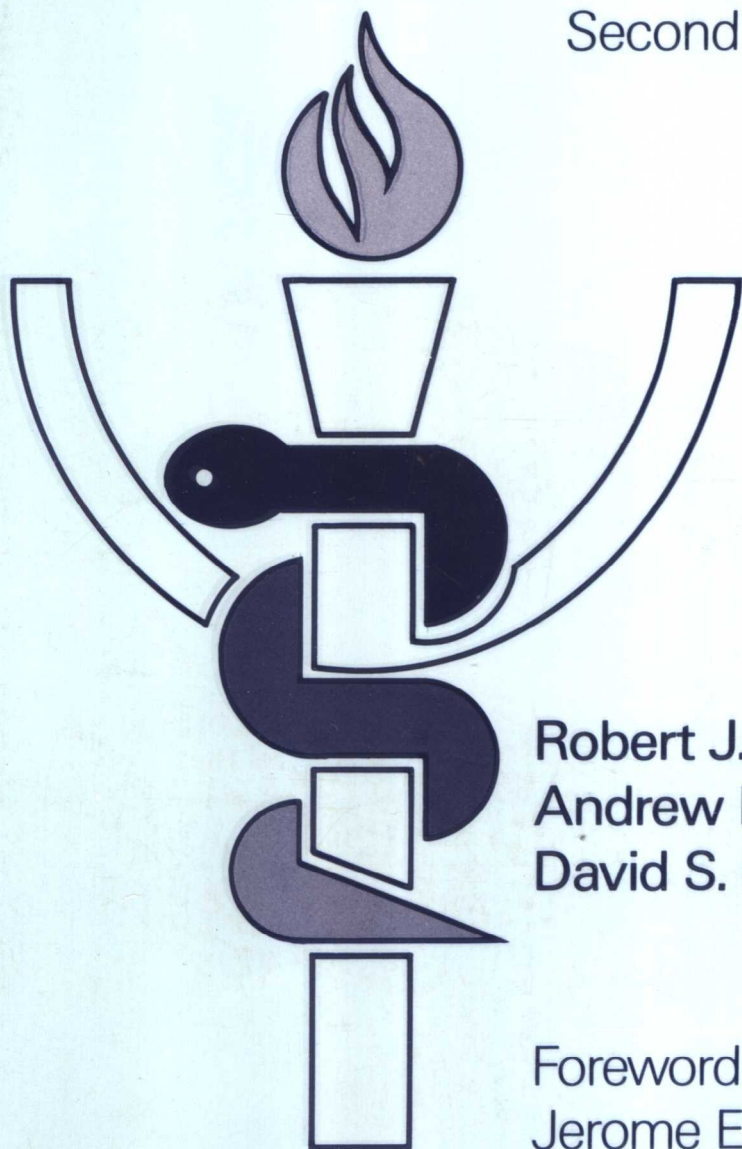


AN INTRODUCTION TO **HEALTH PSYCHOLOGY**

Second Edition



Robert J. Gatchel
Andrew Baum
David S. Krantz

Foreword by
Jerome E. Singer

AN INTRODUCTION TO HEALTH PSYCHOLOGY

SECOND EDITION

|||||

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This book is dedicated to Robert Garrett Gatchel, Jessie Slater Sachs, Michael K. Douma, and Della E. Krantz.

This book is printed on acid-free paper.

Second Edition

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AN INTRODUCTION TO HEALTH PSYCHOLOGY

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FOREWORD

There was a time when textbooks were considered original scholarly works. Their mission, then as now, was to present a field in an orderly fashion to the student. Their stock in trade was organization and the systematic arrangement of theories, research results, and intelligent discussion. Textbooks still do this and they are undoubtedly better at many aspects of presentation than they were in the past. Graphics, photographs, diagrams, even sidebars and boxes to make footnotes exciting, are all now highly developed forms of exposition.

In other ways that have evolved, it is more debatable whether there have been improvements. No textbook can be truly comprehensive and still be portable, so inevitably the authors must be selective in what they include. This selectivity extends to every aspect of the text: what topics to cover, what studies to use as examples, what theories to discuss, what emphasis to give to each selection, what level of readership to write for, are just a few of the many choices that must be made.

