

CRC PRESS
PHARMACY
EDUCATION
SERIES

PHARMACY

What It Is and
How It Works

Third Edition

WILLIAM N. KELLY



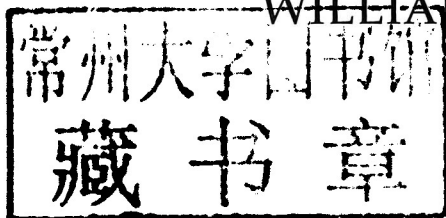
CRC Press
Taylor & Francis Group

PHARMACY

What It Is and How It Works

Third Edition

WILLIAM N. KELLY



CRC Press

Taylor & Francis Group

Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an **Informa** business

CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

© 2012 by Taylor and Francis Group, LLC
CRC Press is an imprint of Taylor & Francis Group, an Informa business

No claim to original U.S. Government works

Printed in the United States of America on acid-free paper
10 9 8 7 6 5 4 3 2 1

International Standard Book Number: 978-1-4398-5305-4 (Hardback)

This book contains information obtained from authentic and highly regarded sources. Reasonable efforts have been made to publish reliable data and information, but the author and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors and publishers have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, please access www.copyright.com (<http://www.copyright.com/>) or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged.

Trademark Notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Library of Congress Cataloging-in-Publication Data

Kelly, William N.
Pharmacy : what it is and how it works / William N. Kelly. -- 3rd ed.
p. ; cm. -- (Pharmacy education series)
Includes bibliographical references and index.
ISBN 978-1-4398-5305-4 (hardcover : alk. paper)
1. Pharmacy. I. Title. II. Series: CRC Press pharmacy education series.
[DNLM: 1. Pharmacy. QV 704]

RS91.K36 2012
615'.1--dc22

2011004409

Visit the Taylor & Francis Web site at
<http://www.taylorandfrancis.com>

and the CRC Press Web site at
<http://www.crcpress.com>

PHARMACY

What It Is and
How It Works

Third Edition

CRC PRESS PHARMACY EDUCATION SERIES

Pharmacy : What It Is and How It Works, Third Edition

William N. Kelly

Essentials of Law and Ethics for Pharmacy Technicians, Third Edition

Kenneth M. Strandberg

Essentials of Human Physiology for Pharmacy, Second Edition

Laurie Kelly McCorry

Pharmaceutical Dosage Forms and Drug Delivery

Ram I. Mahato

Basic Pharmacokinetics

Mohsen A. Hedaya

Basic Pharmacology: Understanding Drug Actions and Reactions

Maria A. Hernandez and Appu Rathinavelu

Managing Pharmacy Practice: Principles, Strategies, and Systems

Andrew M. Peterson

Essential Math and Calculations for Pharmacy Technicians

Indra K. Reddy and Mansoor A. Khan

Pharmacoethics: A Problem-Based Approach

David A. Gettman and Dean Arneson

Pharmaceutical Care: Insights from Community Pharmacists

William N. Tindall and Marsha K. Millonig

Essentials of Pathophysiology for Pharmacy

Martin M. Zdanowicz

Quick Reference to Cardiovascular Pharmacotherapy

Judy W. M. Cheng

Essentials of Pharmacy Law

Douglas J. Pisano

Pharmacokinetic Principles of Dosing Adjustments: Understanding the Basics

Ronald D. Schoenwald

Pharmaceutical and Clinical Calculations, Second Edition

Mansoor A. Khan and Indra K. Reddy

Strauss's Federal Drug Laws and Examination Review, Fifth Edition Revised

Steven Strauss

Inside Pharmacy: Anatomy of a Profession

Raymond A. Gosselin and Jack Robbins

Understanding Medical Terms: A Guide for Pharmacy Practice, Second Edition

Walter F. Stanaszek, Mary J. Stanaszek, Robert J. Holt, and Steven Strauss

*To all the student pharmacists required to read
this book: May you learn much and enjoy the
profession of pharmacy as much as I.*

Foreword

Pharmacy is a wonderful career; one of the reasons is the wealth of opportunities available for pharmacists. Students trying to decide what direction to pursue are well served to seek guidance in Dr. William Kelly's book. Helpful information can be used by high school students, guidance counselors, pharmacy students, pharmacy technician trainees, pharmacists, and pharmacy technicians.

