ESSENTIALS OF MICROBIOLOGY

ESSENTIALS OF MICROBIOLOGY

Dr. Nishu Devi
Ph.D. Scholar, Dairy Microbiology Division
ICAR-NDRI Karnal,132001

Dr. Sahil Girish Kulkarni
Pharmaceutical and Healthcare Professional
Ph.D. in Medical Microbiology
Haffkine Institute Mumbai under MUHS University, Nashik

Dr. Nazir Ahmad Var
Associate Professor, (Microbiology)
K.D. University, Mathura, U.P.

Dr. Priyanka Thakur
Assistant Professor
Department of Medical Laboratory Science School of Allied Healthcare and Science
GNA University, Phagwara Punjab 144401

Dr. Yeshawant Raghunath Govekar
Associate Professor (Plant Pathology)
Regional Fruit Research Station Vengurla, Maharashtra

VITAL BIOTECH PUBLICATION

Kota, Rajasthan, India
http://www.vitalbiotech.org/bookpublication/

An International Publishers

VITAL BIOTECH get Accredited by following International organization

https://www.portico.org/publishers/vital/
101 Greenwich Street, 18th Floor
New York, NY 10006

Copyright © 2026 VITAL BIOTECH PUBLICATION
Published by Vital Biotech Publication
First Edition: 2026

All Rights Reserved
No part of this book may be reproduced in any form, by photostat, microfilm, xerography, or any other means, or incorporated into any information retrieval system, electronic or mechanical, without the written permission of the publisher.

Product Form:
Digital download, online and hard bound

Edition:
ISBN: 978-81-69356-09-1

Head, Production (Higher Education and Professional) & Publishing Director
Dr. Jitendra Mehta

Product Manager
Aman Saxena

General Manager
Jaya Mehta

Graphic Designer
Kritika Lohomi

Information contained in this work has been obtained by Vital Biotech Publication (India), from sources believed to be reliable. However, neither Vital Biotech Publication (India) nor its authors guarantee the accuracy or completeness of any information published herein, and neither Vital Biotech Publication (India) nor its authors shall be responsible for any errors, omissions, or damages arising out of use of this information. This work is published with the understanding that Vital Biotech Publication (India) and its authors are supplying information but are not attempting to render engineering or other professional services. If such services are required, the assistance of an appropriate professional should be required.

Office Address:

VITAL BIOTECH PUBLICATION
772, Basant Vihar, Kota,
Rajasthan-324009 India
Visit us at: http://www.vitalbiotech.org
Contact No. +91-9784677044
Printed at: Vital Biotech Publication, Kota

Preface

Microbiology is a dynamic and rapidly evolving branch of science that explores the fascinating world of microorganisms and their profound influence on life, health, agriculture, industry, and the environment. From the discovery of microbes to the advent of molecular biology, genomics, and biotechnology, the field has transformed our understanding of biological systems and provided innovative solutions to global challenges, including infectious diseases, food security, environmental sustainability, and industrial production.

Essentials of Microbiology has been written to provide students, educators, researchers, and professionals with a clear, concise, and comprehensive introduction to the fundamental concepts of microbiology. The book presents the structure, classification, physiology, genetics, and diversity of microorganisms, while highlighting their beneficial and harmful roles in nature. Special emphasis has been placed on microbial metabolism, host–microbe interactions, immunology, microbial diseases, laboratory techniques, industrial microbiology, environmental microbiology, and recent advances in molecular diagnostics and microbial biotechnology.

The content has been organized in a logical and student-friendly manner, supported by simple explanations, illustrative examples, diagrams, and up-to-date scientific developments. Care has been taken to balance classical microbiological principles with modern applications, enabling readers to develop both conceptual understanding and practical insight.

This book is intended to serve as a valuable resource for undergraduate and postgraduate students of life sciences, microbiology, biotechnology, agriculture, veterinary science, medicine, pharmacy, environmental science, and allied disciplines. We sincerely hope that it inspires curiosity, promotes scientific thinking, and encourages readers to appreciate the remarkable diversity and significance of the microbial world. Any suggestions from readers for improving future editions will be warmly welcomed.

Dr. Nishu Devi **Date – 30 June, 2026**
Dr. Sahil Girish Kulkarni
Dr. Nazir Ahmad Var
Dr. Priyanka Thakur
Dr. Yeshawant Raghunath Govekar

CONTENTS

S. NO.		PAGE NO.
1.	**Introduction to Microbiology and Microbial Diversity** *Nishu Devi*	1-12
2.	**History and Development of Microbiology** *Sahil Girish Kulkarni*	13-26
3.	**Microbial Cell Structure and Function** *Nazir Ahmad Var*	27-38
4.	**Classification and Taxonomy of Microorganisms** *Priyanka Thakur*	39-48
5.	**Microbial Nutrition, Growth, and Metabolism** *Yeshawant Raghunath Govekar*	49-60
6.	**Microbial Genetics and Molecular Biology** *Nishu Devi*	61-74
7.	**Bacteriology: Structure, Physiology, and Importance** *Sahil Girish Kulkarni*	75-84
8.	**Virology: Viruses and Their Applications** *Nazir Ahmad Var*	85-96
9.	**Mycology: Fungi and Their Significance** *Priyanka Thakur*	97-108
10.	**Phycology and Protozoology: Algae and Protozoa** *Yeshawant Raghunath Govekar*	109-120
11.	**Microbial Ecology and Environmental Microbiology** *Nishu Devi, Sahil Girish Kulkarni, Nazir Ahmad Var*	121-134

12. Medical Microbiology and Infectious Diseases 135-146
Priyanka Thakur, Yeshawant Raghunath Govekar

13. The Plant Microbiome: Structure, Function Assembly and Agricultural Significance 147-162
Tanvi Bhatia, Shikha Mehta, Rajesh Gera

14. Microbial Regulation of Carbon, Nitrogen Phosphorus and Sulphur Cycling 163-178
Shikha Mehta, Tanvi Bhatia, Rajesh Gera, Ritu Saini

15. Plant Growth-Promoting Microorganisms: Mechanisms Consortia and Field Applications 179-192
Yamini Siwna, Akhileshwar Sahu