

Textbook of **Biochemistry**

Fourth Edition

is the thoroughly revised and updated edition of the book, primarily aimed at the undergraduate MBBS students, written in conformity with the latest curriculum laid down by Medical Council of India (now National Medical Commission). It not only includes the competencies laid down for biochemistry but also the aligned competencies of other subjects as well. The book has been written in a very lucid and simple language so as to make it easy to understand for the students. Emphasis has been laid on learning applied biochemistry in the form of "Chemistry to Clinics". Several new tables and figures have been included for complete understanding of the subject. Long questions, short questions and multiple choice questions (MCQs) have also been accordingly added at the end of each chapter to enable the students to test their knowledge as well as to prepare themselves for the various competitive examinations.

The book will not only help the students to have a better grasp of the subject but also lay a strong foundation for integration of biochemical processes in clinical subjects, thus helping them in their journey to become medical graduates.

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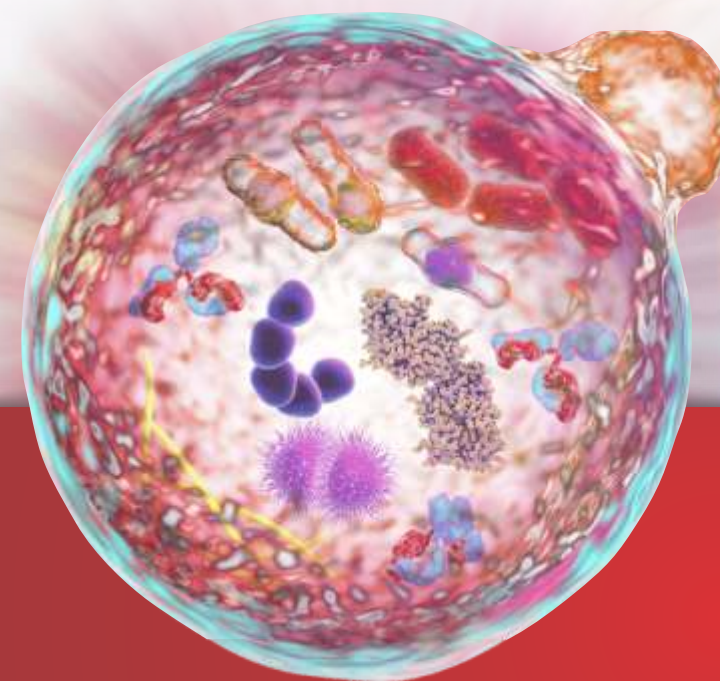
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ISBN: 978-93-90709-44-1



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ISBN: 978-93-90709-44-1

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Fourth Edition: 2021

First Edition: 2004

Reprint: 2008, 2010

Second Edition: 2011

Reprint: 2014

Third Edition: 2017

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Printed at: Goyal Offset Works Pvt. Ltd, Haryana, India

to

Prof. Rajesh Pandey

*A dedicated researcher,
sincere and adorable teacher
and a humble human being
who left us heavenly on 28.01.2016*

| Foreword

It is a pleasure to write a brief introduction to *Textbook of Biochemistry* written by Dr Harbans Lal, Professor, Department of Biochemistry, Pt. BD Sharma Postgraduate Institute of Medical Sciences, Rohtak (Haryana).

Biochemistry deals with the chemistry of life and living processes. The scope of biochemistry is as vast as life itself. It is the most rapidly developing branch of science as it gives an understanding of the functioning of the living body at the cellular and molecular level.

The book written by Dr Harbans Lal will be warmly welcomed both by the students as well as the teachers of various medical institutions in the country, for it is written with clarity and in a simple comprehensive style.

The book is mainly based on the MBBS curriculum; however, recent advances have been covered in almost all the chapters. It gives a thorough understanding of the health and disease status in the human body.

I congratulate Dr Harbans Lal for the enormous efforts he has made in compiling this textbook which will be very useful to the medical students in particular as well as the teaching faculty of various scientific institutions of our country.

Kiranjeet Kaur MD

Professor and Head
Department of Biochemistry
and
Principal
Government Medical College
Patiala

| Preface to the Fourth Edition

It gives us immense pleasure to present the fourth edition *Textbook of Biochemistry*. The book has been thoroughly revised and updated as per the new competency based curriculum of the Medical Council of India (now National Medical Council). Like the previous editions, the new edition intends to convey the knowledge of time-old principles which have been supplemented with modern developments in biochemistry. The figures and diagrams have been updated and simplified. The subject matter has been written in a simple, precise and lucid manner which will not only help the undergraduate students to grasp the basics of the subject but also prepare them for future integration with the clinical subjects in their journey to become knowledgeable Indian medical Graduates. Our endeavor has been to keep the subject matter simple, relevant and easy to understand for all students.

We express our sincere thanks and acknowledgement to the Director, National Institute of Nutrition (ICMR), Hyderabad, for the use of some of the information regarding recommended daily allowances and dietary guidelines for Indians, from the Manual "Dietary guidelines for Indians 2011". We are also thankful to Mr SK Jain and his team from CBS Publishers & Distributors, New Delhi, for bringing out this edition of the book in a very short time during the lockdown, for the benefit of the students. Keeping aside some shortcomings that may have crept in, it is expected that the book will be welcomed by the teachers and the students alike. Comments and constructive criticism, of course, will ensure further improvement of the book.

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|Preface to the First Edition

The appreciative response of my fellow teachers and students from various colleges throughout the country, to my previous publication, *Textbook of Biochemistry for Dental Students*, encouraged me to write this book.

Biochemistry is the chemistry of the living matter in its different phases of activity, from the smallest microorganisms to the most complex and highly evolved human beings. The subject has made a great advances worldwide, backed by intensive research and application.

The purpose of introducing this book *Textbook of Biochemistry* is to convey a knowledge of modern biochemistry to the readers in a simple, precise and lucid manner. The text of the book has been supplemented with the self-explanatory flowcharts, diagrams and tables. Some of the important aspects of clinical relevance/application too have been highlighted in colored boxes for a better understanding of the subject. It is intended that the book will meet the requirement of the students who are to take a basic course in biochemistry, particularly those studying biochemistry in relation to medicine.

This book would never have been accomplished without the encouragement and support of my sincere friends and associates. To each one of them, I extend my most earnest thanks. I am highly indebted to Prof SK Aggarwal, MMES Medical College, Maulana (Haryana), and Dr Vijay Shanker, Associate Professor of Biochemistry, PGIMS, Rohtak, for giving their valuable suggestions. I am also grateful to Dr Rajesh Pandey, Research Associate, Department of Biochemistry, PGI, Chandigarh, for his encouragement and help. I also tender my thanks to Dr Manju Pahwa, Lecturer, and Dr Ashuma Sachdeva; Dr Anjali Singh; Dr Deepa Rao; Dr Richa; Dr Anuj; Dr Munish; Dr Parul and Dr Ekta, Residents, Department of Biochemistry, PGIMS, Rohtak, for their help in completion of the book. My appreciation also extends to Mr SK Jain and his team from CBS Publishers & Distributors, New Delhi, for bringing out this book.

Every care has been taken in preparing the text of this book, however, there could have been a few short-coming oversights. To overcome the same, I welcome comments, criticism along with useful suggestions from the students and faculty for the improvement of this book.

Nov. 2003
Rohtak (Haryana)

Harbans Lal

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