As an academician, I especially appreciate the format of each chapter. After a brief introduction, several learning objectives are listed to help the reader concentrate on the main points of the chapter. Informative tables and figures summarizing data are sprinkled throughout almost all chapters. After chapter summary, the "Challenges" and "Discussion Questions and Exercises" sections are useful to actively engage the reader to reflect, research, and discuss important issues relevant to the chapter. Each chapter is well referenced and includes the section "Web Sites of Interest." Dr. Kelly provides useful information on the development of the pharmacy profession, including the important topic of pharmaceutical care. The descriptions of the drug use process and drug discovery and approval processes aid the understanding of medication use. About half of the chapters deal with a specific career area in detail. Pharmacy technicians will find the chapters devoted to pharmacy supportive personnel and pharmacy technology and automation helpful.

Faculty mentors, professional advisors, and high school guidance counselors will find this book to be of great assistance in working with students who are considering pharmacy as a career or who are trying to decide what path to choose within the career of pharmacy. Decisions on career choices are often a struggle for students. The availability of the information in this book and a counselor or advisor to discuss ideas with the student would be ideal. The exercises at the end of each chapter can be used to guide the thinking and reflection of the student as well as provide an opportunity for the student actually to engage in performing some research on a pharmacy-related topic. Many of the exercises could be adapted to almost any health care profession.

Whether the reader is a student or professional looking for information or a faculty member using the book as a required text, the book is a great resource. The book has the potential to be used as a textbook for a pharmacy orientation course or a required or elective pharmacy practice course or as an additional reference for any course concerning health professions. Pharmacists who serve as preceptors for a pharmacy intern will also find this book of value. Many preceptors have discussions with their interns about various aspects of pharmacy practice, and this volume would serve as an anchor or frame for these discussions. Libraries in high schools, colleges and universities, or communities should add this book to their collections as a reference on pharmacy as a profession and a career.

Not only is the information helpful with making the decision to pursue pharmacy, but also it can be used by pharmacists to assist in continuous professional development. Involvement in pharmacy professional organizations (one of the chapters) is

essential for practicing pharmacists for learning and to provide service to the profession. Several chapters provide data tables, figures, and references that could be helpful to develop proposals for new pharmacy services. A practicing pharmacist wishing to change a career path would find the chapters on career paths and career development informative.

Pharmacy is a wonderful, satisfying health profession that will continue to provide improvements to patient care. Dr. Kelly has done a thoughtful and thorough job in providing information that will assist future, new, and currently practicing pharmacists and pharmacy technicians.

Lisa A. Lawson, PharmD

Dean, Philadelphia College of Pharmacy

*Barbara H. Korberly Professor in Women's Leadership and Health
Philadelphia, Pennsylvania*

Preface

I was 8 years old when I fell in love with pharmacy. In the early 1950s, pharmacy was much different from today. The corner drugstore was the only place you could go to have your prescription filled. My corner drugstore was Barber's Drugstore. The large glass window in front of the store framed several "show globes"—large, clear glass containers filled with colored water—a symbol of pharmacy. Some of the show globes sat in ornate stands or were hung from the ceiling. The window also had interesting displays of medical items and the latest merchandise to purchase. It was the job of the pharmacy intern to change the displays each week.

The corner drugstore was more than a store and a pharmacy. It was a neighborhood asset. Barber's Drugstore had a soda fountain where you could purchase a Coke: 5¢ for a small one and 10¢ for a large one.

There was no self-service at the drugstore. Products were placed behind the counters in glass cases. You had to ask for what you wanted. After purchasing an item, you waited as they pulled white paper off a roller, cut it to size, and neatly wrapped your package. The packages were always tied with string.

