

# Textbook of Tuberculosis

is a complete, rich and valuable resource of knowledge on tuberculosis. It is the first of its kind, a thoroughly updated edition, aligning according to the latest Programmatic Management of Drug-resistant Tuberculosis (PMDT) Guidelines. Several authors from various interdisciplinary specialities, with vast experience in their domain, contributed to the multidisciplinary approach towards tuberculosis. This book opens with a comprehensive content page which is subdivided into 6 sections. Each section is unique as it covers different aspects of tuberculosis like •introduction, •laboratory diagnosis, •clinical features, •management and •prevention. Special stress has been laid on the inclusion of new topics like “science of TB vaccine”, “laboratory diagnosis and treatment of drug resistant TB”, “Nanotechnology in TB and National Tuberculosis Elimination Program (NTEP)” and how it evolved from Revised National Tuberculosis Program. Of note, the detailed explanation of molecular tests in the diagnosis of tuberculosis, with special attention on DNA polymerase chain reaction (PCR) testing was addressed. Currently, PCR technique is the cornerstone for cartridge based nucleic acid amplification test (CBNAAT), the most widely used point of care diagnostic test in the world. In addition, the evolution of COVID-19 pandemic situation and its effect on TB in India is beautifully covered. On the other hand, chapters specifically focussing on extra pulmonary tuberculosis and its management have been clearly illustrated from a holistic viewpoint for the accurate understanding and application of the reader.

Primarily this book aims to give the readers an easy understanding of a complex disease and to serve them to adequately apply the concepts while dealing with TB cases. In addition, this book also serves to enrich the knowledge of undergraduate and postgraduate students in tackling complicated practical questions. Recent advances have been highlighted with special emphasis on ongoing research. The authors of this book firmly believe that this edition is completely updated and serves the purpose of fulfilling the lacunae that exist between theoretical knowledge and practical application that eventually benefit patient care.

An Expert's Review

I congratulate my friend Dr Sunnam Satyasri and other editors and contributors for coming out with a most updated version of this book on tuberculosis. This book will be a blessing for undergraduates, postgraduates and specialists all across India. The problem of tuberculosis is complex in the urban and also in the rural settings of India, where TB literally can affect any part of the body except the nail and the hair. This book comes real handy while dealing with those complex interdisciplinary situations involving tuberculosis that effects other parts apart from the lung.

— KVA Gangadhar Rao MD, Consultant Pulmonologist, Bheemavaram, AP

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Dr Satyasri was awarded “Man of the Year 2003” by American Educational Society and as the ‘best teacher’ twice during his tenure at Rangaraya Medical College, Kakinada. Among his notable positions are having served as Convener for RNTCP and DOTS Committee, ASRAM, Eluru. He is member of Indian Chest Society, Tuberculosis Association of India, and life member of Indian Medical Association. He has also been a reviewer for various scientific journals. Apart from medicine, he immerses himself in philosophy and meditation. Popularly known among the fraternity of Indian pulmonary medicine as “teacher of teachers”, he has contributed immensely to the field of pulmonary medicine, especially tuberculosis in India.

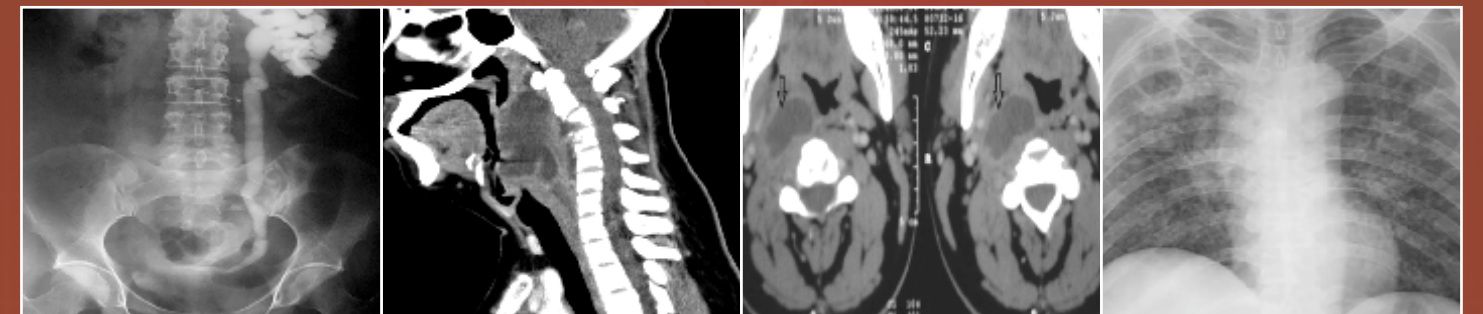
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# Textbook of Tuberculosis

