
Preface

This book is designed for undergraduates taking science and health-related courses in biochemistry and molecular biology. With the rapid development of the subject, course structures in these areas have become complex but our broad aim is to cover most of the requirements of many BSc courses and those in health-related ones of a similar standard. The reason for writing this book continues to be to provide a text suitable for students meeting these subjects for the first time, but of sufficient depth to be intellectually satisfying. The book is written in an approachable style, with a lot of explanation to promote understanding. New terms encountered in the text by students are explained. Biological context to the topics is included so that students can see the relevance of the molecular devices which constitute life. We have also tried to explain what is not yet known so that students can appreciate the interest of a subject in which a good deal remains to be discovered. In general, we hope that the book can take students to the level at which they could handle many of the reviews of the type found in *Trends in Biochemical Sciences* and related journals as well as the mini-reviews found in some of the major journals.

There is a seemingly never ending flood of new developments in the subject, which is exciting, but the rapid increase of information poses problems for students and teachers alike. To achieve our aims and keep the book of a size that students can cope with, we have made subjective decisions to omit certain aspects, mainly in some metabolic areas, which may be less likely to be taught in today's courses. As an example we do not give the metabolic pathways for the synthesis and breakdown of all individual amino acids but rather concentrate on amino acid metabolism of more general relevance or of special interest or medical importance. This policy allows the metabolic and molecular biology areas of widest current interest to be covered more fully without increasing the book's size.

About the book

The book is organized into five main parts:

- 1 Basic concepts of life;
- 2 Structure and function of proteins and membranes;
- 3 Metabolism;
- 4 Information storage and utilisation;
- 5 Molecular biology in health and disease.

The chapters are arranged to give a seamless progression through the subject but teachers usually want to decide in what order topics should be taught. To facilitate this there is extensive cross-referencing between chapters.

What is new in this edition?

- All the chapters have been reviewed to update them and to include a number of new figures and references. This varies in the different chapters from extensive rewriting and major additions to minor changes. A number of complex areas, which some students find difficult, have been rewritten for increased clarity. These include mass spectrometry (Ch. 5), control of glycogen metabolism, (Ch. 16) and the role of histocompatibility complexes (MHCs) in the immune response (Ch. 30). In particular, students sometimes find protein synthesis a difficult topic, possibly because the elongation procedure is counter-intuitive. We have included a preliminary treatment of the chemistry of polypeptide synthesis so that students, having mastered this, can then focus on the complications of what happens on the ribosome more easily (Ch. 24).

The exercise introducing students to the use of a molecular graphic program to obtain 3-D images of proteins using data from the Protein Data Bank (Appendix to Ch. 5) has also been completely rewritten using a more approachable viewer program.

Among important new developments during the past few years that have been added in this edition are the following:

- A new chapter (25) on the RNA world. This includes micro RNA genes and the revolutionary new concept of RNA controlling the expression of protein coding genes. It includes a description of the international ENCODE (Encyclopaedia of DNA Elements) project to document the functional elements of the genome, whose preliminary findings already have somewhat surprising implications.
- RNA interference, its mechanism, and its medical potential including control effects on cancer metastasis by a microRNA gene (Ch. 25).
- New material on the role of the mediator in eukaryotic gene transcription, and its possible mechanism of action; the role of DNA methylation in transcription regulation and imprinting; DNA insulators which restrict the effects of enhancosomes to their intended targets are a new addition (Ch. 23).
- Control of gene expression by riboswitches and attenuation are also new items (Ch. 23).
- The mechanism of selenocysteine (the '21st amino acid') incorporation into proteins (Ch. 24).
- The apoptosis chapter has been largely rewritten to include more recent developments in the mechanism

and control of this important area. The last three chapters which were combined into one previously are now split into three new chapters. (The cell cycle and its control (Ch. 31), Apoptosis (Ch. 32), and Cancer (Ch. 33).)

