

Part I
A Broad Perspective
of Biological Psychology

CHAPTER 1
A Cybernetic Model for Biological
Psychology 1

What Is Biological Psychology?	1
Comparative Psychology	2
The Nature of Systems	3
Principles of Cybernetics	5
Cybernetics—A Historical Perspective	14
Cybernetics of the Body	16
Cybernetics of the Mind	19
Emphasis on a Cybernetic Principle—Negative Feedback	20
Key Terms	21
Study Questions	22
Further Readings	22

CHAPTER 2
Origin and Development of Biological
Science 23

The Importance of Historical Perspective	23
Ancient History of Biology	24
Greek Conceptions of Soul–Mind	26
The Dark Ages and Loss of Knowledge	29
The Nature of “Truth” and the “Truth” of Nature	30
Empiricism and the Probabilistic Nature of Knowledge	33
Galilean Versus Aristotelian Science	34
Science and Technology	35
The Scientific Renaissance	36

Theories of Evolution	41
Two Evolutionary Crises	44
Scientific Controversies About Evolution Theories	51
Who Is Our Closest Relative?	53
Emphasis on a Major Cybernetic Principle— The Biological and Scientific Values of Feedback	54
Enrichment Material	54
Key Terms	55
Study Questions	57
Further Readings	57

CHAPTER 3

The Biology of Mental Processes 58

The Origin of the Concept of Mind	58
Proposed Solutions to the Mind–Body Problem	59
A Brief History of a Natural Science Approach to Mental Processes	62
Where in the Body Is the Mind?	69
Emphasis on a Cybernetic Principle— Organisms Function as Whole Integrated Units by Circuits Within the Brain and Throughout the Body	77
Key Terms	78
Study Questions	79
Further Readings	80

Part II

Systems of the Body and How They Are Studied

CHAPTER 4

An Overview of How the Body Functions 81

Determinants of Behavior Through Cybernetic Circuits	82
Stimulus Reception from the External Environment	83
Neural Transmission and Responding	83
The Internal Environment	85
Cells—The Building Blocks of the Body and Cybernetic Systems	86
Cells—Their Excitability in Transmitting and Processing Information	101

Some Topographical Terms for Orientation of the Body	110
Emphasis on a Cybernetic Principle—Systems of the Body and Their Interaction	111
Key Terms	114
Study Questions	116
Further Readings	116

CHAPTER 5

How We Gather and Interpret Information: The Receptor Systems, Our Sense Modalities, and Perceptual Processes 117

How Do We Perceive Our World?	117
Do Nerves Have Specific Unique Energies?	118
The Principle of Labeled Lines	119
The Receptor Systems	120
Some Unusual Sensory Systems	145
Emphasis on a Cybernetic Principle—Centrifugal Influences from the Brain During Sensory Transmission	149
Key Terms	149
Study Questions	152
Further Readings	152

CHAPTER 6

Integrating and Processing Information: Contributions of the Nervous Systems 153

Defining the Several Nervous Systems	153
The Central Nervous System (CNS)	154
The Peripheral Nervous Systems	172
Brain–Muscle Relations	179
Synapses, Neurons, and the Biochemistry of the Brain	182
Emphasis on a Cybernetic Principle—Neurotransmitters May Function in Positive Feedback Circuits	186
Key Terms	187
Study Questions	188
Further Readings	189

CHAPTER 7

Behaving in Our External and Internal Environments—The Effectors 190

Muscles—Mechanisms for Reacting	190
Glands and Hormones	212

Emphasis on a Cybernetic Principle—The Integrated Use of Feedback and Feedforward in the Control of Behavior	213
Enrichment Material	214
Key Terms	215
Study Questions	217
Further Readings	217

CHAPTER 8

Methods of Studying Systems of the Body and Brain 218

Overview of Biobehavioral Phenomena and Research Techniques	218
Overt and Covert Behavior Contrasted	219
Covert Response Measures	221
Covert Processes	222
Laboratory Techniques for Measuring Covert Processes	223
Electropsychology—Psychophysiological Measures of Covert (and Overt) Processes	228
Methods of Studying the Brain	236
Emphasis on a Cybernetic Principle—Strategy for Measuring Receptor–Neural–Muscular Circuits	249
Enrichment Material	250
Key Terms	251
Study Questions	253
Further Readings	253