In the good old once upon a time, authors used these choices to shape textbooks to their own points of view. The selection and arrangement of materials was made with an eye toward advancing the field, and not just educating the student. Thirty years ago, major texts in almost every area of psychology were well known scholarly achievements. They were acknowledged for their points of view, were advocates for various theoretical positions, and were recognized as benchmarks in reviewing fields of research. Many had chapters that reviewed topics in ways that today would appear in a *Psychological Bulletin* article. In general, such texts were idiosyncratic, pleasing like minded readers, and often alienating those readers who disagreed with their basic premises and orientation.

For better or worse, texts are now different. Their intended audience is more clearly the student and less the instructor. Their selection of materials is now guided not by the authors' perspective, but rather by the publishers' market research as to what coverage is desired by a broad spectrum of adopting instructors. If one successful text has a section on a particular topic, soon all texts in the field report on that topic, lest they be at a competitive disadvantage in the marketplace. Similar market forces have made texts less critical. They are more apt just to report research as a series of studies rather than to discuss strengths and weaknesses of individual studies as a prelude to synthesizing them into a coherent conclusion.

This evolving set of changes in textbooks has both advantages and disadvantages. No one can fault student-oriented texts. After all, it is the students, not the instructors, who must learn from the books, and special viewpoints often are lost on those students who are getting their initial exposure to a particular area.

Less than a decade ago, the field of health psychology provided an opportunity

for textbook authors to combine the best of the old and the new. At that time health psychology was just beginning to emerge as a separate subdiscipline in psychology. To be sure, there have long been psychologists who were interested in health and medical issues related to psychology and who did research and published on these topics, but they were not regarded as engaged in a particular specialty, such as clinical psychology, social psychology, or physiological psychology. In the late 1970s this began to change and a distinctive health psychology began to develop. It went under a variety of names, such as medical psychology or behavioral medicine. Signs of its independent growth began to appear. Specialized journals, focused professional societies, and a health psychology division of the American Psychological Association all date from this time as markers of the inception of the field.

The same *zeitgeist* that produced an independent health psychology also produced a number of new courses, both graduate and undergraduate, in this field. As is often the case as a new area becomes popular, many of the teachers of the first courses are at somewhat of a loss as to how to organize the course and how to select and present the materials. Instructors find that textbooks are extremely useful at this juncture in providing the framework for a new instructional venture in an incipient field. The first version of this text, *An Introduction to Health Psychology*, by Robert Gatchel and Andrew Baum, was the initial major textbook in health psychology.

In writing that initial text, Gatchel and Baum had a prodigious challenge and a marvelous opportunity. On the one hand they were challenged by the mass of material on factors relating health and medical issues to psychological processes. It had to be sorted, arranged, codified, and put into didactic form. On the other hand, they had the opportunity to help structure a new field. To the extent that textbooks now copy the format of previous successful books, texts that follow theirs would adopt their organization, and, in pragmatic fashion, the field would be defined by what was in the textbook.

The Gatchel and Baum text made the most of its opportunity and met its challenge. The book has made a significant contribution by the way it has defined topics and by the inclusion of various perspectives in its discussions of areas of health psychology. The second edition, in which David Krantz joins the author team, continues to take advantage of these opportunities and builds on the record of accomplishment initially laid down.

For example, American psychology is in a period where the relationship of basic research to practice and application are strained, to say the least. The emergence of insurance companies and other third party payers has changed the face of clinical psychology. Without altering the nature of the services that they provide, many clinical psychologists now define themselves as health psychologists. This redefinition is made necessary by insurance plans that will reimburse clients for "medical services" but not for "mental health services." The redefinition of health psychology to embrace standard clinical psychological practice is understandable, but creates considerable terminological confusion in the field. One could imagine a text with the title *Health Psychology* that is entirely clinical in content; alternatively, one could imagine a parallel text, with the same title, that deals only in basic mechanisms and research. This text has integrated the appropriate aspects of each phase of the psychological spectrum as required by the problem being addressed. As a result

chapters such as Chapter 3, dealing with stress, present the basic concepts and theories of stress, review the research literature critically, but also include ways of coping with and managing stress. In cold print this seems simple enough; a quick scan of the volumes of published stress material also shows how rare is such a balanced comprehensive review.