I was intrigued with the pharmacist, Mr. Barber. He wore a crisp, clean, white druggist's jacket; was well respected in the community; and was everyone's friend. He always took time to say hello to everyone who came in the store. I asked Mr. Barber so many questions about pharmacy that he finally invited me behind the counter to watch him work with the medicine. I loved what I saw—all of the chemicals, bottles, and equipment. Mr. Barber compounded most of the medications, measuring and mixing the ingredients, pouring the medicine into tiny colored capsules, and then putting the capsules into small cardboard boxes that measured just 2 or 3 inches wide. He carefully placed a label on top of each box.

When Mr. Barber asked me to be the delivery boy and to do odd jobs around the pharmacy, I was delighted. I swept the sidewalk, washed the front window, took out the trash, and delivered medicine on my bike each day after school. When I could, I watched Mr. Barber prepare and dispense medication. I could not read the prescriptions because they were in Latin.

When I reflect on those days and think about what pharmacy is like today, I see tremendous change and progress. Fifty years ago, pharmacists earned a 4-year bachelor of science degree. Today, they earn a 6-year doctor of pharmacy degree.

Back then, pharmacists filled prescriptions as they were written unless the prescription was for an obvious overdose. Pharmacists were not to question the doctor about the patient or the intended use of the prescription. This interfered with the "doctor-patient" relationship. Today, pharmacists are taking responsibility for the patient and for the outcome patients receive from their medication. Some pharmacists are allowed to prescribe medication, monitor a patient's therapy, and recommend initial therapy for patients. Some doctors request pharmacists to perform complex mathematical calculations to dose critically sick patients with powerful drugs.

Patients' and doctors' respect for pharmacists has never been higher. Pharmacists in some community pharmacies work with patients, the patient's doctor, and the patient's insurance company to manage the patient's disease states. Some community pharmacists are providing immunizations for patients.

There are times I have been impatient with the profession not moving forward quickly enough. That changed when I recently reread the 2009 Whitney Award address by Paul Abramowitz, PharmD. Paul graduated shortly after me from the University of Michigan, so he has watched most of the same changes I have witnessed in pharmacy.

In explaining the metamorphosis of the profession, Dr. Abramowitz covered the period from 1978 to 2009. I was surprised at his documentation of so many changes, many of which I had forgotten. This long list of accomplishments changed my perception that the profession moves too slowly. When I stood back and looked, I could see how many changes have been made during my time as a pharmacist.

Doug Hepler, the chief architect of pharmaceutical care, in his 2010 Whitney Award address, "A Dream Deferred," discussed the issue of why, after 30 years, pharmaceutical care has not been universally implemented. Although the reasons for this are diverse, the dream is not dead, just deferred. At the end of his address, Dr. Hepler challenges new members to accept the legacy built by the many hard-working pharmacists that preceeded them to keep pursuing the dreams of the profession.

This book is written not only to teach you about pharmacy but also to encourage you to seize the vision and to assert your professional autonomy on behalf of patients and for achieving the dream. If you are reading this book because you are a student, please know you are about to become a member of one of the greatest professions, and that we are right on the cusp of achieving the goal of becoming a true clinical profession. If you are a student pharmacist reading this, I want you to know that I believe the highest and most dramatic improvements in the profession are going to occur during your lifetime as a pharmacist. My main advice is to always practice at the top of your game, make sure the patient is always your primary focus.

Writing the book has been a wonderful experience. This is the third edition, and I am still awed and proud of the rich history and accomplishments of pharmacy. Many pharmacists have worked hard to make pharmacy what it is today. After writing the book, I am more fascinated with pharmacy than ever before.

I hope you enjoy the book.

Acknowledgments

I could not have completed this edition of *Pharmacy: What It Is and How It Works* without the help of my wife Trudy, who is a superb reference librarian. She has worked on all three editions, doing the research, sending out the copyright permissions, and proofreading. This book is starting to feel like a third child of ours.

For this edition, several people helped with revision of chapters where my expertise is weak. Thanks go to John Poikonen, who, by the time he finished revising, actually rewrote the chapter on pharmacy automation and technology. This is a fast-moving part of the profession, and John is the expert in this area. Thank yous go to John Reinhold, a consultant pharmacist, who helped update the chapter on long-term care, to Martin Job who helped with the chapter on the pharmaceutical industry, and to Steve Caddick who added some material on compounding pharmacy.

