JOHN P. J. PINEL

BIOPSYCHOLOGY

4TH EDITION

Biopsychology

Fourth Edition

John P. J. Pinel

UNIVERSITY OF BRITISH COLUMBIA

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Preface

The fourth edition of *Biopsychology* is a clear, engaging introduction to current biopsychological theory and research. It is intended for use as a primary text in one- or two-semester courses in biopsychology—variously entitled Biopsychology, Physiological Psychology, Brain and Behavior, Psychobiology, Behavioral Neuroscience, or Behavioral Neurobiology.

The defining feature of *Biopsychology* is its unique combination of biopsychological science and personal, reader-oriented discourse. It is a textbook that is "untextbooklike." Rather than introducing biopsychology in the usual textbook fashion, it weaves the fundamentals of biopsychology together with clinical case studies, social issues, personal implications, and humorous anecdotes. It tries to be a friendly mentor who speaks directly to the reader and enthusiastically relates recent advances in biopsychological science.

My intention was that the personality of *Biopsychology* would be more than mere window dressing. I hope that *Biopsychology's* engaging pedagogical approach facilitates the acquisition and retention of information, so that it delivers more biopsychology and more enjoyment for less effort.

Writing this preface is the final step in my preparation of this edition. It marks the end of a year in which I have dedicated myself to further strengthening *Biopsychology's* strong points, dealing with areas needing improvement, and keeping it abreast of important advances in the field. The following sections of this preface describe the major features of this edition.

Features That Have Carried Over from Previous Editions

The following are features of the first three editions of *Biopsychology* that have been maintained and strengthened in this edition.

- **AN EMPHASIS ON BEHAVIOR** In some biopsychological textbooks, the coverage of neurophysiology, neurochemistry, and neuroanatomy subverts the coverage of behavioral research. *Biopsychology* gives top billing to behavior: It stresses that neuroscience is a team effort and that the unique contribution made by biopsychologists to this team effort is their behavioral expertise.

- **A BROAD DEFINITION OF BIOPSYCHOLOGY** Biopsychology is the study of the biology of behavior. *Biopsychology* focuses on the neural mechanisms of behavior, but also emphasizes the evolution, genetics, and adaptiveness of behavioral processes.

- **EXTENSIVE COVERAGE OF CLINICAL AND HUMAN RESEARCH** *Biopsychology* provides more than the customary coverage of clinical case studies and research on human subjects. One of *Biopsychology's* dominant themes is that diversity is an important feature of biopsychological research: that major advances in biopsychological science often result from the convergence of pure and applied research and from the convergence of research involving human and nonhuman subjects.

- **A FOCUS ON THE SCIENTIFIC METHOD** *Biopsychology* emphasizes important, but frequently misunderstood, points about the scientific method. The following are three of them: (1) The scientific method is a means of answering questions that is as applicable to daily life as it is to the laboratory. (2) The scientific method is fun—it is basically the same method that is used by detectives to solve crimes. (3) Widely accepted scientific theories are current best estimates, not statements of absolute fact.

- **AN INTEGRATIVE APPROACH** *Biopsychology* has not taken the modular approach, dispensing biopsychology as a series of brief independent subject modules. *Biopsychology's* approach is integrative. It creates a strong fabric of research findings and ideas by weaving together related subject areas and research findings into chapters of intermediate length.

- **AN EMPHASIS ON PERSONAL AND SOCIAL RELEVANCE** Several chapters of *Biopsychology*—particularly those on eating, sleeping, sex, and drug addiction—carry strong personal and social messages. In these chapters, students are encouraged to consider the relevance of biopsychological research to their lives outside the classroom.

- **WIT AND ENTHUSIASM** In my experience, biopsychology laboratories are places of enthusiasm, dedication, and good humor. *Biopsychology* communicates these important aspects of "biopsychological life."

■ **ILLUSTRATIONS** The illustrations in *Biopsychology* are special. This is because each illustration was conceptualized and designed by a scientist–artist team who were uniquely qualified to create illustrations to clarify and reinforce the text. This uniquely qualified team was my wife, Maggie, with occasional suggestions from me.

Changes to This Edition

Biopsychology is one of the most rapidly progressing fields of science. This edition of *Biopsychology* has kept abreast of recent developments; it contains approximately 430 references to articles that have been published since the last edition. Indeed, these additions have dictated changes to many parts of this text. The following is a list of some of the topics that receive more or better coverage in this edition than in the last:

- cognitive neuroscience
- thinking about evolution
- mitochondrial DNA
- the human genome project
- functions of the autonomic nervous system
- metabotropic and ionotropic receptors
- ligands and ligand-gated channels
- human brain scanning
- approaches to neuropsychological testing
- genetic engineering
- transgenetic animal models
- necrosis and apoptosis
- ischemic brain damage
- search for a Parkinson's gene
- two streams of visual cortical analysis
- secondary auditory cortex
- anterior cingulate cortex and pain
- conscious awareness
- selective attention
- change blindness
- secondary motor cortex
- somatotopic organization of the motor cortex
- cerebellum and learning
- ob/ob mice
- leptin
- calorie restriction and health
- neuroanatomy of osmoreceptors
- update on the notorious case of ablatio penis
- sexual attraction
- genetics of circadian rhythms
- polyphasic sleep and sleep reduction
- melatonin and sleep
- theories of hippocampal function
- functional brain imaging and memory
- memory and the striatum
- theories of drug conditioning
- methamphetamine and ecstasy
- stem cells
- human studies of neuroplasticity
- genetic treatments of brain disorders
- dyslexia
- functional brain imaging and language
- lateralization of memory
- diathesis-stress model
- ulcers, infection, and stress
- culture and depression
- beneficial effects of sleep deprivation on depression

Learning Aids

Biopsychology has four features that are expressly designed to help students learn and remember the material:

- boldfaced **key terms** and their **marginal definitions**—additional key terms of less importance appear in italics;
- **study exercises** that occur in the chapters at key transition points, where students can benefit most from pausing to consolidate preceding material before continuing;
- **food-for-thought discussion questions** at the end of each chapter;
- **appendices,** which serve as convenient sources of important information that is too detailed for some students of biopsychology.

