Also by the authors

HEALTHY PLEASURES
HEALTHY MIND, HEALTHY BODY HANDBOOK

Also by Robert Ornstein

ON THE EXPERIENCE OF TIME
ON THE PSYCHOLOGY OF CONSCIOUSNESS
ON THE PSYCHOLOGY OF MEDITATION *(now published as* MEDITATION AND MODERN PSYCHOLOGY*)*
THE NATURE OF HUMAN CONSCIOUSNESS
SYMPOSIUM ON CONSCIOUSNESS
COMMON KNOWLEDGE
THE MIND FIELD
THE AMAZING BRAIN *(with R. Thompson and D Macaulay)*
PSYCHOLOGY: THE STUDY OF HUMAN EXPERIENCE
MULTIMIND
NEW WORLD NEW MIND *(with P. Ehrlich)*
THE EVOLUTION OF CONSCIOUSNESS
THE AXEMAKER'S GIFT *(with J. Burke)*
THE RIGHT MIND
MINDREAL

Also by David Sobel

AN EVERYDAY GUIDE TO YOUR HEALTH *(with F. Hornbacher)*
WAYS OF HEALTH: HOLISTIC APPROACHES TO ANCIENT AND CONTEMPORARY MEDICINE
THE PEOPLE'S BOOK OF MEDICAL TESTS *(with T. Ferguson)*

THE HEALING BRAIN

BREAKTHROUGH DISCOVERIES ABOUT HOW THE BRAIN KEEPS US HEALTHY

Robert Ornstein
and
David Sobel

This is a Malor Book
Published by ISHK
PO Box 176, Los Altos, CA 94023

First published by Simon and Schuster, 1987
This edition published by ISHK, 2010

Library of Congress Cataloging in Publication Data:
Ornstein, Robert.
The healing brain: breakthrough discoveries about how the brain keeps us healthy / Robert Ornstein and David Sobel.
p. cm.
Previously published: New York: Simon & Schuster, 1987.
Includes bibliographical references and index.
ISBN 1-883536-17-0
1. Medicine, Psychosomatic. 2. Brain. 3. Health. I. Sobel, David S. (David Stuart) II. Title.
RC49.076 1999
613-dc21

98-52480
CIP

ISBN-10: 1-883536-17-0
ISBN-13: 978-1-883536-17-6

The author is grateful for permission to use material from the following sources:

"Fighting Cancer: One Patient's Perspective" by N. Fiore, *New England Journal of Medicine.*

Neuropsychology of Human Emotion by Kenneth M. Heilman and Paul Satz. Published by Guilford Press.

Vulnerable, But Invincible: A Study of Resilient Children by E. E. Werner and R. S. Smith. Published by McGraw-Hill.

The Hardy Executive by Salvatore R. Maddi and Suzanne C. Kobasa. Published by Dow Jones-Irwin.

"The Faith that Heals" by Jerome D. Frank, *The Johns Hopkins Medical Journal.*

"Postscript" by L. D. Egbert, *Advances*, Journal of the Institute for the Advancement of Health, 1985; 2:58.

The Language of the Heart by James J. Lynch, Ph.D. By permission of the author and Basic Books.

ACKNOWLEDGEMENTS

We'd like to thank many of the people who helped us in the years we were working on this book: Stephen Laberge, Charles Swencionis, James Lynch. We have also had the privilege of working with almost one hundred different lecturers at our symposium, titled *The Healing Brain.* To all of you, thank you again and again for sharing your insights.

We want to thank Chris Mason for literature searches and library research. Tom Kass, Matt Budd, Christina Lepnis, Don Kemper, Meredith Minkler, and Sally Mallam all reviewed the manuscript with effort beyond that of friendship, and each has left an imprint.

THIS BOOK IS DEDICATED
TO THE SPIRIT AND TO THE INFLUENCE OF
RENÉ DUBOS

CONTENTS

Preface 11

SECTION I: *The Stability to Resist Disease*
CHAPTER 1. IN SICKNESS AND IN HEALTH 17

SECTION II: *The Brain Minds the Body*
CHAPTER 2. BODYGUARDS 35
CHAPTER 3. THE SELF-ISH BRAIN: FEELING OUR WAY THROUGH AN UNSTABLE WORLD 35

SECTION III: *Beyond Belief*
CHAPTER 4. THE POWERFUL PLACEBO 73
CHAPTER 5. THE PHARMACY WITHIN: BELIEFS, ENDORPHINS, AND THE INTRINSIC PAIN RELIEF SYSTEM 88
CHAPTER 6. GREAT EXPECTATIONS: ON THE MENTAL REDUCTION OF WARTS AND ENLARGEMENT OF BREASTS 98
CHAPTER 7. SMALL WORLDS, SMALL BRAINS: MAKING UP YOUR MIND 105