About the Author

William N. Kelly has more than 40 years of experience in health care as a pharmacy executive, researcher, professor, and clinician. He has published over 80 peer-reviewed manuscripts and 10 book chapters and has presented his work both nationally and internationally. He is currently president of William N. Kelly Consulting & Publishing Incorporated, a company devoted to advancing medication safety and the practice of pharmacy, vice president of scientific affairs for Visante, and vice president of Vivace Health Solutions.

Dr. Kelly is the author of *The Good Pharmacist: Characteristics, Virtues, and Habits*, published in 2011, and *Prescribed Medication and the Public Health: Laying the Foundation for Risk Reduction*, published in 2006.

He lives with his wife, Trudy, in Oldsmar, Florida, and enjoys reading, swimming, golf, spending time with his children and grandchildren, stamp collecting, and doing medical missionary work.

Contents

Forewordxxix

Preface.....xxxi

Acknowledgments.....xxxiii

About the Authorxxxv

Chapter 1 What Is Pharmacy? 1

 Introduction 1

 Learning Objectives 1

 Pharmacy 1

 What Is a Profession?2

 Study and Training2

 Measure of Success3

 Associations.....3

 The Business of Pharmacy3

 A Brief History of Pharmacy3

 Early Development3

 Community Pharmacy in Early America.....4

 Hospital Pharmacy in Early America.....6

 What Is the Purpose of Pharmacy?8

 What Controls Pharmacy?8

 Pharmacy Licensure8

 State Pharmacy Laws8

 State Pharmacy Rules and Regulations.....9

 Federal Laws9

 What Shapes Pharmacy?9

 Scope of Practice9

 Organizations9

 House of Delegates10

 Standards of Practice.....10

 Consensus Conferences10

 Conference Proceedings and White Papers10

 Study Commissions12

 Leadership12

 Peer Review14

 Pharmacy Ethics.....14

 The Value of Pharmacy16

 Summary16

 Discussion Questions and Exercises17

 Challenges17

 Web Sites of Interest.....17

 References18

Chapter 2	The Pharmacist.....	21
	Introduction	21
	Learning Objectives	21
	Who Are Pharmacists?.....	21
	Education and Training	22
	Formal Education	22
	Internship.....	23
	Licensure	23
	Postgraduate Training.....	24
	Fellowships	25
	Specialty Certification	26
	Continuing Education.....	27
	Postgraduate Education	28
	Characteristics of Pharmacists	28
	Skills and Traits.....	28
	Character and Virtues.....	29
	Habits.....	30
	Professionalism.....	31
	What Pharmacists Do.....	32
	Quality Controller	32
	Caregiver	33
	Clinician	33
	Problem Solver	33
	Advisor	34
	Teacher.....	34
	Manager, Supervisor, and Leader.....	34
	Owner	35
	Researcher	35
	Sales Representative	35
	Quality Reviewer	36
	Titles and Career Paths.....	36
	Job Titles.....	36
	Career Paths.....	36
	Expectations of Pharmacists	36
	Supply and Demand for Pharmacists	37
	The Rewards of Being a Pharmacist	38
	Intrinsic Factors	38
	Extrinsic Factors.....	38
	Job Satisfaction.....	40
	Job Stress	40
	Lifelong Learning and Career Planning	41
	Job Outlook	42
	Summary	42
	Discussion Questions and Exercises	42