Perhaps the most important contribution of this text is the way in which it presents both the biomedical and the psychosocial components of the problems presented. Too often these differing approaches are pictured as opposing, mutually exclusive, ways of viewing a phenomenon. Thus, biofeedback is presented as an alternative to other more invasive treatments, such as pharmacotherapy. In reality, of course, the use of biofeedback is equally effective as a complement to other treatments, effective not because it eliminates other therapies but because it serves as an adjunct to them, such as lowering the dosage level of a drug and minimizing side effects.

By conceptualizing health psychology as part of a larger biosocial fabric, Gatchel, Baum, and Krantz have highlighted the concept that psychological mechanisms are not an alternative to medical ones. It is true that some psychosocial factors can be described in purely behavioral fashion—such as a personality based lifestyle that is a risk factor for one or another disease—but ultimately the behavioral factor must work through the same biological mechanisms as a purely biomedical factor. For example, if people must cope with the death of a spouse while not having a good social support network, they may be at risk of illness or death. The ways in which these risks are expressed are most likely through a compromised or suppressed immune function. The path from the critical event, the spouse's death, to illness involves both social and biological steps. A full picture of what is happening needs both biological and psychosocial explanations. No really meaningful understanding of the process can be gained by casting it one or the other explanation on a mutually exclusive basis.

For the purposes of a health psychology textbook the implications of this perspective are that health psychology must include as part of its discussions of psychosocial factors in health and disease background materials on endocrinology, immunology, and pharmacology, to name just a few of the requisite biomedical materials. The first edition of this text set the standard for a comprehensive treatment of topics by including this material. This edition continues to give an integrated view of the role of psychological factors in health.

Anyone who has written a review article, whether for a professional journal or for a term paper, comes to realize that the mastery of the materials is the easy part: organizing the material for a lucid, coherent, and sensible presentation is the difficult part. This is where *An Introduction to Health Psychology* is brilliant. The first edition was the pacesetter in its field. This edition once again defines health psychology in terms of the topics to be covered, the mixture of basic and applied materials to be incorporated, and the perspective that social and biological views of a phenomenon are but differing aspects of one thing and are to be unified in the presentation. Starting with an overview of mind and body, continuing through behavioral factors in cardiovascular diseases, stress, smoking, eating, and a variety of other illness-specific topics, the text also discusses behavioral mechanisms and factors, such as

control and learned helplessness. Applied topics, prevention, assessment, and biofeedback, for example, are presented in turn.

All in all, this text sets the standard for the field; it is exemplary in coverage, organization, and perspective. It is a wonderful throwback to the vanished texts of yesteryear in making a scholarly contribution as well as educating its readers.

Jerome E. Singer

PREFACE

Behavioral medicine is the broad interdisciplinary field of scientific investigation, education, and practice that concerns itself with health, illness, and related physiological dysfunctions. Health psychology, on the other hand, is a more discipline-specific term used to refer to psychology's primary role as a science and profession in the rapidly developing field of behavioral medicine. Psychologists have always been concerned with issues of illness and health. However, until recently they generally limited themselves to mental health settings and issues such as psychotherapy, mental retardation, and schizophrenia. This focus has changed rapidly during the past fifteen years, with an increased involvement in all areas of health and illness, not just mental health. This text provides a comprehensive review of the many medically related topics and areas that are being dramatically influenced by the new health psychology specialty.

We have taught courses in behavioral medicine and health psychology over a period of years to a varied audience—psychology students, medical and dental students, nurses, and other health care providers and trainees. Our experience has provided us with the opportunity to explore the best method for presenting the field as a meaningful whole to a diversified audience. We have attempted to provide a balanced mixture of material on basic theory, assessment, treatment, and specific practical, applied issues. The reader will be exposed to important psychological theories, concepts, and assessment/treatment methods of psychology as they apply to the area of health and illness. In presenting this material, we were cognizant of the fact that we would be addressing readers who differ in terms of backgrounds and expertise in psychology as well as in terms of basic psychobiological principles and service delivery experience. As a consequence, we have been careful to clearly express important concepts and terms in a manner that does not require a strong background in these areas and to provide basic material where needed. We have tried to present material in clear, understandable language without introducing complicated jargon or, conversely, oversimplifying basic concepts and issues.