SECTION IV: *"No Man Is an Island"*
CHAPTER 8. PEOPLE NEED PEOPLE 119
CHAPTER 9. FROM THE INDIVIDUAL TO THE SOCIAL BODY 129
CHAPTER 10. MIND-MADE IMMUNITY: ON GRIEF, LYMPHOCYTES, AND SHARKS OF THE MIND 138
CHAPTER 11. PRESSURE: SOCIAL AND BLOOD 161
CHAPTER 12. A HEART APART: ON SELF-CENTEREDNESS, HOSTILITY, AND SUDDEN DEATH 173
CHAPTER 13. FRIENDS CAN BE GOOD MEDICINE 191

SECTION V: *Mind-Made Health*
CHAPTER 14. FEELING BORED, FEELING BLITZED 205
CHAPTER 15. OF HARDINESS, COHERENCE, AND STABILITY 228

Notes 259

For Further Reading 285

Index 289

PREFACE

The brain minds the body. This idea seems so simple and central to the understanding of human health, and yet it has escaped the attention of the mainstream of medical practice and psychological thought. Medicine has largely regarded the body as a mindless machine—a perspective elucidated by a brilliant twenty-four-year-old philosopher, René Descartes, more than four hundred years ago. Proposed as a temporary expedient to permit investigation of the human organism unencumbered by the dogma of the ruling Church, this separation of mind and body has dominated medical practice and thought.

Psychology has similarly been restricted by a view that the main purpose of the human brain was to produce rational thought. Never mind that the brain is the largest organ of secretion in the body, and the neuron, far from being like a chip within a computer, is a flesh-and-blood little gland, one that produces hundreds of chemicals. These chemicals do not, for the most part, serve thought or reason. They serve keeping the body out of trouble, from commonplace problems like not falling over or walking into a wall to the myriad of tasks involved in maintaining the stability and health of the organism.

It is in the stability of our social worlds, our mental and emotional

lives, and our internal physiology that health exists, and it is the brain which maintains stability by its countless adjustments, commands, and secretions.

This inconceivable organ evolved as a collection of "small brains" all living together in one body. Sometimes these brains function harmoniously, and sometimes they conflict and send mixed messages to the body. Basic to the evolution of the brain is our early attachment and dependency on other people. Our social nature links us fundamentally to others throughout our lives. When these links are strained or ruptured, the health consequences are profound.

On the positive side, the brain possesses highly refined mechanisms to maintain and restore health. We are not helpless and defenseless in the face of the stresses of everyday life. Some people seem able to view life's inevitable changes as challenges, and a study of such hardy people helps reveal why some people maintain health while others become ill.

This book is one attempt to bring about a new way of looking at the brain; not a new theory or a new study, but simply a new view. It is one which turns around the well-developed assumption that rational thought is the supreme achievement of the human brain and restores the perspective that the major role of the brain is to mind the body and maintain health.

This book, *The Healing Brain*, provides many of the raw materials for the new view: Who twenty years ago could have imagined the complex internal pain-regulation system which underlies turning off pain in response to sugar pills? Who would have thought that the death of a loved one would cause immunity to disease to plummet? Who would have thought that a sudden cardiac arrest after a shocking trauma could be due to signals deep within the brain's frontal lobe?

So the reader has to be, in the cliché, intrepid, intrepid enough to go through the varied "worlds" and disciplines of medicine, social thought, health, evolution, brain science, and psychology. We will move from beliefs to chemicals, from social interaction to high blood pressure, from grieving to suppression of immunity, so that connections—some well worked out as of now, some still yet to come—can be illuminated. Though the individual bits of evidence we present may be debated or the speculative links challenged, we believe the collective weight of the findings helps close the artificial gap between mind and body.

Rather than just presenting a series of interesting findings which link psychological states and health, we attempt, whenever possible, to highlight themes and speculate on commonalties, even, at some moments, when the research is not yet perfect. This is not, however, a final theory which ties all the observations together in one neat, simplified model, but a new perspective about what the brain is doing and about what determines health.

To begin our discussion, we take a new look at both health and the brain. Going a long way around, we start with a consideration of why the health of people in Western societies has improved over the past century. We then take a look at what the brain is actually doing.

April 1986
Robert Ornstein
David Sobel

SECTION ONE

The Stability to Resist Disease

CHAPTER ONE

IN SICKNESS AND IN HEALTH

As Roy Sampson looked down at his dying child, he was angry that the doctor had been unable to help. Sampson was a forty-five-year-old railroad worker whose child, a two-year-old girl, had become ill a week before with fever and relentless diarrhea. The doctor had visited twice before and had administered a potion that, if anything, appeared to make the sick child even worse. Sampson was all too familiar with the disease. He had already lost a child to dysentery.