Challenges	43
Web Sites of Interest.....	43
References	44
Chapter 3 Pharmacists and the Health Care System	47
Introduction	47
Learning Objectives	47
Disease Burden.....	48
Overview of the Health Care System in the United States	48
Access to Care	49
Quality of Care	49
Cost.....	50
Financing.....	52
Private-Sector Funding.....	52
Public-Sector Funding	53
Paying Providers.....	55
Affordable Health Care Act	55
The Delivery of Care.....	56
Patient-Centered Care.....	56
The Health Care Team	57
Prescribing Authority	57
Patient Confidentiality	57
The Place of Drugs in the Health Care System.....	58
The Role of Pharmacists in the U.S. Health Care System	59
Societal Purpose of Pharmacy	60
Pharmacy's Destiny	60
Accountable Care Organizations and the Medical Home.....	60
Opportunity	60
Summary.....	61
Discussion Questions and Exercises	61
Challenges	61
Web Sites of Interest.....	62
References	62
Chapter 4 The Drug Use Process.....	65
Introduction	65
Learning Objectives	65
What Is the Drug Use Process?.....	65
Part I—Drug Products and Distribution	65
The Drugs.....	66
Distribution of Drugs from Pharmaceutical Manufacturers	68
Distribution from Drug Wholesalers.....	68
Distribution from Distribution Centers and Repackagers	69
Counterfeit Drugs	69

Self-Care and the Role of OTC Medication.....	70
Self-Care.....	70
Over-the-Counter Medication	70
Complementary and Alternative Medications.....	71
Dietary Supplements	72
Tips for Consumers.....	72
Prescribing Drugs.....	72
The Prescription	73
Parts of a Prescription	73
Types of Prescriptions	75
Writing the Prescription	75
Drug Orders.....	75
Drug Samples	75
Dispensing.....	76
Types of Retail Pharmacies	76
Independent Community Pharmacies.....	77
Chain Store Pharmacies.....	77
Mass Merchandiser Pharmacies	77
Food Store Pharmacies	77
Mail-Order Pharmacies	77
Outpatient Pharmacies in Hospitals	78
Internet Pharmacies	78
The Dispensing Process	78
Drug Distribution in Organized Health Care Settings.....	78
Drug Sales	79
Drugs Are Big Business	79
Why Costs for Drug Prescriptions Are Rising.....	80
Part II—Medication Use	81
Medication Use in the United States	81
Drug Pricing.....	82
Manufacturers.....	82
Multitier Pricing	82
Prices for U.S.-Made Drugs in Other Countries.....	83
Buyers and Sellers of Prescription Drugs	83
Drug Wholesalers.....	83
Community Pharmacy.....	83
Buying.....	83
Selling	84
Third-Party Contracts.....	84
Medicaid Patients	84
Medicare Patients	85
Gross Margin, Reimbursement, and Making a Profit	85
Hospitals	85
Buying.....	86
Formularies.....	86

Projecting Drug Costs..... 86

Selling 86

Reimbursement 87

Managed Care 87

 Buying..... 87

 Selling 88

Part III—Patients 88

Economic Value of Pharmaceuticals..... 88

Medication Administration 88

 Compliance with Taking the Medication as Prescribed..... 89

 The Problem..... 89

 Cost 90

 Solutions 90

Quality Drug Therapy 91

How Drug Therapy Is Monitored and Reviewed 92

Patient Outcomes..... 93

Medication Safety..... 93

 Side Effects..... 93

 Adverse Drug Reactions 93

 Allergic Drug Reactions 94

 Drug–Drug Interactions 94

 Medication Errors..... 94

Home Medication 94

Control of the Drug Use Process..... 94

Current Issues in the Drug Use Process..... 95

 Nutriceuticals and Herbal Medicines 95

 Direct-to-Consumer Advertising of Prescription-Only Drugs 95

 Importing of Drugs from Other Countries..... 95

 Rising Number of Prescriptions and Not Enough Pharmacists..... 96

Summary 96

Discussion Questions and Exercises 96

Challenges 97

Web Sites of Interest..... 97

References 97

Chapter 5 Pharmacy Supportive Personnel 101

 Introduction 101

 Learning Objectives 101

 The Pharmacy Technician..... 102

 Employment 102

 Why Pharmacy Technicians Are Important 102

 What Pharmacy Technicians Do..... 103

 Functions of Pharmacy Supportive Personnel..... 103

 What Pharmacy Technicians Need to Know 105

 How Pharmacy Supportive Personnel Are Trained 105