

Ace Series

Essentials of Anatomy

A Concise Textbook

Volume 3

Lower Limb, Abdomen and Pelvis, and General Embryology

Second Edition

Subhadra Devi Velichety, MS, FASI (Anatomy)

Emeritus Professor (Dr. NTR University of Health Sciences)

S. V. Medical College

Tirupati, Andhra Pradesh, India

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*Dedicated to
My husband, Dr. Hanumantha Rao Velichety, who has been my inspiration and motivator.*

Subhadra Devi Velichety, MS, FASI (Anatomy)

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Available Online: MCQs, Numerical Aids to Learning Anatomy, Clinical Questions in Anatomy

To access the content, scan the QR code available on the inside of the book's front cover.

Preface

The rapid curricular and assessment reforms introduced by the National Medical Commission (NMC) under the framework of Competency-Based Medical Education (CBME) have reshaped the way anatomy is taught and learned. By integrating basic sciences with clinical applications, CBME sharpens contextual understanding and nurtures problem-solving skills essential for tomorrow's medical professionals.

Today's generation of learners seeks clarity, simplicity, and relevance. They prefer simplified, structured content that aids comprehension. This book is designed:

- To serve as a comprehensive learning and exam preparation tool aligned with the NMC's competency-based syllabi.
- To provide in-depth clinical correlations for every topic in a format that is easily understood and reproduced.

The hallmark of this edition lies in its point-wise presentation, supported by simple diagrams, flow-charts, tables, and mnemonics. Topics are structured in a question-and-answer format, enabling quick recall and effective revision, particularly in the

run-up to university and regulatory examinations. Beyond medical students, this resource will also benefit learners in dental, nursing, physiotherapy, medical laboratory technology, and even alternate systems of medicine such as Ayurveda and homeopathy.

To extend learning beyond the printed page, the online companion content further enhances learning with MCQs, numerical mnemonics, and real-life clinical case scenarios accompanied by explanatory notes. These additions aim to bridge theory with practice, motivating students to appreciate the clinical relevance of anatomy in everyday medical decision-making.

As this work represents the effort of a single author, it remains open to improvement. Constructive feedback from students, colleagues, and specialists across medical and allied disciplines is welcomed to ensure further improvement and relevance across generations of learners. It is my hope that this book not only supports examination success but also inspires a deeper appreciation of anatomy as the foundation of medical science.

Subhadra Devi Velichety, MS, FASI (Anatomy)

Acknowledgments

This book has been prepared with the support of several organizations and individuals who have been associated with me for several years now.

I am deeply grateful to Dr. NTR University of Health Sciences, Vijayawada, Andhra Pradesh, for offering me the position of Emeritus Professor so that I could continue academic activities and be stimulated.

My sincere thanks go to the administrators, faculty, and postgraduate and undergraduate students of the Department of Anatomy at Sri Venkateswara Medical College, Tirupati; SPMCW (SVIMS), Tirupati; Apollo Institute of Medical Sciences and Research (AIMSR), Chittoor; and Osmania Medical College, Hyderabad, for their constant support and feedback.

I am profoundly thankful to Dr. Ravindra Kumar Boddeti, Associate Professor of Anatomy at Parul University Vadodara, Gujarat; Dr. Naga Jyothi, Assistant Professor of Anatomy at Anna Gowri Medical College, Puttur, Andhra Pradesh; Dr. Jyothi Asok Kumar, Assistant Professor at Government Medical College, Kadapa, Andhra Pradesh; Dr. Rajesh, Assistant Professor, Andhra Medical College, Vizag, Andhra Pradesh; Mr. D. Kishore Naick and Mr. Thyagaraju, Assistant Professors at SVIMS – SPMCW, Tirupati,

Andhra Pradesh for continuous support, constant feedback, and valuable insights at various stages of preparing this book.

I humbly acknowledge the unclaimed cadaver donors who have illuminated the path of anatomical knowledge. Their silent contribution has been the cornerstone of medical education, reminding us that even in death, they continue to serve the living.

I extend my gratitude to the team at Thieme for agreeing to publish this book, and to the production team for their dedicated support and meticulous work.

I thank all my students—both undergraduate and postgraduate, past and present—across medicine, alternate systems of medicine, nursing, physiotherapy, and allied health sciences. Their enthusiasm and curiosity have been my continuous source of inspiration in organizing the contents of this and other books I have authored.