It was 1887, and constant disease was common to this family. Sampson's brother had succumbed to tuberculosis, or "consumption," as it was then known. Roy remembered the uncertainty, the continuing pain, and the agony of his brother's disease. It dragged on for years and years as he watched his brother slowly waste away, consumed by coughing and fevers.

Roy and his family did everything they could think of to help, but the medical regime that was undertaken—the fasting, the purging, and the many trips to the sanitarium—did little or nothing in the end to alleviate the horror and the degeneration of his brother.

Sampson's wife had died recently, victim to a high fever that followed the birth of their fifth and last child. But Roy was grateful

for his own good health and because two of his own children *had* survived. Many of Sampson's friends had only one surviving child, and some had none of their children survive their first few years, even though the wife seemed almost continually in childbirth. What would these childless couples do in their old age? Who would care for them?

One hundred years later, Roy Sampson's great-great-grandson, Henry Sampson, looked down at his smiling, healthy girl. She was four, and aside from a few brief colds and an ear infection, she had been healthy all her life. Henry wasn't surprised—this was his third healthy child. The family was under good medical care. All the children made regular visits to the pediatrician. The family was protected by health insurance, and, should they become ill, a new hospital with a modern high-tech emergency room had been built only two miles away.

Disease still touched the Sampson family, but it primarily affected Henry's parents. His father had suffered his first heart attack at age fifty-four and, following his second heart attack, he underwent a complicated and expensive coronary artery bypass operation which seemed to improve his health. Henry's mother had died at age sixty after a long illness, battling uterine cancer. At the end of the treatment, his mother's doctors had tried both chemotherapy and radiotherapy, both of which failed to arrest the spread of cancer throughout her body.

These two families, generations apart, exemplify the changes in health that most people in the United States and Europe have experienced over the last century or so. In the 1800s the average life expectancy at birth was about fifty years. Today, life expectancy of a child born in the United States is well over seventy. Many people who are alive today remember vividly how the hospitals of fifty years ago were hopeless places, choked and clogged with people who suffered from incurable diseases such as tuberculosis. Then, seemingly overnight, the tuberculosis wards were emptied as this major infectious killer was almost completely knocked out by one of the first modern "wonder drugs"—streptomycin.

In the 1980s hardly a week goes by without report of a medical breakthrough: There are new developments in organ transplants;

artificial hearts; *in vitro* fertilization; drugs to lower blood-pressure and cholesterol levels; cures for impotence; instruments to peer into joints; bone-marrow transplants; new delivery systems for drugs; and inventions such as positron emission tomography and magnetic resonance imaging, which allow new ways to see into the body so that diseases can be easily diagnosed.

Many people owe their lives to the development of lifesaving antibiotics and immunizations. Smallpox is gone. Polio has nearly vanished from developed countries. Syphilis is no longer a dreaded, lethal disease. Tumors that would have killed someone defended by the medicine of 100 years ago are today removed in routine outpatient surgery. Using microsurgery, physicians can treat disorders of the eye and the knee which would have permanently disfigured or at least disabled someone only twenty-five years ago.

These important and dramatic developments have given impetus to decisions to provide ever-increasing amounts of "medical care." The United States spends more and more on medicine and its associated technology, now nearly twelve percent of the gross national product.

We don't mind spending so much, because it seems quite obvious to anyone that the developments of modern medicine are responsible for the overall dramatic improvement in health in lives like the Sampsons'.

But this assumption is wrong.

Medical treatments, especially the drug and surgical treatment of sick individuals, have had relatively little to do with the better health that people in Western societies enjoy. We are wedded to medical ideas that are incorrect.

Consider the dramatic increase in longevity that citizens of Western societies have experienced during the nineteenth and twentieth centuries. During this time the average age at death rose from about fifty to about seventy-four. But this increase in life expectancy was *not* due in the main to those medical interventions which prolonged the lives of adults.

If we look at adult lives, the changes are quite different. Roy Sampson, forty-five years old in 1887, could expect to live for about another twenty-five years. Henry Sampson at forty-five, living a century later, with all the benefit of modern medicine—the microsurgery, the image scans of the living body, the organ transplants, the beta-blockers for heart trouble, the easy availability

of antibiotics, and more—could expect to live for only a few years more than his great-great grandfather, who lived before all these highly visible and dramatic developments.

What lowered the death rate and increased longevity was a decline in deaths from the infectious diseases of youth. A person who survived the hazardous years of childhood was likely to live nearly as long with or without modern medicine. The rise and fall of the great epidemics of infectious diseases has more to do with social changes than medical treatments.

