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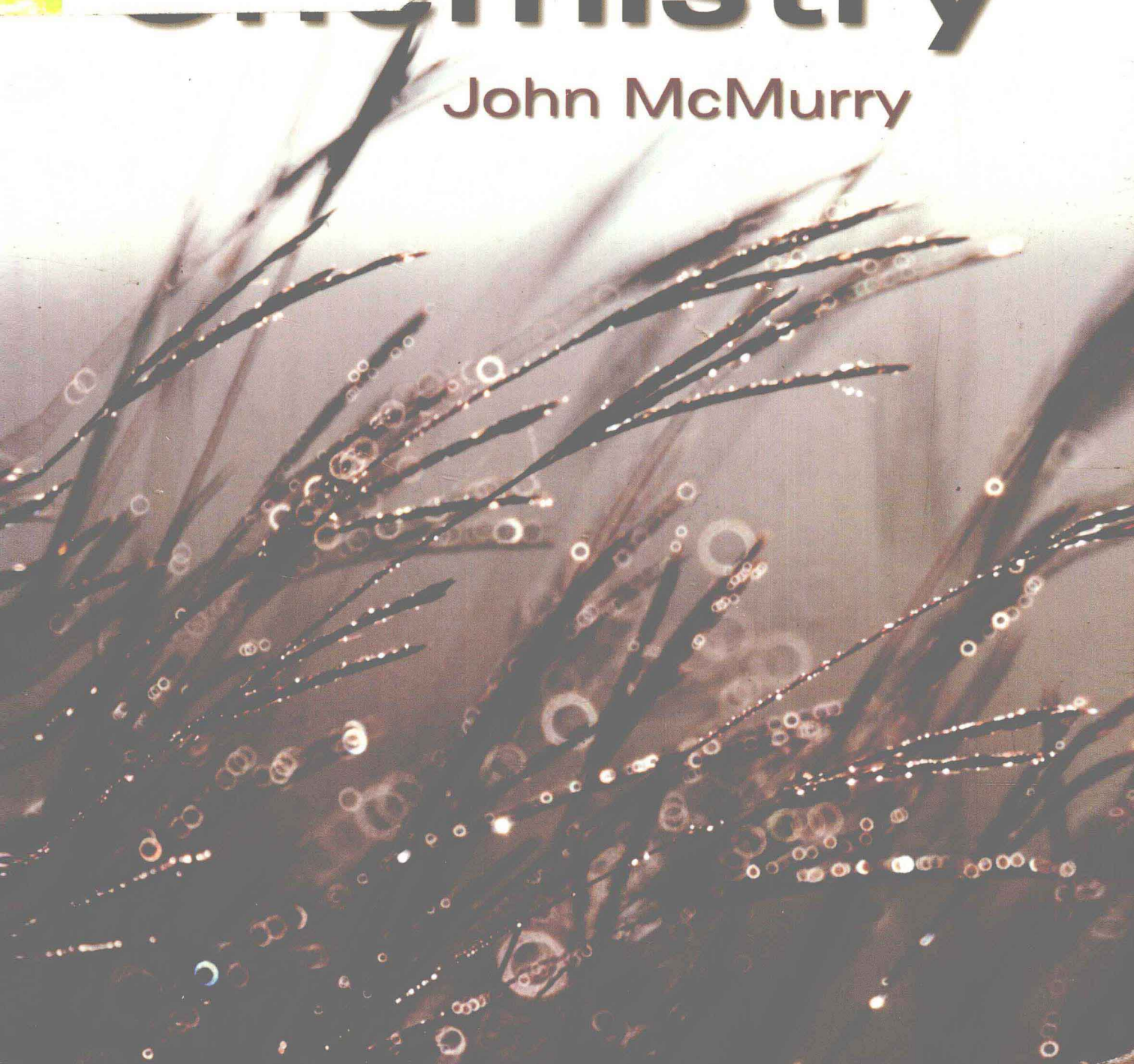
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fifth edition

