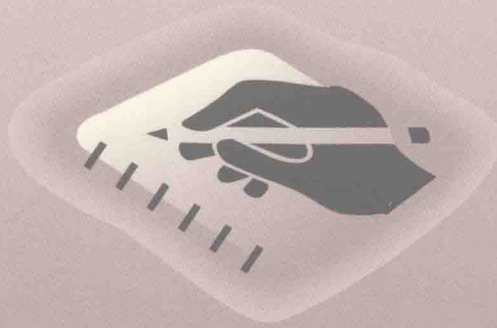


student study
ART NOTEBOOK



FOUNDATIONS
IN

MICRO

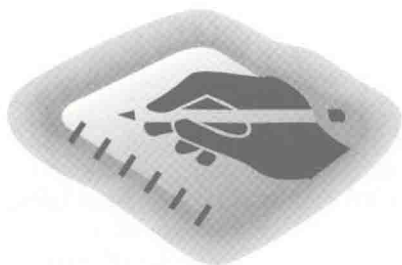
student study
ART NOTEBOOK
FREE
with your NEW
WCB
Microbiology Book

KATHLEEN TALARO
ARTHUR TALARO

Second Edition

BIOLOGY

student study
ART NOTEBOOK



FOUNDATIONS IN
MICROBIOLOGY
Second Edition

KATHLEEN TALARO
Pasadena City College

ARTHUR TALARO
Pasadena City College



Wm. C. Brown Publishers

Dubuque, IA Bogotá Buenos Aires Caracas Chicago Guilford, CT London
Madrid Mexico City Seoul Singapore Sydney Taipei Tokyo Toronto



A Times Mirror Company

The credits section for this book begins on page 157 and is considered an extension of the copyright page.

Copyright © 1996 Times Mirror Higher Education Group, Inc.
All rights reserved

A Times Mirror Company

ISBN 0-697-28329-1

No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher.

Printed in the United States of America by Wm. C. Brown Communications, Inc.,
2460 Kerper Boulevard, Dubuque, IA 52001

10 9 8 7 6 5 4 3 2

TO INSTRUCTORS AND STUDENTS

The Student Study Art Notebook is designed to help in your study of microbiology. The notebook contains art taken from the text and overhead transparencies; thus you can take notes during lectures, or jot down comments as you are reading through the chapters.

We hope this notebook, used along with your text, helps to make the study of microbiology easier for you.

DIRECTORY OF NOTEBOOK FIGURES

TO ACCOMPANY TALARO-TALARO FOUNDATIONS IN MICROBIOLOGY, 2/E

Chapter 1

Diversity of the Microbial World Figure 1.1	1
Worldwide Mortality from Infectious Diseases Figure 1.3a	1
Common Measurements Encountered in Microbiology Figure 1.5	2
Inductive and Deductive Approaches to the Scientific Method Figure 1.8	3
Use of Controls in Experiments Figure 1.9	4
Levels in Classification Figure 1.12	5
<i>Paramecium caudatum</i> Traced through its Taxonomic Series Figure 1.13	5

Chapter 2

The pH Scale for Various Substances and Habitats Figure 2.12	6
Common Classes of Carbohydrates Figure 2.14	7
Polysaccharides Figure 2.16	8
Formula for Cholesterol Figure 2.19	9
Stages in the Formation of a Functioning Globular Protein Figure 2.22	10
Basic Structure of Nucleic Acids Figure 2.23	11
Replication of DNA Figure 2.26	12

Chapter 3

General Laboratory Techniques Figure 3.1	13
Methods for Isolating Bacteria Figure 3.4	14
Resolvable Cells Figure 3.19	15
Simple and Differential Stains Figure 3.27	15

Chapter 4

Structural Features of Typical Rod-Shaped Bacterium Figure 4.1a	16
Orientation of Axial Filaments on the Spirochete Cell Figure 4.7	16
Gram Stain Technique and Theory Microfile Box Figure 4.1	17
Comparison of Gram-Positive and Gram-Negative Envelopes Figure 4.15	17
Comparison of Gram-Positive and Gram-Negative Cell Walls Figure 4.16	18
Bacteria Arranged by Basic Shapes and Arrangements Figure 4.22	19
DNA Hybridization Using Probes Figure 4.28	20

The Life Cycle of Myxobacterium Figure 4.36	21
---	----

Chapter 5

Structure of Three Representative Eucaryotic Cells Figure 5.2	21
Eucaryotic Cells Microfile Box Figure 5.1	22
Changes in the Cell and Nucleus That Accompany Mitosis Figure 5.6a	23
Schematic of Haploid versus Diploid Life Cycles Figure 5.7	24
Rough Endoplasmic Reticulum Figure 5.8	25
The Origin and Action of Lysosomes in Phagocytosis Figure 5.11	26
Model of the Cytoskeleton Figure 5.14	27
Types of Asexual Mold Spores Figure 5.19	27
Formation of Zygosporangia in <i>Rhizopus stolonifer</i> Figure 5.20	28
Production of Ascospores in a Cup Fungus Figure 5.21	28
Cycle of Transmission in Chagas' Disease Figure 5.33	29
Stages in the Infection and Transmission of Amebic Dysentery Figure 5.34	30
Parasitic Flatworms Figure 5.35	30

Chapter 6

Generalized Structure of Viruses Figure 6.3	31
An Array of Virus Types Figure 6.9	31
Events in the Multiplication Cycle of T-Even Bacteriophages Figure 6.10	32
Features in the Multiplication Cycle of Animal Viruses Figure 6.15	33
Two Principle Means by Which Animal Viruses Penetrate Figure 6.17	34
Summary of Methods Used to Diagnose Virus Infections Figure 6.24	35

Chapter 7

Extracellular Digestion in a Saprobe with a Cell Wall Figure 7.3	36
Endocytosis Figure 7.9	37
Steps in Binary Fission Figure 7.15	37
The Growth Curve Figure 7.17	38