Finally, I express my heartfelt gratitude to my children, their spouses, and grandchildren whose unwavering support and encouragement have sustained me in pursuing my academic ambitions. Their patience and motivation have been the foundation upon which this work rests.

Subhadra Devi Velichety, MS, FASI (Anatomy)

List of Reviewers

AbhiBhushan Mishra

Professor
Department of Anatomy
KD Medical College
Mathura, Uttar Pradesh

Akhilesh Kumar Singh

Principal
Department of Anatomy
Kaya Chikitsa
Sardar Ajit Singh Smriti Ayurveda
Bhopal, Madhya Pradesh

Akhtar Ur Zaman

Professor
Department of Anatomy
Tripura Santiniketan Medical College
Agartala, Tripura

Anjana Mittal

Professor and Head
Department of Anatomy
Maharishi Markandeshwar Institute of Medical Sciences & Research
Ambala, Haryana

Anjulata Rai

Professor
Department of Anatomy
Dr. Ram Manohar Lohia Hospital Post Graduate Institute of Medical Education and Research
New Delhi, Delhi

Anterpreet Arora

Professor and Head
Department of Anatomy
Shri Guru Ram Das Institute of Medical Sciences and Research
Amritsar, Punjab

Aparna Veda Priya

Professor and Head
Department of Anatomy
Government Medical College
Yadadri, Telangana

A.P.S. Batra

HOD
Department of Anatomy
BPS Government Medical College for Women
Sonapat, Haryana

Apurba Patra

Associate Professor
Department of Anatomy
AIIMS
Bhatinda, Punjab

Arpan Haldar

Registrar
Department of Anatomy
All India Institute of Medical Sciences (AIIMS), Deoghar
Deoghar, Jharkhand

Avni Patel

Assistant Professor
Department of Anatomy
Pacific Institute of Medical Science
Udaipur, Rajasthan

Azmi Mohsin

HOD
Department of Anatomy
Saraswati Medical College
Unnao, Uttar Pradesh

Banna Arpitha

Assistant Professor
Department of Anatomy
Government Medical College
Sircilla, Telangana

Benjamin W.

Professor
Department of Anatomy
PK Das Institute of Medical Sciences
Palakkad, Kerala

Bishwajeet Saikia

Assistant Professor
Department of Anatomy
North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences
Shillong, Meghalaya

Chada Jayasree

Associate Professor
Department of Anatomy
Surabhi Institute of Medical Sciences
Siddipet, Telangana

List of Reviewers

Charu Taneja

Professor
Department of Anatomy
Govt. Medical college Nagaur
Nagaur, Rajasthan

Debabani Bora

Associate Professor
Department of Anatomy
Jorhat Medical College & Hospital
Jorhat, Assam

Deepanshu Shukla

Assistant Professor
Department of Anatomy
T.S. Misra Medical College & Hospital
Lucknow, Uttar Pradesh

Devena Chhayala

HOD
Kaya Chikitsa
Sardar Ajit Singh Smriti Ayurveda
Bhopal, Madhya Pradesh

Golla Rohini Devi

Professor and Head
Department of Anatomy
Viswabharathi Medical College
Kurnool, Andhra Pradesh

Gyanaranjan Nayak

Associate Professor
Department of Anatomy
Institute of Medical Sciences and Sum Hospital, Campus-II
(Siksha 'O' Anusandhan)
Bhubaneswar, Odisha

Gyanraj Singh

Assistant Professor
Department of Anatomy
Jajati Keshari Medical College and Hospital
Jajpur, Odisha

Ina Nath Sutia

Professor
Department of Anatomy
Lakhimpur Medical College
North Lakhimpur, Assam

Jagbhan Singh

Assistant Professor
Department of Anatomy
Autonomous State Medical College
Lakhimpur, Uttar Pradesh

Jaswinder Kaur

Professor and Head
Department of Anatomy
Maharishi Markandeshwar Institute of Medical Sciences &
Research
Sadopur, Haryana

Jayakumar V.R.