While plague struck Europe in the 1300s, infectious diseases like cholera, measles, smallpox, polio, and many of the respiratory viruses appear to have first become a major health problem quite late in history. These epidemics of infectious diseases began during the great social upheavals in the late Middle Ages, around the fifteenth century. These new burdens were referred to as "crowd diseases," arising with social changes which brought large concentrations of people together. At the same time, people began to make long sea expeditions in the hope that they would encounter undiscovered treasures, but often they settled for encountering undiscovered peoples—and with them, new and undiscovered diseases.

Travelers brought unfamiliar diseases to the lands they visited and carried new diseases home. There was no specific immunity to the "new germs," and "host resistance" (the ability to withstand disease) was undermined by poor nutrition and unsanitary conditions. So the germs had a field day, and unprecedented epidemics began to decimate large populations.

A French observer in the sixteenth century stated that the many diseases then plaguing his countrymen

> have scarcely anything in common except infection, such illnesses as diphtheria, *cholerine,* typhoid fever, *picotte,* smallpox, purple fever, the bosse, dendo, tac *or* harion, *the* trousse galant *or* mal chaud; *or again whooping cough,* scarlatine, *grippe, influenza.*

Diseases suddenly appeared and went away forever in this new mixing of germs. "Sweating sickness" ravaged England from 1486 to 1551. It affected the heart and the lungs and carried with it rheumatic pains and fits of shivering: It usually killed its hosts within a few hours. It appeared five different times and has not been seen again. Epidemics jumped from one population to another. One traveler, Alonso Montecuccoli, wrote on September

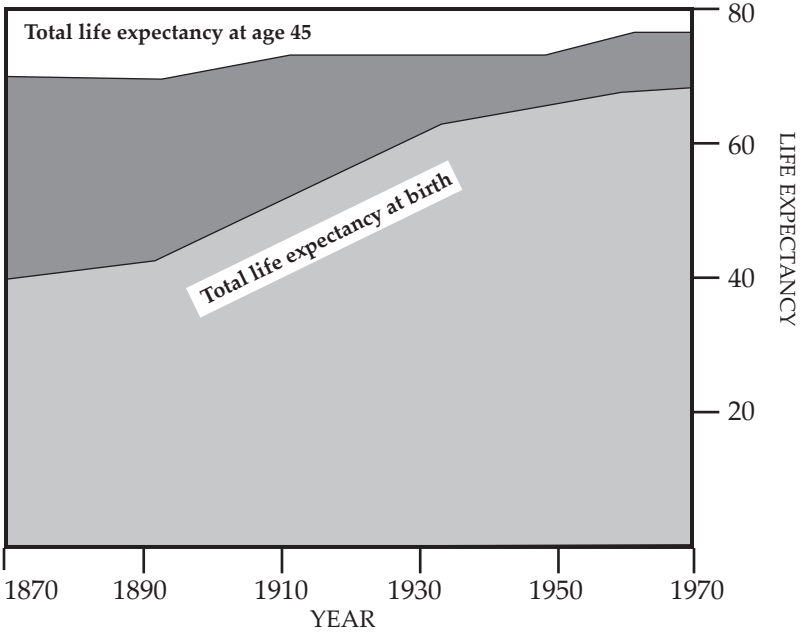
2, 1603, that he could trace the progress of the plague as it moved along the trade route. He adjusted his own business and travel plans so as to keep away from it.

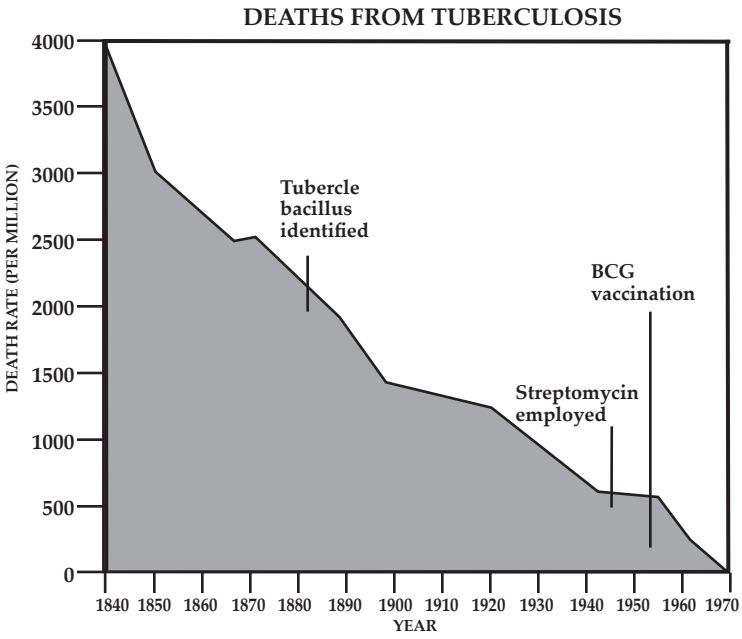
But it was unavoidable: New disease traveled everywhere in the world in the sixteenth to the nineteenth centuries. Plague came into Europe from China and India via Constantinople and Egypt. Both tuberculosis and cholera arrived in the West from India in the eighteenth century.

