

Sixth Edition

Sixth Edition

# Viva Voce in Biochemistry

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

is the thoroughly revised and updated edition containing concise and to the point information. The book's content and topics are *competency based* and as per the latest CBME Guidelines | Competency Based Undergraduate Curriculum for the Indian Medical Graduate prescribed by the National Medical Commission.

### Salient Features

- This edition is competency based and new relevant chapters have been incorporated to enhance the usefulness of the book.
- Answers are quite concise, to the point, lucid and written in easy to understand language.
- Several chapters of this book will prove to be of great help and knowledge-enhancing for the postgraduate students of medicine, pediatrics, physiology, PSM, pathology, and pulmonary and chest diseases.
- It is a unique title concerning the attractive text layout, easy to understand language, question-answer format, and relevance.
- It will prove to be an asset for grasping knowledge at a glance for those appearing in NEET and other foreign-entrance examinations (for aspirants who wish to go to advanced countries for higher studies).
- It is a *ready-reckoner* of answers to all medical biochemistry-related questions.
- Very useful for students of MBBS/MD/DM (cardiology, nephrology, neurology, gastroenterology, etc.); candidates appearing in PhD entrance examinations; and students of MSc, BSc and other branches of life-sciences courses in which biochemistry is an essential element of study.



**SP Singh** PhD (Medical Biochemistry); FACBI, recipient of Commonwealth Medical scholarship and WHO fellowship is a biochemist of repute who has served as Professor and Head, Department of Biochemistry, at various Government Medical Colleges in India like Gorakhpur, Agra, Jhansi and Azamgarh.

His total teaching experience is over 46 years, out of which 36 years as head of the department of biochemistry. So far, he has written 34 books, all single-handedly except one. He has written one book of biochemistry in Hindi at the request of HRD Ministry, Govt. of India; his other book *Manual of Practical Biochemistry* has been translated into Persian. His wide experience of having visited almost every state of India as an examiner of MBBS, MD, BPT, BPharm, DPharm, BSc, MSc, BDS and other such many courses of medical field, led him to gain much experience which he has incorporated in this book.



Viva Voce in Biochemistry

Singh



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For the students of MBBS, MD, BDS, BMLT, DMLT, MSc (Home Science), MSc (Biochemistry), MSc (Biotechnology), MSc (Nursing), MSc (Food Science and Technology), BSc (Nursing), BSc (Biochemistry), BSc (Food Science and Technology) and other applied courses and candidates preparing for

**NEET and EXIT Examinations**



SP Singh



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 Dedicated to Education

**Sixth Edition**

# **VIVA VOCE IN BIOCHEMISTRY**

**Including  
Physiology, Molecular Biology and Biotechnology**

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

to



*My eldest brother Late Shri CP Singh  
(30th August 1940 to 5th Dec 2007)  
former Director, Cement Research Institute of India, Ballabgarh  
and*



*My elder brother Late Shri JP Singh  
(15th June 1941 to 23rd Sept 2012)  
former Works Manager, NRly Workshop, Kalka*

## Other Books by Dr SP Singh

- ★ *Textbook of Biochemistry*, 7th ed
- ★ *Practical Manual of Biochemistry*, 8th ed
- ★ *A Textbook of Dental Biochemistry*, 3rd ed
- ★ *Concepts of Biochemistry* (for Physiotherapy and Pharmacy)
- ★ *Principles of Biochemistry* (for Home Science and Nursing)
- ★ *Textbook of Biochemistry and Clinical Pathology* for Diploma in Pharmacy Students

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**NEET AND EXIT EXAMINATIONS**

**SP Singh** PhD FACBI

Former Professor and Head, Department of Biochemistry  
MLB Government Medical College, Jhansi, UP

Nominated by Government of India for Medical Commonwealth Fellowship, 1983

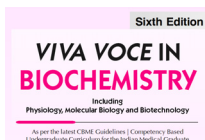
Cited in Wikipedia-2010 for contribution to Biochemistry

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## Foreword

**D**r SP Singh, Ex-Professor and Head, Department of Biochemistry, BRD Government Medical College, Gorakhpur; SN Government Medical College, Agra; MLB Government Medical College, Jhansi and Government Medical College, Azamgarh; is a prolific writer.



