Preface

This book was written for the student with little to no biology background. The goal of the book is to introduce the student to the world of biotechnology but in a way that runs deeper than a mere survey. There are a myriad of biotechnologies in the world today, and the number continues to grow. I happen to find the world of biotechnology a very exciting world, and I want to share that excitement with you, the reader. However, to fully appreciate just how cool some of these technologies are, one must understand some of the science underlying the glamour.

This is not intended to be a comprehensive book on all biotechnologies. One could spend the better part of a decade becoming an expert in only one area. Likewise, while I state that one must understand the science behind a technology to fully appreciate it—and healthy portion of that science is covered in this book—the text is not intended to be a complete, rigorous reference book for the biological or chemical sciences. Instead, it was my aim to produce a book that serves as a mix of both basic science and biotechnological applications so that you, the reader, might become energized about part or all of the field on a level that is deep enough to allow you to continue further pursuits of it with the knowledge that a solid foundation has been laid. If you still have a passion for one of the subjects contained in this book after studying it, that passion is probably quite real. I want you to get enough foundation so that you can appreciate what is out there in the world of biotechnology, so that you will understand new developments in greater depth than what you might hear in the news, and so that you will not be fooled by unsubstantiated claims you might read on the Internet.

The book is divided into three units. In the first, basic science is covered to introduce the reader to the cell, how it behaves, and what it is made of. For instance, if you want to design a drug that you want to enter the cell, you must know and understand the barrier that separates the inside of the cell from the exterior environment. If you want that drug to affect how the cell is behaving, then you should understand how a cell functions so that you can pick a cellular target upon which your drug can act. Perhaps, you want the cell to produce a product that you can isolate and sell, such as recombinant insulin, ethanol, or a novel protein that you have designed. To be successful in this endeavor, you must understand how the cell would go about producing the product, in addition to knowing exactly what your product would be. While we do not cover every possible product that could be produced by a cell, we do cover some of the building blocks such as amino acids/proteins and nucleic acids/DNA/RNA.

The second unit in the book is aimed at the biotechnological application of scientific principles in the laboratory. In the first unit, we will see how things work, but in the second unit, we will see how we can employ such knowledge to design, produce, and analyze products on a laboratory scale. These applications have allowed for the identification of pathogens so that appropriate antibiotic selections can be made, the production of cell cultures for the study of investigational drugs or engineered tissue constructs, and the amplification of DNA or RNA for the engineering and construction of entire genes.

The third unit of the book presents biotechnologies "in the real world." This should not imply that the laboratory is not the real world! Certainly, the laboratory makes up the primary world of many biotechnologists. The unit title refers to technologies that are used for practical purposes to aid nonscientists. Examples include recombinant proteins that are available to millions of patients, plants that have been engineered to produce food that has been made available to people around the world, and regenerative medicine that may someday allow patients to receive organs that have been grown from their own cells. From fighting crime to removing fingernail polish to powering automobiles without the use of fossil fuels, biotechnology is being applied in wide applications that affect the lives of millions of people every day.

When I first undertook the writing of this book, I was under the impression that biotechnology was a new and cutting-edge field. While the cutting-edge part is correct, upon citing important references for the book, I came to realize that the information is not necessarily what is commonly referred to as "new." Sure, there are famous experiments from the 1950s that we learn in school, but it was a little surprising when I found myself citing a paper from 1948 and then heavily relying upon a referenced paper from 1852. However, when I came across texts that predated the Bible, my outlook on biotechnology changed from it being a new field to it being a timeless field. Progress in and applications of biotechnology perhaps occur at a greater rate these days, but it is entirely incorrect to think that the only "real" science has occurred in recent times. We may utilize more sophisticated equipment today, but the science that took place in, for example, G. G. Stokes' laboratory in the mid-1800s was just as real (and the mathematics just as complex) as what is performed today.

Finally, this book was written primarily for the student, not the teacher. The style is informal throughout, which will undoubtedly irritate some professors. Not to worry, they simply will not adopt the book for their course. However, the text is written in a style that is easy to follow, perhaps a little light-hearted in places, with numerous figures to reinforce the material that is being presented. The material is solid, however. The student and teacher can both feel confident that, just because the material may be entertaining and easy to understand, the topics covered in the book are based on decades of personal experience, education, and consultation with experts in the individual topics.