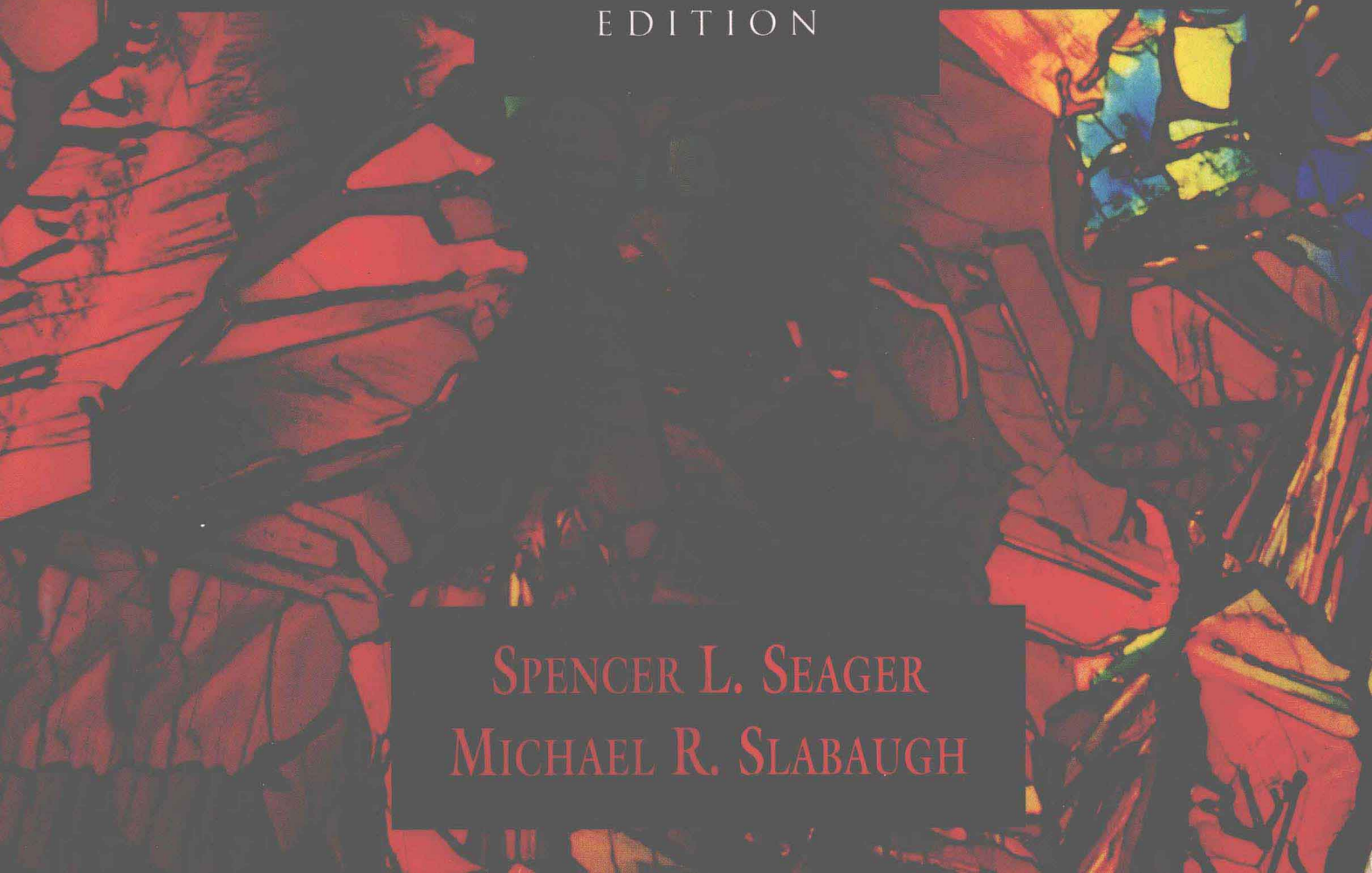
Organic and Biochemistry for Today

THIRD EDITION



Spencer L. Seager
Michael R. Slabaugh

ORGANIC AND BIOCHEMISTRY FOR TODAY

Third Edition

SPENCER L. SEAGER
Weber State University

MICHAEL R. SLABAUGH
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To our students, who have made our teaching and writing activities incredibly satisfying.