Chapter 8

Summary of Metabolic Functions

Figure 8.1

How the Active Site and Specificity of the Apoenzyme Arise Figure 8.4

Enzyme-Substrate Reactions: Fit, Proximity, and Orientation Figure 8.5

The Carrier Functions of Coenzymes Figure 8.6

Types of Enzymes Figure 8.7

Enzyme Control by Negative Feedback in System Figure 8.10

Feedback/Enzyme Repression Figure 8.11

A Simplified View of the Cell's Energy Machine Figure 8.12

Overview of Aerobic Respiration Figure 8.18

The Reactions of the Glycolysis System Figure 8.19

The Reactions of a Single Turn of the TCA Cycle Figure 8.21

Electron Transport Chain Figure 8.23

A Summary of Metabolic Interactions Figure 8.26

Reactions That Produce and Convert Amino Acids Figure 8.27

Chapter 9

Location and Forms of the Genome in Microbes Figure 9.2

Three Views of DNA Structure Figure 9.4

Simplified Steps in Semiconservative Replication of DNA Figure 9.6

The Bacterial Replication: a Model for DNA Synthesis Figure 9.7

Flow of Genetic Information in Cells Figure 9.10

Steps in Transcription Figure 9.13

Genetic Stages in the Multiplication of DNA Viruses Figure 9.19

Replication of Positive-Sense RNA Viruses Figure 9.20

The Lactose Operon in Bacteria Figure 9.21

Repressible Operon: Control of a Gene Through Excess Nutrient Figure 9.22

Conjugation: Genetic Transmission Through Direct Contact Figure 9.27

Griffith's Classic Experiment in Transformation Figure 9.28

Generalized Transduction: Genetic Transfer by Means of a Virus Carrier Figure 9.29

