

# Textbook of Human Embryology

Second Edition

with Clinical Cases, 3D Illustrations and Flowcharts

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

is the fully rewritten, revised and updated edition of the popular text which aims to meet the requirements of students and teachers as per the latest CBME Guidelines | Competency Based Undergraduate Curriculum for Indian Medical Graduate. The topics have been divided into small chapters to generate the confidence in the learner on the pattern of the Miller's pyramid.

## Salient Features of the Book

- **A complete textbook** on the subject for undergraduate medical, dental, AYUSH and nursing students.
- **Concise text** with clinical correlation for quick recapitulation during examination.
- **280 Color atlas 3D illustrations** to provide easy imagining of developing structures.
- **105 Line diagrams** are easy to draw figures for theory examination.
- **110 Flowcharts** help to revise and memorise the text and to consolidate the knowledge.
- **61 Tables** to summarise essential facts.
- **Summary (examination guide)** to overcome the difficulty of summarising the facts and developmental sequence in theory examinations.
- **NEXT, MCQ, Viva Voce, High Yielding Facts and Clinical Facts** markings for preparation of various upcoming academic entrance examinations.
- **81 Boxes** to focus on important topics.
- **Interesting facts** to isolate them from the main text so that these facts should not be missed by readers and ease the reading burden.
- **40 Scanning electron micrographs** to give real insight in developing structures.
- **76 Clinical cases** for early clinical exposure of various clinical anomalies encountered by eminent clinicians (vertical integration).
- **Special topics** such as assisted reproductive techniques (including *in vitro* fertilisation) and ultrasonography in embryology, surrogate motherhood, contraception, abortion, and infertility are also included to give orientation towards clinical aspects.
- **Companion Workbook** included to help students practise drawing of embryology diagrams.

**Yogesh Sontakke** MBBS, MD (Anatomy)

is currently Additional Professor, Department of Anatomy, Jawaharlal Institute of Postgraduate Medical Education & Research (JIPMER), Puducherry, an Institution of National Importance under the Ministry of Health & Family Welfare, Government of India. He is a compassionate teacher and admired by the students for chalk-n-board teaching. He is also a leading medical illustrator and known for stunning illustrations in anatomy. His constant perseverance, dedication and passion towards the field of teaching is reflected in his well-read books: *Textbook of Human Histology*, *Textbook of Human Anatomy* Vols 1 to 6, *Principles of Clinical Genetics*, *Principles of Histological Techniques*, *Immunohistochemistry and Microscopy*, and *Principles of Scientific Writing*.



**CBS Publishers & Distributors Pvt Ltd**

4819/XI, Prahlad Street, 24 Ansari Road, Daryaganj, 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  
Hyderabad | Jharkhand | Nagpur | Patna | Pune | Uttarakhand



QR Code to access online CBS Catalogue

ISBN:978-93-90709-10-6



Yogesh Sontakke

Textbook of Human Embryology

Second Edition

Free Companion Workbook Included

Second Edition

# Textbook of Human Embryology

with Clinical Cases, 3D Illustrations and Flowcharts

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



Free access to learn step-by-step drawing of embryology figures through videos on CBSiCentral App.



Yogesh Sontakke



CBS Dedicated to Education

CBS Publishers & Distributors Pvt Ltd



# Companion Workbook for Textbook of **Human Embryology** Second Edition

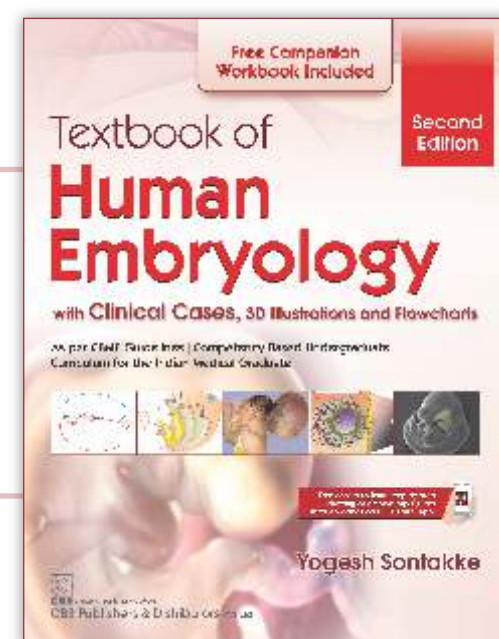
Free access to learn step-by-step  
drawing of embryology figures  
through videos on CBSiCentral App.



# Companion Workbook for Textbook of **Human Embryology** Second Edition

**Yogesh Sontakke**

This Logbook is free with  
Yogesh Sontakke's  
*Textbook of Human Embryology, 2/e*



Dedicated to Education  
**CBS**

**CBS Publishers & Distributors Pvt Ltd**

4819/XI, Prahlad Street, 24 Ansari Road, Daryaganj, 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  
Hyderabad | Jharkhand | Nagpur | Patna | Pune | Uttarakhand



QR Code to  
access online  
CBS Catalogue



Dedicated to Education

**CBS Publishers & Distributors Pvt Ltd**

Name: \_\_\_\_\_

Course: \_\_\_\_\_ Year: \_\_\_\_\_

Batch: \_\_\_\_\_ Roll number: \_\_\_\_\_

Name of the institute: \_\_\_\_\_

A 3D illustration of a human embryo in the early stages of development, showing the head, neck, and upper torso. The illustration is rendered in a realistic, anatomical style with soft lighting and a warm color palette of pinks, reds, and oranges. It is positioned in the upper right quadrant of the cover, partially overlapping the title text.

Second Edition

Textbook of  
**Human**  
**Embryology**

**with Clinical Cases, 3D Illustrations and Flowcharts**

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



Second Edition

# Textbook of **Human Embryology**

**with Clinical Cases, 3D Illustrations and Flowcharts**

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

**Yogesh Sontakke** MBBS, MD

Additional Professor

Department of Anatomy

Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER)

(An Institution of National importance under the Ministry of Health and Family Welfare, Government of India)

Puducherry, India



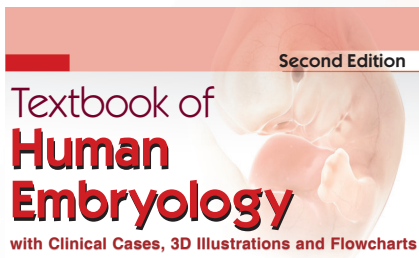
**CBS Publishers & Distributors Pvt Ltd**

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 author has tried his best in giving information available to him while preparing the material for this 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, the printer and the author will not be held responsible for any inadvertent errors, or inaccuracies.



ISBN: 978-93-90709-10-6

Copyright © Yogesh Sontakke and Publisher

Illustrations: © Yogesh Sontakke

**Second Edition:** 2022

**First Edition:** 2019

Reprint: 2020

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 written, from the author and the 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: 011-23289259, 23266861, 23266867 Fax: 011-23243014

Website: [www.cbspd.com](http://www.cbspd.com)

e-mail: [delhi@cbspd.com](mailto:delhi@cbspd.com); [cbspdubs@airtelmail.in](mailto:cbspdubs@airtelmail.in)

Corporate Office: 204 FIE, Industrial Area, Patparganj, Delhi 110 092

Ph: 011-4934 4934

Fax: 011-4934 4935

e-mail: [publishing@cbspd.com](mailto:publishing@cbspd.com); [publicity@cbspd.com](mailto:publicity@cbspd.com)