The new edition features updated discussions of the material that was reviewed in the first edition and expanded or new coverage of three central issues in health psychology. Chapter 5 represents a summary of research and practical issues of behavioral factors in cardiovascular disease, which has historically been one of the most important areas in the development of the field. Chapter 6 is new, covering the emerging area of psychoneuroimmunology, behavioral factors in the etiology and treatment of cancer, and of AIDS, a vitally important area for behavioral study. Finally, Chapter 13 is a summary of research and practice of prevention, important to the aspects of health psychology concerned with health promotion and the minimization of disease.

We have organized the text in such a way that readers will first be introduced to the important concepts and issues in the field of health psychology. After an introduction and historical overview of the field in Chapter 1, we provide a summary of physiological bases of behavior and health in Chapter 2. We thought it would be beneficial to provide a "short course" in basic human physiology early in the text, since throughout the book we refer to various physiological factors and mechanisms when discussing concepts and phenomena. We then discuss basic concepts and behaviors that span the entire field of health psychology: stress (Chapter 3), control, and learned helplessness (Chapter 4).

Starting in Chapter 5, which deals with cardiovascular disorders, we turn to more specific areas within the field of health psychology. Chapter 6 considers psychological aspects of immunoregulation, cancer, and AIDS. The prevalence and significance of psychophysiological disorders are dealt with in Chapter 7, followed by a discussion of the impact of hospitalization and patient behavior on health and illness in Chapter 8. A review of psychological assessment techniques that can be employed in medical settings is presented in Chapter 9. This review is provided not only for clinicians in the reading audience, but also to introduce nonclinicians to procedures they are likely to encounter in their research and training activities. Chapter 10 reviews the various cognitive-behavioral treatment procedures that have been effectively employed with problem behaviors often seen in medical settings. Pain and its treatment are discussed in Chapter 11. In Chapter 12 we discuss three common appetitive problem behaviors that have significant health consequences—obesity, problem drinking/alcoholism, and smoking. We have selected these topics in order to provide vivid examples of how comprehensive psychological approaches can be applied to help us better understand the biological and psychosocial factors involved in these problem behaviors and thus treat the behaviors more effectively. The text concludes with discussion of health psychology contributions to the promotion of health and prevention of disease.

No text of this type is possible without the aid of many dedicated people. We are especially grateful to a number of colleagues who read drafts of the original text and provided helpful criticism and suggestions: David S. Holmes, Russell A. Jones, Mary Ellen Olbrisch, Paul B. Paulus, James W. Pennebaker, and Shelley Taylor. Extensive revisions were made as a result of their expert comments. Critical readings of sections of the new edition by Neil E. Grunberg and Carol S. Weisse were also extremely helpful. We would like to thank and acknowledge the great amount of help and support we received from the staff at McGraw-Hill, particularly from Rochelle Diogenes and Tom Holton. Their persistence and expertise were greatly appreciated. We would also like to thank Mary Cranford, Shera E. Raisen, Rebecca A. Raymond, and Kitti Virts for their valuable assistance in the preparation of the book.

R.J.G.

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CONTENTS

Foreword	vii
Preface	xi
CHAPTER 1 OVERVIEW	1
The Mind–Body Relationship: A Historical Review 1 / The Development of Psychosomatic Medicine 3 / The Changing Nature of Health and Illness 5 / Methodological Developments 6 / Emergence of Behavioral Medicine 9 / Summary 11 / Recommended Readings 12	
CHAPTER 2 PHYSIOLOGICAL BASES OF BEHAVIOR AND HEALTH	13
Systems of the Body 13 / Genetic Influences on Health and Behavior 28 / Summary 34 / Recommended Readings 35	
CHAPTER 3 STRESS	36
The Modern Concept of Stress 36 / What Is Stress? 37 / Stressors 49 / Appraisal 53 / Mediating Variables 54 / Physiological Aspects of the Stress Response 58 / Stress and Illness 66 / Summary 72 / Recommended Readings 73	
CHAPTER 4 CONTROL AND LEARNED HELPLESSNESS	74
What Is Control? 74 / Control and Stress 77 / Learned Helplessness 84 / Summary 96 / Recommended Readings 96	
CHAPTER 5 CARDIOVASCULAR DISORDERS AND BEHAVIOR	97
Coronary Heart Disease 97 / Biobehavioral Factors in Hypertension 114 / Summary 119 / Recommended Readings 119	
CHAPTER 6 PSYCHONEUROIMMUNOLOGY, CANCER, AND AIDS	121
Psychoneuroimmunology 121 / Cancer 134 / AIDS 138 / Summary 143 / Recommended Readings 143	
CHAPTER 7 PSYCHOPHYSIOLOGICAL DISORDERS	145
The DSM-III Classification of Psychophysiological Disorders 146 / Major Forms of Psychophysiological Disorders 148 / The Role of Physiological Factors in Psychophysiological Disorders 152 / The Role of Genetic	