Transposons: Shifting Segments of the Genome Figure 9.30

38

39

40

41

42

42

43

43

44

45

46

47

48

49

49

50

51

52

53

54

54

55

56

57

58

59

60

61

62

61

62

62

Chapter 10

Main Categories of Genetic Engineering

Figure 10.1

Schematic of the Polymerase Chain

Reaction Figure 10.6

Strategy for the Applications of Gene Cloning in Genetic Engineering

Figure 10.7

The General Steps in Recombinant DNA, Gene Cloning, and Product Retrieval

Figure 10.9

Bioengineering of Plants Figure 10.12

Mechanisms of Antisense DNA and Triplex DNA Figure 10.17

Chapter 11

Modes of Action Affecting Protein Function Figure 11.4

Electromagnetic Radiation Used in Chemical Control Figure 11.7

Cellular Effects of Irradiation Figure 11.8

Formation of Pyrimidine Dimers by the Action of UV Radiation Figure 11.11

Chapter 12

The Course of Events in Chemotherapy Figure 12.1

Natural Selection and Drug Resistance Figure 12.11

The Role of Antimicrobics in Disrupting Flora and Causing Superinfections

Figure 12.20

Chapter 13

The Landscape of the Skin Figure 13.2a

Areas of the Alimentary Tract Figure 13.4

Colonized Regions of the Respiratory Tract Figure 13.6

Location of the Female and Male

Genitourinary Flora Figure 13.7

Transplacental Infection of the Fetus Figure 13.10

Mechanisms of Adhesion by Pathogens Figure 13.11

The Origins and Effects of Circulating Exotoxins and Endotoxins Figure 13.13

Types of Carriers Figure 13.18

Summary of How Communicable Infectious Diseases Are Acquired Figure 13.21

Koch's Postulates Figure 13.24

Chapter 14

The Levels of Host Defense Figure 14.1

The Primary Physical and Chemical Defense Barriers Figure 14.2

The Ciliary Defense of the Respiratory Tree Figure 14.3a

The Body Compartments Are Separate but Connected Figure 14.5

The Macroscopic Composition of Whole Blood Figure 14.7

63

64

65

66

67

68

69

69

70

71

72

73

73

74

74

75

75

76

76

77

78

79

79

80

81

82

83

84

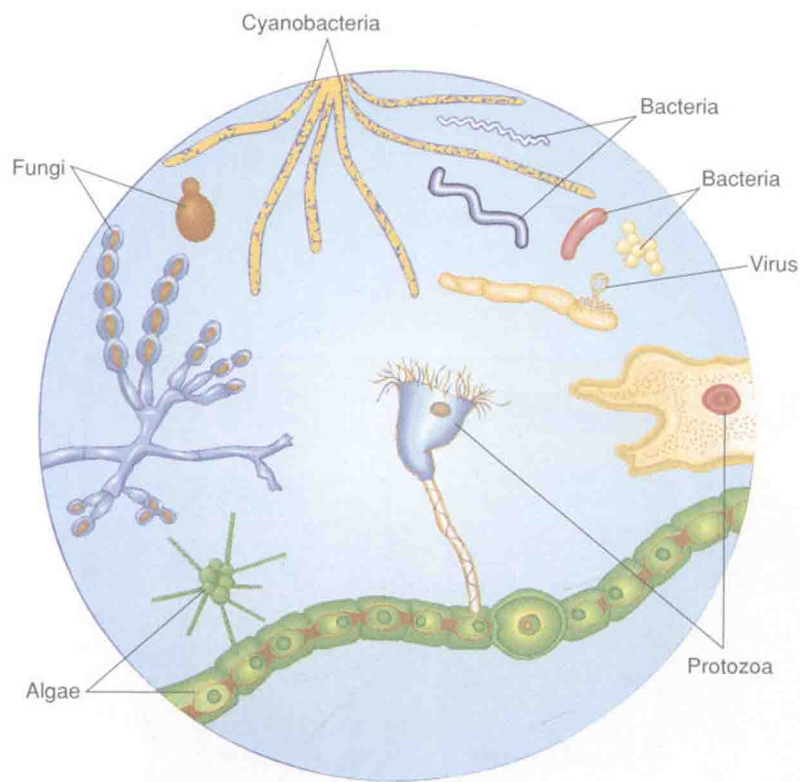
84

84

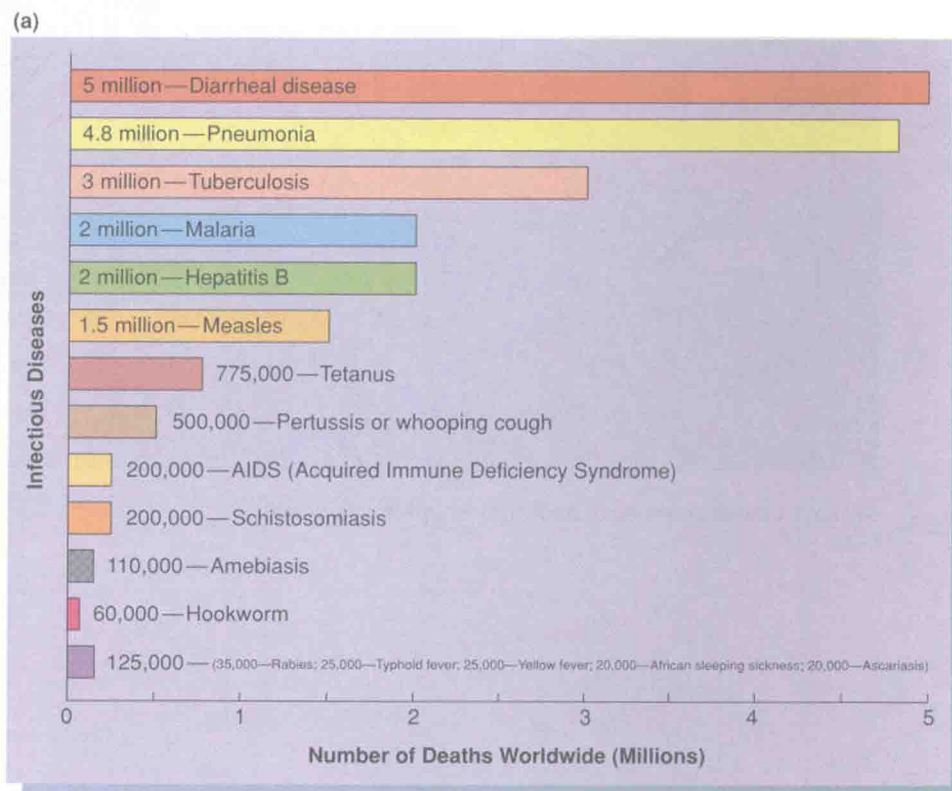
The Development of Blood Cells and Platelets	Figure 14.9	85
The Microanatomy and Circulating Cells of the Bloodstream	Figure 14.10	86
General Development and Functions of Lymphocytes	Figure 14.12	86
Diapedesis and Chemotaxis of Leukocytes	Figure 14.13	87
General Components of the Lymphatic System	Figure 14.14	87
The Circulatory Scheme of the Lymphatic Vessels	Figure 14.15	88
The Anatomy of the Spleen	Figure 14.16	89
The Thymus Gland	Figure 14.17	89
The Major Events in Inflammation	Figure 14.18	90
Chemical Mediators of the Inflammatory Response	Figure 14.19	91
Sites Containing Macrophages	Figure 14.21bc	92
The Phases in Phagocytosis	Figure 14.22	93
Enzyme Cascade	Figure 14.24	94
The Characteristics of Acquired Immunity	Figure 14.25	95
Chapter 15		
Overview of the Stages of Lymphocyte Development and Function	Figure 15.1	96
Receptor Formation in a Developing Cell	Figure 15.2	97
Glycoprotein Receptors of the Human Major Histocompatibility Gene Complex	Figure 15.3	97
Clonal Selection Theory	Figure 15.4	98
A Simplified Look at Immunoglobulin Genetics	Figure 15.6	99
Proposed Structure of the T-Cell Receptor for Antigen	Figure 15.7	99
Major Stages in the Development of B and T Cells	Figure 15.8	100
Characteristics of Antigens	Figure 15.9	101
The Hapten-Carrier Phenomenon	Figure 15.11	101
Cell Cooperation between a Macrophage and a T-Cell	Figure 15.12	102
Events in B-Cell Activation	Figure 15.13	103
Working Models of Antibody Structure	Figure 15.14	104
Summary of Antibody Functions	Figure 15.16	105
Pattern of Human Serum Following Electrophoresis	Figure 15.17	105
Primary and Secondary Responses to Antigens	Figure 15.18	106
Technique for Producing Monoclonal Antibodies	Figure 15.19	107
Scheme of T-Cell Activation	Figure 15.20	108
Stages of Cell-Mediated Cytotoxicity	Figure 15.21	109

Chapter 16	
Basic Principles of Testing Using Antibodies and Antigens	Figure 16.3
Theory and Interpretation of Viral Hemagglutination	Figure 16.6
Complement Fixation Test	Figure 16.10
Immunofluorescence Testing	Figure 16.11
Methods of ELISA Testing	Figure 16.12
Chapter 17	
The Immune System in Health and Disease	Figure 17.1
Schematic View of Cellular Reactions during the Allergic Response	Figure 17.3
The Spectrum of Reactions to Inflammatory Mediators	Figure 17.4
Strategies for Circumventing Allergic Attacks	Figure 17.7
Microscopic View of a Transfusion Reaction	Figure 17.10
The Development and Aftermath of Rh Sensitization	Figure 17.11
The Background of Immune Complex Disease	Figure 17.13
Potential Reactions in Transplantation	Figure 17.20
Common Pathway for Neoplasias	Figure 17.24
Chapter 18	
Staphylococcal Osteomyelitis in a Long Bone	Figure 18.4a
Cutaway View of Group A <i>Streptococcus</i>	Figure 18.10
The Course of Bacterial Pneumonia	Figure 18.18
Front View of the Male Reproductive Tract	Figure 18.23
Invasive Gonorrhea in Women	Figure 18.24
Chapter 19	
The Events in Tetanus	Figure 19.6
The Physiological Effects of Botulism Toxin (Botulin)	Figure 19.8
Testing for Tuberculosis	Figure 19.18
Chapter 20	
Procedures for Isolating and Identifying Selected Enteric Genera	Figure 20.8
The Phases of Typhoid Fever	Figure 20.16
The Infection Cycle of <i>Y. pestis</i> Simplified for Clarity	Figure 20.19
Chapter 21	
The Cycle of Lyme Disease	Figure 21.11
The Transmission Cycle in Rocky Mountain Spotted Fever	Figure 21.18
The Life Cycle of <i>Chlamydia</i>	Figure 21.22