Associate Professor
Department of Anatomy
Government Coimbatore Medical College
Coimbatore, Tamil Nadu

Jayasri Devi

Professor
Department of Anatomy
Fakhruddin Ali Ahmed Medical College
Barpeta, Assam

Julie Tudu

Associate Professor
Department of Anatomy
Hi-Tech Medical College & Hospital
Bhubaneswar, Odisha

Jyoti Dhakad

Assistant Professor
Department of Anatomy
Rajiv Gandhi Ayurved College
Bhopal, Madhya Pradesh

Jyotsna Singh

Associate Professor
Department of Anatomy
Government Medical College and Hospital, Chandigarh
Chandigarh

K. Malathi

Professor
Department of Anatomy
Nimra Institute of Medical Sciences
Vijayawada, Andhra Pradesh

K. Savithri

Professor and Head
Department of Anatomy
Coimbatore Medical College
Coimbatore, Tamil Nadu

Kalpana Sogala

Assistant Professor
Department of Anatomy
Government Medical College
Ramagundam, Telangana

Kalyana Panchakshari

Associate Professor
Department of Anatomy
Kamineni Academy of Medical Science
Hyderabad, Telangana

Kiran K.

Associate Professor
Department of Anatomy
Palakkad Institute of Medical Sciences
Palakkad, Kerala

M. Padmavathi

Professor and Head
Department of Anatomy
Government Medical College
Vikarabad, Telangana

M. Vijaianand

Professor and Head
Department of Anatomy
KMCH Institute of Health Sciences & Research Centre
Coimbatore, Tamil Nadu

Malamoni Dutta

Associate Professor
Department of Anatomy
Pragjyotishpur Medical College & Hospital
Guwahati, Assam

Manali Arora

Associate Professor
Department of Anatomy
Mahatma Gandhi Medical College
Jaipur, Rajasthan

Manoj Kumar Naik

Associate Professor
Department of Anatomy
SCB Medical College
Cuttack, Odisha

Meet Krishna

Associate Professor
Department of Anatomy
Baba Kinaram Autonomous State Medical College
Chandauli, Uttar Pradesh

Mohammed Shafique

Assistant Professor
Department of Anatomy
Hi-Tech Medical College & Hospital
Bhubaneswar, Odisha

Nirmal Kumar K.

Associate Professor
Department of Anatomy
Mahavir Institute of Medical Sciences
Vikarabad, Telangana

P. Samata Rohini

Professor
Department of Anatomy
Surabhi Institute of Medical Sciences
Siddipet, Telangana

Pankaj Singh

Associate Professor
Department of Anatomy
Saraswati Medical College
Unnao, Uttar Pradesh

P.K. Ramakrishnan

Professor and Head
Department of Anatomy
PK Das Institute of Medical Sciences
Palakkad, Kerala

Prashant E. Natekar

Professor and Head
Department of Anatomy
Mahavir Institute of Medical Sciences
Vikarabad, Telangana

Punnya S. Nath

Professor
Department of Anatomy
Employee State Insurance Corporation Medical College & Hospital
Guwahati, Assam

R. Neelima

Professor and Principal
Department of Anatomy
Maharaja Institute of Medical Sciences
Vizianagaram, Andhra Pradesh

R.S. Chauhan

Professor and Head
Department of Anatomy
Maharishi Markandeshwar Institute Of Medical Sciences & Research
Solan, Himachal

Rahul Rai

Associate Professor
Department of Anatomy
Heritage Institute of Medical Sciences
Varanasi, Uttar Pradesh

List of Reviewers

Rajasri Chunder

Professor
Department of Anatomy
Jagannath Gupta Institute of Medical Sciences & Hospital
Kolkata, West Bengal

Rajib Kundu

Associate Professor
Department of Anatomy
Institute of Postgraduate Medical Education & Research
Kolkata, West Bengal

Ram Prakash Saini

Senior Demonstrator
Department of Anatomy
Pacific Institute of Medical Science
Udaipur, Rajasthan

Ramakrushna Sahu

Principal
Department of Anatomy
Pt. Raghunath Murmu Medical College and Hospital
Baripada, Odisha

Rani Nallathambi

Professor and Head
Department of Anatomy
MOSC Medical College
Kolenchery, Kerala

Rashmi Rekha Bordoloi

Associate Professor
Department of Anatomy
Nalbari Medical College
Nalbari, Assam

Reshma Ghosh

Assistant Professor
Department of Anatomy
RG Kar Medical College
Kolkata, West Bengal

Rubi Saikia

Professor
Department of Anatomy
Assam Medical College
Dibrugarh, Assam

Sakthivel N.

