

Introduction

Welcome to *Biochemistry For Dummies*!

We are certainly happy you have decided to delve into the fascinating world of biochemistry. Biochemistry is a complex area of chemistry, but understanding biochemistry isn't really complex. It takes hard work, attention to detail, and the desire to know and to imagine. Biochemistry, like any area of chemistry, is not a spectator sport. You must interact with the material, try different explanations, and ask yourself why things happen the way they do.

Work hard and you will get through your biochem course. More importantly, you might grow to appreciate the symphony of chemical reactions that take place within a living organism, whether it be a one-celled organism, a tree, or a person. As each individual instrument contributes to an orchestra, each chemical reaction is necessary, and sometimes its part is quite complex. However, when you combine all the instruments, and each instrument functions well, the result can be a wonder to behold and hear. If one or two instruments are a little out of tune or aren't being played well, the orchestra still functions — but things are a little off. The sound isn't quite as beautiful, or there is a nagging sensation of something being wrong. The same is true of an organism. If all the reactions occur correctly at the right time, the organism functions well. If a reaction or a few reactions are off in some way, the organism may not function nearly as well. Genetic diseases, electrolyte imbalance, and other problems may cause the organism to falter. And what happens then? Biochemistry is often where ways of restoring the organism to health are found.

About This Book

Biochemistry For Dummies is an overview of the material covered in a typical college-level biochemistry course. We have made every attempt to keep the material as current as possible, but the field is changing ever so quickly. The basics, however, stay the same, and that is where we concentrate our efforts. We also include information on some of the applications of biochemistry that you read about in your everyday life, such as forensics, cloning, gene therapy, genetic testing, genetically modified foods, and so on.

As you flip through this book you will see a lot of chemical structures and reactions. Much of the biochemistry revolves around knowing the structures of the molecules involved in biochemical reactions. If you are in a biochemistry course, you probably have had at least one semester of organic chemistry. You will recognize many of the structures, or at least the functional groups, from your study of organic chem. You will see many of those mechanisms that you loved/hated here in biochemistry.



If you bought this book just to gain general knowledge about a fascinating subject, try not to get bogged down in the details. Skim the chapters. If you find a topic that interests you, stop and dive in. Have fun learning something new.

Conventions Used in This Book

We have organized this text in a logical progression of topics that might be used in a biochemistry course. We have made extensive use of structures and reactions. While reading, try to follow along in the associated figures, whether they be structures or reactions. The icons point out things to which you should pay particular attention, for various reasons. If you are taking a biochemistry course, use this rather inexpensive book to supplement that very expensive biochemistry textbook.

Icons Used in This Book

If you have ever read other *For Dummies* books (such as the wonderful *Chemistry For Dummies*) you will recognize the icons used in this book, but here are their meanings anyway:



This icon is a flag for those really important things that you shouldn't forget as you go deeper into the world of biochemistry.



We use this icon to alert you to a tip on the easiest or quickest way to learn a concept. Between the two of us, we have almost 70 years of teaching experience. We've learned a few tricks along the way and we don't mind sharing.



The Real World icon points out information that has direct application in the everyday world.



The Warning icon points to a procedure or potential outcome that can be dangerous. We call it our Don't-Try-This-At-Home icon.

What You're Not to Read

Don't read what you don't need. Concentrate on the area(s) in which you need help. If you are interested in real-world applications of biochemistry, by all means read those sections (indicated by the Real World icon). However, if you just need help on the straight biochemistry, feel free to skip the applications. You don't have a whole lot of money invested in this book, so don't feel obligated to read everything. When you're done, you can put it in your bookshelf alongside *Chemistry For Dummies*, *The Doctor Who Error Finder*, and *A Brief History of Time* as a conversation piece.

Foolish Assumptions

We assume — and we all know about the perils of assumptions — that you are one of the following:

- ✓ A student taking a college-level biochemistry course.
- ✓ A student reviewing your biochemistry for some type of standardized exam (the MCAT, for example).
- ✓ An individual who just wants to know something about biochemistry.
- ✓ A person who has been watching way too many forensic TV shows.

If you fall into a different category, we hope you enjoy this book anyway.

How This Book Is Organized

Here is a very brief overview of the topics we cover in the various parts of this book. Use these descriptions and the Table of Contents to map out your strategy of study.

Part I: Setting the Stage: Basic Biochemistry Concepts

This part deals with basic aspects of chemistry and biochemistry. In the first chapter you find out about the field of biochemistry and its relationship to other fields within chemistry and biology. You also get a lot of info about the different types of cells and their parts. In Chapter 2 we review some aspects of water chemistry that have direct applications to the field of biochemistry, including pH and buffers. Finally, you end up with a one-chapter review of organic chemistry, from functional groups to isomers.

Part II: The Meat of Biochemistry: Proteins

In this part we concentrate on proteins. You are introduced to amino acids, the building blocks of proteins. Having the building blocks in hand, in the next chapter we show you the basics of amino acid sequencing and the different types of protein structure. Finally, we will finish this part with a discussion of enzyme kinetics, both catalysts (speeding up reactions) and inhibitors (slowing them down).

Part III: Carbohydrates, Lipids, Nucleic Acids, and More

In this part we show you a number of biochemical species. You'll see that carbohydrates are far more complex than that doughnut you just ate might lead you to believe, but we do show you some biochemistry that is just sweet! Then we jump over to lipids and steroids. Next are nucleic acids and the genetic code (Da Vinci, eat your heart out!) of life with DNA and RNA. Then it's on to vitamins (they are involved more than once a day) and hormones (no humor here — it would be just too easy).

Part IV: Bioenergetics and Pathways

It all comes down to energy, one way or another. In these chapters we look at energy requirement and where that energy goes. This is where you meet our friend ATP and battle the formidable Citric Acid Cycle. Finally, since you will be hot and sweaty anyway, we throw you into the really smelly bog of nitrogen chemistry.

Part V: Genetics: Why We Are What We Are

In this part we tell you all about making more DNA, the processes of replication, and several of the applications related to DNA sequencing. Then it's off to RNA and protein synthesis. We also spend some time talking about the Human Genome Project.

Part VI: The Part of Tens

In this final part of the book we discuss ten great applications of biochemistry to the everyday world and reveal ten not-so-typical biochemical careers.

Where to Go from Here

The answer to this question really depends of your prior knowledge and goals. As with all *For Dummies* books, this one attempts to make all the chapters independent, so that you can pick a chapter containing material you are having difficulty with and get after it, without having to have read other chapters first. If you feel comfortable with the topics covered in general and organic chemistry, feel free to skip Part I. If you want a general overview of biochemistry, skim the remainder of the book. Dive deeper into the gene pool when you find a topic that interests you.

And for all of you, no matter who you are or why you are reading this book, we hope that you have fun reading it and that it helps you to learn biochemistry.