#### Branches

- **Bengaluru:** Seema House 2975, 17th Cross, K.R. Road, Banasankari 2nd Stage, Bengaluru 560 070, Karnataka, India  
Ph: +91-80-26771678/79 Fax: +91-80-26771680 e-mail: [bangalore@cbspd.com](mailto:bangalore@cbspd.com)
- **Chennai:** 7, Subbaraya Street, Shenoy Nagar, Chennai 600 030, Tamil Nadu, India  
Ph: +91-44-26680620, 26681266 Fax: +91-44-42032115 e-mail: [chennai@cbspd.com](mailto:chennai@cbspd.com)
- **Kochi:** 42/1325, 1326, Power House Road, Opp KSEB, Power House, Ernakulam 682 018, Kerala, India  
Ph: +91-484-4059061-65 Fax: +91-484-4059065 e-mail: [kochi@cbspd.com](mailto:kochi@cbspd.com)
- **Kolkata:** 6/B, Ground Floor, Rameswar Shaw Road, Kolkata 700 014, West Bengal, India  
Ph: +91-33-22891126, 22891127, 22891128 e-mail: [kolkata@cbspd.com](mailto:kolkata@cbspd.com)
- **Lucknow:** Basement, Khushnuma Complex, 7-Meerabai Marg (behind Jawahar Bhawan), Lucknow 226 001, UP, India  
Ph: +91-522-4000032 e-mail: [tiwari.lucknow@cbspd.com](mailto:tiwari.lucknow@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 400 009, Maharashtra, India  
Ph: +91-22-66661880/89 e-mail: [mumbai@cbspd.com](mailto:mumbai@cbspd.com)

#### Representatives

- |                    |              |                    |              |                      |              |
|--------------------|--------------|--------------------|--------------|----------------------|--------------|
| • <b>Hyderabad</b> | 0-9885175004 | • <b>Jharkhand</b> | 0-9811541605 | • <b>Nagpur</b>      | 0-9021734563 |
| • <b>Patna</b>     | 0-9334159340 | • <b>Pune</b>      | 0-9623451994 | • <b>Uttarakhand</b> | 0-9716462459 |

Printed at Nutech Print Services (India), Faridabad, Haryana, India

# Preface to the Second Edition

This edition of *Textbook of Human Embryology* has been revised to fulfil the requirements of students and teachers as per the latest Competency Based Undergraduate Curriculum for Indian Medical Graduate.<sup>1</sup> The topics are divided in small chapters to generate the confidence in the learner in the pattern of the Miller's pyramid.<sup>2</sup> It helps to train the students to achieve the required levels of the given competencies: Knows (K), knows how (KH), and shows how (SH), with the help of included domains of learning, Knowledge (K) and skills (S). To fulfil the need for curriculum, requirements of the students and the field of medicine, this textbook characterizes the following features:

- **Concise text** with clinical correlation for quick recapitulation during examination.
- **280 Color atlas 3D illustrations** to provide easy imagining of developing structures.
- **105 Line diagrams** (practice figures) are easy to draw figures for theory examination.
- **110 Flowcharts** help to revise and memorize the text and to overcome the difficulty of summarizing the facts and developmental sequence in theory examinations and consolidation of knowledge.
- **61 Tables** to summarize essential facts.
- **Summary (examination guide)** to overcome the difficulty of summarizing the facts in theory examinations.
- **NEXT, MCQ, Viva, High yielding facts and Clinical facts** markings for preparation of various upcoming academic entrance examinations.
- **81 Boxes** to focus on important topics.
- **Interesting facts** to isolate them from the main text, so that these facts should not be missed by readers and ease the reading burden.
- **40 Scanning electron micrographs** to give real insight into developing structures.
- **76 Clinical cases** for *early clinical exposure* of various clinical anomalies encountered by eminent clinicians (vertical integration).
- **Special topics** such as assisted reproductive techniques (including *in vitro* fertilization) and ultrasonography in embryology, fetal viability, surrogate motherhood, contraception, sex ratio, teratogenesis, abortion, infertility, sterility and pregnancy tests are also included to give orientation toward clinical aspects.

I am hopeful that this book will help to fulfil all the requirements of students and teachers.

Students are suggested to read the book in the following sequence:

Color atlas 3D illustrations → Stages of development →  
Flowchart → Table → Summary (Examination Guide) →  
Practice Figure

Any suggestions from the readers are welcome.

**Yogesh Sontakke**

[dryogeshas@rediffmail.com](mailto:dryogeshas@rediffmail.com)

<sup>1</sup>Medical Council of India, Competency Based Undergraduate Curriculum for the Indian Medical Graduate, 2018. Vol 1; pg 41–80.

<sup>2</sup>Miller GE. The assessment of clinical skills/competence/performance. Acad Med 1990;65(9 Suppl):S63–7.





# Preface to the First Edition

This *Textbook of Human Embryology* has been written keeping in mind the requirements of students and teachers. Due to the complexity of the subject, readers face difficulty in understanding and imagining the developing human structures. Hence, in the present book, the attempt has been made to provide all necessary information for easy understanding.

User-friendly features of this book with their purposes are as follows:

- **Concise text** is given in easy language; unnecessary details are avoided.
  - **3D illustrations** to provide easy imagining of developing structures.
  - **Flowcharts** to revise and memorise the developmental sequence.
  - **Tables** to summarise essential facts.
  - **Summary (examination guide)** to overcome the difficulty of summarising the facts in theory examinations.
  - **Neet, MCQ, Viva Voce and Clinical facts** markings for preparation of various upcoming academic entrance examinations.
- **Boxes** to focus on important topics.
  - **Interesting facts** to isolate them from the main text, so that these facts should not be missed by readers.
  - **40 Scanning electron micrographs** to give real insight in developing structures.
  - **70 Clinical cases** for early clinical exposure of various clinical anomalies encountered by eminent clinicians.
  - **Special topics** such as assisted reproductive techniques (including *in vitro* fertilisation) and ultrasonography in embryology are also included to give orientation towards clinical aspects.

I am hopeful that this book will help to fulfil all the requirements of students and teachers.

Students are suggested to read in the following sequence:

Illustrations → Stages of development → Flowchart → Table  
→ Summary (examination guide) → Practice Figure

Any suggestions from the readers for rectification and improvement are welcome at [dryogeshas@rediffmail.com](mailto:dryogeshas@rediffmail.com)

**Yogesh Sontakke**



# Acknowledgements

I am thankful to Prof Dr Rakesh Aggarwal, Director, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry, for encouraging and giving suggestions for the improvement of this book. I am thankful to Professors Dr Pankaj Kundra, Dean (Academics); Dr Parkash Chand, former Professor Senior Scale in Anatomy; Dr M Sivakumar, former Professor and Head and Dean, JIPMER, Karaikal; and Dr K Aravindhan, Professor, Dr Suma HY, Professor and Head, Department of Anatomy, JIPMER, Puducherry; for their continuous encouragement and inspiration.

I am obliged to Prof Kathleen Sulik (Chapel Hill, North Carolina, USA), Dr Kumaravel S (Paediatric Surgery, JIPMER), Dr Bibekanand Jindal (Paediatric Surgery, JIPMER), Dr Uday Kumbhar (General Surgery, Puducherry), Dr Adhisivam B Neonatology, JIPMER), Dr Subashini Kaliaperumal (Ophthalmology, JIPMER), Dr Haritha Sagili (OBGY, JIPMER), Dr Mamatha Gowda (OBGY, JIPMER), Dr Keshav Malhotra (Rainbow IVF, Agra), Dr Saikat Chakraborty (Oral Pathology, Puducherry), Dr Rohit Rao (Ophthalmology, Raipur), Dr Prakhar Mohaniya (Paediatrics, Jhansi) for their contribution of scanning electron micrographs, clinical images and suggestions.

I acknowledge the encouragement and continuous unconditional support from Dr Sarasu J, Dr Raveendranath V, Dr Suman Verma, Dr Sulochana Sakthivel, and Dr Rajasekhar SSSN. I am especially thankful to Dr V Gladwin, Vice-Dean (Academics), Dr Dharmaraj Tamgire, Dr Dinesh Kumar V, Dr G Dhivya Lakshmi, and Dr Mrinmayee Deb Barma for their critical suggestions.

I also acknowledge Drs Chandan Lal Gupta, Surraj S, Arun Prasad (senior residents) for their support. I also acknowledge Drs Sankaranarayanan G, Jahira Banu T, Lavanya R, CH Chaitanya Kumar, Raju Kumaran T, Srinivasan S, Sivasakthi M, Abbirami GR, Regina C, Sandy S, Urvi Sharma, Grace Suganya, Nandhini R, Nithya D, Kalaivani K, Jakkula Akhil (junior residents) for their help. I am thankful to Mr S Kirubanandan for his help in the typesetting of this manuscript.

