

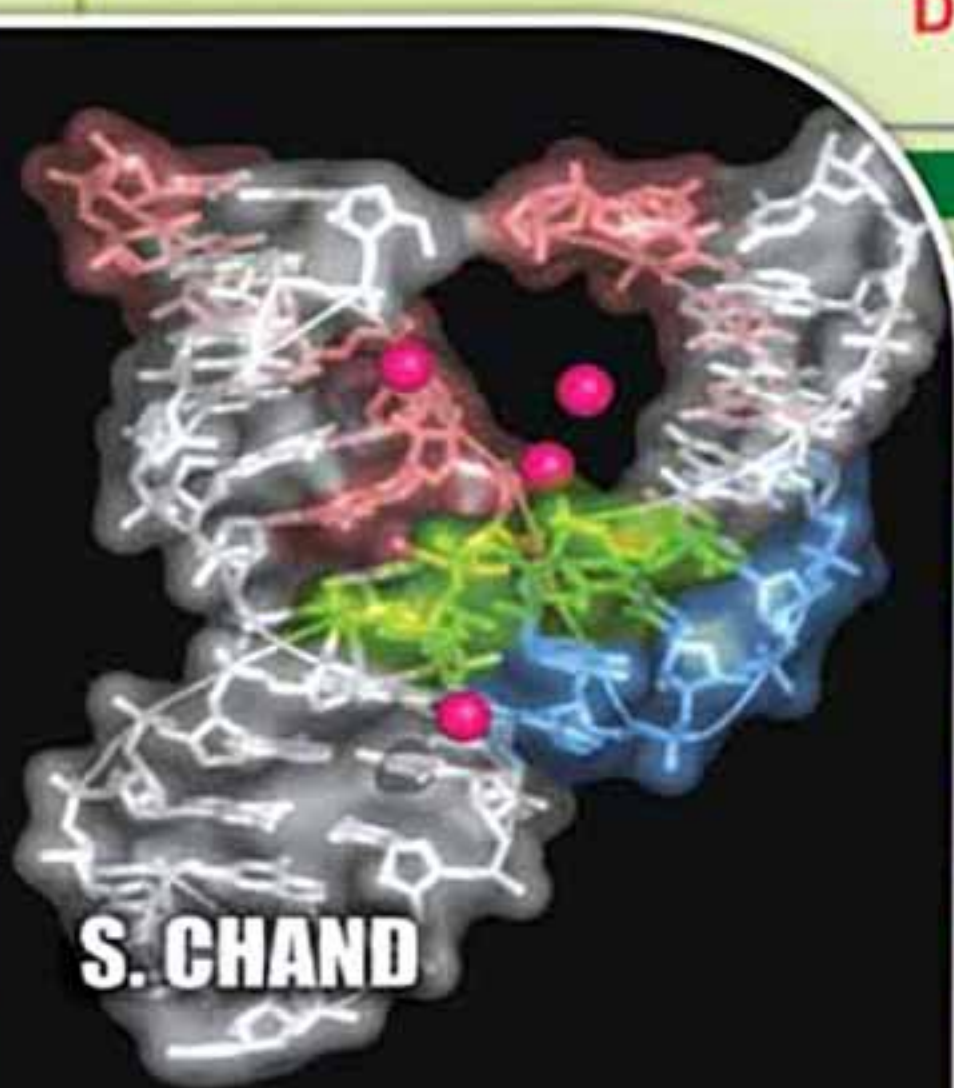
Revised Edition

# Microbiology

## QUESTIONS AND ANSWERS

For B. Sc. (Pass/Hons.), M. Sc. Students of all Indian Universities and also Useful for Competitive Examinations like NET, GATE, etc.