Associate Professor
Department of Anatomy
KMCH Institute of Health Sciences & Research Centre
Coimbatore, Tamil Nadu

Sarah Ralte

Assistant Professor
Department of Anatomy
North Eastern Indira Gandhi Regional Institute of Health
and Medical Sciences
Shillong, Meghalaya

Shweta Solan

Associate Professor
Department of Anatomy
Kalinga Institute of Medical Sciences
Bhubaneswar, Odisha

Brig. Sushil Kumar

Professor and Head
Department of Anatomy
Amrita School of Medicine
Faridabad, Haryana

Sumalatha

Professor and Head
Department of Anatomy
Government Medical College
Sangareddy, Telangana

Sunil Mishra

Associate Professor
Department of Anatomy
Vijayshree Ayurvedic Medical College and Hospital
Jabalpur, Madhya Pradesh

Suranjali Sharma

Associate Professor
Department of Anatomy
Employee State Insurance Corporation Medical College &
Hospital
Guwahati, Assam

Swathi Purnima

Professor and Head
Department of Anatomy
Pinamaneni Sidhartha Institute of Medical Sciences
Vijayawada, Andhra Pradesh

Tejendra Singh

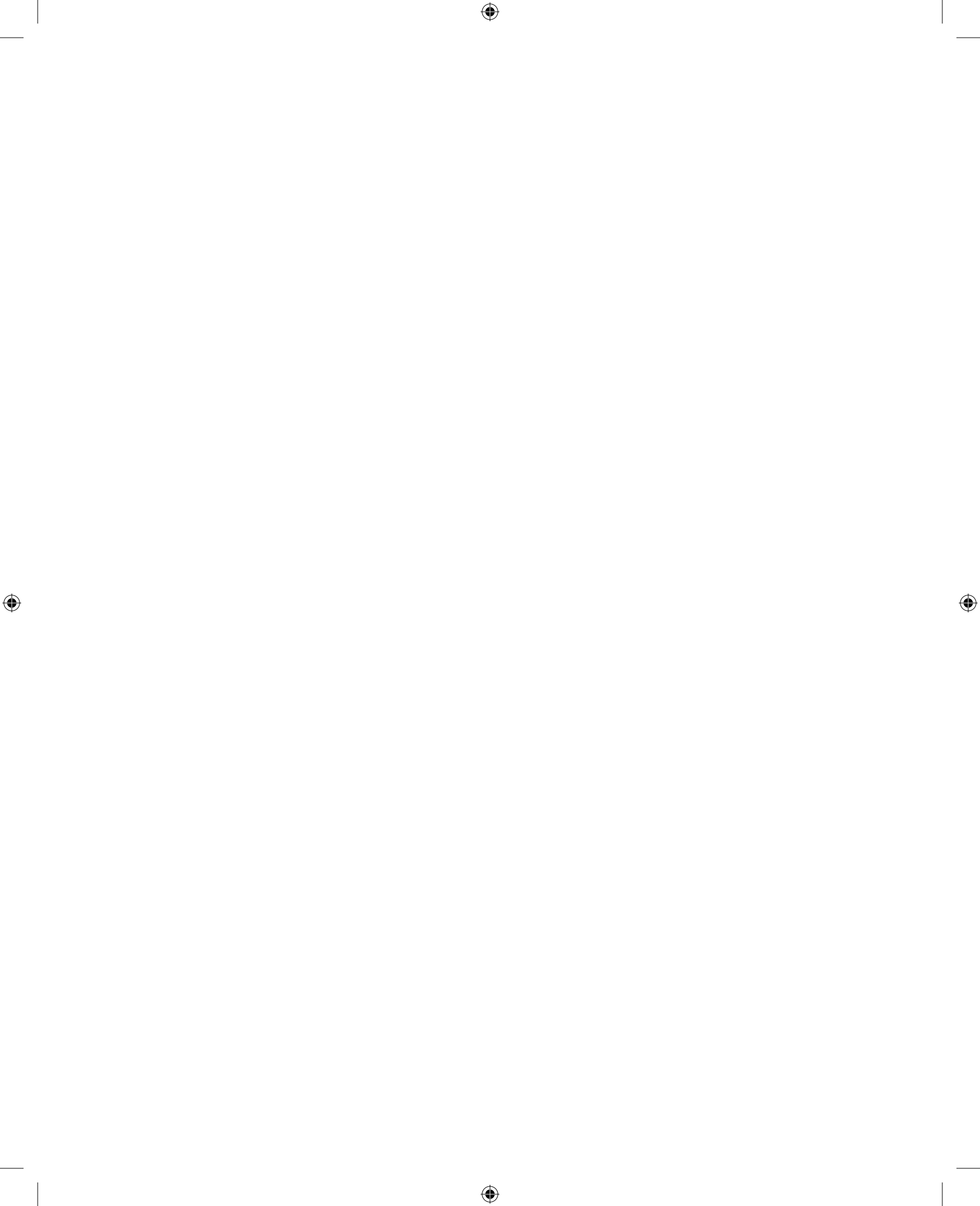
HOD
Department of Anatomy
KD Medical College
Mathura, Uttar Pradesh