I am thankful for the acceptability of views and support of Mr SK Jain (CMD) and Mr Varun Jain (Director), CBS Publishers & Distributors Pvt Ltd. I am obliged for continuous support from Mr YN Arjuna (Senior Vice-President—Publishing, Editorial and Publicity) and his entire team, especially Ms Ritu Chawla (GM—Production), Ms Ritu Tiwari (DTP operator), Mr Neeraj Prasad (graphic artist), Mr Neeraj Kumar Sharma (Editor). I appreciate the entire team of CBS Publishers & Distributors in the shaping of this book.

I am thankful to the support of entire CBS team for making the success of this book especially: Mr Deepak Rao (Bangalore), Mr Prasun Bhattacharya (Kolkata), Mr Sarkar (Mumbai), Mr Dinesh Dheek (Delhi), Mr James KC (Kochi), Mr S Ramesh (Chennai), Mr Sarbajit Gon (Bangalore), Mr Sumit Behl (New Delhi), Mr Ramesh (Hyderabad), Mr Jacob Joseph (Cochin), Mr S Muralidaran (Chennai), Mr B Jothi (Chennai), Mr BL Pradeep (Bangalore), Mr Ajay Kumar M (Bangalore), Mr Vikrant Shah (Uttarakhand), Mr Dinesh Giri (Rajasthan), Mr Javed (Mumbai), Mr Anand C (Bangalore), Mr Manish (Mumbai), Mr Dipam Chatterjee (Bihar and Jharkhand), Mr Krishnendu (Kolkata), Mr Pravin S Dhotre (Nagpur), Mr P Rajan (Chennai), Mr T Shinod (Calicut), Mr Narendra Singh (MP), Mr Somnath (Kolkata), Mr Sunil Pandey (Lucknow), Mr Vijay Pratap Singh (Lucknow), Mr Sujeet Morabad (Belgaum), Mr Balraj (Mangalore), Mr Tarak (Kolkata).

I thank my wife Dr Anindita for editing, proof-reading, and her continuous support. I appreciate my little girl Aripa for her unconditional love and support. My sincere regards to my family for moral support. I thank all my supporters who made this possible. I thank the Almighty for giving me strength and patience to continue my work.

## Acknowledgements for Image Courtesy

I am grateful to the following academicians for their suggestions and contributions of clinical images (indicated in front of their names) in the present book.

- **Professor Kathleen Sulik**, PhD, Emeritus Professor, University of North Carolina School of Medicine, Department of Cell Biology and Physiology, Chapel Hill, North Carolina, USA.  
Scanning electron micrographs: 7.1 to 7.5, 8.1 to 8.5, 11.1 to 11.3, 12.1 to 12.4, 13.1, 14.1, 14.2, 15.1, 18.1 to 18.4, 19.1, 20.1, 21.1 to 21.3, 22.1 to 22.4, 23.1, 23.2, 24.1, 24.2, AV.1, AV.2.
- **Dr Kumaravel S**, MBBS, MS, MCh (Paediatric Surgery), Professor, Department of Paediatric Surgery, JIPMER, Puducherry, 605 006, India.  
Clinical images: 7.2, 9.5, 10.1 to 10.3, 11.1, 14.2 to 14.7, 17.1, 18.3, 20.1, 20.2, 21.1 to 21.5, 22.1 to 22.3, 26.1, 30.1, AV.1 to AV.3.
- **Dr Uday Kumbhar**, Professor, Department of Surgery, JIPMER, Puducherry, 605006, India. Clinical images 11.2, 21.6, 21.7, 27.1



- **Dr Adhisivam B**, Professor, Department of Neonatology, JIPMER, Puducherry, 605 006, India. Clinical images: 12.2, 14.1, 22.4A, 22.5 to 22.7.
- **Dr Subashini Kaliaperumal**, MBBS, MS (Ophthalmology), FRCS, DNB (Ophthalmology), Professor and Head, Department of Ophthalmology, JIPMER, Puducherry. 605 006, India. Clinical images: 23.5 to 23.9.
- **Dr Haritha Sagili**, MBBS, MD, MRCOG, MFSRH, European University Diploma in Operative Gynaecological Endoscopy, FICS, CIMP, FIMSA, Professor, Department of Obstetrics and Gynaecology, JIPMER, Puducherry, 605 006. India. Clinical images: 9.1 to 9.4, 18.1, 28.1, 30.2.
- **Dr Mamatha Gowda**, Additional Professor, Department of Obstetrics and Gynaecology, JIPMER, Puducherry, 605 006, India. Clinical images: 7.1, 18.1, 18.2, 22.8 to 22.11, 29.1 to 29.4, 30.3.
- **Dr Keshav Malhotra**, MBBS MCE, Director, Rainbow IVF, Rainbow Hospitals, Agra, Uttar Pradesh, 282007. Clinical images: 3.1, 4.1, 4.2, 4.3, 5.1.
- **Dr Rohit Rao**, MBBS, MS (Ophthalmology), IOL and Anterior Segment Fellowship (Aravind Eye Hospital), Anterior Segment Surgeon, Shri Ganesh Vinayak Eye Hospital, Raipur, Chhattisgarh, India. Clinical images: 23.1 to 23.4, 23.10.
- **Dr Prakhar Mohniya**, MBBS, MD (Paediatrics), Fellowship in Neonatology. Senior Resident, Maharani Laxmi Bai Medical College, Jhansi, UP, 284128. India. Clinical images: 12.1, 22.4B.
- **Dr Saikat Chakraborty**, Resident, MDS (Oral Pathology), Mahatma Gandhi Postgraduate Institute of Dental Sciences, Puducherry, 605 006, India. Clinical images: 13.1.

**Yogesh Sontakke**

## Acknowledgements

I would like to thank the following teachers of anatomy for their constant blessings, encouragement, support, and kind words for this as well as my previous books.

