Practical Techniques in Molecular Biotechnology

A well-designed research-based experimental laboratory course is critical for students interested in research in biotechnology and related disciplines, and this book will help immensely in developing these kinds of courses. At the graduate level, this book is a good reference for instructors interested in developing innovative theoretical and practical courses related to biochemistry/biophysical chemistry/biotechnology fields and also for designing research-based courses for the molecular biology lab, or for instruction in cellular biology, nanotechnology, and neurobiology.

Practical Techniques in Molecular Biotechnology engages students in the learning of laboratory and practical research skills by focusing on the solution of some real-world scientific problems. This approach helps students learn biochemical techniques in a context, and allows better integration with research projects. The text intends to familiarize students with the basics of experimental biotechnology science for their use and application in research. While providing the fundamentals of biochemistry, it focuses primarily on concepts and practices related to biotechnology. Theoretical principles underlying experimental techniques, procedures, assignments, and data analysis are presented with adequate examples. The book is designed in such a way that it exposes students to the practice of general biochemical and biophysical techniques, which lay the groundwork for future courses and research projects in biotechnology and its related fields. In addition, the book contains information on data analysis, statistics, units, safety, and best practices.

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Preface

Over the last 50 years, the development of far superior understanding of genomics and proteomics, has spurred the growth of biotechnology to a level where the revenues the sector generates are now of the order of about $430 billion a year and growing at approximately 8.3%. Directed manipulation of cell genes and development of recombinant technologies are allowing research institutions and industry to create fresh platforms for development of new technologies, products, markets, and indeed expectations. All this is contributing to ever increasing the pervasive influence of the biological organism in our everyday life.

Use of biotechnological processes is not new. For centuries some of these techniques have been used in the manufacturing of wines, beers, milk-based products, bread, and so many others. Although how biological mechanisms worked exactly was not well understood, the optimized biotechnological processes involved for such manufacturing were well established.

A fascinating aspect of biotechnology is its multidisciplinary nature, which draws upon concepts, theory and practices from a gamut of different fields including biology, chemistry, biochemistry, molecular biology, genetics, microbiology, and process engineering.

Although there are several books available on bioanalytical techniques, cellular biology, molecular biology, biotechnology, and so on, there is no readily available source of information that comprehensively yet concisely presents the techniques employed in biotechnology. Accordingly, a book covering the range of principles and applications of biotechnology should be handy for research students.

One of the goals of a science education is to inculcate scientific literacy in such a way that students should be free of any bias while making decisions on day-to-day scientific problems. In this case, the purpose of such education is that students imbibe adequately, the principles, the theory and applications thereof, to develop laboratory and practical research skills focused on the solution of a real scientific problem. This book, on biotechnology, intends doing just that.

Our intention is to familiarize students with the basics of some of the well-known experimental biotechnology processes and practices, for their use and application in research. By referring to this book, students will find the contents useful in strengthening their basic skills in their field of interest and applying their learning to real-world problems. In the experience of the authors, a focus on practical problems helps students learn biochemical techniques in a context, and allows better integration with research projects. This book, at the graduate level (for biotechnology, chemical biotechnology, molecular biotechnology and cell biology courses), should be invaluable for learning the basics of biochemical and biophysical techniques, and would help build a strong foundation for further biomedical courses.

It consists of detailed treatment and study of the fundamental principles and techniques of biotechnology, essential for the understanding of biochemical/biophysical phenomena. Theoretical principles behind

experimental techniques and procedures, have been explained extensively and this has been reinforced with assignments and data analysis. This book is replete with examples and questions posed for a better grasp of the topics. In addition, the book contains information on data analysis, statistics, units, safety, and best practices. Unique features of this book include new pedagogical approaches (such as questions to ponder over and protocols), real-world relevance, clear illustrations, and integrated biochemical and biotechnological concepts. All the while, the focus has been on basic concepts combined with some key applications.

Using this book, an instructor can design an experimental course for biochemistry, molecular biology, cellular biology, or biophysics. Instructors may use this book as a quick guide to prepare their lectures and laboratory assignments. Further, this book provides instructors with references. These may be made use of to develop innovative theoretical and practical courses for the fields of biochemistry, biophysical chemistry, and biotechnology.

A well-designed research-based experimental laboratory course is critical for research students interested in following biotechnology and related disciplines, and this book will help immensely in developing such courses.

Conceptualizing this book involved years of work and interaction with several experts in the area of biochemistry and biotechnology. The book has been developed through extraction of topics, experiments, and experience from several courses that were taught by the authors over a long a period of time. These courses included, Biochemistry Laboratory, Physical Biochemistry, Introduction to Biomedical Engineering and Biotechnology, Chemical Biology and Technology, Biological Spectroscopy, Fluorescence Spectroscopy for Biochemists, and Instrumental Methods of Analysis.

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