Factors in Psychophysiological Disorders	153	/	Psychological Formulations of Psychophysiological Disorders	154	/	The Diathesis-Stress Model of Psychophysiological Disorders	156	/	Treatment of Psychophysiological Disorders	159	/	Summary	159	/	Recommended Readings	160			
CHAPTER 8 MEDICAL SETTINGS AND PATIENT BEHAVIOR																161			
Hospitalization	161	/	Health Behavior	170	/	Coping with Chronic Illness	177	/	Compliance with Medical Regimens	185	/	Summary	195	/	Recommended Readings	196			
CHAPTER 9 PSYCHOLOGICAL ASSESSMENT IN MEDICAL SETTINGS																197			
Classification of Psychological Disorders	197	/	Traditional Psychological Assessment Procedures	200	/	Psychological Assessment Methods Developed for Medical Settings	207	/	Summary	215	/	Recommended Readings	216						
CHAPTER 10 COGNITIVE-BEHAVIORAL TREATMENT TECHNIQUES IN MEDICAL SETTINGS																217			
Major Learning Principles	217	/	Behavior Therapy Approaches	221	/	Cognitive Behavior Therapy Techniques	229	/	Biofeedback	231	/	Broad-Spectrum Cognitive Behavior Therapy	240	/	Summary	241	/	Recommended Readings	241
CHAPTER 11 PAIN AND PAIN MANAGEMENT TECHNIQUES																243			
The Physiology of Pain	243	/	Psychological Influences on Pain Perception	249	/	Specific Pain Treatment Methods	255	/	Summary	263	/	Recommended Readings	263						
CHAPTER 12 APPETITIVE BEHAVIORS: OBESITY, ALCOHOLISM, AND SMOKING																264			
Obesity	264	/	Problem Drinking/Alcoholism	272	/	Cigarette Smoking and Tobacco Use	281	/	Summary	288	/	Recommended Readings	289						
CHAPTER 13 PREVENTION AND HEALTH PROMOTION																290			
Lifestyle Risk Factors and Mortality: Behavioral Immunogens and Pathogens	290	/	Behavior Modification and Cognitive Approaches to Prevention	300	/	Summary	313	/	Recommended Readings	314									
REFERENCES																315			
GLOSSARY																365			
INDEX																375			

1 OVERVIEW

Traditionally, psychology and medicine have had little to do with each other. The “health” in psychology was mental health rather than a holistic mental and physical well-being. With the growing realization that psychological variables are important in health and illness, however, a new association between psychology and medicine has developed, as psychologists have begun to participate more actively in the diagnosis, treatment, and prevention of medical problems. Moreover, psychologists have brought their special research skills and technology to bear on major problem areas including the causes of illness, the nature of threats to health, and the care and management of patients and health care. Before more specifically defining and discussing this growing area, which is most commonly referred to as health psychology or behavioral medicine, we will briefly review how medicine and psychology have been linked historically.

THE MIND–BODY RELATIONSHIP: A HISTORICAL OVERVIEW

The relationship between the mind and the body has long been a controversial topic among philosophers, physiologists, and psychologists. Are experiences purely mental, purely physical, or an interaction of the physical and the mental? As Gentry and Matarazzo (1981) point out, the view that there are delicate interrelationships, such as the dry mouth and racing heart associated with fear or anger, or the headache triggered by emotional stress, can be found in ancient literary documents from Babylonia and Greece. The ancient Greek physician Hippocrates proposed one of the earliest temperamental theories of personality. He proposed that four bodily fluids or humors were associated with specific personality attributes or temperaments. An excess of yellow bile was linked to a choleric temperament. It was assumed that this yellow bile prompted an individual to become chronically angry and irritable, hence the word choleric (angry), which literally means bile. An excess

of black bile was considered to cause a person to be chronically sad or melancholic, hence the term melancholy, which literally means black bile. The sanguine or optimistic temperament was the result of excess blood in the system. Finally, the phlegmatic temperament, characterized by calm, listless personality attributes, was seen as being due to an excess of the bodily humor phlegm.