Just as the rise of mortality from infectious diseases was occasioned by cultural and social changes, so was its decline. The decline was not due, for the most part, to medical interventions in sick individuals, but to making the environment less hazardous and improving the general resistance of people to defend themselves against germs.

These changes were the crucial part of the modern improvement in health: Deaths and disease from common infections were already declining drastically long before antibiotics, long before effective immunizations, long before effective individual medical intervention (see graphs). Look at the time course of the conquest of tuberculosis—the major cause of death in the mid-nineteenth century.

LIFE EXPECTANCY





Deaths from tuberculosis began to decline long before medical science provided effective treatment for it.

The death rate from tuberculosis declined from nearly three thousand deaths per million people in 1850 to fewer than twenty deaths per million today, at least as of 1973. While many drugs and severe treatments, such as surgically collapsing the lung, were tried for almost one hundred years, the first effective treatment for tuberculosis was the antibiotic streptomycin, developed in 1947. The effect of streptomycin was dramatic: Death rates from tuberculosis were quickly cut in half and declined further. Only forty years later, tuberculosis became a rarity in the West.

Most people believe the decline of tuberculosis is due to the introduction of the antibiotic. But our perspective is wrong, our time frame is wrong, and our conclusion is wrong as well. Most people are, in effect, looking only at a few exciting and vivid happenings within their lifetime, the past forty to fifty years, basing their conclusions on this familiar but very restricted evidence.

A longer view reveals that most of the total decline of deaths from tuberculosis since the 1800s occurred *before* streptomycin was first introduced. By 1945, 97 percent of the cases had already been

eliminated, leaving only the remaining 3 percent to be improved by the modern medical treatments. The dramatic emptying of the hospitals that many of us and our parents have observed, then, was only the very end of the massive improvement.

Tuberculosis is not unusual: Similar reductions occurred with pneumonia, influenza, whooping cough, measles, and scarlet fever. Whooping cough (pertussis) was rampant in the late 1800s, killing over one in each thousand children. Yet today deaths from whooping cough are rare. Once again, credit often goes to the pertussis immunization, which was introduced in the 1950s. But by that time the death rate had already fallen by 90 percent

Polio is, of course, a notable exception. This viral disease was rare before the late nineteenth century, but since then has occurred in epidemics. The death rate from the disease, along with the incidence of crippling disabilities, dropped dramatically following the introduction of the polio vaccine in 1956. Nevertheless, the trend in death rates from nearly all the infectious diseases was markedly downward, with the majority of the decline occurring *before* the introduction of effective medical therapies or immunizations.

Since most of the improvement occurred before the development of specific medical interventions, what accounts for this decline of the infectious diseases? The advances in agriculture in the eighteenth and nineteenth centuries allowed people to eat much more varied and nutritious foods. Better nourished people had better immunity, too, and could thus resist better the infectious diseases. The farmer, not the doctor, was most important.

Other interventions helped: The purification of water, improved sewage disposal, and better food hygiene together account for roughly one-fifth of the total decline in infectious disease mortality. Pasteurization of milk, the food most likely to spread disease, was probably the major reason for the decrease in deaths from gastroenteritis and for the decline in infant mortality from diarrheal diseases from about 1900. Again, it was a social change, led by the food handler and sewage engineer rather than the heroics of the doctor, that deserves the credit.

Also, as more children survived the ravages of infancy and society began to provide more secure jobs, pensions, as well as social programs to care for the elderly, parents responded by choosing to have fewer babies. Had it not been for this unprecedented change

in sexual behavior, long before the advent of modern methods of contraception, the population of England and Wales would have grown to 140 million rather than the 55 million it is today. The effects of such unbridled population growth on food supplies, sanitation, hygiene, and consequently on health can be imagined.

There were, of course, some medical successes, too: By the early 1900s immunizations protected against smallpox and tetanus; antitoxin treatment limited deaths from diphtheria; appendicitis and peritonitis responded to surgery; Salvarsan successfully stopped syphilis; intravenous therapy saved some with severe diarrhea; and improved obstetric care prevented childbed fever.

Today many people are alive because of the lifesaving interventions of modern medicine: the immunizations, the antibiotics, the treatment of diabetes, and the startling surgical advances including organ transplants. Many other people, while not living longer, enjoy an improved quality of life due to the advances in medical treatment for allergies, heart disease, asthma, arthritis, and pain.

Medicine has made some contribution to health, but its interventions in diseases have been greatly overemphasized as to their real effectiveness and worth to society. The contemporary health and medical effort has, in large part, been misdirected, misspent, and its successes misattributed.