Important technological developments include the following:

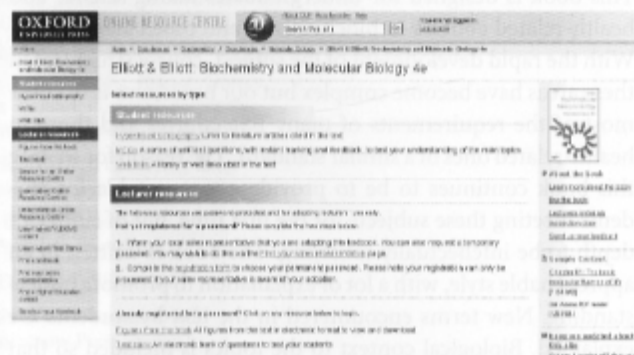
- The role of single nucleotide polymorphisms (SNPs) coupled with microarrays for the location of disease producing genes and individual genotype determination for prediction of disease susceptibility (Ch. 28).
- Developments in the reprogramming of human skin cells into pluripotent stem cells by treatment with transcription factors (Ch. 28). The potential of this may, if it proves to be clinically applicable, cope with immunological problems in stem cell therapy, and, since no human or animal eggs are involved, possibly ethical questions as well.
- The advent of synchrotron radiation in X-ray diffraction of proteins and the use of selenomethionine-labelled proteins is described. This facilitates 3-D determination of proteins especially since micro crystals can be used (Ch. 5).
- The production and use of humanized monoclonal antibodies in therapy (Ch. 30).

In metabolism, new material includes:

- Fructose metabolism and its control, and its repercussions on diabetes (Ch. 16).
- Some new factors in appetite control and fat metabolism.
- New boxes: Smoking, elastin, emphysema, and antiproteases (Box 4.2); *Trans* fatty acids (Box 7.1); Repetitive DNA sequences (Box 28.1); Red wine and cardiovascular health (Box 29.1).

- Further reading references. References at the end of each chapter direct the reader mainly to review articles of the shorter type found in Trends journals.

Online Resource Centre



The Online Resource Centre has been developed to provide students and lecturers with ready-to-use teaching and learning resources. It is free-of-charge, designed to complement the textbook, and offers additional materials which are suited to electronic delivery. Visit www.oxfordtextbooks.co.uk/orc/elliott4e to find out more.

Lecturer resources

The following resources are password protected to ensure only lecturers can access them. Instructors may find these useful for preparing lectures and course assessment.

- **Illustrations.** All of the illustrations in the textbook available to download electronically. Ideal for the preparation of lecture slides.
- **Testbank of questions.** A customizable testbank featuring questions of different format, with feedback keyed to the book. Ideal for use in both formative and summative assessment.

Student resources

Accessible to all, with no registration or password required.

- **Web links.** A selection of annotated general web links as well as links relevant to specific topics and specific chapters in the book.
- **Hyperlinked bibliography.** A fully hyperlinked version of the further reading lists included in the text, providing links to electronic versions of literature articles cited in the text (where available). (Note that these are just hyperlinks: institutional subscription will be required to obtain full-text access in most cases, though abstracts for linked articles will usually be available.)

Using the book

This book includes a number of features to help make it easy to use, and to make learning from it as effective as possible.

- **Index of diseases.** A separate index of diseases and medically relevant topics helps students on health-related courses to identify relevant topics.
- **Medical boxes.** These illustrate the direct relevance of biochemistry and molecular biology to medicine and health-related issues. A separate list of these boxes is shown on the Contents pages.
- **Questions and answers.** Questions at the end of each chapter (with answers at the back of the book) are designed to support student learning.
- **Chapter summaries.** Summaries at the end of each chapter highlight the key concepts presented and aid revision.

- **Online self-test questions.** A selection of multiple-choice questions for readers to check their understanding of each chapter. Each question has feedback keyed to the book to help the reader review concepts relevant to the questions posed.
- **Molecular structures.** A library of three-dimensional, interactive versions of key biological structures featured in the book.

The testbank and online self-test questions have been kindly compiled by Dr Tony Bradshaw, Oxford Brookes University, Dr Shirley McCready, Oxford Brookes University, Racheline Rogers, University of Adelaide, and Dr John Wright, University of East London.

The library of molecular structures has been prepared by Dr Keith Johnstone and Ms Katy Jordan, Department of Plant Sciences, University of Cambridge.

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