Early Clinical Exposure in **BIOCHEMISTRY** Workbook for MBBS Phase I Students

is a unique workbook, first of its kind, in the subject of biochemistry on early clinical exposure (ECE).

Salient Features

- Simple, clear and lucid presentation.
- Adequate space provision for recording the answers to the various questions asked under each clinical case.
- Serves as a question bank of clinical reasoning based questions for Phase I MBBS learners.
- Comprehensive record of different case-based scenarios, carefully selected as per the topic-wise competencies in biochemistry.
- O Handy means of conducting formative assessment of learners for facilitators and faculty.

Neeru Bhaskar MBBS, MD (Biochemistry)

is currently Professor and Head, Department of Biochemistry, Adesh Medical College and Hospital, Shahabad (M), Kurukshetra, Haryana. In addition, she is Incharge Academics in the institute. Earlier, she has served as Professor, Department of Biochemistry, MM Institute of Medical Sciences & Research, Mullana, Ambala, where she taught biochemistry to MBBS, BDS, BPT, Bsc (MLT) and postgraduate courses like MD, MDS, MSc and MPT. She has total teaching experience of 13 years, including 8 years of postgraduate teaching. She is actively involved in the implementation of new CBME curriculum for the Indian Medical Graduate. She has to her credit 46 research papers published in various indexed national and international journals. She has recently published Logbook in Biochemistry including AETCOM Modules for Phase I MBBS students.

Priyanka Tangri PhD (Medical Biochemistry)

is currently Professor, Department of Biochemistry, Adesh Medical College and Hospital, Shahabad (M), Kurukshetra, Haryana. Earlier, she was Associate Professor, Department of Biochemistry, Dr Radhakrishnan Government Medical College & Hospital, Hamirpur, Himachal Pradesh, where she was an active member and resource faculty of Medical Education Unit and Curriculum Committee. She was actively involved in implementation of new CBME curriculum for the Indian Medical Graduate. She has 11 years experience of teaching to undergraduate students. She has to her credit numerous research papers published in various indexed national and international journals. She has recently published Logbook in Biochemistry including **AETCOM Modules for Phase I MBBS Students.**



Publishers & Distributors Pvt Ltd

4819/XI, Prahlad Street, 24 Ansari Road, Daryagani, New Delhi 110 002, India E-mail: delhi@cbspd.com, cbspubs@airtelmail.in; Website: www.cbspd.com New Delhi | Bengaluru | Chennai | Kochi | Kolkata | Lucknow | Mumbai G Hyderabad | Jharkhand | Nagpur | Patna | Pune | Uttarakhand





Early

Clin

Exposure

Ξ.

BIO

I

S

RX

Workbook



Early Clinical Exposure in BIOCHEMISTRY Workbook for MBBS Phase I Students

As per the latest CBME Guidelines | Competency Based Undergraduate Curriculum for the Indian Medical Graduate

CBSPD Dedicated to Education **CBS Publishers & Distributors Pvt Ltd**

Neeru Bhaskar Priyanka Tangri

Early Clinical Exposure in **Biochemistry** Workbook

for MBBS Phase I Students

As per the latest CBME Guidelines | Competency Based Undergraduate Curriculum for the Indian Medical Graduate

lame of the Student	
Roll No.	
Registration Number University	,
Date of Admission to MBBS Course	
Date of Beginning of the First Professional Year	
Permanent Address	
Nobile No	/

Early Clinical Exposure in **Biochemistry** Workbook

for MBBS Phase I Students

As per the latest CBME Guidelines | Competency Based Undergraduate Curriculum for the Indian Medical Graduate

Neeru Bhaskar

MBBS, MD (Biochemistry) Professor and Head, Department of Biochemistry Incharge Academics Adesh Medical College and Hospital, Kurukshetra (Haryana)

Priyanka S Tangri

PhD (Medical Biochemistry) Professor, Department of Biochemistry Adesh Medical College and Hospital, Kurukshetra (Haryana)



CBS Publishers & Distributors Pvt Ltd

New Delhi • Bengaluru • Chennai • Kochi • Kolkata • Lucknow • Mumbai Hyderabad • Jharkhand • Nagpur • Patna • Pune • Uttarakhand

Disclaimer

Science and technology are constantly changing fields. New research and experience broaden the scope of information and knowledge. The authors have tried their best in giving information available to them while preparing the material for this the book. Although, all efforts have been made to ensure optimum accuracy of the material, yet it is quite possible some errors might have been left uncorrected. The publisher, printer and the authors will not be held responsible for any inadvertent errors or inaccuracies.