chemistry

John McMurry



Fundamentals of Organic Chemistry

Fifth Edition

John McMurry
Cornell University

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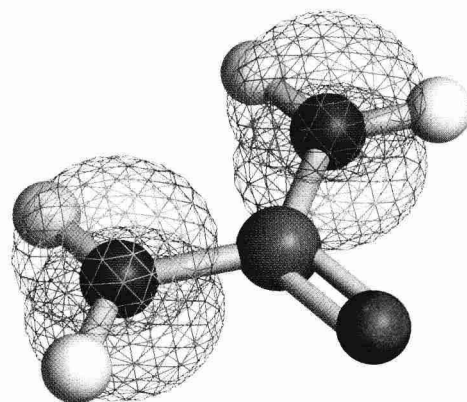
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Fundamentals of Organic Chemistry



Preface

I wrote this book for the simple reason that I love writing. I get great satisfaction from taking a complicated subject, turning it around until I see it from a new angle, and then explaining it in simple words. I write to explain chemistry to students today the way I wish it had been explained to me years ago.

The enthusiastic response to the four previous editions has been very gratifying and suggests that this book has served students well. I hope you will find that this fifth edition of *Fundamentals of Organic Chemistry* builds on the strengths of the first four and serves students even better. I have made every effort to make this fifth edition as effective, clear, and readable as possible; to show the beauty and logic of organic chemistry; and to make the subject interesting to learn.

Organization and Teaching Strategies

The primary organization of this book is by functional group, beginning with the simple (alkenes) and progressing to the more complex. Within this primary organization, however, there is also an emphasis on explaining the fundamental mechanistic similarities of reactions. This emphasis is particularly evident in the chapters on carbonyl-group chemistry (Chapters 9–11), where mechanistically related reactions like the aldol and Claisen condensations are covered together. By the time students reach this material, they have seen all the common mechanisms and the value of mechanisms as an organizing principle has become more evident.

Reaction Mechanisms

In the first edition, I introduced an innovative format for explaining reaction mechanisms in which the reaction steps are printed vertically while the changes taking place in each step are explained next to the reaction arrow. This format allows the reader to see easily what is occurring at each step in a reaction without having to jump back and forth between structures and text. The number of vertical mechanisms is increased in this edition, and molecular models have even been added on occasion. Page 284 shows an example.

Basic Learning Aids

Clarity of explanation and smoothness of information flow are crucial requirements for a textbook. In writing and revising this text, I consistently

aim for summary sentences at the beginning of paragraphs, lucid explanations, and smooth transitions between paragraphs and between topics. New concepts are introduced only when they are needed, not before, and are immediately illustrated with concrete examples. Frequent cross-references to earlier material are given, and numerous summaries are provided to draw information together, both within chapters and at the ends of chapters. In addition, the back of this book contains a wealth of material helpful for learning organic chemistry, including a large glossary, an explanation of how to name polyfunctional organic compounds, and answers to most in-text problems. For still further aid, an accompanying *Study Guide and Solutions Manual* gives complete solutions to all problems, summaries of reaction mechanisms and of methods for preparing functional groups, a list of named reactions with examples, and a list of the uses of important reagents.

Changes and Additions for the Fifth Edition

The primary reason for preparing a new edition is to keep the book up-to-date, both in its scientific coverage and in its pedagogy. My overall aim has been to retain and refine the features that made earlier editions so successful, while adding new ones.

- The writing has again been revised at the sentence level, streamlining the presentation, improving explanations, and updating a thousand small details. Particularly important is that the book has been given an increased focus on biologically related chemistry. Some reactions that are less relevant for biology have been shortened or deleted (alkane halogenation, Grignard carboxylation, and the Sandmeyer reaction, for instance), and a few more relevant ones have been added (the conjugate nucleophilic addition reaction in Section 9.10 and reductive amination in Section 12.4, for instance). Other changes include a return to the “steering-wheel” method of assigning *R,S* configuration to stereocenters in Section 6.6.
- The artwork has been completely redone, and several hundred new computer-generated molecular models have been added. Figures frequently present structures in several different formats, side by side, so that students learn structures thoroughly and become used to the various ways in which chemists graphically represent their work. Look at pages 19, 44, and 60 to see some examples.