Satyasri  
Rani  
Badusha

# Textbook of Tuberculosis



Sunnam Satyasri  
N Usha Rani  
MD Badusha

Dedicated to Education



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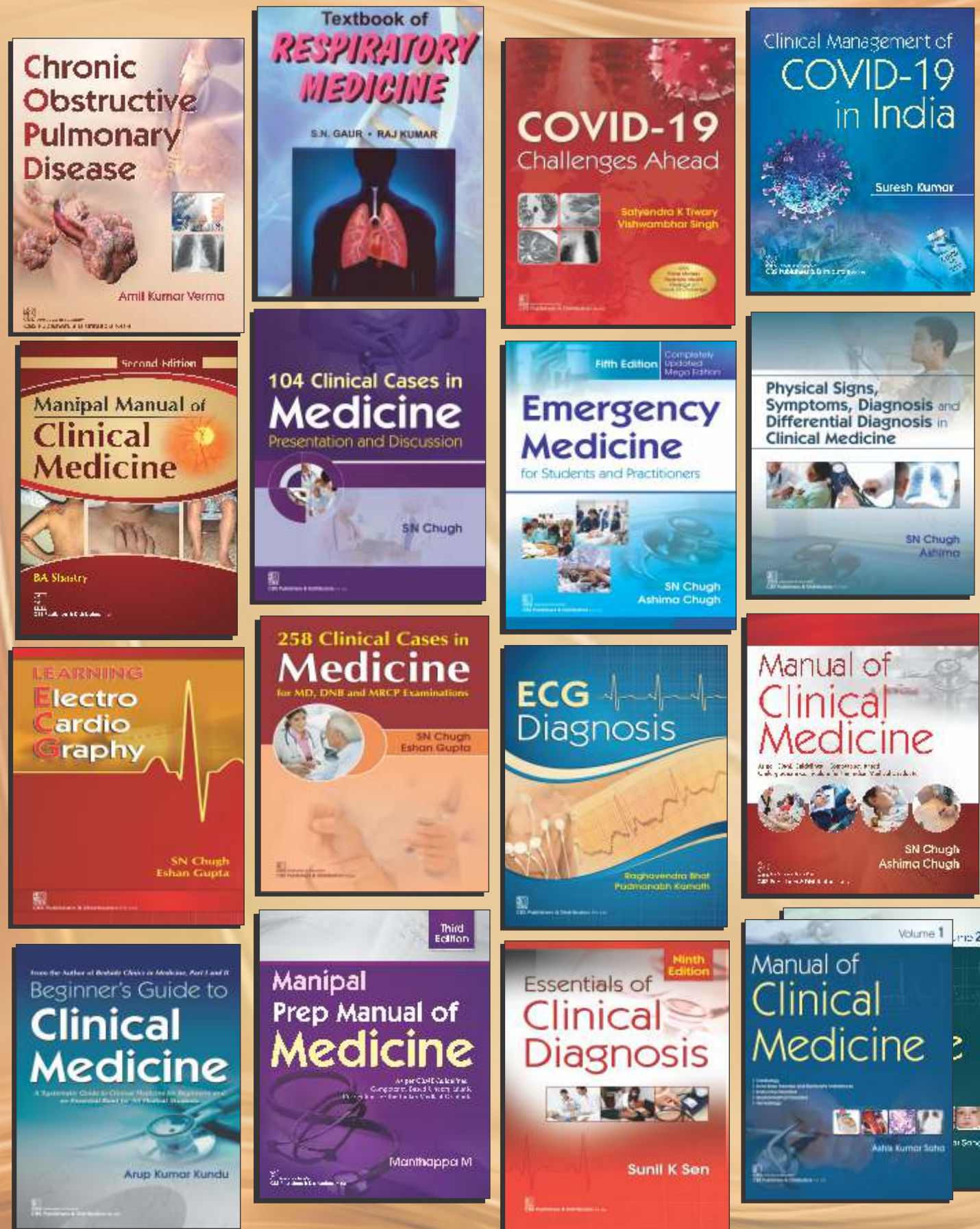
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A microscopic view of various bacteria, including rod-shaped and spherical forms, some with flagella, set against a warm orange and yellow background.

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A decorative graphic at the bottom of the page consisting of a grid of squares in various shades of gray, creating a checkered or mosaic effect.





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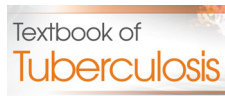


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*to*

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## Foreword

When one thinks of textbook in any subject of medicine, one cannot imagine the gravity of task senior author and his team undertaken. The circumstances about 30 years ago were different. Common student of medicine probably had only major and authentic source of knowledge which was textbooks, but with advent of internet, info-media, various apps, groups and relevant sources, the values of textbook appears to be plummeting fast. Though compiling articles and editing has become faster, easier and probably less costly, the latter part, i.e. printing the book and taking it to the doors of readers has become a difficult task. With everything at our fingertips, the need to open a heavy textbook at bedside for reference has become a cumbersome endeavour now. Not many students are opening the heavy textbooks when an academic question is asked by the teacher these days. That is the problem in textbook publishing. Now, the student thinks the textbook as only a source of knowledge for completing the degree course.