Early Clinical Exposure in **Biochemistry** Workbook

for MBBS Phase I Students

ISBN: 978-93-5466-343-7

Copyright © Authors and Publisher

First Edition: 2022

All rights reserved. No part of this book may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any information storage and retrieval system without permission, in writing, from the authors and publisher.

Published by Satish Kumar Jain and produced by Varun Jain for

CBS Publishers & Distributors Pvt Ltd 4819/XI Prahlad Street, 24 Ansari Road, Daryaganj, New Delhi 110 002, India. Ph: 23289259, 23266861, 23266867 Website: www.cbspd.com Fax: 011-23243014 e-mail: delhi@cbspd.com; cbspubs@airtelmail.in.

Corporate Office: 204 FIE, Industrial Area, Patparganj, Delhi 110 092 Ph: 4934 4934 Fax: 4934 4935 e-mail: publishing@cbspd.com; publicity@cbspd.com

Branches

- Bengaluru: Seema House 2975, 17th Cross, K.R. Road, Banasankari 2nd Stage, Bengaluru 560 070, Karnataka
- Ph: +91-80-26771678/79
 Fax: +91-80-26771680
 e-mail: bangalore@cbspd.com

 • Chennai: 7, Subbaraya Street, Shenoy Nagar, Chennai 600 030, Tamil Nadu
- Ph: +91-44-26680620/26681266
 Fax: +91-44-42032115
 e-mail: chennai@cbspd.com

 • Kochi: 42/1325, 26, Power House Road, Opp KSEB, Ernakulam 682 018, Kochi, Kerala
 Ph: +91-484-4059061-65
 Fax: +91-484-4059065
 e-mail: kochi@cbspd.com
- Kolkata: 147, Hind Ceramics Compound, 1st Floor, Nilgunj road, Belghoria, Kolkata 700056, West Bengal
 Ph: 033-25633055/56
 e-mail: kolkata@cbspd.com
- Lucknow: Basement, Khushnuma Complex, 7-Meerabai Marg (Behind Jawahar Bhawan), Lucknow-226 001, Uttar Pradesh, India.
- Ph: +0552-4000032
 e-mail:tiwari.lucknowi@cbspd.com

 Mumbai: PWD shed, Gala No. 25/26, Ramchandra Bhatt Marg, Next to JJ Hospital Gate No. 2, OPP, Union Bank of India, Noorbaug, Mumbai-400009, Maharashtra

 Ph: 022-66661880/89
 Mob: 0-8424005858
 e-mail: mumbai@cbspd.com

Representatives

 Hyderabad 	0-9885175004	 Jharkhand 	0-9811541605	 Nagpur 	0-9421945513
• Patna	0-9334159340	• Pune	0-9623451994	 Uttarakhand 	0-9716462459

Printed at: SRK Graphics, Delhi, India

Preface

Early clinical exposure (ECE) has been introduced in the subject of biochemistry in Phase I MBBS as per the latest Competency Based Medical Education (CBME) based curriculum in accordance with Graduate Medical Education Regulations (2019). So, this workbook on ECE which is first of its kind has been designed keeping in mind the requirement of Phase I learners who have just entered the medical institution with literally no exposure to patients and/or hospital as well as the facilitators/faculty who want their learners not only to understand the different case-based scenarios in depth but also to keep a handy record of the various concepts taught in the classroom for the future reference of their learners.

In addition, an attempt has been made to include all the possible reasoning-based questions as well as other important questions pertaining to a particular clinical case. Utmost care has been exercised while selecting the clinical cases so that these cases are relevant to the learners in real-time.

Further, this workbook would serve as a tool for carrying out the formative assessment of the learner throughout Phase I.

This ECE workbook is an endeavor to simplify learning in biochemistry.

Best Wishes

Neeru Bhaskar Priyanka Tangri

Acknowledgments

 ${
m A}$ t the outset, we would like to thank Almighty for providing us the strength and ability throughout the journey of preparation of this book.

Further, we duly acknowledge the everlasting support and motivation given by our families.

We owe our heartfelt gratitude to our worthy Chairman, Dr. Harinder Singh Gill for his constant guidance and belief in our abilities that has enabled us in accomplishing this task. Our Principal, Dr BL Bhardwaj, deserves a special mention for his never-ending support and encouragement.