Of course this humoral theory of personality was long ago abandoned, along with a number of other prescientific notions. On a historical level, however, it points out how physical or biological factors have been seen through the ages as significantly interacting with and affecting the personality or psychological characteristics of an individual.

The traditional historical view of the interrelationship between mind and body lost favor in the seventeenth century. With the advent of physical medicine during the Renaissance, the belief that the mind influences the body came to be regarded as unscientific. The understanding of the mind and soul was relegated to the areas of religion and philosophy, while the understanding of the body was considered to be in the separate realm of physical medicine. This perpetuated the dualistic viewpoint that mind and body function separately and independently. Before this time, civilization's physicians, serving the multiple roles of philosopher-teacher, priest, and healer, had approached the understanding of mind-body interactions in a holistic way.

The individual usually credited with the development of the dualistic viewpoint and the resultant move away from the holistic approach was the French philosopher René Descartes. Descartes argued that the mind or soul was a separate entity parallel to and incapable of affecting physical matter or somatic processes in any direct way. This Cartesian dualism of mind and body became the preeminent philosophical basis of medicine. Although Descartes did indicate that the two entities could interact (he proposed that the pineal gland located in the midbrain was the vital connection between the mind and body), his basic tenet of dualism moved the newly independent field of medicine away from a holistic approach that emphasized psyche-soma interactions and toward the mechanistic pathophysiology approach that has dominated the field until relatively recently.

The discovery in the nineteenth century that microorganisms caused certain diseases produced further acceptance of the dualistic viewpoint. During this new scientific era of medicine, mechanical laws or physiological principles became the only permissible explanations of disease. Such an orientation, though, left a great many disorders unclassifiable. As McMahon and Hastrup (1980) note:

There gradually emerged . . . an ambiguously defined diagnostic category designed to accommodate what we know today as "psychosomatic" disorders. This category was called "nervous". . . . The apparent influence of "emotions of the mind" in such conditions made their etiology an enigma. It was agreed that if a physician had evidence that a patient was "only nervous," he should "stop further inquiry. He is then without the pale of rational medicine. . . . According to the received view, that which was caused by a psychological variable could itself be nothing but psychological. Thus the "nervous" condition became dissociated from physiological processes, and a

somatic complaint "of nervous origin" was understood as having no physical basis. (p. 206)

Strict dualism mellowed somewhat during the mid-nineteenth century, primarily because of the work of Claude Bernard. Bernard was one of the first prominent physicians to emphasize the contributions of psychological factors to physical ailments. Subsequently, Sigmund Freud was very influential in stressing the interaction of psychological and physical factors in various disorders. Though emphasis was still placed on the body, microorganisms, and biological determinants of illness, gradually we were becoming aware of other sources of influence.

THE DEVELOPMENT OF PSYCHOSOMATIC MEDICINE

The twentieth century has seen a great deal of growth toward an integrated, holistic approach to health and illness. The major arena of this integration has traditionally been the area of psychophysiological medicine, which, as we will see, is based on the belief that social and psychological factors are important in the etiology (origin and development) and maintenance of many illnesses and in the treatment of these illnesses. The growth of this area of inquiry was partially a result of an increasing number of instances of illness that did not fit the solely biomedical view of health and disease and partially the result of gathering evidence that, in response to the environment, the psyche and the body often act as one.