The question of what improves health needs to be turned around entirely from our emphasis upon the relief of sick individuals. People are healthier today not because they receive all this well-publicized better treatment when ill, but simply because *they tend not to become ill in the first place*.

It is not as profitable as we imagine to focus almost exclusively upon "specific etiology" of diseases, spending all our research funds to isolate identifiable agents of diseases, whether they be germs, viruses, or, according to one of the terms currently in vogue, "stressors." We should rather consider the ways in which organisms remain stable in the changing world of emergencies, germs, and threats—stable to resist infection and other disorders. We might then discover the way this resistance can be strengthened.

Obviously, much of the resistance conferred is genetic: Some people, by virtue of inheriting a stronger constitution, may be to

resist disease better. Nutrition and public health measures have increased stability and thus resistance to disease, and many other measures have had this result. But there is new and much more modern evidence on this story: The evidence that the way we interact with others, the way we see ourselves as *a part of* or *apart from* other people and our society, also appears to influence general resistance to disease. These psychological and social factors are represented in brain processes, as are many of the internal systems that participate in resistance. It is the brain which is the missing link.

Not only is there new scientific evidence that connects the social world with internal states of the brain, but our medical needs themselves are now different. In many respects people in developed Western societies have reached an age of diminishing returns whereby more medical care and more and more medical expenditures will probably contribute only marginally to better health, because the increasing medical care and medical apparatus were not responsible in the first place for much of it.

Further, the benefits from the massive medical interventions must be discounted by the potential for harm. Consider the hazards of modern medicine, the so-called iatrogenic (physician-generated) diseases. These include surgical misadventures, drug reactions, missed diagnoses, and hospital-acquired infections.

One study at Boston University Medical Center found that 36 percent of patients admitted to the hospital suffered from one or more complications as a side effect of medical care. In 9 percent of patients the iatrogenic illnesses were serious, and in 2 percent contributed to the death of the patient.

Another study focused on ninety-three children who were told by their doctors that "something was wrong with their heart." When the diagnoses were evaluated it was found that only 19 percent had actual heart disease. The rest (over 80 percent) suffered only from *cardiac nondisease*, a "disorder" created entirely by misdiagnosis. The consequences of cardiac nondisease, however, are serious. Nearly half of these healthy children were restricted in their physical activity. In a subsequent study children with activity restricted as a result of their diagnosis of cardiac nondisease were found to have impaired intellectual development.

Utah and Nevada are similar in geography, climate, income, education, and degree of urbanization but are strikingly different ill the health of their inhabitants. The death rate for adults is nearly

40 percent higher in Nevada than Utah. The health differences cannot be accounted for on the basis of differences in medical care. The states have similar numbers of physicians and hospital beds per capita.

The key differences are in the way people live. Utah is inhabited primarily by Mormons, who abstain from smoking and drinking and have a quite rigid social organization and generally lead quiet, stable lives. In contrast, people in Nevada prescribe liberal doses of alcohol and tobacco for themselves and have consequently 100 to 600 percent higher death rates from cirrhosis and lung cancer. Further, the Nevada residents are transient (more than nine of ten Nevadans of middle age were not born in Nevada). They are "socially unstable" (in plain English this means that Nevadans are twice as likely to be single, divorced, separated, or widowed).

There are many further indications that the way people behave, rather than the medical care they receive, has a very great influence on their ability to resist diseases. Important evidence on this comes from a large study of nearly seven thousand adults in Alameda County, near San Francisco. After an initial survey which established their health at the time, these seven thousand people were tracked for seven years and surveyed again. Certain health habits were identified that characterized those who remained healthy and those who became ill and died. These "grandmother knows best" health habits included not smoking, drinking in moderation or not at all, exercising regularly, eating breakfast, maintaining a normal weight, eating regular meals, and getting adequate sleep.

Consider two different forty-five-year-old men living today. One practices five or six of these positive health habits, and the other only one or two. The clean-living fellow can expect to live eleven years longer than his sedentary, smoking, heavy-drinking counterpart. Eleven years is an enormous difference considering that the increase in life expectancy in the last century for a forty-five-year-old man (like Roy or Henry Sampson) was considerably less. And this gain—which took the century of immense effort, massive funding, research developments, testing, and retesting that has gone into modern scientific medicine—is less than the difference a person potentially has in his or her own control.

It is a shameful waste of billions of dollars and millions of lives. Why should we place our faith and resources in a medicine based

largely on the treatment of diseases? Why spend 12 percent of our gross national product on medical care? Why is the largest single budget expense in a new General Motors automobile not the steel, not the design work, not the factory expenses, but the cost of health insurance for the workers involved? We should be studying what really controls our bodies and our health.