- **Dr Shakuntala Pai** Former Associate Dean, Professor and Head, Kasturba Medical College, Manipal
- **Dr Mahesh GM** Professor, Basaveshwara Medical College and Hospital, Chitradurga, Karnataka
- **Dr TK Rajashree** Vice-Principal (Academics), Professor and Head, Malla Reddy Institute of Medical Sciences, Hyderabad, Telangana
- **Dr Rajneet Guha** Principal, and Professor, Indra Gandhi Institute of Medical Sciences, Sheikhpura, Patna, Bihar
- **Dr Joy Ghoshal** Dean, Professor and Head, All India Institute of Medical Sciences, Mangalagiri, AP
- **Dr Ashutosh Mangalagiri** Dean, Chirayu Medical College, Bhopal, MP
- **Dr Shivaji B Sukre** Dean, SRTR Government Medical College and Hospital, Ambejogai, MS
- **Dr Ashok Patil** Principal, Professor and Head, SMBT Dental College and Hospital and Postgraduate Research Centre, Sangamner, Ahmednagar, MS
- **Dr B Naveen Kumar** Vice-Dean and Professor, Mamata Academy of Medical Sciences, Bachupally, Hyderabad, Telangana
- **Dr Pritha S Bhuiyan** Professor and Head, Seth GS Medical College, Mumbai, MS
- **Dr Sundar Lal Jethani** Chief Medical Superintendent and Professor, Himalayan Institute of Medical Sciences, Dehradun, Uttarakhand
- **Dr Bertha AD Rathinam** Professor and Head, All India Institute of Medical Sciences, Bhopal, MP
- **Dr Brijendra Singh** Professor and Head, All India Institute of Medical Sciences, Rishikesh, Uttarakhand
- **Dr Surajit Ghatak** Professor and Head, All India Institute of Medical Sciences, Jodhpur, Rajasthan
- **Dr Padamjeet Panchal** Professor and Head, All India Institute of Medical Sciences, Patna, Bihar
- **Dr Biswabina Ray** Professor and Head, All India Institute of Medical Sciences, Kalyani, WB
- **Col (Dr) Sushil Kumar** Former Professor and Head, Armed Forces Medical College, Pune, MS
- **Dr Deepti Shastri** Dean (Academics), Professor and Head, Vinayaka Mission's Kirupananda Variyar Medical College and Hospitals, Salem, Tamilnadu
- **Dr Simmi Mehra** Professor and Head, All India Institute of Medical Sciences, Rajkot, Gujarat
- **Dr T Rajan** Vice Principal, Professor and Head, AarupadaiVeedu Medical College and Hospital, Puducherry
- **Dr Manisha R Gaikwad** Additional Professor and Head, All India Institute of Medical Sciences, Bhubaneswar, Odisha
- **Dr Priti Chaudhary** Additional Professor and Head, All India Institute of Medical Sciences, Bhatinda, Punjab
- **Dr Mrudula Chandrupatla** Additional Professor, All India Institute of Medical Sciences, Bibinagar, Hyderabad, Telangana
- **Dr A Hima Bindu** Professor and Head, GITAM Institute of Medical Sciences and Research, Visakhapatnam, AP
- **Dr AK Srivastava** Professor and Head, Saraswati Dental College, Lucknow, UP
- **Dr Abha Bharadwaja** Senior Professor, JLN Medical College, Ajmer, Rajasthan
- **Dr Aloka Gupta** Professor and Head, MGM Medical College, Jamshedpur, Jharkhand
- **Dr Aloka Sharma** Professor and Head, Jawaharlal Nehru Medical College, Bhagalpur, Bihar
- **Dr Amar Jayanthi A** Professor and Head, Government Medical College, Idukki, Kerala
- **Dr Ambica Wadhwa** Professor and Head, Punjab Institute of Medical Sciences, Jalandhar, Punjab
- **Dr Amit Mehta** Professor and Head, Government Medical College, Chindwada, MP
- **Dr Amrut Mahajan** Professor and Head, Dr Ulhas Patil Medica College, Jalgaon, MS
- **Dr Anantha Kumari** Professor and Head, Deccan College of Medical Sciences, Hyderabad, Telangana
- **Dr Angela A Viswasom** Professor and Head, Travancore Medical College, Kollam, Kerala
- **Dr Anil Rahule** Professor and Head, Government Medical College, Rajnandgaon, CG
- **Dr Anjali Jain** Professor, Christian Medical College, Ludhiana, Punjab
- **Dr Anjali Sabnis** Professor and Head, MGM Medical College, Navi Mumbai, MS
- **Dr Anju Partap** Professor and Head, Indra Gandhi Medical College, Shimla, HP
- **Dr Anu Sharma** Professor, Dayanand Medical College and Hospital, Ludhiana, Punjab
- **Dr Anupama Mahajan** Professor and Head, Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar, Punjab
- **Dr Anurag** Professor, Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, Uttarakhand
- **Dr Aparna K Vedapriya** Professor and Head, Osmania Medical College, Hyderabad, Telangana
- **Dr Aprajita Sikka** Professor and Head, Christian Medical College, Ludhiana, Punjab
- **Dr Archana Goel** Professor, Adesh Medical College, Ambala, Haryana
- **Dr Arindom Banerjee** Professor and Head, IQ-City Medical College, Durgapur, WB
- **Dr Arun Prasad Singh** Professor and Head, Patna Medical College, Patna, Bihar
- **Dr Arun Pundlikrao Kasote** Professor and Head, Government Medical College, Jalgaon, MS
- **Dr Ashwini Jadhav** Professor, Grant Government Medical College, Mumbai, MS
- **Dr Asis Kumar Ghosal** Professor and Head, Institute of Postgraduate Medical Education and Research, Kolkata, WB
- **Dr Ausavi Siraz Mustapha** Professor and Head, Great Eastern Medical School and Hospital, Srikakulam, AP
- **Dr Avinash Rudrajwar** Professor and Head, Maitri College of Dentistry, Durg, CG
- **Dr Azhar Ahmed Siddiqui** Professor and Head, JIU's Indian Institute of Medical Science and Research, Badnapur, Jalna, MS
- **Dr Beena Nambiar** Professor and Head, Government Medical College, Pariyaram, Kannur, Kerala
- **Dr Bhaudas Khanderao Jadhav** Professor and Head, Dr Vasant Rao Pawar Medical College, Hospital and Research Centre, Nashik, MS
- **Dr Binod Kumar Tamang** Professor and Head, Sikkim Manipal Institute of Medical Sciences, Gangtok, Sikkim
- **Dr BS Lala** Former Professor and Head, Sri Aurobindo Medical College and Postgraduate Institute, Indore, MP
- **Dr C Kishan Reddy** Professor and Head, Prathima Institute of Medical Sciences, Karimnagar, Telangana
- **Dr C Lalitha** Professor and Head, Kempaguda Medical College (KIMS), Bengaluru, Karnataka
- **Dr Chitti Narasamma** Professor and Head, Kurnool Medical College, Kurnool, AP
- **Dr DAVS Sesi** Professor and Head, Ranga Raya Medical College, Kakinada, AP
- **Dr DH Gopalan** Professor and Head, Tagore Medical College and Hospital, Chennai
- **Dr Dimpal Patel** Professor and Head, AMC Met Medical College, Ahmedabad, GJ
- **Dr Dipali Trivedi** Professor, BJ Medical College and Hospital, Ahmedabad, GJ
- **Dr Fatima M De Souza** Professor and Head, Goa Medical College, Goa
- **Dr Ganesh N Trivedi** Former Professor and Head, Andaman and Nicobar Islands Institute of Medical Sciences, Port Blair
- **Dr Gautam A Shroff** Professor and Head, MGM Institute of Health Sciences, Aurangabad, MS
- **Dr Gunapriya Raghunath** Professor and Head, Department of Anatomy, Saveetha Medical College and Hospital, Chennai
- **Dr Gunwant Chaudhari** Professor and Head, Zydus Medcal College and Hospital, Dahod, GJ