In the early 1900s, efforts were being made by psychologists to integrate a psychological approach to health and illness into the field of clinical medicine. As Gentry and Matarazzo (1981) indicate:

The symposium on "The Relations of Psychology and Medical Education," sponsored by the American Psychological Association, at its 1911 annual meeting is a prime example of such an attempt. . . . The psychologists participating in this symposium, Shepard Ivory Franz and John Broadus Watson, and their physician-colleagues, Adolph Meyer, E. E. Southard, and Martin Prince, agreed (a) that medical students enter training with too little knowledge of psychology; (b) that such knowledge is essential to proper medical training; (c) that in fact courses in psychology should precede courses in psychiatry and neurology; and (d) that more hours should be devoted to psychology in the medical curriculum. (p. 6)

Two decades later, however, this new role for psychology was still under discussion and little practical progress had been made (see Bott, 1928). The role of psychological factors was being recognized, but little was being done about them. It would take many years for the connections among psychological factors, illness, and the psychological processes underlying disease states to be studied more carefully and explained.

Initial discoveries of the importance of psychological factors in health-relevant matters were made largely by psychiatrists and psychodynamically oriented

psychologists. For example, one of the first major controversies was whether personality factors were related to specific diseases (see Dunbar, 1943). Ruesch (1948) reported that a pattern of infantile behaviors characterized many patients, and others found associations between personality and the incidence of psychophysiological illness (see Deutsch, 1953). Oral and anal conflict, unconscious motives, maternal conflict, and the like seemed to find expression in health and susceptibility to illness.

Psychological input was not substantial during the early development of psychosomatic medicine. This was due in part to the inability of psychiatry and psychology to integrate practices and knowledge on a general level. However, it was also due to the way in which psychology developed. Psychology was founded as a narrow field concerned primarily with the subjective analysis of the structure of sensation and mental events. As this concern gave way to the study of purposive behavior, mental abilities, and functional aspects of behavior, the way was temporarily cleared for input into other areas. But the behaviorist revolution, with its interest in learning theory and its tendency to reduce behavior to its constituent, observable elements, sidetracked this growth. And so, for the greater part of the first half of this century, psychology remained insular.

Since World War II, psychology has grown in new directions. Renewed emphasis on the physiological bases of behavior, successful application in areas ranging from architecture to law, and the transcendence of the "schools" of psychology have all helped to bring about a richer and more open discipline. The expectation that psychology can contribute to many other fields is now firmly entrenched, and psychological input into matters of health and illness has increased greatly.

Not all of the initial work in health psychology was done by psychologists. Wolff (1950), for instance, made particularly important contributions to the study of health and illness with his extensive studies of the role of stress and adaptation in the development of disease states. He viewed illness as being caused by a number of factors, one of which was failure to adapt to the changes and stresses that are a normal part of life. Failure to adapt led to emotional and biological responses that could facilitate the onset of disease. Further, the particular ways in which people responded psychologically were linked to specific organs in the body and specific kinds of ailments.

Wolff's work remains of interest today, as does that of several other pioneering researchers (see Alexander, 1950; Graham, 1972) who were important in linking psychological and physiological realms of inquiry and in demonstrating how emotional factors influenced functioning by organ systems. Psychophysiological research provided basic evidence of the relationships between emotion and physiological responses (see Ax, 1953), and physiological research suggested that emotional and cognitive factors are extremely important in eliciting specific patterns of bodily response to threat (see Mason, 1975).

During the last decade, psychological contributions to medically relevant topics have become an important part of medical science, with the growing interest in treating patients as "whole" human beings and the realization that psychological factors are important in the course of almost any disease. In a comprehensive

overview of the field of psychophysiological medicine during the 1970s, Lipowski (1977) noted a great resurgence of interest in this field. Indeed, most professionals today take the position that mind and body are not separate entities. A change in emotional state will be accompanied by a change in physiological response, and a change in physiological functioning will frequently be accompanied by alterations in emotional affect. In clinical treatment today, a holistic approach is advocated, with the view that to understand comprehensively health and disease, it is important to study people as "individual mind-body complexes ceaselessly interacting with the social and physical environment in which they are embodied" (see Lipowski, 1977, p. 234).

Gentry and Matarazzo (1981) have labeled this renewed orientation a reemergence rather than the emergence of a psychological approach to medical diagnosis and treatment. With the development of more effective psychological treatment and research technologies tailored specifically for medically relevant issues, there has been a dramatic reemergence of psychology in the study of health.