Health itself is difficult to see and to quantify. Preventing disease is a peculiar business in which one must gain satisfaction more from what does *not* happen that from what does. The absence of an automobile accident, the protection from an infectious disease, or the unseen prevention of a possible suicide attracts less attention (and funding) than the heroics of a trauma surgeon, the cure with antibiotics, or the pharmacological reversal of a drug overdose.

It is understandable that we know very little about health, since there is always a strong need to respond to and care for those who are sick. It is far simpler, much easier, more exciting, and more personally satisfying to look for the dramatic medical "magic bullets," for dramatic surgical rescues, than it is to weigh, judge, and confirm the more complex determinants of health like behavior, estranged social relationships, and deleterious environments.

Medical scientists are just beginning to break free of their early and simplistic engineering mentality. This oversimplified approach, a way of doing science always useful at the beginning, attempted to understand all relevant aspects of health in physical and chemical terms. Medical scientists looked only to biology and analyzed the structure and mechanical functioning of the human body in fine detail.

Anatomy, physiology, biochemistry, and molecular biology were considered the "basic medical sciences," and psychiatry, with its emphasis upon mental causes of diseases, was in another department (probably in another building); social and emotional factors were not even on the chart. "Real" diseases were definable organic diseases. Medical therapy consisted of physical and chemical interventions in the "body machine," the way a garage mechanic would do a valve job on the family car. Disease was essentially a technical problem requiring a technical solution.

Yet the word *health* appears everywhere: "*health* care system,"

"*health* care providers," "*health* science expenditures," "*health* maintenance organizations." Some medical schools are now called "health science centers." With all the discussion of "health care," one might have imagined there would have been some understanding of it.

Nearly all the talk of "health" is about the care for the sick—we have what might be better called a "disease care system." And the relationship between disease or sickness care and health is tenuous at best.

Providing more and more medical care does not necessarily produce healthier people; a healthy population is one that does not get sick in the first place, rather than one that gets sick and then is returned to health by medical care. There is more to be gained by a thorough study of how organisms avoid illness than there is from the study of disease agents alone.

The most brilliant, successful, and influential approach to the study of disease agents was Louis Pasteur's germ theory of disease. Yet even in his early studies of the diseases of silkworms, as Pasteur elaborated this central discovery of modern medicine, he was aware of the alternative: that host resistance could be strengthened.

In the 1870s the silk industry in France was nearly wiped out by a disease that attacked the developing silkworm. Pasteur was called upon to stop the disease, which he discovered was caused by a protozoan. He demonstrated that the disease could be controlled by eliminating the microbe from the silkworm nurseries.

However, Pasteur also noticed that it was not just the presence of the germ but the physiological state of the silkworm that also determined the susceptibility to infection. While his later studies with anthrax and rabies still reflected his focus on the agents of disease, he later noted: "If I were to undertake new studies on the silkworm disease, I would concern myself with the ways of increasing their general vigor. . . I am convinced that it would be possible to discover techniques for giving worms a higher level of robustness and thereby rendering them more resistant to infection."

In addition to his interest in the causative role of microorganisms in disease, he was also aware of the importance of what he called the *"terrain"*—the environmental factors which determined susceptibility and resistance to disease. In fact, Pasteur and his colleague and contemporary Claude Bernard long debated

whether the disease producer, the microbe, or the body's equilibrium was more important. Pasteur sometimes reflected that "the road not taken" might have been more profitable and that the body's biochemical and physiological state, even emotional states, profoundly affects the course and outcome of infectious disease.

He was so concerned with this point that on his deathbed he said, *"Bernard avait raison. Le germe n'est rien, c'est le terrain qui est tout"* (Bernard was right. The germ is nothing, the soil is everything). While Pasteur may have gone a little too far in his assessment of his work at the moment of his death—certainly the germ is not "nothing"—he may have been reacting to the out-of-balance and simplistic medicine he helped to create.

While some infectious agents, such as measles, cause symptoms in nearly everyone exposed, this is the exception rather than the rule. In most cases exposure to an infectious agent is not sufficient to cause disease. Why does one person who is exposed become ill, while another remains symptom-free? The difference lies in the "resistance of the host." Previous exposure to the infectious agent either naturally or through immunization can stimulate immunity. Immunity also can be influenced by genetic constitution and nutritional factors. But now there is evidence that brain processes can influence immunity to infectious diseases.

Consider tuberculosis. Presence of the tubercle bacillus is necessary but not sufficient to explain the onset or course of the disease; many people who are exposed to this pathogenic agent do not become infected. And of those infected, only 5 to 15 percent become clinically ill. As early as 1919 researchers studying tuberculosis observed a decrease in the activity of white blood cells in patients during emotional excitement. Many had severe life crises in the one to two years preceding the onset or relapse of the disease.