**Dr. PURSHOTAM KAUSHIK**  
**Dr. KIRTI KAUSHIK**



# **MICROBIOLOGY**

**QUESTIONS AND ANSWERS**



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*Dedicated to the memory of  
'Padmashree' Dr. P.N. Mehra (1907 – 1994)  
D.Sc. F.N.A., F.N.A. Sc.  
Professor Emeritus  
Panjab University, Chandigarh*



# GENESIS

In my teaching experience of more than 30 years no doubt I came across several good books of microbiology but what I missed dearly was a study material of some sort of questions and answers which I could give to my dear students so that they could do self assesment. Therefore, an idea came to my mind to prepare such a text myself which would contain in ink my live and interactive experience with students during the last three decades. It was conceived for a text which would help students for both, to study and to test themselves; and to revise on their own. Thus was born “Microbiology Questions and Answers.”

Wish you a **happy and joyful reading** and a **wonderful career ahead.**

PURSHOTAM KAUSHIK



## **Foreword**

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I am happy to write a foreword to 4th edition of “MICROBIOLOGY: QUESTIONS AND ANSWERS” by Dr. Purshotam Kaushik, Professor & Dean, Faculty of Life Sciences, Department of Botany and Microbiology, Gurukul Kangri University, Haridwar; and Dr. Kirti Kaushik, Post doctoral Associate, University of Minnesota, St. Paul, U.S.A.

The microbiology is considered to be one of the most applied branches of biology. It provides not merely information regarding cellular and non-cellular microorganisms, rather more important aspects of life including microbial genetics and molecular biology, which are comparatively much difficult to study in higher plants and animals. Some of the strange characteristics, viz. survival of bacterial spores, concept of enzyme energetics and metabolism make it more fascinating. Today, we not only understand viruses but viroids and prions also. The production of several important chemicals besides antibiotics, vitamins, and amino acids, and brewing find application in large scale as well as small scale in the industry.

This book provides chapters on history of microbiology, microscope, microbial diversity, the bacteria, the Bergey’s Manual, the viruses, ribosomal RNA in microbial taxonomy, cultivation and growth of microorganisms, immunology, microbial genetics, microbial biotechnology, industrial microbiology, food and dairy microbiology, soil microbiology, water and waste water microbiology, biological control, mycorrhizae, biosensors, and applications of microbiology.

Prof. Purshotam Kaushik who has already authored an excellent book “Introductory Microbiology” which was first published by Emkay Publications, Delhi in 1996, has several research monographs and books to his credit and is an established author.

Prof. Kaushik received his early training under a distinguished biologist Prof. P.N. Mehra, and has professed teaching and research at Panjab University, Chandigarh, and Guru Nanak Dev University, Amritsar. He has also visited the Universities of London, Cambridge and Kew (United Kingdom) and Institute Pasteur, Paris (France), and is highly experienced in this field.

The book provides latest information in the field and will be informative and useful for graduate as well as postgraduate students besides, those interested in objective learning of microbiology for competitive examinations.

March 14, 2011

**Prof. P.K. Khosla**  
Vice-Chancellor  
Shoolini University of Biotechnology  
and Management, SOLAN, (HP)  
& Formerly Vice-Chancellor  
HP Krishi Vishwavidyalaya  
Palampur, HP 176062



## **PREFACE TO THE FOURTH REVISED EDITION**

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The popularity of this text book among students and teachers has been the motivating force in revising as per the U.G.C. model curriculum. New chapters have been added on 'Human Immunodeficiency virus and AIDS' 'Ecological Groups of Microorganisms', 'Extremophiles', 'Aeromicrobiology', 'Biogeochemical Cycling' and 'Pharmaceutical and Microbial Technology' besides many illustrations. The text has been made more informative.