- **Dr Gurdeep Singh Kalyan** Professor and Head, Government Medical College, Patiala, Punjab
- **Dr Gyan Prakash Mishra** Professor and Head, Autonomous State Medical College, Basti, UP
- **Dr Hariitha Nimmagadda** Professor and Head, Department of General Anatomy and General Histology, Bharti Vidyapeeth Dental College, Navi Mumbai, MS
- **Dr Hitant Vohra** Professor and Head, Dayanand Medical College and Hospital, Ludhiana, Punjab
- **Dr Hrishikesh Jadhav** Professor and Head, GMERS Medical College, Sola, Ahmadabad, GJ
- **Dr Jaba Rajguru** Professor, Parul Institute of Medical Science and Research, Vadodra, GJ
- **Dr Jaideo Manohar Ughade** Professor, Government Medical College, Nizamabad, Telangana
- **Dr Jaswinder Kaur** Professor and Head, MM Institute of Medical Sciences and Research, Mullana, Ambala, Haryana
- **Dr Jayasree K** Professor and Head, Government Medical College, Kozhikode, Kerala
- **Dr Jitendra Kain** Professor and Head, Geetanjali Medical College, Udaipur, Rajasthan
- **Dr Jitendra Patel** Professor and Head, NHL Medical College, Ahmedabad, GJ
- **Dr KK Agarwal** Professor and Head, Veer Chandra Singh Garhwali Government Medical Sciences and Research Institute Srinagar, Uttarakhand
- **Dr Kalyan Bhattacharya** Professor, Medical College, Kolkata, WB
- **Dr Kanchan Kapoor** Professor and Head, Government Medical College, Chandigarh
- **Dr Komala B** Professor and Head, BGS Global Institute of Medical Sciences, Bengaluru
- **Dr Krishnaiah M** Professor and Head, Kamineni Institute of Medical Sciences, Narketpally, Telangana
- **Dr Kumar Satish Ravi** Additional Professor, All India Institute of Medical Sciences, Rishikesh, Uttarakhand
- **Dr L Hema** Professor and Head, Narayana Medical College, Nellore, AP
- **Dr Lakshmikantha** Professor, DM WIMS Medical College, Meppadi, Wayanad, Kerala
- **Dr Lola Das** Professor and Head, Government Medical College, Thrissur, Kerala
- **Dr M Chatterjee** Professor and Head, Pt. JNM Medical College, Raipur, CG
- **Dr MG Puranik** Professor, Bharthi Vidyapeeth Medical college, Pune, MS
- **Dr M Prasad** Professor and Head, Patliputra Medical College, Dhanbad, Jharkhand
- **Dr MA Doshi** Professor and Head, Krishna Institute of Medical Science, Karad, MS
- **Dr Madhusmita Panda** Professor and Head, SCB Medical College, Cuttack, Odisha
- **Dr Mahendra Kumar Pant** Professor and Head, Government Medical College, Dehradun, Uttarakhand
- **Dr Mahesh Ugale** Professor and Head, MIMSR Medical College, Latur, MS
- **Dr Mamata Sar** Professor and Head, Veer Surendra Sai Institute of Medical Sciences and Research, Burla, Odisha
- **Dr Manish Patil** Professor and Head, RD Gardi Medical College, Ujjain, MP
- **Dr Manisha Nakhate** Professor and Head, Dr DY Patil Medical College, Hospital and Research Centre, Navi Mumbai, MS
- **Dr Manjunath V Motugi** Professor and Head, People's Medical College, Bhopal, MP
- **Dr Martin Lucas A** Professor and Head, Dr Chandamma Dayananda Sagar Institute of Medical Education and Research, Bengaluru
- **Dr Meenakshi Parthasarathy** Professor and Head, Bowring and Lady Curzon Medical College and Research Institute, Bengaluru
- **Dr Mehandi V Mahajan** Professor, Sri Muthukumar Medical College Hospital and Research Institute, Chennai
- **Dr Mehera Bhoir** Professor and Head, HHSBT Medical College and Dr Rustom Narsi Cooper Municipal General Hospital, Mumbai, MS
- **Dr Mini Kariappa** Professor and Head, Amala Institute of Medical Sciences, Thrissur, Kerala
- **Dr Minnie Pillay** Professor, Amrita Institute of Medical Science, Kochi, Kerala
- **Dr Monika Gupta** Professor and Head, Adesh Institute of Medical Sciences and Research, Bhatinda, Punjab
- **Dr Mukesh Mittal** Associate Professor, Government Medical College, Shivpuri, MP
- **Dr Muthukumaravel Narayanaswamy** Professor and Head, Sri Venkateshwara Medical College Hospital and Research Centre, Puducherry
- **Dr Nandita Dutta** Professor and Head, College of Medicine and Sagore Dutta Hospital, Kolkata, WB
- **Dr Natwar Agrawal** Professor and Head, NSC Bose Medical College, Jabalpur, MP
- **Dr Nava Kalyani** Professor and Head, Government Medical College, Mahabubnagar, Telangana
- **Dr Neeta Chhabra**, Professor and Head, GS Medical College and Hospital, Hapur, UP
- **Dr Neha Rai** Professor, LN Medical College, Bhopal, MP
- **Dr Neelamjit Kaur** Professor and Head, Gian Sagar Medical College and Hospital, Patiala, Punjab
- **Dr Nidhi Puri** Professor and Head, YS Parmar Government Medical College, Nahan, HP
- **Dr Nitin R Mudiraj** Professor and Head, Bharti Vidyapeeth Medical College and Hospital, Sangali, MS
- **Dr Nusrat Jabeen** Professor, Government Medical College, Jammu, J&K
- **Dr P Bapuji** Professor and Head, Alluri Sitaramaraju Academy of Medical Sciences, Eluru, AP
- **Dr PK Ramakrishnan** Professor and Head, PK Das Institute of Medical Sciences, Palakkad, Kerala
- **Dr PP Kulkarni** Professor, Prakash Institute of Medical Science and Research, Islampur, MS
- **Dr Pankaj Maheria** Professor and Head, GMERS Medical College, Valsad, GJ
- **Dr Patil Shirish** Professor and Head, Basaveshwara Medical College and Hospital, Chitradurga, Karnataka
- **Dr PG Khanwalkar** Professor and Head, Shyam Shah Medical College, Rewa, MP
- **Dr Poonam Delmotra** Professor and Head, Aadesh Medical College and Hospital, Shahbad, Haryana
- **Dr Prajakta Kishve** Professor and Head, Employees State Insurance Corporation Medical College, Hyderabad, Telangana
- **Dr Prakash Baburao Hosmani** Professor and Head, Dr VM Government Medical College, Solapur, MS
- **Dr Prakash KG** Professor and Head, Azeezia Medical College, Kollam, Kerala
- **Dr Prasanna MB** Professor and Head, Government Medical College, Ernakulam, Kerala
- **Dr Praveen B Iyer** Additional Professor, Seth GS Medical College, Mumbai, MS
- **Dr Praveen Singh** Professor and Head, Pramukhswami Medical College, Karamsad, GJ
- **Dr Priti Sinha** Professor and Head, Sheikhul-Hind-Maulana-Mehmood Government Medical College, Saharanpur, HP
- **Dr Priya Ranganath** Professor and Head, Bangalore Medical College, Bengaluru
- **Dr R Manoranjitham** Professor and Head, Dhanalakshmi Srinivasan Medical College and Hospital, Perambalur, TN
- **Dr RS Bulagouda** Professor and Head, Shri BM Patil Medical College Hospital and Research Centre BLDE (Deemed to be University), Vijayapura, Karnataka
- **Dr Rajendra Prasad** Professor and Head, Anugrah Narayan Magadh Medical College, Gaya, Bihar
- **Dr Rajendrakumar D Virupaxi** Professor, JN Medical College, Belagavi, Karnataka
- **Dr Rajesh Arora** Professor and Head, Rajasthan University of Health Sciences Medical College, Jaipur, Rajasthan
- **Dr Rajkumar KR** Professor and Head, Gulbarga Institute of Medical Sciences, Gulbarga, Karnataka
- **Dr Rajlaxmi Panda** Professor and Head, MKCG Medical College, Berhampur, Odisha
- **Dr Rakesh Kumar Verma** Additional Professor, KGMU, Lucknow, UP
- **Dr Rakesh Mishra** Reader and Head, Sardar Patel Postgraduate Institute of Dental and Medical Sciences, Lucknow, UP
- **Dr Ramprakash Busar** Professor and Head, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur, Rajasthan