THE CHANGING NATURE OF HEALTH AND ILLNESS

The importance of mind-body interactions and of research on the relationships between behavior and health is further suggested by the changing nature of health care and threats to good health. Since 1900, life expectancy for both men and women in the United States has increased by 50 percent, a change made possible in part by breakthroughs in treating and preventing infectious illnesses such as polio, influenza, rubella, and smallpox (Matarazzo, 1984b). With the elimination of these diseases through vaccination, "new" diseases became more prominent and now account for most deaths in this country. Cancer deaths, for example, have tripled since 1900, and heart disease, cancer, and acquired immune deficiency syndrome (AIDS) have become major killers. These diseases have no "magic bullet" cure or vaccine but are, in some respects, diseases caused by lifestyle and behavior. Diet, smoking, exercise, stress, and substance use are all behavioral factors that are associated with development of today's most feared illnesses. USDHEW (1979a) noted that, at the turn of the century, 580 deaths out of every 100,000 U.S. citizens were due to influenza, pneumonia, diphtheria, tuberculosis, and gastrointestinal infections. Today these diseases account for only 30 deaths per 100,000 citizens. This rapid decline in deaths from infectious agents, he argues, has been accompanied by increased numbers of deaths from diseases caused or facilitated by preventable, behavioral factors such as smoking (see Figure 1.1).

Within the past decade, observable changes in the lifestyles of Americans reflect directly on these behavioral factors associated with heart disease, cancer, and other modern illnesses. Data from the 1981 Surgeon General's report (Harris, 1981) suggest that many people have taken steps to exercise, change their diets, quit smoking, and so on. Though some of these trends are not positive, as in recent increases in smoking among teenage girls, most reflect a growing awareness of lifestyle as a determinant of health (see Figure 1.2).

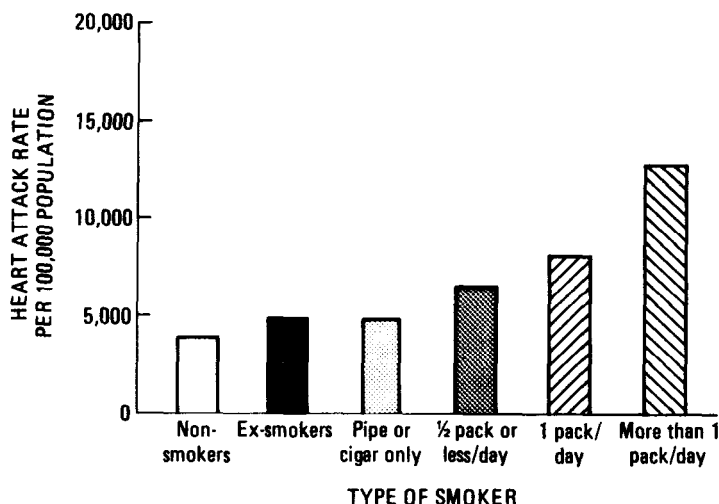


Figure 1.1 Age-adjusted rates of first heart attack for white males aged 30–59, United States, categorized by smoking status.

Adapted from J. A. Califano, Jr. *Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention*. Washington, D.C.: U.S. Government Printing Office, 1979.

METHODOLOGICAL DEVELOPMENTS

How does one go about studying the relationships between psyche and bodily tissue damage or resistance? The following example will demonstrate the complexity of the problem.

Assume that you are interested in the relationships between personality and illness. You first devise a personality scale that distinguishes people along a personality dimension, dividing people into “X” and “Not-X” categories. You develop the hypothesis that all people with the “X” trait are more likely to develop high blood pressure than are those without this trait. You therefore assemble a pool of 2,000 potential subjects, carefully matched on a number of variables such as education and income, and administer your personality scale to each subject. You recruit 500 people in each category, then you take each subject’s blood pressure and inquire as to his or her history of high blood pressure (or lack thereof). When you tabulate your data, the findings are remarkable—not only do 70 percent of the “Xs” have a history of high blood pressure while only 10 percent of the “Not-Xs” have such a history, but the mean blood pressure of “Xs” is 20 mm of mercury higher than that of the “Not-Xs.” Such results initially prompt you to believe that you have discovered the cause of high blood pressure.

The only problem with these results is that they have *not* demonstrated that your personality trait causes high blood pressure. Your evidence is correlational in nature—it shows that the personality trait “X” is related to high blood pressure, but it does not show that the factors are causally linked. It is possible, for example, that a third factor is also coincidentally related to blood pressure. This is a common