! You can eat starch but you cannot eat cellulose! Starch is granular but cellulose is fibrous. Their macroscopic natures exactly coincide with their microscopic structures.

This story will be the last topic of the textbook! The author mention it here because it is a fascinating example of the understanding of nature that stereochemistry can provide to citizens, the reason why the author recommend basic stereochemistry as a part of scientific literacy for everyone.

## **Acknowledgement**

Finally the author wishes to express his sincere thanks to Prof. M. M. Ito for his tremendous efforts from the beginning of this project. Without his initiative and action, this project could never be realized. Thanks are also due to the late Prof. H. Yoshida who put the project splendid ideas at the initial stage. It is indeed a great pity and a great loss that he passed away so early.

The author greatly appreciate the corporation by Professor Emeritus Edward E. Daub who kindly took responsibility to read the English manuscript and gave many valuable changes—additions and deletions—to make the English of the book to an acceptable level.

Finally the author likes to extend his thanks to Kodansha Scientific and Mr. S. Sawada, the editor. The publisher generously allowed the translation and free distribution of the book and Mr. Sawada organized this delicate business very skillfully.

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