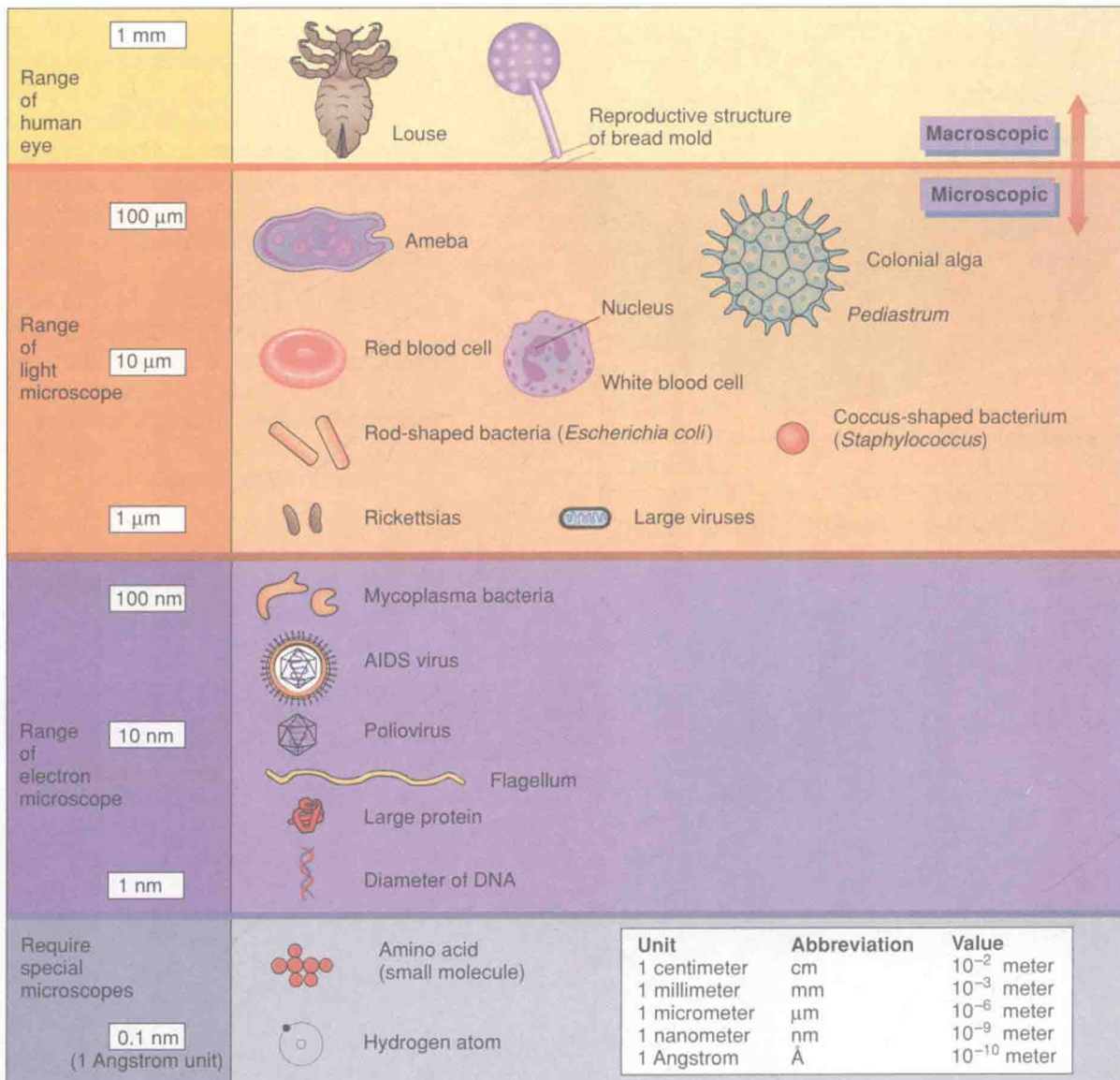
The Anatomy of a Tooth Figure 21.27	131	Chapter 25	
Stages in Plaque Development and Cariogenesis Figure 21.29	132	RNA Virus Families Table 25.1	143
Chapter 22		Stages in Cell Invasion and Disruption by the Influenza Virus Figure 25.1	144
The General Changes Associated with Thermal Dimorphism Figure 22.1	133	A Pathological Picture of Rabies Figure 25.7	144
Levels of Invasion by Fungal Pathogens Figure 22.5	133	A Cutaway Model of HIV Figure 25.12	145
Events in Histoplasmosis Figure 22.7	134	Stages of AIDS Figure 25.15	146
Events in Coccidioidomycosis Figure 22.8	135	The General Life Cycle of HIV Figure 25.16	147
Chapter 23		Stages of Infection and Pathogenesis of Poliomyelitis Figure 25.25	148
Cellular Forms of <i>Entamoeba histolytica</i> Figure 23.1	136	Surface of Rhinovirus Figure 25.28	148
<i>Entamoeba coli</i> Figure 23.3	136	Chapter 26	
The Trichomonads of Humans Figure 23.6	137	Levels of Organization in an Ecosystem Figure 26.1	149
Distribution and Generalized Cycle of Trypanosomiasis Figure 23.8	137	Comparison of a Food Chain and a Food Web in an Aquatic Ecosystem Figure 26.3	150
Life Cycle and Transmission of <i>Plasmodium</i> Figure 23.11	138	The Carbon Cycle Figure 26.6	151
Life Cycle and Morphologic Forms of <i>Toxoplasma gondii</i> Figure 23.13	139	The Calvin Cycle Figure 26.9	151
Five Basic Helminth Life and Transmission Cycles Figure 23.16(abc)	140	The Nitrogen Cycle Figure 26.10	152
Five Basic Helminth Life and Transmission Cycles Figure 23.16(de)	140	The Phosphorus Cycle Figure 26.13	153
The Life Cycle of <i>Taenia saginata</i> Figure 23.26c	141	Most Probable Number (MPN) Procedure for Coliform Testing Figure 26.22	154
Chapter 24		Food-Borne Illnesses of Microbial Origin Figure 26.27	155
Stages in Pock Development Figure 24.1	141	Primary Methods of Preventing Food Poisoning and Spoilage Figure 26.28	156
Comparative Incidence of Viral Hepatitis in the U.S., 1965–1995 Figure 24.16	142		
The Clinical Features of Hepatitis B Figure 24.18	142		