Particularly useful are the approximately 100 electrostatic potential maps, which use color to show calculated regions of positive and negative charge within a molecule, thereby making it possible to visualize the electrophilic/nucleophilic character of atoms in various functional groups. So important are these maps that they are even included in mechanism presentations (see pages 222 and 284), in biological chemistry (see page 522), and in Problems (see pages 89 and 401).

- Biologically related chemistry is emphasized more heavily in this new edition than in the past. Whenever possible, biological examples are given, and every attempt is made to emphasize the enormous impor-

tance of organic chemistry in understanding the reactions that occur in living organisms. Among the topics added are biological alkene additions (Section 4.8), conjugate nucleophilic addition reactions such as occur in fatty acid metabolism (Section 9.10), biological carbonyl reactions (Section 11.11), alkaloids (Section 12.7), and reductive aminations such as occur in amino acid metabolism (Section 12.4).

Biomolecules have also received particular attention in this edition to ensure that coverage is up-to-date. Section 14.11, for instance, contains new material on carbohydrate-based vaccines, and Section 15.11 contains a new section on the mechanism of enzyme action, using citrate synthase as the example. In addition, all the material on nucleic acids has been updated, with special treatment of the latest DNA sequencing technology (Section 16.13).

- Interlude boxes at the end of each chapter present interesting applications of organic chemistry relevant to the main chapter subject. Including topics from science, medicine, and day-to-day life, these applications enliven and reinforce the material presented in each chapter. New subjects include Terpenes (Chapter 3), Vitamin C (Chapter 10), β -Lactam Antibiotics (Chapter 11), and DNA Fingerprinting (Chapter 16).
- The problems within and at the end of each chapter have been reworked, and many are new. The *Visualizing Chemistry* problems, in which substances are shown as molecular models rather than as typical line structures, have received particular attention and are now included within as well as at the ends of chapters. These questions can be a good deal more challenging than they initially appear, and they provide excellent practice for thinking about chemistry on the atomic level. See pages 99 and 205 for examples.
- Practice Problems have been rewritten to make them more useful. Practice Problems now begin with a *Strategy* discussion that focuses on general approaches to problem solving and on the thought processes used for finding solutions. See pages 108 and 190 for examples.

A Complete Ancillary Package

For Instructors

Transparency Acetates (0-534-39577-5) One hundred twenty-three transparencies, chosen by author John McMurry and featuring important text illustrations, enlarged for use in the classroom and lecture halls.

Printed Test Bank (0-534-39575-9) By Tammy Tiner, Texas A & M University. The printed test bank features approximately 30 short answer question per chapter (500 total).

ExamView Computerized Testing (0-534-39576-7) Create, deliver, and customize tests with this computerized testing system.

Multimedia Manager: A Microsoft® PowerPoint® Link Tool (0-534-39005-6) This digital library and presentation tool consists of text

art, photos, and tables from McMurry's *Organic Chemistry*, fifth edition, and *Fundamentals of Organic Chemistry*, fifth edition.

MyCourse 2.0 A simple, free solution for a custom course Web site that allows you to assign, track, and report on student progress; load your syllabus; and more. A demo of MyCourse 2.0 is available at <http://mycourse.thomsonlearning.com>.

The Brooks/Cole Chemistry Resource Center This site features everything from online quizzing to an array of instructor resources to useful study aids. <http://www.brookscole.com/chemistry>

For Students

Study Guide/Student Solutions Manual (0-534-39574-0) By Susan McMurry. The Study Guide and Solutions Manual contains answers to all of the problems in the text.

Interactive Organic Chemistry CD-ROM (with Workbook) (0-03-033481-0) By William J. Vining, University of Massachusetts. This dual-platform CD-ROM includes six interactive multimedia modules: Nomenclature, Mechanisms, Spectroscopy, Reactivity Explorer, Supporting Concepts, and Multi-Step Synthesis.