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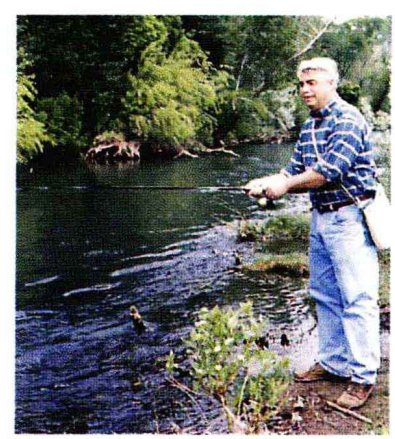
Spencer L. Seager is a professor of chemistry at Weber State University, where he served as chemistry department chairman from 1969 until 1993. He teaches general and physical chemistry at the university and is also active in projects to help improve chemistry and other science education in local elementary schools. He received his B.S. degree in chemistry and Ph.D. degree in physical chemistry from the University of Utah. Other interests include minor home repairs, working in the garden, listening to classical music, and walking for exercise.

MICHAEL R. SLABAUGH



Michael R. Slabaugh is a professor of chemistry at Weber State University, where he teaches the year-long sequence of general, organic, and biochemistry. He received his B.S. degree in chemistry from Purdue University and his Ph.D. degree in organic chemistry from Iowa State University. His interest in plant alkaloids led to a year of postdoctoral study in biochemistry at Texas A&M University. His current professional interests are chemistry education and community involvement in science activities, particularly the State Science and Engineering Fair in Utah. He also enjoys the company of family, hiking in the mountains, and fishing the local streams.

PREFACE

THE IMAGE OF CHEMISTRY

When the first and second editions of this text were published in 1987 and 1994, respectively, we expressed concern about the negative images associated with the words *chemistry* and *chemicals* by our students. Our concern persists as we encounter increasing numbers of students who express genuine fear about working with chemicals in the laboratory portion of the courses we teach. This fear, which goes beyond a healthy respect for chemicals and appropriate cautions when using them, continues to be reinforced by the focus of the mass media on the negative aspects of chemical use in our society. Only rarely are benefits of chemicals and chemistry in our society depicted in news stories. Our hope continues with this edition that those who use this book will gain a more positive understanding and appreciation of the role of chemistry in our lives. We especially desire that this understanding and appreciation be gained by those entering the nursing and other health care professions. Persons served by these professionals expect them to possess knowledge of many topics related to the general health of the body, such as the effects of administered medications, general functions of the body, digestion, waste elimination, and nutrition. When a respected professional provides a description of such processes in terms of their chemical nature with the accompanying involvement of chemicals, some of the fear of chemistry and chemicals shared by the general public is dispelled.

THEME AND ORGANIZATION

In the second edition we used an emphasis on the positive and useful contributions of chemistry in our world as a theme. Keeping with that theme in this edition, we continue the chapter opening focus on health care professionals introduced in the second edition. This focus takes the same form it did in the second edition—a photo of a health care professional at work and a brief description of how chemistry is important in his or her work. An extension to each chapter opening discussion has been added in the form of a Web site where a wealth of career information can be obtained about the featured profession. Available information includes wages, work setting, required skills, and the current employment outlook.

This text is designed for use in a one-semester or two-quarter course of study that provides an introduction to organic chemistry and biochemistry. It is assumed that students who take the course have a background in general chemistry at least equivalent to that obtained by completing a one-term course of introductory general chemistry. Most of these students are majors in nursing, other health professions, or the life sciences. These students consider biochem-

istry to be the most important and relevant part of the course of study. However, biochemistry cannot be understood without a sound background in organic chemistry, and an understanding of organic chemistry depends on a sound foundation of general chemistry. We attempt to present organic chemistry in sufficient depth and breadth to make biochemistry understandable.

We used experience from our combined 55-plus years of teaching as well as input from numerous reviewers and adopters of the text to guide us in making the necessary decisions about what to include and what to omit. We used this same experience and input to decide what learning aids to include. We think of a textbook as a personal tutor that is available for student use at any time. In this role, it must be more than just a collection of facts, data, and exercises.

NEW TO THIS EDITION

The publication of a third edition of this text was motivated by the positive reception of the second edition by our own students and by the students of other adopters, and by our continuing desire to provide a student-oriented textbook for use in programs of study that incorporate all or part of the introductory chemistry sequence of organic chemistry, and biochemistry.

Our teaching experience with the second edition, together with input we received from our own students, from reviewers, and from other chemistry teachers who have used the text, prompted us to make some significant changes in this third edition while retaining many positive features of the second edition. More than 15 Chemistry Around Us boxes of the 2nd edition have been replaced with new boxes that emphasize health-related topics. Most of the drill-type exercises in chapters 1–6 were put into matching pairs, with one member of the pair answered in Appendix B and the other member left unanswered to give teachers more flexibility in assigning exercises.