We would like to acknowledge all the people who are involved in the preparation of this book especially Shri SK Jain (Chairman), Shri Varun Jain (Managing Director), Shri YN Arjuna (Sr Vice President—Publishing, Editorial and Publicity), Ms Ritu Chawla (GM—Production), Mr Parmod Kumar (DTP operator), and Mr Sumit Behl for bringing out the book in the present form.

We hope that you will enjoy reading this book as much as we enjoyed writing it.

Neeru Bhaskar Priyanka Tangri

Contents

Preface

S. No. Name of the Topic **Page Number Signature of Faculty** 1. Chemistry of Carbohydrates 1 ECE 1.1 Lactose Intolerance 1 ECE 1.2 Role of Cardiac Glycosides 4 ECE 1.3 7 Clinical Significance of Heparin 2. Chemistry of Lipids 10 ECE 2.1 Essential Fatty Acid Deficiency 10 ECE 2.2 Respiratory Distress Syndrome (RDS) 13 ECE 2.3 Role of COX Inhibitor as Drug 16 ECE 2.4 Role of Low Dose Aspirin in the Treatment of 19 Ischemic Heart Disease (IHD) 3. Chemistry of Amino Acids and Proteins 22 ECE 3.1 Multiple Myeloma 22 ECE 3.2 Alpha-1 Antitrypsin Deficiency 26 29 ECE 3.3 Alzheimer's Disease 32 4. Enzymes ECE 4.1 32 Gouty Arthritis ECE 4.2 Acute Myocardial Infarction (AMI) 34 ECE 4.3 37 Muscle Injury ECE 4.4 Competitive Inhibition 40 ECE 4.5 Methanol Poisoning 43 ECE 4.6 Acute Pancreatitis 46

v

Early Clinical Exposure in Biochemistry

S. No.	Name of the Topic	Page Number	Signature of Faculty
5. Metabolism of Carbohydrates		49	
ECE 5.1	Pyruvate Kinase Deficiency	49	
ECE 5.2	Lactic Acidosis	52	
ECE 5.3	Von Gierke Disease	55	
ECE 5.4	Glucose-6-Phosphate Dehydrogenase Deficiency	58	
ECE 5.5	Hereditary Fructose Intolerance	61	
ECE 5.6	Galactosemia	64	
ECE 5.7	Hypoglycemia	67	
ECE 5.8	Type 1 Diabetes Mellitus	70	
ECE 5.9	Type 2 Diabetes Mellitus	73	
ECE 5.10	Diabetic Ketoacidosis	76	
ECE 5.11	Starvation Ketoacidosis	79	
ECE 5.12	Renal Glycosuria	82	
ECE 5.13	Hurler Syndrome	85	
6. Metabolism of Lipids		88	
ECE 6.1	Steatorrhea	88	
ECE 6.2	Carnitine Deficiency	91	
ECE 6.3	Refsum's Disease	94	
ECE 6.4	Liver Cirrhosis	97	
ECE 6.5	Fatty Liver	100	
ECE 6.6	Methylmalonic Aciduria	103	
ECE 6.7	Familial Hypercholesterolemia	106	
ECE 6.8	Xanthelasma	109	
ECE 6.9	Atherosclerosis	112	
ECE 6.10	Hypobetalipoproteinemia	115	
ECE 6.11	Cholelithiasis	118	

viii

I	Content	S	ix
S. No.	Name of the Topic	Page Number	Signature of Faculty
ECE 6.12	Gaucher's Disease	121	
ECE 6.13	Tay-Sach's Disease	124	
ECE 6.14	Niemann-Pick Disease	127	
7. Metabo	lism of Proteins	130	
ECE 7.1	Hyperammonemia Type II	130	
ECE 7.2	Citrullinemia	133	
ECE 7.3	Phenylketonuria	136	
ECE 7.4	Alkaptonuria	139	
ECE 7.5	Albinism	142	
ECE 7.6	Parkinsonism	145	
ECE 7.7	Pheochromocytoma	148	
ECE 7.8	Hartnup Disease	151	
ECE 7.9	Carcinoid Syndrome	154	
ECE 7.10	Maple Syrup Urine Disease	157	
ECE 7.11	Homocystinuria	160	
ECE 7.12	Cystinuria	163	
ECE 7.13	Cystinosis	166	
ECE 7.14	Role of Nitric Oxide in Angina	169	
8. Metabo	lism of Nucleotides	172	
ECE 8.1	Gout	172	
ECE 8.2	Lesch-Nyhan Syndrome	175	
ECE 8.3	Orotic Aciduria	178	
9. Biologic	al Oxidation	181	
ECE 9.1	Cyanide poisoning	181	
10. Heme	Metabolism and Hemoglobin	184	
ECE 10.1	Sickle cell Anemia	184	
ECE 10.2	Thalassemia	187	
			1

