

# Microbiology

*A Self Instruction Manual*

*Compiled & Edited by:*  
**Hemapriyaa Vijayan**



*Published by:*

**Lincoln University College**

[www.lincoln.edu.my](http://www.lincoln.edu.my) ● [www.lucp.net](http://www.lucp.net)

# Microbiology

*A Self Instruction Manual*

*Compiled & Edited by:*

**Hemapriyaa Vijayan**

*Faculty of Applied Science*

Lincoln University College, Malaysia



*Published by:*

**Lincoln University College**

[www.lincoln.edu.my](http://www.lincoln.edu.my) ● [www.lucp.net](http://www.lucp.net)

Copyright © 2024

Lincoln University College, Malaysia

All rights reserved

No part of this book can be reproduced or transmitted by any means, electronic or mechanical, including photocopying recording or by any information storage and retrieval system without prior written permission from the publisher.

Published on: 31<sup>st</sup> October, 2024

*Published by:*

**Lincoln University College**

Wisma Lincoln, No. 12,14,16 & 18,  
Jalan SS 6/12, Off Jalan Perbandaran  
47301 Petaling, Jaya,  
Selangor Darul Ehsan, Malaysia

Tel.: +603-7806 3478

Fax: +603-7806 3479

Toll Free: 1-300-880-111

E-mail: [lucp@lincoln.edu.my](mailto:lucp@lincoln.edu.my)

[info@lincoln.edu.my](mailto:info@lincoln.edu.my)

Web: [www.lucp.net](http://www.lucp.net)

[www.lincoln.edu.my](http://www.lincoln.edu.my)

ISBN: 978-967-2819-40-0

e ISBN: 978-967-2819-44-8

Printed By:

PERCETAKAN HORIZON WAVES  
27 Jalan Velox 2, Taman Industry Velox,  
4800 Rawang Selangor, Malaysia

## **Preface**

Microbiology is a field of science that explores the unseen world of microorganisms, examining their structures, functions, roles in ecosystems, and impacts on human health. This module aims to provide a comprehensive introduction to the fundamental concepts of microbiology, emphasizing the diversity of microbial life, the mechanisms by which microorganisms interact with their environments, and the methods used to study them. By delving into the microscopic world, students will gain a deeper understanding of the significance of microbes in both beneficial and harmful contexts, laying a foundation for careers in healthcare, research, biotechnology, and environmental science.

**Hemapriyaa Vijayan**  
*Faculty of Applied Science*  
Lincoln University College, Malaysia

## **Table of Content**

<b>Chapter 1: Basic Concepts of Microbiology</b>	1
1.1 Major contributors in Microbiology Field	2-3
1.2 Techniques Used for Studying Microorganism	3-6
1.3 Classification of Bacteria	6-8
Summary	8
<b>Chapter 2: Physiology of Prokaryotes and Eukaryotes</b>	10
2.1 Cell Structure and Evolutionary history	11-12
2.2 Microbial diversity	12-14
2.3 Microscopy and Cell Morphology	14-18
2.4 Cell Membrane and Cell Wall	18-21
2.5 Surface Structures of Prokaryotes	21-25
Summary	27
<b>Chapter 3: Functional Anatomy</b>	29
3.1 Functions of cellular structure of Bacteria	30-32
3.2 Osmosis and water transport in bacteria cell	32-35
3.3 Transport of material through Plasma Membrane	35-36
3.4 Protozoa	37-39
3.5 Fungi	39-43
3.6 Algae	43-45
Summary	46
<b>Chapter 4: Microbial Growth &amp; Requirements</b>	50
4.1 Steps in Bacterial Cell Division	50-51
4.2 Key Proteins Involved in Bacterial Cell Division	52-53
4.3 Phases of Bacterial Growth:	54-56
4.4 Key Environmental Factors Affecting Bacterial Growth:	57-60
Summary	62
<b>Topic 5: Metabolism- Central Metabolic Pathway</b>	64
5.1 Carbohydrate Metabolism in Bacteria	65-66
5.2 Photosynthesis	66-67
5.3 Anabolic Pathway	67-69
Summary	71
<b>Topic 6: Microbial Growth Control</b>	73
6.1 Physical antimicrobial control	74-75
6.2 Chemical Antimicrobial Control	75-76
6.3 Antimicrobial Agents Used in Vivo: Control of Viruses and Eukaryotic	76-77

Pathogens Antiviral Agents:	
6.4 Antimicrobial Drug Resistance and Drug Discovery	77-78
Summary	79
<b>Topic 7: Microbial Genetics</b>	<b>81</b>
7.1 Microbial Genome: Structure and Replication	82-83
7.2 Bacterial Replication	83-84
7.3 Gene Mutations in Bacteria	84-87
Summary	87
<b>Topic 8: Bacteria and Diseases</b>	<b>89</b>
8.1 Factors contributes to diseases	90-93
8.2 Comparison of Endotoxins and Exotoxins	93-94
8.3 Effects of Endotoxin and exotoxin	94-95
8.4 Pathogenic Gram-Positive Cocci	95-97
8.5 Pathogenic Gram-Positive Bacilli	97-98
8.6 Pathogenic Gram-Negative Cocci	98-99
8.7 Pathogenic Gram-Negative Bacilli	99
Summary	100
<b>Topic 9: Application of Microorganism</b>	<b>102</b>
9.1 Industrial Microorganisms and Product Formation	103-105
9.2 Medical Products for the Health Industry	105-107
Summary	109

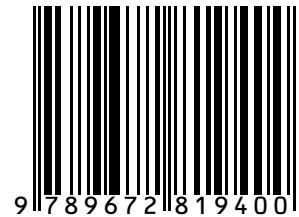
## **Lincoln University College**

Wisma Lincoln, No. 12,14,16 & 18,  
Jalan SS 6/12, Off Jalan Perbandaran  
47301 Petaling, Jaya,  
Selangor Darul Ehsan, Malaysia  
Tel.: +603-7806 3478, Fax: +603-7806 3479  
Toll Free: 1-300-880-111  
E-mail: [lucp@lincoln.edu.my](mailto:lucp@lincoln.edu.my)  
[info@lincoln.edu.my](mailto:info@lincoln.edu.my)  
Web: [www.lucp.net](http://www.lucp.net)  
[www.lincoln.edu.m](http://www.lincoln.edu.m)

e ISBN 978-967-2819-44-8



ISBN 978-967-2819-40-0



[www.lincoln.edu.my](http://www.lincoln.edu.my) ● [www.lucp.net](http://www.lucp.net)