As of now he has about 34 books (including editions) in his name as an author. One of his books, Manual of Practical Biochemistry has been translated into Persian language for which he is also recognized globally in biochemistry.

One of his books has been written in Hindi at the request of HRD Ministry, Government of India. Prof (Dr) SP Singh has 65 research publications to his credit. In the year 1981, he was nominated for Medical Commonwealth Scholarship and again in the year 1984, he was awarded WHO Fellowship for working with Prof George, Department of Pharmacology and Toxicology, College of Medical Sciences, Texas A&M University, USA for special training in ocular biochemistry. His name is already cited in Wikipedia in the year 2010 in the field of biochemistry.

Now I feel deeply honoured to pen down a *Foreword* to the book *Viva Voce in Biochemistry* sixth edition authored by Prof (Dr) SP Singh. It is my belief that this book is going to prove to be a boon for the students of biochemistry. This book is written in an easy to understand language. All the topics covered in the book are as per the recent advances in the syllabus of biochemistry.

I am highly confident that such a magnificent and majestic book of biochemistry by a very experienced talented knowledgeable teacher, researcher and author shall prove to be a very useful learning resource not only for the medical students (UG and PG) but also for the students from other medical streams in India and abroad.

A handwritten signature in black ink, appearing to read 'Shreya Nigoskar'.

**Shreya Nigoskar**

Professor and Head  
Department of Biochemistry  
Index Medical College, Indore (MP)

## Foreword

**D**r SP Singh, Ex-Professor and Head, Department of Biochemistry, BRD Government Medical College, Gorakhpur; SN Government Medical College, Agra; MLB Government Medical College, Jhansi and Government Medical College, Azamgarh is a dynamic teacher, guide, researcher and author who has about 34 books (including editions and in different languages, i.e. English, Hindi, Persian, etc.) and 65 research publications in his name.



He was nominated for Medical Commonwealth Scholarship (1981 and 1984). He was awarded with WHO Fellowship. He has undergone special training in ocular biochemistry. His name is already cited in Wikipedia in the year 2010 for his involvement and contribution in the field of biochemistry.

I feel privileged and honoured to pen down a *Foreword* to the sixth edition of *Viva Voce in Biochemistry* authored by Prof (Dr) SP Singh. The book is written in student-friendly simple language and in an impressive way covering all the topics of biochemistry as per the latest CBME syllabus of NMC which will prove to be beneficial for the medical students (UG/PG) in India and abroad.

A handwritten signature in black ink, appearing to read 'Javin Bishnu Gogoi'.

**Javin Bishnu Gogoi**

Professor and Head, Department of Biochemistry  
SSJ Govt. Institute of Medical Sciences and Research  
Almora, Uttarakhand



## Foreword

**I**t is a lifetime honor and privilege to write a *Foreword* to a book being penned down by my teacher, philosopher and guide Dr (Prof) SP Singh.

It is probably a herculean task to critically acclaim and recommend, but for my association with 'Sir' as my thesis co-guide, I take upon this opportunity to say that this work reflects the usual charisma of a knowledge seeker, distinguished teacher and a research scholar par excellence.



Understanding the pathogenesis of a clinical condition entails solid background in basic sciences, most importantly in biochemistry. Dr Singh is respected and acknowledged as a great teacher of the subject and a wonderful motivator to the students. He had the opportunity to shape the future of today's several distinguished medical faculties of the country as Head, Department of Biochemistry at BRD Government Medical College, Gorakhpur; SN Government Medical College, Agra; MLB Government Medical College, Jhansi; and Government Medical College, Azamgarh. With 65 research publications, Medical Commonwealth Scholarship, WHO fellowship and citation in Wikipedia (2010) in the field of biochemistry, he stands as the most distinguished and tallest educationist among his contemporaries. With almost 34 books (including editions) to his credit and that to in several languages he reaches out to students across continental boundaries.

I believe that the book *Viva Voce in Biochemistry* sixth edition is going to be a big boon for the medical students. As a dispenser of knowledge, this book sets the benchmark for being the most comprehensive text and that too in a simple lucid language. All the topics covered are as per the recommendations of the National Medical Commission. I am highly confident that such a reference book in the field of biochemistry shall prove to a very useful source, not only for the medical students from the stream of the biochemistry, but for students from nursing and pharmacy backgrounds as well.