Part III

Normal Biopsychological Functions

CHAPTER 9

Motivated and Emotional Behaviors 255

Biologically Motivated Behavior	255
Emotional Behavior	282
Behavior Genetics	288
Species-Specific Behaviors	291
A Summary of Some Important Advances in the Study of Motivated Behavior	291
Emphasis on a Cybernetic Principle—Evolution of a Central-Peripheral Model of Motivated Behavior	292
Enrichment Material	292
Key Terms	293
Study Questions	295
Further Readings	295

CHAPTER 10

Learning and Memory 296

- Principles of Learning and Memory Form the Basis for Scientific and Applied Psychology 297
- The Nature of Learning 297
- Measures of Learning 299
- The Acquisitions of Conditional Responses—Two Procedures 299
- Some Additional Conditioning Phenomena 309
- How Many Kinds of Learning Are There? 313
- Cybernetic Circuits and the Biological Value of Conditioning 314
- Ethological Learning and Species-Specific Constraints 316
- Some Learning Questions with Social Significance 323
- Memory 325
- The Physiological Psychology of Learning and Memory 327
- Emphasis on a Cybernetic Principle—Response Retrieval of an Engram 346
- Key Terms 348
- Study Questions 350
- Further Readings 351

CHAPTER 11

The Biology of Language and Lateral Systems 352

- What Is Language? 352
- Can Other Species Be Taught Human Language? 354
- Evolution of the Speech Systems 358
- Side Preferences of the Head and Body 360
- Emphasis on a Cybernetic Principle—A Review of Interactions of Brain Laterality with Other Head and Body Systems 377
- Key Terms 379
- Study Questions 380
- Further Readings 380

CHAPTER 12

The Psychophysiology of Aging 381

- The Importance of Studying the Aging Process 381
- Life Span Development 382

Normal Aging Changes—Why Do We Grow Old?	383
Quantifying the Aging Process	391
What Keeps Us Young?	393
Treatment of the Enfeebled Elderly	398
Alzheimer's Disease	398
Falls	400
Theories of Aging	400
Emphasis on a Cybernetic Principle— A Beneficial Negative Feedback System in Aging	401
Key Terms	402
Study Questions	402
Further Readings	403

CHAPTER 13

Cognitive Psychophysiology: The Biology of Higher Mental Processes 404

Mind and Cognition	404
Illustrative Psychophysiological Events During Some Cognitive Activities	410
Capability of Speech Muscles for Refined Differential Activity	428
An Illustration of Self-Control with a Cybernetic Model—Relaxation and Mental Practice in Sports Psychology	430
Do Animals Think?—Evolution of Cognition and Intelligence	431
Psychochronology	432
Emphasis on a Cybernetic Principle— Conclusions About the Nature of Mental Processes	433
Key Terms	435
Study Questions	436
Further Readings	437

Part IV

Pathological Conditions and Clinical Applications

CHAPTER 14

Biology of Pathological Behavior and Disease 439

Engineering Behavior for a Better Life	440
Nature and Extent of Our Problems	440

The Importance of Biobehavioral Control	441
Kinds of Disorders	441
Some Special Problems of Youth	491
Disorders of Initiating and Maintaining Sleep	493
Dyslexia and Learning Disorders	494
Emphasis on a Cybernetic Principles— Addictive Behaviors Have Some Characteristics of a Positive Feedback Model	495
Key Terms	496
Study Questions	498
Further Readings	498

CHAPTER 15

Therapy and Control of Pathological and Normal Behavior 499

Our Search for Happiness	499
Quackery	501
The Costs of Detrimental Behavior	501
How to Achieve What We Want—Self-Control and the Development of Will Power	502
A Word About Strategies and Models for Research	546
Emphasis on a Cybernetic Principle— Multicausal and Multieffect Models Must Replace Single Cause-Effect Models of Behavior	546
Key Terms	547
Study Questions	548
Further Readings	548

Part V

Confronting Society's Problems Through Science and Technology

CHAPTER 16

The Future of Humanity as It Relates to Biological Science 551

Anticipating and Controlling the Future	552
A Pessimistic Future	552
An Optimistic Future	561
Warfare—An Optimistic Future	571
Bioethics	572
Conclusion	573

Emphasis on a Cybernetic Principle— Intervening into Positive Feedback Systems to Achieve Stable Negative Feedback Systems	573
Key Terms	576
Study Questions	576
Further Readings	577

References 578

Name Index 587

Subject Index 591