Pushing Electrons: A Guide for Students of Organic Chemistry, Third Edition (0-03-020693-6) By Daniel P. Weeks, retired, Northwestern University. The brief text teaches a skill essential to learning organic chemistry. By working through the program, students learn to push electrons to generate resonance structures and write organic mechanisms.

Practical Spectroscopy: The Rapid Interpretation of Spectral Data (0-534-37230-9) By Paul Young, University of Illinois, Chicago. This workbook contains proton and carbon NMR, infrared, and mass spectra for 100 organic molecules along with expanded tutorial sections to aid undergraduate students in analysis.

The Brooks/Cole Chemistry Resource Center This site features everything from online quizzing to useful study aids. <http://www.brookscole.com/chemistry>

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Thanks are also due to those professors who provided feedback on surveys regarding the prior edition of this text.

A Note for Students

We have the same goals. Yours is to learn organic chemistry; mine is to help you learn. I've done the best I can with my part, and now it's going to take some work from you. The following suggestions should prove helpful.

- Don't read the text immediately. As you begin each new chapter, look it over first. Read the introductory paragraphs, find out what topics will be covered, and then read the summary at the end of the chapter. You'll be in a much better position to learn the material if you know where you're going.
- Work the problems. There are no shortcuts; working problems is the only way to learn organic chemistry. The Practice Problems show you how to approach the material, the in-text problems at the ends of most sections provide immediate practice, and the end-of-chapter problems provide both additional drill as well as some real challenges. Pay particular attention to the Visualization Problems, which can help you begin to "see" molecules rather than think of them as vague abstractions. Short answers to in-text problems are given at the back of the book; full answers and explanations for all problems are given in the accompanying *Study Guide and Solutions Manual*.
- Use the study guide. The *Study Guide and Solutions Manual* that accompanies this text gives complete solutions to all problems as well as a wealth of supplementary material. Included are a summary of how to prepare functional groups, a summary of the reactions that functional groups undergo, a summary of important reagents, a summary of name reactions, and much more. This material can be extremely useful, both as a source of information and as a self-test, particularly when you're studying for an exam. Find out now what's there so you'll know where to go when you need help.
- Ask questions. Faculty members and teaching assistants are there to help you. Most will turn out to be extremely helpful people with a sincere interest in seeing you learn.
- Use molecular models. Organic chemistry is a three-dimensional science. Although this book uses many careful drawings to help you visualize molecules, there's no substitute for building a molecular model and turning it around in your own hands.

Good luck. I sincerely hope you enjoy learning organic chemistry and come to see the beauty and logic of its structure. I heard from many students who used the first four editions of this book and would be glad to receive more comments and suggestions from those who use this new edition.

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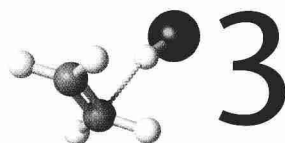
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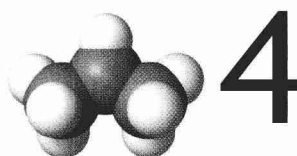
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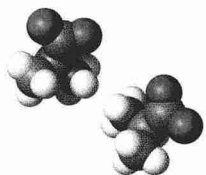
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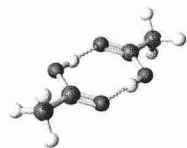
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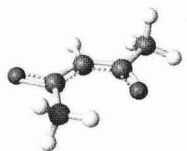
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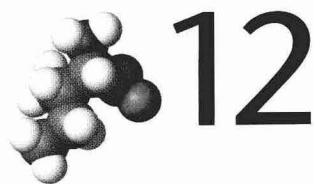
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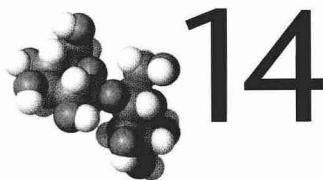
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