*D.K. Yadav*

**Dinesh Kumar Yadav**

Head  
Division of Pediatric Cardiology  
Department of Pediatrics  
ABVIMS and Dr RML Hospital, New Delhi





## Preface to the Sixth Edition

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It accords me immense pleasure and a moment of great happiness to bring out the sixth edition of my book *Viva Voce in Biochemistry* for the students of MBBS, MD, MSc and BSc of various universities in our country and abroad.

The last edition had been a great success and encouraging to me which has now been revised thoroughly in the light of development of medical sciences which is rising day by day and keeping in mind viewpoints/feedback of students/readers.

At the end of revision, I have concluded that this book which is very light in weight and palatable, will prove to be a great source of learning to the medical postgraduate students as well pursuing MD (medicine), DM (cardiology), DM (neurology), DM (nephrology), DM (gastroenterology), MD (preventive and social medicine), MD (chest diseases) and other such allied courses. In fact, it will prove for them just like a 'ready reckoner' for knowing the answers of certain questions and for enhancing knowledge of internal medicine—of which *biochemistry* is an integral part and component. I am sure that this book shall certainly update their knowledge to a great extent.

At the end, an appeal to worthy students/readers to feed me more suggestions in order to make it more useful and to the point for the students and the readers.

SP Singh



## Preface to the First Edition

**G**rowing demand of the students led me to write the small book *Viva Voce in Biochemistry* which in fact shall fulfill the desire of the students of medical, biotechnology, homoeopathic, agriculture and as well as general science students going through biochemistry.

While going to face Viva Voce examination, it is never possible for the students to go through any textbook because of its thickness. At this stage, they require a small cozy book in order to conceive the question with its answer within no time. Keeping this aspect in mind, the book has been written. Language of this book has been kept easily understandable.

I am really highly obliged to my wife Dr (Smt) Manju Singh, Reader, Bundelkhand College, Jhansi for her sincere encouragement in the write-up of this book. I am also highly indebted to my well-wishers, i.e. Prof. Mridula Kapur, Head, Department of Obstetrics and Gynaecology of MLB Medical College, Dr KP Singh, Senior Surgeon, District Hospital, Jhansi, Prof RK Gandhi, Head, Department of Forensic Medicine, Dr DP Singh Maurya, Department of Pharmacology, who all always pushed me to finish the gigantic work at the earliest possible.

I am also highly thankful for the sincere suggestions of my fellow colleagues, i.e. Prof SD Bhardwaj, Prof VD Bohra, Prof Praveen Sharma, Prof Maheep Sinha (all of Jaipur) Prof PP Singh (Udaipur), Prof PK Sharma (Ajmer), Prof CR Vyas (Bikaner), Prof DC Sharma (Jaipur), Prof Nisha Khalsa (Jodhpur), Prof RC Gupta (Kota), Prof RK Singh (Lucknow), Dr VK Singh (Lucknow), Prof VS Singh (Meerut), Dr SP Saxena (Gorakhpur), Dr Ajai Kumar (Kanpur), Prof RK Mittal (Allahabad), Dr Geeta Jaiswal (Allahabad), Prof MC Pant (Agra), Prof AK Singh (Ranchi), Prof B Karr (Cuttack), Prof LM Srivastava (New Delhi), Prof AG Singh (Manipur), Prof BK Aggarwal (Bhopal), Prof Meena Verma (Indore), Prof BL Patel (Raipur), Prof Sneh Shukla (Bhopal), Prof Neelima Singh (Gwalior), Prof Kiran Hasija (Jabalpur), Prof NK Gandhi, Anaesthesia Department, S.N. Medical College, Agra, Dr RK Srivastava, Medical Superintendent, Safdarjung Hospital, New

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I am also highly grateful to my well-wishers, i.e. Prof PL Shukla, Retd. Principal and Dean, B.R.D. Medical College, Gorakhpur, UP, Journalists Shri Ramesh Chaube and Shri Arun Dwivedi of Jhansi, my brothers Shri CP Singh, Joint Director, Cement Research Institute of India, Ballabgarh (Haryana), Shri IP Singh, Works Manager, Northern Railway Workshop, Kalka (Haryana), Mr VP Singh, Civil Defence Officer, Bareilly, Mr Ajai Pal Singh and sister Shakuntala Devi (Bikaner), Mr Satish Kumar Jain and Mr Vinod Kumar Jain of CBS Publishers & Distributors, New Delhi, who always thought very good of mine.