Tribeni Medhi

Associate Professor
Department of Anatomy
Fakhruddin Ali Ahmed Medical College
Barpeta, Assam

Uday Kumar
Professor and Head
Department of Anatomy
Neelima Institute of Medical Sciences
Hyderabad, Telangana

Vuppala Janaki
Professor and Head
Department of Anatomy
Government Medical College
Mahabubnagar, Telangana



About the Ace Series

Medical education is evolving—and so are the resources that support it.

The **Ace Series** reimagines the familiar Q&A format as a **concise, academically rigorous textbook experience**, bringing together essential knowledge, conceptual clarity, clinical relevance, and curricular alignment in a format designed for contemporary medical education.

Built around a simple premise—that the right question can lead to deeper understanding—the Ace Series transforms questions and answers into a structured pathway through the subject. “Ace”, meaning *to do very well*, represents the series’ aspiration: to make essential medical knowledge clearer, more accessible, and more meaningful for both learners and educators.

The series is designed not merely as a collection of questions and answers but also as a focused learning resource that can support the entire academic journey—from classroom teaching and independent learning to consolidation, application, and continued development of medical knowledge.

What Defines the Ace Series?

- **The Q&A Format, Reimagined as a Concise Textbook**

The Ace Series combines the accessibility of questions and answers with the depth, structure, and continuity of a textbook.

Each title brings together the essential and high-yield concepts of the MBBS curriculum in a carefully curated format.

- **Designed Around Understanding**

A question is more than a prompt for recall—it is an entry point into a concept. The Ace Series uses this principle to organize medical knowledge in a way that encourages learners to identify, understand, connect, and retain important concepts. Information is presented with a deliberate emphasis on clarity, hierarchy, and relevance, helping learners see the larger picture while remaining focused on what matters.

- **Curriculum-Aligned, Academically Relevant, Clinically Connected**

Core content is aligned with the MBBS curricula and essential areas of subject knowledge, while clinical

perspectives and case-based applications help connect foundational concepts with their relevance to medical practice. This balance creates a resource that is academically grounded while remaining connected to the way medicine is understood and applied.

- **A Resource for Learning and Teaching**

The structured nature of the Ace Series makes it equally relevant beyond independent study.

For students, it offers a clear, dependable, and easy-to-navigate learning companion.

For faculty, it provides a structured, curriculum-aligned resource that can complement lectures, tutorials, classroom discussions, and other teaching methodologies.

For institutions, it offers an opportunity to incorporate a consistent and academically curated learning resource within broader educational frameworks.

- **From Knowledge to Application**

Understanding medicine requires more than knowing individual facts. It requires the ability to connect concepts and apply them in context.

The Ace Series therefore integrates case studies and clinical, conceptual, and case-based MCQs to extend learning beyond the written answer. These elements encourage learners to engage with concepts from different perspectives and develop the ability to apply knowledge to clinical situations.

Why Does the Ace Series Matter?

The challenge in medical education is not simply the volume of information—it is making that information accessible, coherent, relevant, and usable.

The Ace Series addresses this challenge through a carefully considered balance of the following:

- Conciseness without compromising substance.
- Structure without unnecessary complexity.
- Conceptual depth without excessive detail.
- Clinical relevance without losing academic focus.
- Curricular alignment without limiting independent learning.

By bringing these qualities together within a Q&A-based concise textbook, the series creates a distinctive learning experience for modern medical education.

The Ace Difference

The Ace Series brings together the strengths of a textbook and the accessibility of a Q&A resource to create something distinct.

- Concise, yet comprehensive.
- Structured, yet engaging.
- Academically rigorous, yet accessible.
- Concept-driven, yet clinically relevant.
- Student-focused, yet faculty- and institution-ready.

The Ace Series represents a contemporary approach to medical learning—one that recognizes that effective education is not about presenting more information but about presenting the right information in the right structure, with the right context.