Early Clinical Exposure in Biochemistry

S. No.	Name of the Topic	Page Number	Signature of Faculty
ECE 10.3	Methemoglobinemia	190	
ECE 10.4	Carbon Monoxide Poisoning	193	
ECE 10.5	Lead Toxicity	196	
ECE 10.6	Porphyria	199	
ECE 10.7	Kernicterus	202	
ECE 10.8	Hemolytic Jaundice	205	
ECE 10.9	Hepatic Jaundice	208	
ECE 10.10	Obstructive Jaundice	211	
11. Mineral	S	214	
ECE 11.1	Wilson's Disease	214	
ECE 11.2	Menkes Disease	217	
ECE 11.3	Indian Childhood Cirrhosis	220	
ECE 11.4	Hypercalcemia	223	
ECE 11.5	Hypocalcemia	226	
ECE 11.6	Iron Deficiency Anemia	229	
ECE 11.7	Hemochromatosis	232	
ECE 11.8	Acrodermatitis Enteropathica	235	
ECE 11.9	Keshan Disease	238	
ECE 11.10	Fluorosis	241	
ECE 11.11	Goiter	244	
12. Vitamins		247	
ECE 12.1	Beriberi	247	
ECE 12.2	Wernicke-Korsakoff Syndrome	250	
ECE 12.3	Ariboflavinosis	253	
ECE 12.4	Pellagra	256	
ECE 12.5	Pernicious Anemia	259	

x

J	Contents		xi
S. No.	Name of the Topic	Page Number	Signature of Faculty
ECE 12.6	Megaloblastic Anemia	262	
ECE 12.7	Vitamin B ₆ Deficiency	265	
ECE 12.8	Scurvy	268	
ECE 12.9	Night Blindness	271	
ECE 12.10	Rickets	274	
ECE 12.11	Osteomalacia	277	
ECE 12.12	Vitamin K Deficiency	280	
13. Nutrition	ו	283	
ECE 13.1	Kwashiorkor	283	
ECE 13.2	Marasmus	286	
ECE 13.3	Obesity	289	
14. Extrace	Ilular Matrix	292	
ECE 14.1	Ehlers-Danlos Syndrome	292	
ECE 14.2	Duchenne Muscular Dystrophy (DMD)	295	
ECE 14.3	Osteogenesis Imperfecta	298	
15. Endocri	nology	301	
ECE 15.1	Hypothyroidism	301	
ECE 15.2	Hashimoto's Thyroiditis	304	
ECE 15.3	Graves' Disease	307	
ECE 15.4	Addison's Disease	310	
ECE 15.5	Cushing's Disease	313	
ECE 15.6	Diabetes Insipidus	316	
16. Acid-Bo	16. Acid-Base Balance		
ECE 16.1	Metabolic Acidosis	319	
ECE 16.2	Metabolic Alkalosis	322	
ECE 16.3	Respiratory Acidosis	325	
ECE 16.4	Respiratory Alkalosis	328	

Early Clinical Exposure in Biochemistry

S. No.	Name of the Topic	Page Number	Signature of Faculty
17. Water a	nd Electrolyte Balance and Imbalance	331	
ECE 17.1	Dehydration	331	
ECE 17.2	Hyponatremia	334	
ECE 17.3	Hyperkalemia	337	
18. Miscella	neous Topics	340	
ECE 18.1	Cholera	340	
ECE 18.2	Severe Combined Immunodeficiency Disorder (SCID)	343	
ECE 18.3	Myasthenia Gravis	346	
ECE 18.4	Acute Renal Failure	349	
ECE 18.5	Chronic Renal Failure	352	
ECE 18.6	Nephrotic Syndrome	355	
ECE 18.7	Cystic Fibrosis (CF)	358	
ECE 18.8	COVID-19 Infection	361	

xii