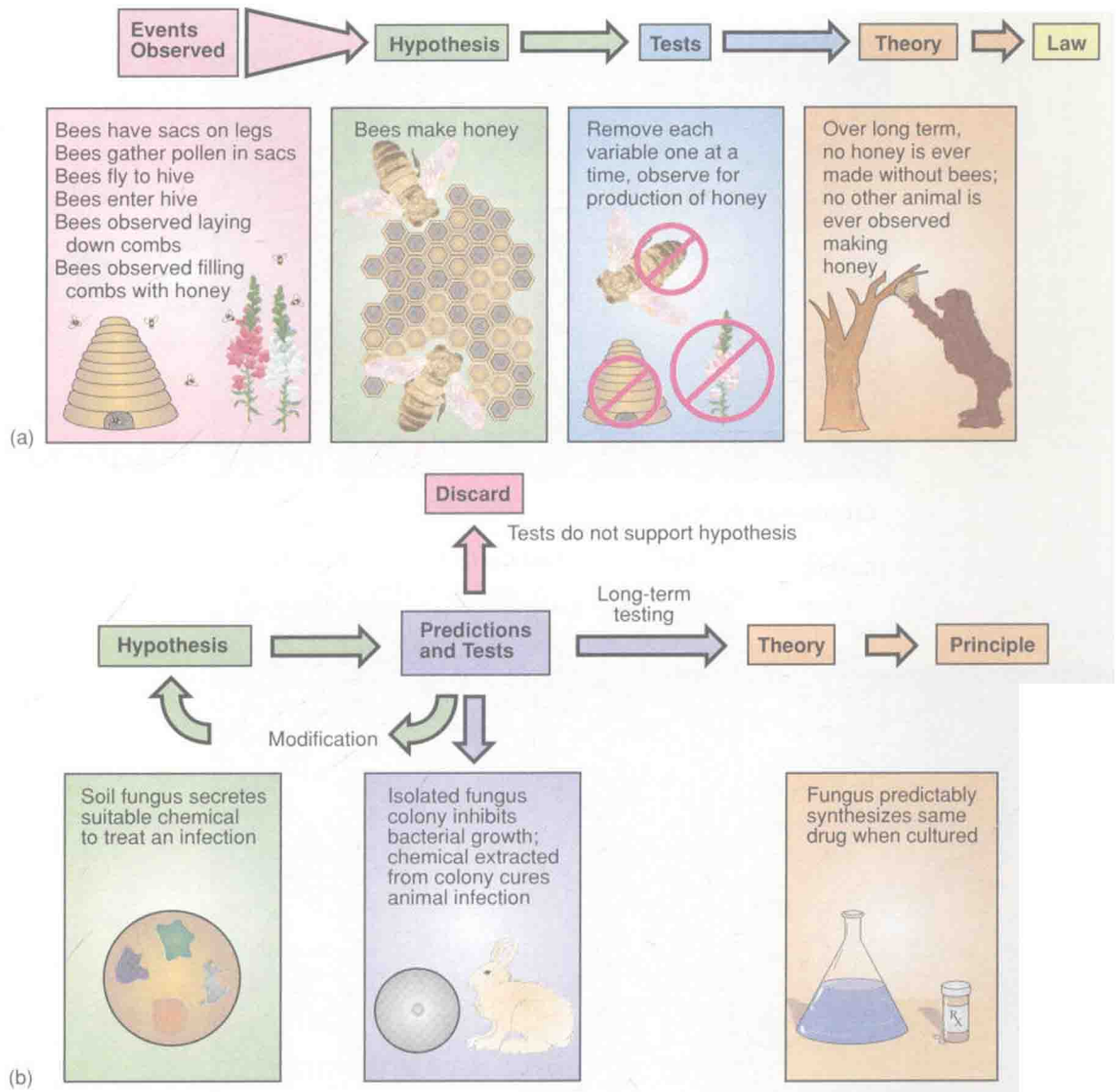
Diversity of the Microbial World
Figure 1.1



Worldwide Mortality from Infectious Diseases
Figure 1.3a



Common Measurements Encountered in Microbiology
Figure 1.5



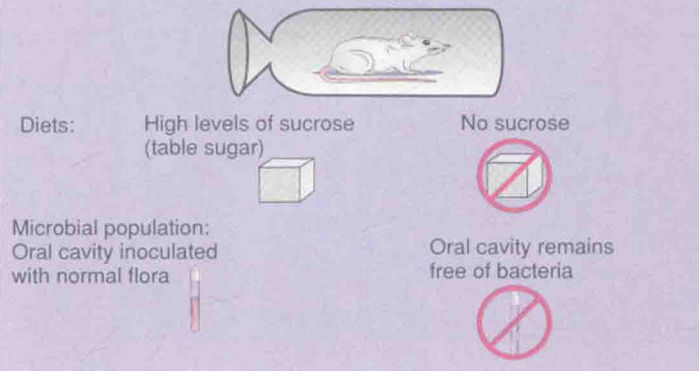
Inductive and Deductive Approaches to the Scientific Method
Figure 1.8

Subject: Testing the factors responsible for dental caries

Hypothesis: Dental caries (cavities) involve dietary sugar or microbial action or both.