Ancillary Materials Available with Biopsychology

■ **TEST BANK** The test bank for this edition of *Biopsychology* comprises more than 2000 multiple-choice questions. The difficulty of each item is rated—easy, moderate, or difficult—to assist instructors with their test construction. The test bank is prepared by John Pinel.

■ **INSTRUCTOR'S MANUAL** The instructor's manual, skillfully prepared by Mike Mana for *Biopsychology,* includes a set of lecture notes. The instructor's manual is available on disk.

■ **STUDY GUIDE** Each chapter of the study guide prepared by Michael Mana of Western Washington University includes three sections. Section I is composed of "jeopardy" study items—named after the popular television quiz show. The jeopardy study items are arranged in two columns: questions on the left and answers on the right. Sometimes there is nothing in the space to the right of a question, and the student's task is to write the correct answer. Sometimes there is nothing in the space to the left of an answer, and the student's task is to write in the correct question. Once the jeopardy study items are completed, the student has a list of questions and answers that summarize the main points of the chapter, conveniently arranged for bidirectional studying.

Section II of each chapter is composed of essay study questions. Spaces are provided for the student to write outlines of the correct answers to each question. The essay study questions encourage students to consider general issues.

Section III of each chapter is a practice examination. Students are advised to use their results on the practice examination to guide the final stages of their preparation for in-class examinations.

In addition, Allyn and Bacon's Digital Image Archive for Physiological Psychology is available to adopters of the book. This Instructor's Resource, available on CD-ROM from your local A&B sales representative, provides over 250 full color images from the text and from other sources. Finally, we are happy to provide a new resource for both students and instructors at http://www.abacon.com/pinel. Students will find multiple-choice questions that will allow them to "practice" taking exams on line, as well as web links and activities. Instructors will find helpful information about integrating technology in the classroom as well as up-to-date web links and updates about the newest research in biopsychology and the other neurosciences.

■ **BIOPSYCHOLOGY VIDEO** Instructors who adopt *Biopsychology* can obtain a new 60-minute biopsychology videotape. Based on the *Films for the Humanities* series, this video provides students with glimpses of important biopsychological phenomena such as sleep recording, growing axons, memory testing in monkeys, the formation of synapses, gender differences in brain structure, human amnesic patients, rewarding brain stimulation, and brain scans.

Additional ancillary materials are also available to instructors. Please consult your local Allyn and Bacon representative for details.

Acknowledgments

I wrote *Biopsychology,* but Maggie Edwards made important contributions to all other aspects of the manuscript preparation. Her role in the preparation of the art warrants special acknowledgment. Users of this book will come to recognize that its illustrations are special: The illustrations are so finely attuned to the writing that it appears as if the author must be a talented designer who designed them himself—but I'm not, and I didn't. The illustrations were all designed by Maggie after discussion, debate, and, in some cases, argument with me. You see, Maggie is a professional artist with an extensive background in psychology who also happens to be my partner in life. Maggie took a year from her own successful career to help me achieve a level of illustration that is normally out of reach of writers who are not lucky enough to share their lives with such a talented and dedicated person. I thank her on behalf of the many students who will benefit from her contribution.

Allyn and Bacon did a remarkable job of producing this book. They shared my dream of a textbook that meets the highest standards of pedagogy but is still personal, attractive, and enjoyable. Thank you to Bill Barke, Carolyn Merrill, and the other executives at Allyn and Bacon for having faith in *Biopsychology* and providing the financial and personal support necessary for it to stay at the forefront of its field. A special thank you goes to Elaine Ober and Margaret Pinette for coordinating the entire production effort—an excruciatingly difficult and often thankless job.

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To the Student

In the 1960s, I was, in the parlance of the times, "turned on" by an undergraduate course in biopsychology. I could not imagine anything more interesting than a field of science dedicated to studying the relation between psychological processes and the brain. My initial fascination led to a long career as a student, researcher, and teacher of biopsychological science. *Biopsychology* is my attempt to share this fascination with you.

I have tried to make *Biopsychology* a different kind of textbook, a textbook that includes clear, concise, and well-organized explanations of the key points but is still interesting to read—a book from which you might suggest a suitable chapter to an interested friend or relative. To accomplish this goal, I thought about what kind of textbook I would have liked when I was a student, and I decided immediately to avoid the stern formality and ponderous style of conventional textbook writing.

I wanted *Biopsychology* to have a relaxed and personal style. In order to accomplish this, I imagined that you and I were chatting as I wrote, and that I was telling you—usually over a glass of something—about the interesting things that go on in the field of biopsychology. Imagining these chats kept my writing from drifting back into conventional "textbookese," and it never let me forget that I was writing this book for you, the student.

I hope that *Biopsychology* teaches you much, and that reading it generates in you the same personal feeling that writing it did in me. If you are so inclined, I welcome your comments and suggestions. You can contact me at the Department of Psychology, University of British Columbia, Vancouver, B.C., Canada, V6T 1Z4 or at the following e-mail address:

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