- **Dr Randhir S Chauhan** Professor and Head, Maharishi Markandeshwar Medical College, Solan, HP
- **Dr Rashmi Deopujari** Professor and Head, ABV Medical College, Vidisha, MP
- **Dr Rashmi Malhotra** Additional Professor, All India Institute of Medical Sciences, Rishikesh, Uttarakhand
- **Dr Rashmi Prasad** Professor and Head, Vardhman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar
- **Dr Rashmoni Jana** Professor, Vardhman Mahavir Medical College and Safdarjung Hospital, Delhi
- **Dr Ravi Kant** Professor and Head, Government Medical College, Amritsar, Punjab
- **Dr Raviendra Marathe** Professor and Head, RR Kambe Dental College, Akola, MS
- **Dr Ritesh Shah** Professor, GCS Medical College, Ahmadabad, GJ
- **Dr Rohini Karambelkar** Professor and Head, Prakash Institute of Medical Science, Islampur, MS
- **Dr Romi S** Professor and HOD, Government TD Medical College, Alappuzha, Kerala
- **Dr Rupa Chaparrwal** Professor and Head, Sri Aurobindo Medical College and Postgraduate Institute, Indore, MP
- **Dr SK Chavan** Professor, Maharashtra Institute of Medical Education and Research, Pune, MS
- **Dr SM Belsare** Professor, MIMER Medical College, Talgaon, Pune, MS
- **Dr S Muralidhar Reddy** Professor and Head, NRI Medical College, Mangalagiri, AP
- **Dr S Naveen Kumar** Professor and Head, Government Medical College, Nalgonda, Telangana
- **Dr SS Saiyad** Professor and Head, Dr ND Desai Faculty of Medical Science, Nadiad, GJ
- **Dr Sandhya Kurup** Professor and Head, MOSC Medical College, Kolanchery, Kerala
- **Dr Sangeeta Gupta** Professor and Head, Government Medical College, Jammu, J&K
- **Dr Sangeeta M** Professor and Head, MVJ Medical College and Research Hospital, Bangalore
- **Dr Santhini Arulseelvi** Professor and Head, Vinayaka Missions Medical College and Hospital, Karaikal, Puducherry
- **Dr Saritha S** Professor and Head, Kamineni Academy of Medical Sciences and Research Center, Hyderabad, Telangana
- **Dr Satheesha KS** Professor and Head, Srinivas Institute of Medical Sciences and Research Center, Mangaluru, Karnataka
- **Dr Savithri Krishnan** Professor and Head, Government Medical College, Kollam, Kerala
- **Dr Seema Sharma** Professor and Head, Government Medical College and Associated Hospital, Rajouri, J&K
- **Dr Sheela Sivan** Professor and Head, MES Medical College, Perinthalmanna, Malappuram, Kerala
- **Dr Seema SR** Professor and Head, ESI Postgraduate Institute of Medical Sciences and Research, Bangalore
- **Dr Shema Nair** Professor, LN Medical College, Bhopal, MP
- **Dr Shilpa Bhimalli** Professor and Head, JN Medical College, Belagavi, Karnataka
- **Dr Shaifaly Madan Rustagi** Professor and Head, Army Medical College, Delhi
- **Dr Shailaja Shetty** Professor and Head, Department of Anatomy, MS Ramaiah Medical College, Bangalore, Karnataka
- **Dr Shashi Munjal** Professor and Head, Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, UK
- **Dr Shobha Ramnarayan** Professor and Head, Malankara Orthodox Syrian Church Medical Mission Hospital, Kolenchery, Ernakulum, Kerala
- **Dr Shruthi BN** Professor and Head, Raja Rajeshwari Medical College, Bangalore
- **Dr Simmi Soni** Professor, Dr VVK Womens Medical College, Aziznagar, Telangana
- **Dr Soumya Chakraborty Bhattacharya** Professor and Head, Employees State Insurance Corporation Medical College, Joka, Kolkata, WB
- **Dr SS Jadhav** Professor, MIMER Medical College, Talgaon, Pune, MS
- **Dr Subhash K Deshpande** Professor and Head, SDM Medical College, Dharwad, Karnataka
- **Dr Suchetra Chaudhary** Professor and Head, BJ Medical College and Hospital, Ahmadabad, GJ
- **Dr Sukhinder Baidwain** Professor, Dr YS Parmar Government Medical College, Nahan, HP
- **Dr Sunita Gupta** Former Professor and Head, AMC Meit Medical College, Ahmedabad, GJ
- **Dr Sushma Kushal Kataria** Senior Professor and Head, Dr SN Medical College, Jodhpur, Rajasthan
- **Dr T Sreekanth** Professor and Head, Shadan Institute of Medical Sciences, Research Centre and Teaching Hospital, Peerancheru, Telangana
- **Dr Tapan Kumar Jana** Professor and Head, Murshidabad Medical College and Hospitals, Murshidabad, WB
- **Dr Tarkeshwar Golghate** Professor and Head, Government Medical College, Chandrapur, MS
- **Dr TC Singel** Professor, Zydus Medcal College and Hospital, Dahod, GJ
- **Dr V Anandhi** Professor and Head, K P Viswanathan Government Medical College, Trichy, TN
- **Dr VK Chimurkar** Professor and Head, Jawaharlal Nehru Medical College, Wardha, MS
- **Dr V Ravi Kumar** Professor and Head, Subbaiah Institute of Medical Sciences, Shimoga, Karnataka
- **Dr V Subhashini** Professor and Head, GSL Medical, College, Rajahmundry, AP
- **Dr Vaishali Inamdar** Professor and Head, Dr Shankarrao Chavan Government Medical College and Hospital, Nanded, MS
- **Dr Vandana Mehta** Director and Professor, Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi
- **Dr Vanita Gupta** Professor and Head, Acharya Shri Chander College of Medical Sciences, Jammu, J&K
- **Dr Varsha Mokhasi** Professor and Head, Vydehi Institute of Medical Sciences and Research Centre, Bangalore
- **Dr Vasant Vaniya** Professor, Medical College and SSG Hospital, Vadodra, GJ
- **Dr Venkateshwar Reddy** Professor and Head, SVS Medical College, Mehboobnagar, Telangana
- **Dr Vijayamma KN** Professor, Belivers Medical College, Kottayam, Former Professor and Head, Kottayam Medical College, Kerala
- **Dr Vinay G** Professor and Head, Mamata Medical College, Khammam, Telangana
- **Dr Vineet Gohiya** Professor and Head, Government Medical College, Khandwa, MP
- **Late Dr Vinnakota Sunitha** Former Professor and Head, Maharajah's Institute of Medical Science, Vizianagaram, AP
- **Dr Vinodini** Professor and Head, Gandhi Medical College, Secunderabad, Telangana
- **Dr X Chandra Philip** Professor and Head, Mahatma Gandhi Medical College and Research Institute, Puducherry
- **Dr Prashant Chaware** Associate Professor, All India Institute of Medical Sciences, Bhopal, MP
- **Dr Sumit Patil** Associate Professor, All India Institute of Medical Sciences, Bhopal, MP
- **Dr Rohini Motwani** Associate Professor, All India Institute of Medical Sciences, Bibinagar, Hyderabad, Telangana
- **Dr Amit Kumar** Associate Professor, Chhattisgarh Institute of Medical Sciences, Bilaspur, CG
- **Dr Amol Durgkar** Associate Professor, Chindwada Institute of Medical Sciences, Chindwada, MP
- **Dr Amol Shinde** Associate Professor, Dr DY Patil Medical College, Hospital and Research Center, Pune, MS
- **Dr Anil Agrawal** Associate Professor, Triveni Institute of Dental Science, Bilaspur, CG
- **Dr Anne George** Associate Professor, Government Medical College, Kottayam, Kerala
- **Dr Anwar Unisa Sabry** Associate Professor, Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar, Telangana
- **Dr Aparna Muraledharan** Associate Professor, Puducherry Institute of Medical Sciences and Research, Puducherry
- **Dr Archana Kalyankar** Associate Professor, Government Medical College and Hospital, Aurangabad, MS
- **Dr Archana Kannamwar** Associate Professor, Shri Vasant Rao Naik Government Medical College, Yavatmal, MS
- **Dr Ashok Kumar Singh** Associate Professor, Vardhman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar

- **Dr Bhavik Doshi** Associate Professor, GMERS Medical College, Sola, Ahmadabad, GJ
- **Dr Binod Kumar** Associate Professor and Head, Shri Krishna Medical College, Muzzafarpur, Bihar
- **Dr D Sudhakar Babu** Associate Professor, Government Medical College, Nizamabad
- **Dr Gajanan L Maske** Assistant Professor, Shri Vasant Rao Naik Government Medical College, Yavatmal, MS
- **Dr Gayatri Muthiyam** Associate Professor, All India Institute of Medical Sciences, Nagpur, MS
- **Dr Gursharan Singh** Associate Professor, Guru Govind Singh Medical College, Faridkot, Punjab
- **Dr I Gowri** Associate Professor, Dr Patnam Mahender Reddy Institute of Medical Sciences, Chevella, Telangana
- **Dr J Sreevidya** Associate Professor, Stanley Medical College, Chennai
- **Dr Jagriti Agrawal** Associate Professor, Pt. Jawaharlal Nehru Memorial Medical College, Raipur, CG
- **Dr Jessy Rose George** Associate Professor Government Medical College, Kozhikode, Kerala
- **Dr Joyti R Gaikwad** Associate Professor, Terna Medical College, Navi Mumbai, MS
- **Dr Jwalant Waghmare** Associate Professor, Mahatma Gandhi Institute of Medical Sciences, Sevagram, MS
- **Dr KKP Singh** Associate Professor, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand
- **Dr K Shanmuganathan** Associate Professor, Indira Gandhi Medical College and Research Institute, Puducherry
- **Dr Kanan Shah** Associate Professor, NHL Medical College, Ahmadabad, GJ
- **Dr Kirti Nemade** Associate Professor, Government Medical College, Nagpur, MS
- **Dr Mangesh Selukar** Associate Professor, Deputy Dean, Vilasrao Deshmukh Government Institute of Medical Sciences, Latur, MS
- **Dr Mani Kathapillai** Associate Professor, Shree Sathya Sai Medical College, and Research Institute, Chengalpattu, TN
- **Dr Manjusha Tabhane** Associate Professor, NKP Salve Institute of Medical Sciences and Research Centre and Lata Mangeshkar Hospital, Nagpur, MS
- **Dr Meenakshi Borkar** Associate Professor, Hindu Hruday Samrat Balasaheb Thackarey Medical College and Dr RustomNarsi Cooper Municipal General Hospital, Mumbai, MS
- **Dr MS Arathi** Associate Professor, Chettinad Hospital and Research Institute, Chennai
- **Dr Nagraj S** Associate Professor, SVS Medical College, Mahabubnagar, Telangana
- **Dr Naina Wakode** Associate professor, ABV Medical College, Vidisha, MP
- **Dr Prafull Nikam** Associate Professor, Government Medical College, Rajnandgaon, CG
- **Dr Rajashree S Raut** Associate Professor, RCSM Government Medical College, Kolhapur, MS
- **Dr Rani Raphael M** Associate Professor, Government TD Medical College, Alappuzha, Kerala
- **Dr Renuka Ahankari** Associate Professor, Smt Kashibai Navale Medical College and General Hospital, Pune, MS
- **Dr Ritu** Government Medical College, Rajouri, Jammu and Kashmir
- **Dr Rupali Kavitate** Associate Professor, HHSBT Medical College and Dr Rustom Narsi Cooper Municipal General Hospital, Mumbai, MS
- **Dr S Satish Kumar** Associate Professor, Government Dharmapuri Medical College, Dharmapuri, TN
- **Dr Sajey PS** Associate Professor, Government T D Medical College, Alappuzha, Kerala
- **Dr Sandeep S Mohite** Associate Professor, Krishna Institute of Medical Sciences, Karad, MS
- **Dr Santoshkumar A Dope** Associate Professor, Medical Superintendent, Vilasrao Deshmukh Government Institute of Medical Sciences, Latur, MS
- **Dr Saurabh Kulkarni** Associate Professor, Government Medical College, Jalgaon, MS
- **Dr Sayantan Das** Associate Professor, Mata Gujri Memorial Medical College, Kishanganj, Bihar
- **Dr Shantanu Nandy** Associate Professor, Bankura Sammilani Medical College, Bankura, WB
- **Dr Sherry Sharma** Associate Professor, Punjab Institute of Medical Sciences, Jalandhar, Punjab
- **Dr Shilpa Sonare** Associate professor, Government Medical College, Nagpur, MS
- **Dr Shrikant Verma** Associate Professor, Raipur Institute of Medical Sciences, Raipur, CG
- **Dr Subhash Gujar** Associate Professor, GMERS Medical College, Vadnagar, GJ
- **Dr Subodh Kumar** Associate Professor and Head, Nalanda Medical College, Patna, Bihar
- **Dr Sumedha Anjankar** Associate Professor, Datta Meghe Medical College, Nagpur, MS
- **Dr Surekha W Meshram** Associate Professor, Government Medical College, Gondia, MS
- **Dr Sushil Jiwane** Associate Professor, Gandhi Medical College, Bhopal, MP
- **Dr Tejaswi HL** Associate Professor, Adichunchanagiri Institute of Medical Sciences, Mandya, Karnataka
- **Dr Ujwala Bhanakar** Associate Professor, GS Medical College, Hapur, UP
- **Dr V Dharani** Associate Professor, Government Villupuram Medical College, Villupuram, TN
- **Dr Varsha Dahiphale** Associate Professor, Swami Ramanand Tirth Rural Government Medical College, Ambajogai, MS
- **Dr Yogesh Diwan** Associate Professor, Indira Gandhi Medical College, Shimla, HP
- **Dr Zuberi Hussain Riyaz** Associate Professor, JIIU's Indian Institute of Medical Science and Research, Badnapur, Jalna, MS
- **Dr R Sarah** Assistant Professor, All India Institute of Medical Sciences, Mangalagiri, AP
- **Dr Sonali Adole** Assistant Professor, All India Institute of Medical Sciences, Jodhpur, Rajasthan
- **Dr Sunita Nayak** Assistant Professor, All India Institute of Medical Sciences, Patna, Bihar
- **Dr Aloka Bhingardeo** Assistant Professor, All India Institute of Medical Sciences, Bibi Nagar, Hyderabad
- **Dr Prashant Munjamkar** Assistant Professor, All India Institute of Medical Sciences, Bibi Nagar, Hyderabad
- **Dr Payal Kasat** Senior Resident, All India Institute of Medical Sciences, Nagpur, MS
- **Dr Abid Ali** Assistant Professor, Bhaskar Medical College, Yenkapally, Telangana
- **Dr Amarappa S Nagalikar** Assistant Professor, Nodal Officer, Belgaum Institute of Medical Sciences, Belagavi, Karnataka
- **Dr Amrita Kumari** Assistant Professor, Patna Medical College, Patna, Bihar
- **Dr BS Patil** Assistant Professor, Shri BM Patil Medical College, Hospital and Research Centre BLDE (Deemed to be University), Vijayapura, Karnataka
- **Dr Chandan Kumar Yadav** Assistant Professor, Chandra Dental College and Hospital, Lucknow, UP
- **Dr Faizal Mohammad** Assistant Professor, Government Medical College, Siddipet, Telangana
- **Dr Garima Pardhi** Demonstrator, ABV Government Medical College, Vidisha, MP
- **Dr Harsh Chawre** Assistant Professor, ABV Medical College, Vidisha, MP
- **Dr Israr Ahmed Khan** Assistant Professor, Government Medical College, Shahdol, MP
- **Dr Jayasree Reddy** Assistant Professor, Surabhi Institute of Medical Sciences, Siddipet, Telangana, Telangana
- **Dr Jolly Agarwal** Assistant Professor, Government Medical College, Dehradun, Uttarakhand
- **Dr Kiran Kalloor** Assistant Professor, Government Medical College, Palakkad, Kerala
- **Dr Kunal Chawla** Assistant Professor, Indira Gandhi Medical College, Shimla, HP
- **Dr Kundan Amitabh** Tutor, Darbhanga Medical College, Lehrisara, Bihar



- **Dr Lenin S** Assistant Professor, Kanyakumari Government Medical College, Kanyakumari, TN
- **Dr MM Peerzade** Assistant Professor, Dr VM Government Medical College, Solapur, MS
- **Dr M Siva Kumar** Assistant Professor, Government Thiruvannamalai Medical College, Thiruvannamalai, TN
- **Dr MP Sultana** Assistant Professor, ACSR Government Medical College Nellore, AP
- **Dr Mubeen Rashid** Assistant Professor, In-charge HOD, Government Medical College, Kathua, J&K
- **Dr Nimisha Madhu** Tutor, Anugrah Narayan Magadh Medical College, Gaya, Bihar
- **Dr P Ashok** Assistant Professor, Deccan College of Medical Sciences, Hyderabad, Telangana
- **Dr PN Panshewdikar** Assistant Professor, Dr VM Government Medical College, Solapur, MS
- **Dr Praveen Kurrey** Assistant Professor, Pt. Jawahrlal Nehru Memorial Medical College, Raipur, CG
- **Dr Priti Nemade** Assistant Professor, Indira Gandhi Medical College and Hospital, Nagpur, MS
- **Dr Rajeev Panwar** Assistant Professor, Shree Sathya Sai Medical College, and Research Institute, Chengalpattu, TN
- **Dr Rakesh Shukla** Assistant Professor, Prasad Institute of Medical Science, Lucknow, UP
- **Dr Rashmi S Sinha** Assistant Professor, Grant Medical College And Hospital, Mumbai, MS
- **Dr Rimpi Gupta** Assistant Professor, Kalpana Chawla Government Medical College, Karnal, Haryana
- **Dr Ritika Gaddewar** Assistant Professor, Indira Gandhi Medical College and Hospital, Nagpur, MS
- **Dr Roli Joshi** Assistant Professor, Saraswati Medical College, Unnao, UP
- **Dr Sabin Malik** Former Tutor, Andaman and Nicobar Islands Institute of Medical Sciences, Port Blair
- **Dr Saikat Roy** Assistant Professor, College of Medicine and JNM Hospital, Kalyani, Nadia, WB
- **Dr Saleena N Ali** Assistant Professor, MES Medical College, Perinthalmanna, Malappuram, Kerala
- **Dr Sanjana Devi** Assistant Professor, Adesh Institute of Medical Sciences and Research, Bhatinda, Punjab
- **Dr Shailendra Singh** Assistant Professor, GSVM Medical College, Kanpur, UP
- **Dr Shanthini S** Assistant Professor, Sree Lakshmi Narayana Institute of Medical Sciences, Puducherry
- **Dr Sindhu Chaudhary** Assistant Professor, Government Medical College, Dehradun, Uttarakhand
- **Dr Subhasis Chakraborty** Assistant Professor, Nilratan Sircar Medical College, Kolkata, WB
- **Dr Sudha Rani** Assistant Professor and Head, Hazaribagh Medical College, Hazaribagh, Jharkhand
- **Dr Sujithaa N** Assistant Professor, Government Medical College, Villupuram, TN
- **Dr Taquuddin Mohammed** Resident, Indira Gandhi Medical College and Hospital, Nagpur, MS
- **Dr Thuslima M** Tutor, Government Medical College, Omandurar Medical College, Chennai
- **Dr Tom J Nallikuzhy** Assistant Professor, Sree Narayana Institute of Medical Sciences, Ernakulum, Kerala
- **Dr Vishal Bhadkaria** Assistant Professor, Bundelkhand Medical College, Sagar, MP
- **Dr Yogendra Singh** Assistant Professor, Baba Raghav Das Medical College, Gorakhpur, UP
- **Dr Yogesh Ganorkar** Assistant Professor, Government Medical College, Gondia, MS
- **Dr Anjali Prasad** Assistant Professor, Shri Krishna Medical College, Muzzafarpur, Bihar