Variables:

Test animal: Requires germ-free rats reared in total absence of microorganisms (in order to control this variable)

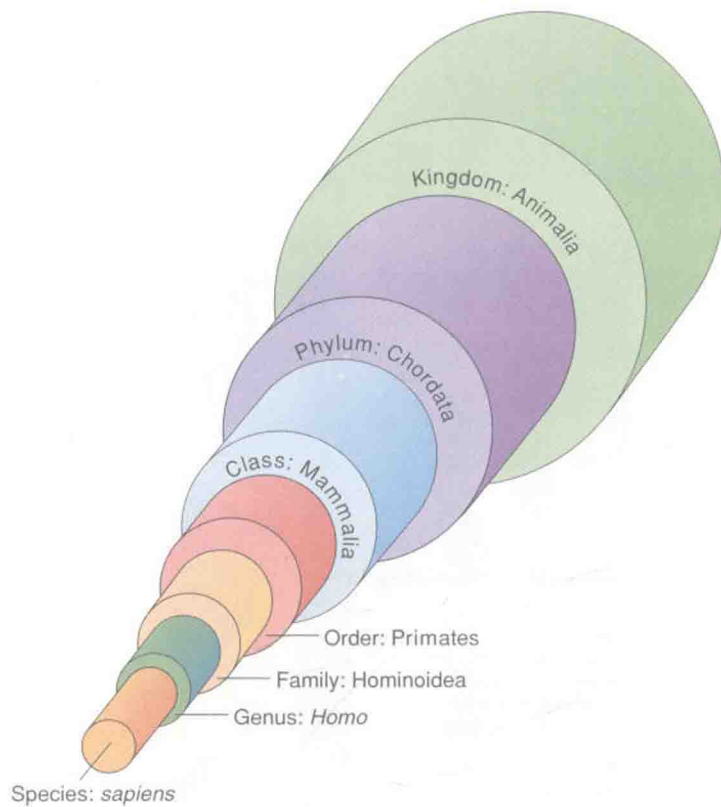


Experimental Protocol:

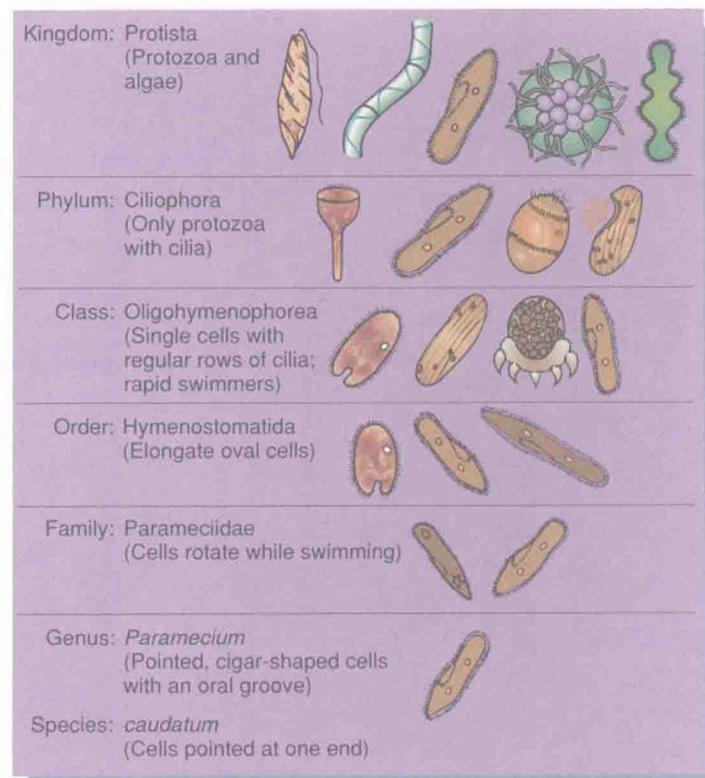
	Diet	Oral Cavity	Results
Control			
Rat #1	No sucrose 	No microbes 	No dental caries develop
Test 1			
Rat #2	Sucrose 	No microbes 	No dental caries develop
Test 2			
Rat #3	No sucrose 	Microbes 	No dental caries develop
Test 3			
Rat #4	Sucrose 	Microbes 	Dental caries develop

Conclusion: Dental caries will not develop unless both sucrose and microbial action are present. What other variables were not controlled?

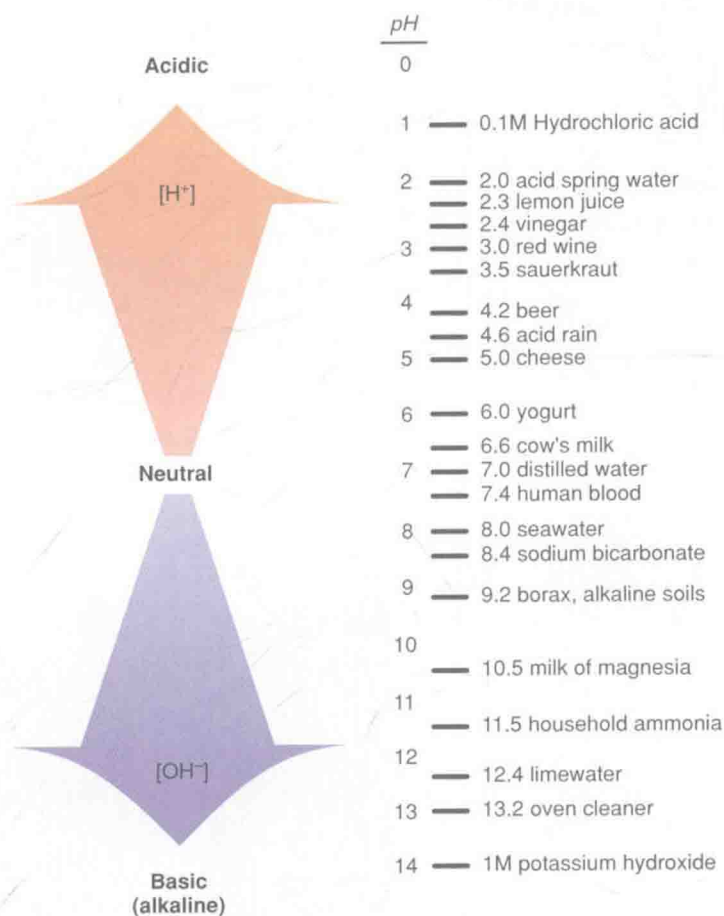
Use of Controls in Experiments
Figure 1.9