If one considers the volume of knowledge flooded in medicine every moment, I do not think it is humanly possible to keep all those articles, case reports, mushrooming guidelines, huge number of associations, and their activities, their ever-changing protocols, etc. in editor's mind, and formulate a precise structure of a textbook. The precise structure of any book is soul of publication, because that is the only merit the whole business of editing and publishing is banking on. Why one wants to read, recommend, and refer a book is decided by multiple socioeconomic factors. Thus, this element is assuming more importance day-by-day.

And yet publication of a textbook is very essential for the real progress of medicine. In a crowded place or in a dense jungle, a traveller definitely needs a guide. How will one decide which is the correct approach when multiple pointers show multiple directions? So, the senior author chooses wisely the contributors, their inputs, and the relevance of every matter, and undertakes the venture. Thus, the textbook is a lighthouse for the traveller, especially one is novice. Nowadays, though, one edition may have less of life as compared to past, textbooks have rock-solid importance in understanding and progress of all facets of medicine.

If the reader has formed the impression that the basic teaching is the only purpose of textbooks, then it will be too much of undervaluation. The selection of right kind of opinions, guidelines, procedures and highlighting them is utmost important. This difficult and delicate task cannot

be performed by the editors of periodicals. The periodicals are, by virtue of their formation, victim of individual or organisational biases. No textbook can succumb to these factors, because they are independent entities.

It will be pertinent to cast some light on some tricky factors involved in medical research. This forms the very fluid characteristic in medicine. Gone are the days of opinions of stalwarts were quoted as advances in medical science. Now, series of cases, clinical trials with adjectives like controlled, single blind, double blind, came into vogue, have their influence in medicine only to fade. Soon the community realised the shortcomings of every method, and meta-analysis appeared on horizon. Various bodies of international repute started engulfing various popular research titles. The arguments of supporters of such meta-analysis is to eliminate the personal biases and produce unbiased guidelines. But are these meta-analysis beyond biases or statistical fallacies?

I would like to describe a meta-analysis which I had thoroughly studied. Long ago, a meta-analysis by Gotzsche PC and Johanson HK, described as 'House-Dust Mite Control Measures for Asthma (Review) of Cochrane Collaboration' was an important systematic analysis. It, probably, was considered as an opinion maker, because it has formed the basis of GINA guidelines. I could trace and study 48 out of original trials, and reanalysed in a simple way. Preventive measures gave favourable results in total 27 trials. 18 trials with multiple preventive measures gave favourable and one unfavourable result. Chemical and physical measures together had shown 6 unfavourable and 2 favourable results. Single physical preventive measure in 11 trials had unfavourable and in 5 favourable results. Thus, majority of original research workers were of the opinion that house-dust-mite can be prevented by multiple, if not by single, methods. On the other hand, only a team of so called meta-analysers nullified their impression, and the final conclusion was, GINA words, "chemical and physical methods aimed at reducing exposure to house-dust-mite allergens cannot be recommended". Only my question, whose opinions carry more value on the important matters like HDM prevention all over the world? The majority of original workers' opinion or the limited statisticians who have analysed the whole work without understanding the very soul of the research work? Thus, I do not feel that even meta-analysis is a criteria which can eliminate any biases. Well, one can say meta-analysis may try to eliminate basic workers' biases only to add its statistical fallacies.

Naturally, the conclusion of this prestigious meta-analysis was a pleasant surprise to pharmaceuticals. Thus, finance becomes a very important deterrent of basic scientific research. Prevention of diseases, though it is spoken loudly, practiced meekly. Curing a patient, especially with chronic ailments is a loss to every element involved in health care. This is another factor, needs to be addressed rationally. Textbooks have, here, a very important role to play. And that is possible with correct selection of supporting work and highlighting it.

Some years ago, 'evidence-based medicine' was a magic word for medicine, especially in the era of Consumer Protection Act. This was an undoubtedly a good torch to guide a medical man in darkness of ignorance. If one assumes unbeaten path in medicine, one is likely to invite calamities. This evidence-based medicine has many advantages as far as protection of a medical professional concerned, but the freedom to manipulate a regimen; implement a new idea has become difficult. One can stretch the above example here too. If a physician, in good faith, advises more prevention rather than drug therapy as per guidelines, he is likely to invite medicolegal eventualities, in spite of good intentions, because the very attempt was not made in original researches to prove its value. Thus, evidence-based medicine may not be conducive to clinical research. Here, a textbook editor may help to restore a balance, give clues to deficient researches or such pertinent functions.