March 13, 2011

**Dr. Purshotam Kaushik**

Webpage : [purushotam.kaushik.googlepages.com](http://purushotam.kaushik.googlepages.com)

**Dr. Kirti Kaushik**

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## **PREFACE TO THE THIRD EDITION**

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Keeping in view the U.G. C. model curriculum in microbiology and considering the request of teachers and students many additions have been made in the present edition. The chapter on biotechnology has been updated. New chapters have been included on biopesticides, tools and techniques of microbiology, xenobiotics the foreign chemicals in the body, carbohydrates, proteins : structure and function, lipids, enzymes : biological catalysts or biocatalysts, enzyme technology or applications of enzymes and bioinformatics. Lastly, there is a chapter on objective assessment or a question bank with correct answers to make readers more inquisitive and vibrant on arrival of an opportunity to pose to Indian and international biotechnological and microbiological icons, to compete and pursue their research and excel in their **academic and job careers** in public and private sectors in this age of globalization at a crucial juncture while multinational companies in the area of biotechnology and microbiology are emerging fastly in India or any where else in the world.

March, 2007

**Dr. Purshotam Kaushik**

## **PREFACE TO THE SECOND EDITION**

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The first edition of the book was liked by the students and teachers and won their appreciation which prompted me to revise the first edition. Some new chapters and diagrams have been added and the book has been made more informative.

May, 2003

**Dr. Purshotam Kaushik**

*Professor & Head  
Department of Botany and Microbiology  
Gurukul Kangri University  
Haridwar 249404*

## **PREFACE TO THE FIRST EDITION**

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Microbiology is one of the recent facets of science. Its emergence and major developments took place in the latter half of the 19th century and the beginning of the 20th century, a period of almost 50 years, and is referred to as golden age of microbiology. Further development of microbiology is expected to usher in a “New golden age” in the 21st century. The teaching courses of microbiology have been started by different colleges and universities at both graduation and postgraduation levels. The microbiology being one of the applied branches of science has a vast scope for interdisciplinary developments.

The present text has been prepared to create quest for knowledge among the students undergoing introductory courses of microbiology both at graduation and postgraduation levels. The outstanding features of the subject have been presented in the form of objective type questions and answers. This has made the subject interesting and precise for better understanding. Almost all aspects of microbiology have been covered and the latest information in the field has been provided. The special features include development of microbiology in India, applications of microbiology, revealing microbial diversity, the concept of microbiological species, distribution of microorganisms in nature, classification of microorganisms, DNA hybridization, 16S rRNA sequencing, bacterial nomenclature, modern trends in bacterial taxonomy, Bergey’s system of bacterial classification, general features of classification of bacteria, cyanobacteria, rickettsia, chlamydia, mycoplasmas, algae, archaeobacteria, actinomycetes, fungi and protozoa.

The nutritional types of microorganisms give information about autotrophs, heterotrophs, psychrophiles, mesophiles, thermophiles, hyperthermophiles, and nutritional requirement of microorganisms.

The microbial growth includes the growth curve of bacteria, measurement of growth-mass and volume measurement, cell membrane and indirect methods in addition to parameters of growth and growth in batch and continuous culture.

**Dr. Purshotam Kaushik**

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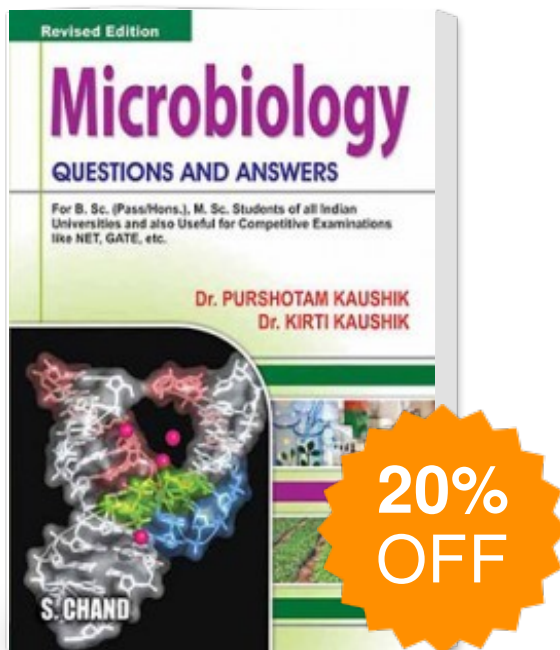
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