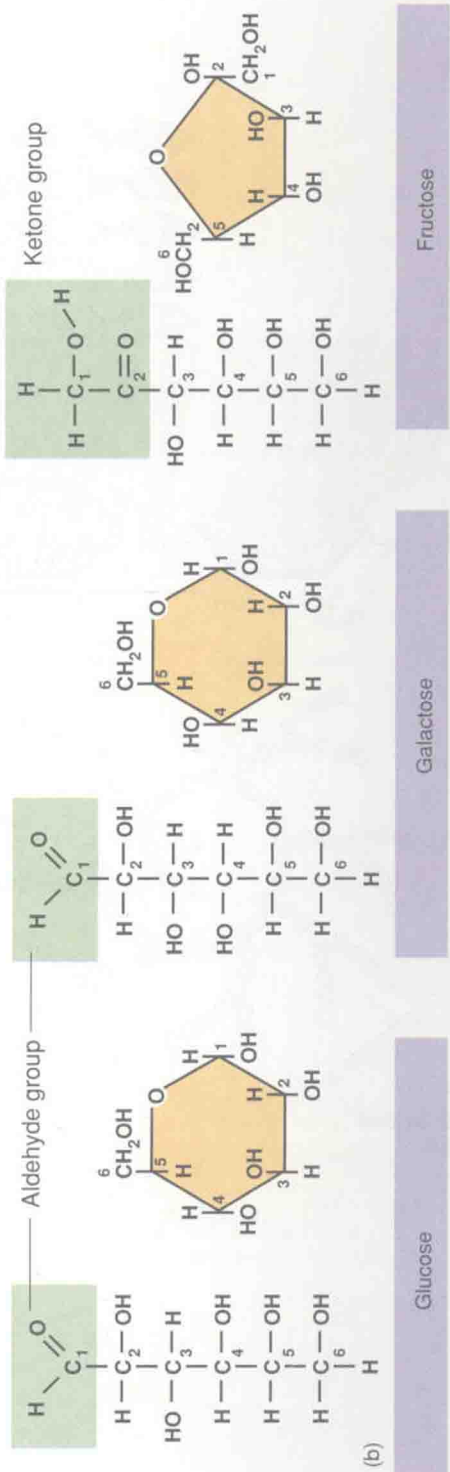
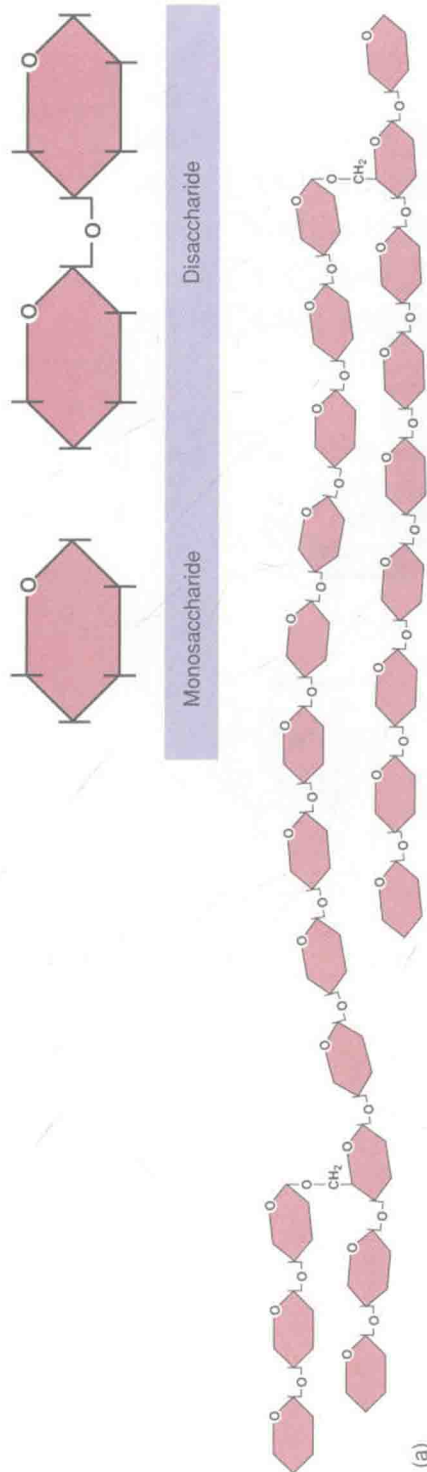
Levels in Classification
Figure 1.12



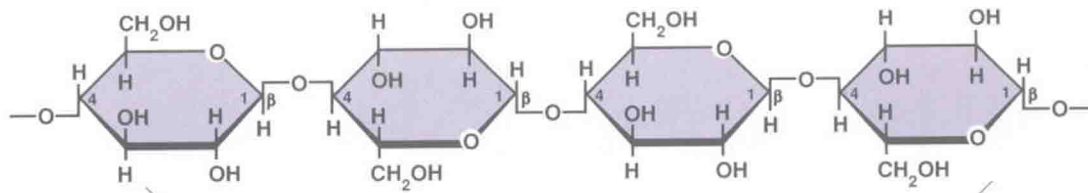
***Paramecium caudatum* Traced through its Taxonomic Series**
Figure 1.13