A Study Skill feature introduced in the second edition proved to be very popular with students. In this feature we attempt to help improve the understanding and mastery of especially challenging ideas or concepts by providing study suggestions, analogies, or specific approaches that we have found to be effective with our students. One Study Skill that is designed to help students remember and master organic and biochemical reactions is the reaction-mapping technique. Two new reaction maps have been added to the third edition, one for alkenes and one for triglycerides.

The number of full-color photographs has been increased slightly in this edition. The practice, introduced in the second edition, of asking questions based on some photos has been continued. As in the second edition, some of these questions are expanded on in Points to Ponder and Pursue questions that follow the end-of-chapter exercises.

A new and significant feature of this edition is the periodic reference to Web sites where students can further explore specific topics. Each chapter contains about five of these topics.

FEATURES

Each chapter has features especially designed to help students organize, study effectively, understand, and enjoy the material in the course.

Chapter Opening Photos. Each chapter opens with a photo of one of the many health care professionals that provide us with needed services. These professions represent some of the numerous professions that require an understanding of chemistry.

Chapter Outlines/Learning Objectives. At the beginning of each chapter, a chapter outline provides students with a convenient overview of the topics and concepts they will be studying. At the end of the chapter, they encounter a list

of learning objectives that indicate skills and concepts they should have acquired or mastered from their study of the chapter. Thus, students begin each chapter with a topical preview and end with an indication of what they should have learned from the topics.

Key Terms. Identified within the text by the use of bold type, key terms are defined in the margin near the place where they are introduced. Students reviewing a chapter can quickly identify the important concepts on each page with this marginal glossary. A full glossary of key terms and concepts appears at the end of the text.

Chemistry Around Us. These boxed features present everyday applications of chemistry that emphasize in a real way the important role of chemistry in our lives. A significant number of these are new to this edition and emphasize health-related applications of chemistry.

Key Chemicals. Focusing on specific chemicals that have present or historical significance, these boxed discussions point out the prime role of the chemicals in important chemical developments and current applications.

Examples. To reinforce students in their problem-solving skill development, carefully worked out solutions in numerous examples are included in each chapter. The number of these examples that are based on health-related topics has been increased in this edition.

Learning Checks. Short self-check exercises follow examples and discussions of key or difficult concepts. A complete set of solutions is included in Appendix C. These allow students to immediately measure their understanding and progress. The number of these exercises that are based on health-related topics has also been increased in this edition.

Study Skills. Most chapters contain a Study Skills feature in which a challenging topic, skill, or concept of the chapter is addressed. Study suggestions, analogies, and approaches are provided to help students master these ideas.

How Reactions Occur. The mechanisms of representative organic reactions are presented in four boxed inserts to help students dispel the mystery of how these reactions take place.

Concept Summary. Located at the end of each chapter, this feature provides a concise review to reinforce the major ideas.

Key Terms and Concepts. These are listed at the end of the chapter for easy review.

Key Equations. This boxed feature provides a useful summary of general equations and reactions from the chapter. This feature is particularly helpful to students in the organic chemistry chapters.

Web Sites. This feature allows students to further explore specific topics on the Internet, where a wealth of information on chemical topics and health-related subjects can be found. Each chapter location of this feature is identified with an icon and a description of the information to be found at that site. Specific Internet addresses can be obtained at the home page, where an updated list of these addresses will be maintained: http://www.weber.edu/today text/.

Exercises. More than 900 end-of-chapter exercises are arranged by section. Color-coded for easy identification, approximately half of the exercises are answered in the back of the text. Completely worked out solutions to these answered exercises are included in the Student Study Guide. Solutions and answers to the remaining exercises are provided in the Instructor's Manual. We have included a significant number of clinical and other familiar applications of chemistry in the exercises.

Points to Ponder and Pursue. Included at the end of each chapter are special questions designed to encourage students to expand their reasoning skills. Some of these exercises are based on photographs found in the chapter, others emphasize clinical or other useful applications of chemistry, and a number are based on information found at various Internet sites given in each chapter.

POSSIBLE COURSE OUTLINES

This text may be used effectively in either a one-semester or two-quarter course of study:

One semester: Chapters 1–15 (organic chemistry and biochemistry)

First quarter: Chapters 1–8 (organic chemistry)
Second quarter: Chapters 9–15 (biochemistry)

ANCILLARIES

The following ancillaries have been prepared for use with this text.