At its heart, the Ace Series is built on a simple idea: ask the right question, understand the answer, and build from there.

User's Guide to This Book

Dear Readers,

Anatomy is one of the most important foundational subjects in the MBBS curriculum. A clear understanding of anatomical structures and their relationships forms the basis for learning physiology, pathology, surgery, radiology, and other clinical subjects.

At the same time, anatomy can feel overwhelming because of the sheer volume of information, complex terminology, and the need to understand three-dimensional relationships between structures.

Ace Series: Essentials of Anatomy has been designed to simplify this learning process.

Presented in three comprehensive yet concise volumes, the book focuses on making anatomy easier to understand, remember, and revise. The content is presented in a question-and-answer format (Q&A), allowing students to approach each topic in a structured and examination-oriented manner without losing conceptual clarity.

What Makes This Book Different?

- **Concise and focused learning:** The book is designed for students who want to understand anatomy without getting lost in unnecessary detail. The content emphasizes:
 - Concise explanations of essential anatomical concepts.
 - Focused coverage of important topics.
 - Q&A presentation for active learning.
 - Simple and easy-to-understand language.
 - Clear organization for systematic study and revision.

The concise format helps students cover the subject efficiently while retaining the concepts that matter most.

- **Simplifying complex anatomy:** Anatomy is not simply about memorizing structures—it is about understanding their location, relations, connections, functions, and clinical significance.

The book simplifies complex anatomical concepts by presenting them in a clear and structured manner. Difficult topics are broken down into

manageable sections so that students can progressively build their understanding.

The goal is to make anatomy less intimidating and more approachable, particularly for students encountering the subject for the first time.

- **High-quality illustrations:** The book uses high-quality illustrations to support the written content and simplify the understanding of anatomical structures.

These illustrations help students:

- Visualize anatomical relationships.
- Correlate text with structures.
- Recall important anatomical details.
- Revise complex topics more effectively.

- **A three-volume approach to anatomy**

- The three-volume structure allows students to approach the subject in an organized manner rather than attempting to manage the entire breadth of anatomy at once.
- Each volume can be studied systematically alongside the academic curriculum, helping students build their anatomical knowledge progressively.

How Students Can Use This Book

For maximum benefit, students should use the book consistently throughout the academic year rather than relying on it only during examinations.

A practical approach is:

1. Attend lectures and practical sessions regularly.
2. Read the corresponding topic from the relevant volume after class.
3. Study each topic through the Q&A format.
4. Use the illustrations alongside the text to visualize structures.
5. Try to recall the answer before reading it completely.
6. Revisit difficult topics and illustrations during revision.
7. Before examinations, use the Q&A format for rapid and repeated revision.

The aim should be to understand first, recall next, and revise repeatedly.

A Practical Companion for Anatomy Learning

Ace Series: Essentials of Anatomy is designed to bridge the gap between detailed anatomical knowledge and the practical need for concise, understandable, and revisable study material.

Its combination of the following features makes it a practical learning companion for undergraduate medical students:

- Concise content.
- Q&A-based learning.
- High-quality illustrations.
- Simplified explanations.
- Focused revision.

Final Message

Anatomy becomes easier when complex information is presented in a way that is simple to understand, easy to visualize, and convenient to revise.

Ace Series: Essentials of Anatomy has been designed with this approach in mind. Use it alongside your lectures and practical sessions, return to it regularly, and make the illustrations and questions an active part of your learning.

Understand the Structures. Visualize the Relationships. Ace Anatomy.

Key Highlights

Competencies

- AN2.1 Describe the parts, types, peculiarities of each type, and the blood and nerve supply of bones
AN2.2 Describe the laws of ossification, epiphysis, and various types of epiphyses and their importance
AN2.3 Describe the special features of a sesamoid bone

A comprehensive content mapping has been done to align with the revised NMC 2024 curriculum, ensuring integration of newly introduced topics for enhanced learning outcomes.