The pH Scale for Various Substances and Habitats
Figure 2.12

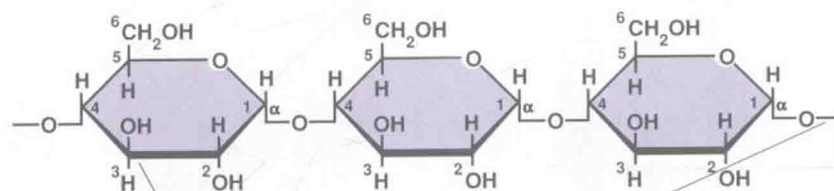
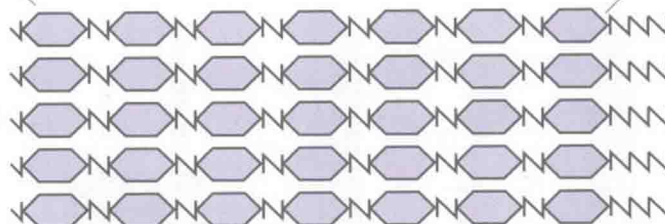


Common Classes of Carbohydrates
Figure 2.14



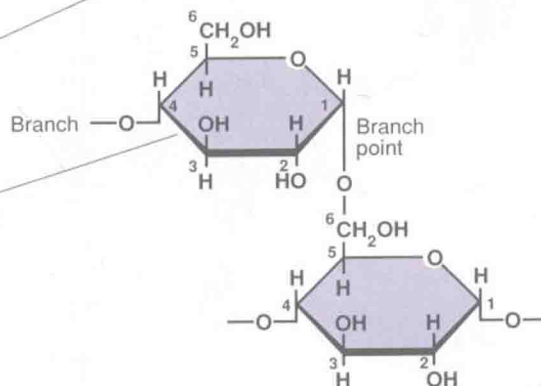
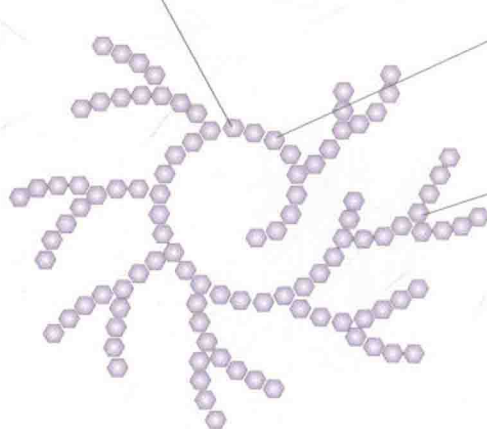
Cellulose

(a)

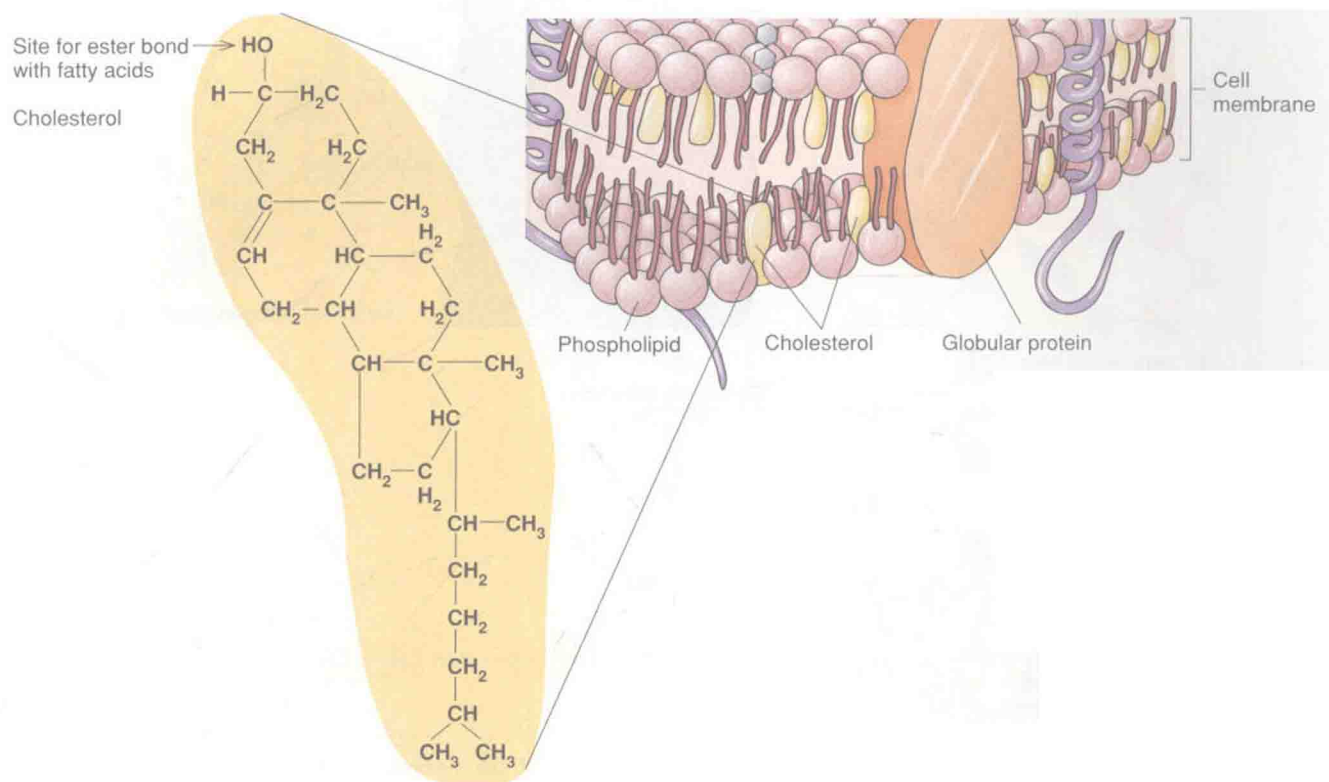


Starch

(b)



Polysaccharides
Figure 2.16



Formula for Cholesterol
Figure 2.19