I am thankful to the following students for their support and suggestions: Raghunandan Ramanathan (Chennai), Arghadip Dey, Tamoghna Banerjee, Mostafi Ahamed, Shayantan Ghara, Rahul Kumar Jha, Chandan Kumar Seni, Angan Mandal (Kolkata), Subhajit Hazra (Burdwan), Tathagata Das (Midnapore), Soujanya Chakraborty (Bankura), Md Abu Salman Halder (Kalyani), Jakir Hossain, Souvik Sen, Bibaswan Chatterjee (Murshidabad), Atanu Mandal (Malda), Soumya Chanda (Darjeeling), Arghyadeep Pal (Haldia), Abyartha Dash (Cuttack), Asish Kumar Mahapatra (Berhampur), Alok Kumar Mahali (Sambolpur), Mr Ashwanth (Bhubaneswar), Ankit Raj (Gaya), Pooja Singh (Patna), Rohit Kumar (Patna), Aman Kashyap (Gaya) and Raushan Kumar (Patna).

**Yogesh Sontakke**

Acknowledgements





# Contents

<i>Preface to the Second Edition</i>	<i>v</i>
<i>Preface to the First Edition</i>	<i>vii</i>
<b>1. Introduction</b>	<b>1</b>
<i>Reviewer: Dr Prashant Chaware Competencies: AN76.1, AN76.2</i>	
<b>2. Menstrual Cycle</b>	<b>7</b>
<i>Reviewer: Dr Deepti Shastri Competencies: AN77.1, AN77.2</i>	
<b>3. Gametogenesis</b>	<b>15</b>
<i>Reviewer: Dr C Kishan Reddy, Dr Priya S Patil Competency: AN77.3</i>	
<b>4. First Week of Development</b>	<b>25</b>
<i>Reviewer: Jaideo Manohar Ughade Competencies: AN77.4, AN78.1, AN78.3</i>	
<b>5. Assisted Reproduction Technology</b>	<b>35</b>
<i>In vitro Fertilization and Intracytoplasmic Sperm Injection</i>	
<i>Reviewer: Dr Keshav Malhotra</i>	
<b>6. Second Week of Development: Bilaminar Germ Disc</b>	<b>40</b>
<i>Reviewer: Dr Harsha Pratap Competencies: AN78.2, AN78.4</i>	
<b>7. Third Week of Development: Trilaminar Germ Disc</b>	<b>48</b>
<i>Reviewer: Dr Aparna Muralitharan Competencies: AN79.1, AN79.2, AN79.3</i>	
<b>8. Further Development of Embryo</b>	<b>60</b>
<i>Reviewer: Dr Rohini Motwani Competencies: AN79.4, AN52.4</i>	
<b>9. Placenta and Umbilical Cord</b>	<b>73</b>
<i>Reviewer: Dr Saleena N Ali Competencies: AN80.1, AN80.2, AN80.3, AN80.5, AN80.7, AN78.5</i>	
<b>10. Integumentary System: Skin, its Appendages, and Mammary Gland</b>	<b>87</b>
<i>Reviewer: Dr Rupa Chaparrwal Competencies: AN9.3, AN72.1</i>	
<b>11. Pharyngeal Apparatus</b>	<b>96</b>
<i>Reviewer: Dr Ravi Kant, Dr Ujwala Bhanarkar Competency: AN43.4</i>	
<b>12. Alimentary Tract I: Development of Face, Nose and Palate</b>	<b>109</b>
<i>Reviewer: Dr Gayatri Muthiyan Competency: AN43.4</i>	
<b>13. Alimentary Tract II: Development of Teeth, Pharynx, Tongue and Salivary Glands</b>	<b>117</b>
<i>Reviewer: Dr R Sarah Competencies: AN43.4, AN39.1</i>	
<b>14. Alimentary Tract III: Development of Intestine</b>	<b>126</b>
<i>Reviewer: Dr Nagaraj S Competency: AN52.6</i>	
<b>15. Alimentary Tract IV: Development of Liver, Gallbladder, Pancreas and Spleen</b>	<b>141</b>
<i>Reviewer: Dr Payal Kasat Competency: AN52.6</i>	
<b>16. Respiratory System</b>	<b>149</b>
<i>Reviewer: Dr Hitant Vohra Competencies: AN25.2, AN25.4</i>	

17. <b>Development of Body Cavities and Diaphragm</b>	158
<i>Reviewer: Dr Thuslima M Competencies: AN25.2, AN52.5</i>	
18. <b>Cardiovascular System I: Development of Heart</b>	168
<i>Reviewer: Dr Haritha Nimmagadda Competencies: AN25.2, AN25.4</i>	
19. <b>Cardiovascular System II: Blood Vessels and Fetal Circulation</b>	185
<i>Reviewer: Dr V Dharani Competencies: AN25.3, AN25.5, AN25.6</i>	
20. <b>Urinary System: Kidney, Ureter, Urinary Bladder, Urethra</b>	205
<i>Reviewer: Dr Bertha AD Rathinam, Dr Ujwala Bhanarkar Competency: AN52.7</i>	
21. <b>Reproductive System: Male and Female Reproductive Organs</b>	218
<i>Reviewer: Dr Prajakta Kishve Competency: AN52.8</i>	
22. <b>Nervous System</b>	235
<i>Reviewer: Dr Betty Anna Jose Competencies: AN63.2, AN64.2, AN64.3, AN79.3, AN79.5, AN79.6</i>	
23. <b>Development of Eye</b>	259
<i>Reviewer: Dr Rohit Rao Competency: AN43.4</i>	
24. <b>Development of Ear</b>	268
<i>Reviewer: Dr Nidhi Puri</i>	
25. <b>Endocrine System</b>	275
<i>Reviewer: Dr Anjali Sabnis Competency: AN43.4</i>	
26. <b>Skeletal System</b>	281
<i>Reviewer: Dr Joti Gaikwad Competencies: AN79.4, AN79.5</i>	
27. <b>Muscular System</b>	291
<i>Reviewer: Dr Anjali Jain</i>	
28. <b>Fetal Period: Nine Weeks to Birth</b>	295
<i>Reviewer: Dr Sabin Malik</i>	
29. <b>Clinical Applications and Ultrasonography in Embryology</b>	298
<i>Reviewer: Dr Gunvant Chaudhari</i>	
30. <b>Twinning (Multiple Pregnancy)</b>	303
<i>Reviewer: Ujwala Bhanarkar Competency: AN80.4</i>	
<b>Annexures</b>	309
<i>Reviewer: Dr Jahita T Banu Competencies: AN13.8, AN20.10, AN76.2, AN77.5, AN77.6, AN78.5</i>	
I. Embryonic Remnants	
II. Placenta Previa	
III. Hermaphrodite	
IV. Derivatives of Neural Crest Cells	
V. Miscellaneous: Fetal viability, contraception, teratogenesis, fertility, infertility, sterility, surrogate motherhood, sex ratio, abortion, pregnancy test, development of limbs, development of joints	
<b>Index</b>	321