Q1. Name the components of the skeletal system and their functions. (AN2.1)

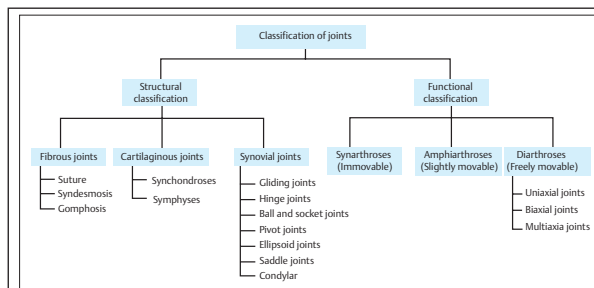
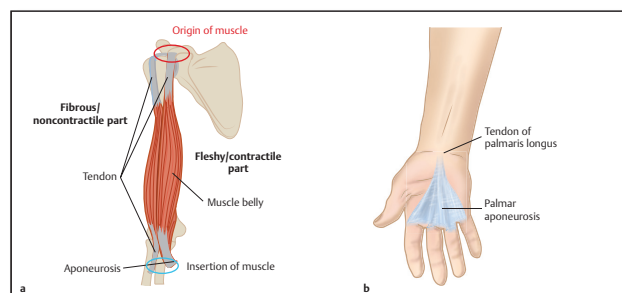
Components of the Skeletal System

The following are the components of the skeletal system:

- Rigid structures: *Bones* that contribute to the skeleton.
- Flexible connective tissue: *Cartilage* that reduces friction and absorbs shock at joints.
- Tough bands of dense connective tissue: *Ligaments* that connect bones to each other.

Updated CBME-aligned content structured in concise Q&A format which enhances clarity, boosts engagement and strengthens retention.

High-quality illustrations for better clarity and enhanced visual impact.



Pulmonary circulation (lesser circulation)	Systemic circulation (greater circulation)
Supplies oxygen and removes carbon dioxide from the heart	Moves blood from the heart to various tissues of the body and vice versa
Components are the pulmonary veins	Components are the aorta and the superior and inferior venae cavae
Carries deoxygenated blood from the right ventricle via the pulmonary trunk and pulmonary arteries to the lungs	Carries oxygenated blood and nutrients from the left ventricle via the aorta to the tissues of the body
Transport of oxygenated blood via pulmonary veins from the lungs to the left atrium	Transport of deoxygenated blood via the superior and inferior venae cavae from the body to the right atrium
The chambers used are the right ventricle and the left atrium	The chambers used are the left ventricle and the right atrium
Blood flow is from right to left	Blood flow is from left to right

Incorporates numerous flowcharts and tables to simplify complex topics, support easy retention, and ensure reproducibility in exams.

Clinical Importance

- Deep vein thrombosis (DVT): Clots in deep veins (especially legs).
- Varicose veins: Superficial venous incompetence (e.g., great saphenous vein).
- Central venous access: Jugular, subclavian, or femoral veins are used for intravenous (IV) lines.
- Superficial limb veins: Used for grafts (e.g., great saphenous vein in coronary bypass).

Covers a variety of clinical conditions pertaining to the topic for understanding the anatomical basis of the clinical condition.

Integrated online MCQs makes content more interactive, strengthens self-assessment, enhances knowledge retention, and prepares students for their exams.

30. Choose the odd one regarding the testing of muscles.
- Clavicular fibers of the pectoralis major—asking to abduct the arm to 90 degrees and then move anteriorly against resistance
 - Trapezius—shrugging the shoulders
 - Serratus anterior—asking the person to stretch both upper limbs and push the wall
 - Latissimus dorsi—abducting the arm to 60 degrees and then adducting against resistance

List of Five

- Nerves of the brachial plexus with root value C5, C6—four S's and A
 - Suprascapular nerve
 - Subscapular nerve (upper)
 - Subscapular nerve (lower)
 - Subclavius nerve
 - Axillary nerve

'Numerical Aids to Learning Anatomy' helps students remember anatomy more easily, makes learning quicker, supports exam preparation, and reduces mental effort.

Clinical case scenarios enable students to apply anatomy and develop clinical reasoning.

Clinical Case Scenario-10

Problem: A young adult presents to the orthopedic OPD with a 15-day history of falling on an outstretched hand with pain and weakness of the right wrist.

On examination: The patient complained about pain along the lateral side of the wrist when asked to dorsiflex and abduct the hand. There is tenderness over the anatomical snuffbox.

X-ray examination confirmed a fracture of the scaphoid.

Question:

- Give an anatomical explanation for the condition.
- Why is this condition clinically important?

Explanation:

- The most fractured carpal bone is the scaphoid.
- Fracture occurs across the narrow part -waist of the scaphoid.

Competency Chart

Q. no.	Competency	Topic	Page no.
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