Guidelines are another fashion in academic associations. There are many international organisations, subsequently national ones too, making major changes in guidelines, so frequently that one may not find any coherence in the whole activity. Formation of guidelines is venture of selected persons who apparently, speak more, and write more in journals. Since publication of journals or periodicals is privy to a particular organisation, it will be out of context to talk here. One observation however, surfaces significantly. When research workers in other system of medicine are dividing and subdividing a complex disease, pulmonologists are having diplomatic, may not be scientific, approach. Dermatologists or psychiatrists have limited drugs in their armamentarium, but they go on hair splitting a disease. But pulmonologists have terms like COPD, DPLD and some overlap syndromes which create diagnostic dustbins. What I say will be better understood if one pays sympathetic ear to me.

In spite of serious attempts for about 40 years, the so-called COPD group is undergoing almost yearly changes. The very facts prove that there is serious basic error. In case of COPD, if we had divided the group say on the basis of pathology, or accuracy of symptoms, probably we would have reached more logical conclusions. Here,

we have combined mucus-producing disease and emphysema, a dry disorder together long ago. And what is the result? We go on changing the guidelines frequently. By this time, probably correct research in the sub-groups would have resulted in developing a more specific drug like mucus-reducing agents or regenerative agents easily.

Similarly, fast changes are occurring in tuberculosis recently. The issue appears to be tricky. Here is disease which develops slowly, bacteria multiply slowly and guidelines are frequently changed. It is a perplexing condition. Though the diagnostic modalities have drastically changed, human body, behaviour, mind, social and biological remain largely unchanged. We need to understand rather relatively slowly and steadily so that resources may be properly utilised.

Hi-tech researches are beyond the purview of even most advanced medical institution. Genetics, robotics and nanotechnology are developed by highly developed, specialised research laboratories in the modern world. We work on applied techniques. Our research is again dependent on the basic technique supplied by these commercial firms. Thus, we are in no position to comment whether the technique received by us is best or otherwise.

Here is another role for textbooks review of the researches and its evaluations. The textbooks can do this immensely important work effectively, criticism of guidelines, evaluation of work done, so far can be achieved by books.

If we consider multidimensional challenges to a textbook in pulmonary medicine, the present book tries to reach ideal standards. Tuberculosis is eluding mankind ages together. Therefore, all intricacies of a chronic ailment have percolated in every nook and corner of pathology. This book has focused on basics of tuberculosis, starting from the history, and the basic culprit, i.e. *Mycobacterium tuberculosis* to most recent advances in tuberculosis. Thus, the readers will reap the benefits together. Prevention of a disease is commonly a title found in the book but has less to reveal. This book has considered more detailed and ultra-modern approach for the social management of tuberculosis. To mention, latent tuberculosis—nanotechnologies have important contributions.

On the whole, I am confident that this book will be a good torch of a lighthouse in the ocean of knowledge and the readers will receive rational guidance.

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## Preface

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**I**t is a shame to mankind that even 140 years after, the discovery of TB germs by Robert Koch, we could not tame this disease. It is saddening to know that the TB problem is more now than before. TB is the biggest public health programme in developing countries like India which is about one-fifth of global burden and it has resurged back in the developed world due to the HIV pandemic after 1979. This dreadful disease is a major barrier for the development of a nation and some of the biggest challenges in TB, like HIV-TB co-infection and MDR tuberculosis have broken the already breaking back of a poor country like India.

Natural decline of tuberculosis started occurring in the developed world at the turn of the 20th century and it was not due to specific man-made efforts such as the BCG vaccination or chemotherapy as they did not exist at that time. It was due to improvement of socioeconomic standards, better working and living conditions, good diet,

suburbanisation, and staying away from overcrowding. It is difficult to see such a natural decline in a poor country like India as the poor man is becoming poorer.

For control of TB, drugs are not enough; we have to improve the living conditions. How can you expect a patient to take medicines, if he does not have one square meal a day?

DOTS was implemented in India in 1997 and now, it is covering the entire country which is giving encouraging results.

This book includes all the recent guidelines and the idea is to make it more comprehensive and easy for reading. Special emphasis has been laid on topics covering the diagnostic and treatment aspects of tuberculosis and topics like HIV-TB co-infection, MDR-TB, etc.

We hope, this book will receive good encouragement and patronage.

We feel God's grace all the time.

**Sunnam Satyasri  
N Usha Rani  
MD Badusha**







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We hereby wish all the readers of the book all the best in their endeavors.

**Sunnam Satyasri  
N Usha Rani  
MD Badusha**



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