Safety-Scale Laboratory Experiments for General, Organic, and Biochemistry, 2nd Edition. Prepared by Spencer L. Seager and Michael R. Slabaugh, this well-tested collection of experiments has been developed during more than 20 years of laboratory instruction with students at Weber State University. This manual provides a blend of training in laboratory skills and experiences illustrating concepts from the authors' textbook. The experiments are designed to use small quantities of chemicals, and emphasize safety and proper disposal of used materials.

Instructor's Guide for Safety-Scale Laboratory Experiments. Prepared by the authors of the laboratory manual, this useful resource gives complete directions for preparing the reagents and other materials used in each experiment. It also contains useful comments concerning the experiments, answers to questions included in the experiments, and suggestions for the proper disposal of used materials.

Study Guide and Solutions Manual. Prepared by Garth L. Welch of Weber State University, each chapter contains a chapter outline, learning objectives, a programmed review of important topics and concepts, detailed solutions to the even-numbered exercises answered in the text, and self-test questions.

Instructor's Manual and Testbank. Prepared by Garth L. Welch of Weber State University, each chapter contains a summary chapter outline, learning objectives, instructors resource materials, solutions to Points to Ponder and Pursue questions, answers and solutions to odd-numbered exercises not answered in the text, and more than 1300 sample exam questions.

Test File. This computerized test-generation system contains all the exam questions from the Instructor's Manual.

Acetate Package. The publisher provides nearly 100 full-color acetates illustrating key figures from the text for use in class.

Current Issues in General, Organic, and Biochemistry, 1997 Edition. This supplement of selected readings is a collection of articles gathered from recent health, general interest, and science magazines. Each article has been carefully chosen to help students gain a more balanced understanding of the important role of chemistry in the allied health fields and in our society. Each article begins with a brief overview and is followed by a few questions to help students focus on the main points discussed in the article.

Software. Software support is available for students and instructors for testing, and tutorial and lab support. Contact the West sales representative for details.

Powerpoint Presentation for General, Organic, and Biochemistry. Prepared by James Hardy, this electronic transparency package provides outlines, full-color graphics, and 33 animations to help students follow what are, in some cases, new or complex topics. Organized into chapters corresponding to the main text, the package contains between 20 and 80 slides per chapter. Examples from the health and medical care fields make this presentation especially relevant to students in nursing and allied health fields. Appropriate chapters contain math sidebars with examples for students' review. An instructor can edit, rearrange, and add slides to the package using Microsoft® Powerpoint version 4.0.

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Spencer L. Seager

Michael R. Slabaugh

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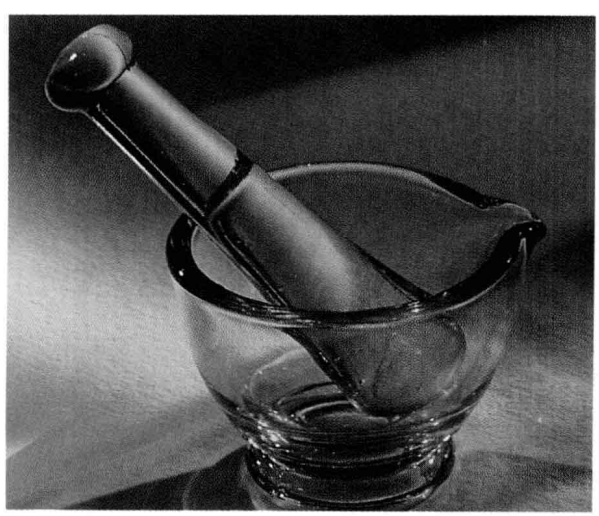

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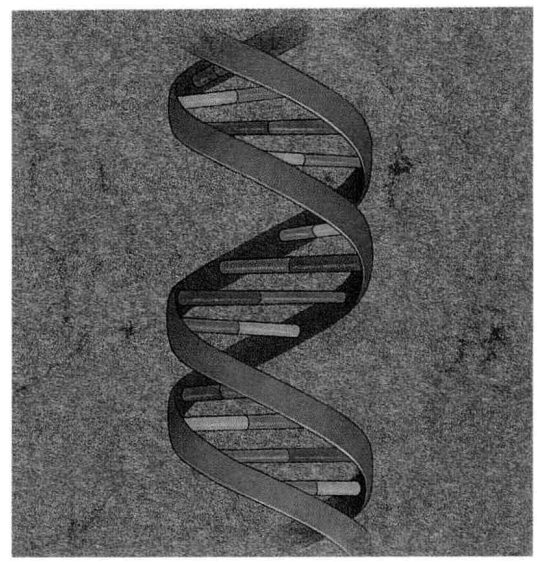

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