I shall fail in my duty if I do not express the sacrifice done by my sons, i.e. Vikrant and Vijyant during write-up of this book.

In the end suggestions from the readers and students shall be highly appreciated in order to improve this book further for the welfare of masses.

**Dussehra 11th Oct' 97**

(The pious day on which  
Lord Rama got victory over Ravana)

**SP Singh**

## Acknowledgements

While accomplishing revision of any book, in the beginning it appears to be a task of a few months but later on becomes a gigantic task and unending but eventually a day comes when the building gets erected and ready from all point of views. One feels great pleasure and solace when building is finally complete in all respects.

While completing this new edition which took nearly two years, my wife Dr Manju Singh, Ex-Professor and Head, Department of History, Bundelkhand University, Jhansi, stood by me just like a 'wall' as at certain occasions, I thought to drop this idea to complete this book. I am highly indebted to her for her encouragement at certain difficult hours.

I am also grateful to my son *Dr Vikrant Singh*, M Tech, PhD, Deputy General Manger, Sonalika Tractors (International Marketing), India, and his wife *Ms Charu Singh* and their children *Avvni*, *Yuwan* and *Shanaya* who all always knocked at me to complete this heavy work soon.

Side by side, I cannot forget the impetus given to me by my another son *Mr Vijyant Singh*, M Tech (Senior Telecommunication Manager), Erickson Group, Ireland; his wife *Ms Radha Singh*, MBA, MSc (Data Analysis), working as a '*Data Scientist*' in Dublin (Ireland) and their daughters *Ananya* and *Kuhu*.

I am also thankful to my few taughts, namely Dr Pushpendra Kumar Bansal, Pediatritian, Moradabad; Dr Vivek Kumar Saxena, Neurologist, Delhi, Dr Siddhartha Srivastava, Professor, Department of Gastroenterology, G.B. Pant Hospital, New Delhi. Dr Anshuman Singh, Additional Chief Medical Officer, Raebareli; Dr Manoj Srivastava, Oncosurgeon, Lucknow, Dr Krishna Dev Shakya, Medical Superintendent, G.T.B. Hospital, Delhi, for their time to time encouragement in completing this book.

I am also grateful to my innumerable fellow colleagues for their ever good wishes to promote this book and their new ideas for this current edition—to take a few names: Dr Narendra Singh Sengar, Principal and Dean, MLB Medical College, Jhansi; Dr Geeta Jaiswal and Dr Shewta Dwivedi (Professors, Department of Biochemistry at United Institute of Medical Sciences, Prayagraj); Dr AN Singh, Professor and Head, Department of Biochemistry, G.S.V.M. Medical College, Kanpur; Dr Ajay Bhargava, Professor and Head, Department of Biochemistry, Government Medical College, Jhalawar; Dr Basavraj Aski, Professor, Department of Biochemistry, Medical College, BLDE University, Bijapur; Dr ZG Badade, Professor, Department of Biochemistry, MGM Medical College, MGM University, Navi Mumbai; Dr Shreya Nigoskar, Professor and Head, Department of Biochemistry, Index Medical College, Indore; Dr Pradeep Sharma, Professor and Head, Department of Biochemistry, Government Medical College, Fatehpur and his wife Dr Preeti Sharma, Professor, Department of Biochemistry, Santosh Medical College, Ghaziabad; Dr Mukesh Kumar Agarwal, Surgeon and Chairman, Chandra Laxmi Hospital, Ghaziabad and many other teachers of our country and abroad—a long list.

In the end, I am highly obliged to Mr Satish Kumar Jain (CMD), CBS Publishers and Distributors, and his worthy son Mr Varun Jain (Director), for encouraging me from time to time to bring out this edition at an early date.

I am also highly grateful to Mr YN Arjuna (Senior Vice-President—Publishing, Editorial and Publicity) and Ms Ritu Chawla (GM—Production), who always stood by me in giving this book a final very good-looking shape—really highly obliged from inner corner of my heart.

**SP Singh**



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