It was even then hypothesized that the "stress of contemporary life" could impair immunological function, thus increasing susceptibility to tuberculosis. But these observations were not followed up until the 1970s when technical advances made brain-immune connections feasible to study scientifically.

At the time, there was great hope that cures such as those found for syphilis would be found for everything. So the "magic bullet" approach to disease has ignored psychological and social

factors in the development, course, and resolution of diseases. The focus on pathology of most medical scientists (we almost wrote "pathological focus") has made scant the development of knowledge of how to bolster the body and how to strengthen the resistance to disease. Ironically, scientists in agriculture and animal husbandry have given more effort to producing environmental and nutritional milieus that foster disease resistance. In this sense, our livestock have better health care than we do.

With the reduction in mortality from acute infectious disease in most parts of the developed world, the kinds of illnesses we now suffer are different: As tuberculosis replaced sweating sickness and other diseases, now chronic degenerative diseases like heart disease, stroke, cancer, arthritis, cirrhosis, chronic lung disease, and mental illness predominate. These multifactorial diseases are not suitable to the methods of trying to isolate a single cause. As Henry Dixon points out, "The dazzling achievements of specific etiology have now been followed by a situation where all of our major health problems—most obviously cardiovascular disease, cancers, and much mental illness—represent areas where the theory has failed." We need to consider multiple causes and reopen consideration of psychological and social forces as determinants of disease.

This book is an attempt to look ahead, to look beyond the evidence we now possess, an attempt to redirect our ideas of what the brain is for, and how we might improve health. As with any such attempt, there are holes and gaps in the current evidence, but the overall shape of the argument is, we think, becoming clear. It is our belief that there is a new understanding arising in the health, psychological, and brain sciences: To understand health is to understand the central role of the brain in maintaining the resistance of the body.

The general disregard of social and mental factors in health mirrors the attitude in the 1800s when surgeons ridiculed the concept of antisepsis and the germ theory of disease. The surgeons persisted in operating in unclean surroundings, sometimes defiantly sharpening their scalpels on the soles of their shoes to show their contempt for the putative power of invisible germs. Similarly, the current ignorance and insensitivity to the "invisible" symbolic messages in human interactions, including those between doctor and patient, limits the effectiveness of contemporary medicine.

In some ways the shift from an emphasis on sickness to

an emphasis on health has just begun, although the initial understanding is oversimplified. In popular medical columns, in popular magazines, the message is disseminated that something called "life-style" is the culprit. The "new germs" of today are bad habits such as smoking, risk factors such as broad changes in "life events," and the extreme psychological reactions to environmental disruptions such as job loss or divorce. These are now viewed as the modern external agents that attack us and produce modern "disorders" like "stress."

Yet even these "bad actions" and potential stressors are not sufficient to explain who gets sick and who stays healthy. Heart disease is the leading cause of death and sickness in the developed countries. Through years of research several key "risk factors"have been discovered. These factors (which may be behavioral or biological) increase the probability of developing coronary heart disease: Cigarette smoking, elevated serum cholesterol, and elevated blood pressure are the most important. The evidence seems strong and compelling. People who have one of these risk factors have twice the likelihood of developing coronary heart disease; those with two factors are 3.5 times as likely, and those with all three risk factors have nearly 6.0 times greater probability of developing heart disease.

But the obvious conclusion is misleading: *Knowing whether a person smokes, has high blood pressure, or elevated cholesterol does very little to predict who will have a heart attack.* A comprehensive look at the evidence suggests something different. Combining the data from the six major heart disease projects shows that of the seventy-three hundred men in the studies, six hundred had high values for all three of the risk factors. Yet of this group of six hundred high-risk men, only eighty-two suffered a heart attack during the ten years of follow-up study. So *86 percent of those who had the very highest risk for heart attacks did not have a heart attack over the ten years of study.*

Further, of the twenty-two hundred men with two of the risk factors, 91 percent suffered no heart attack. Conversely, the vast majority of people who did have a heart attack did not have all of the major risk factors. This is not to suggest that smoking, elevated cholesterol, or high blood pressure are not important, but only that they do surprisingly little to predict who stays healthy and who becomes ill. Attention is again misdirected to a few dramatic factors, as it was in the consideration of tuberculosis.

So it is not only germs that attack and that can be killed by a

"magic bullet," and it is not only those horrible lurking stressors and risk factors that kill. We and medicine should turn around the questions of health and disease and focus not upon those few fortunate people who are relieved of their illnesses by medical means, but to consider those, far greater in numbers, who do not become ill or who in the face of disease move towards health.

It is important to get away from an idea that one is either sick or not, healthy or not, and to look instead at the person as a balancing act of these forces, sometimes stable, sometimes not; sometimes not sick, but with perhaps 20 percent of a flu, sometimes with a full outbreak, sometimes with pain, sometimes not. The person changes, grows up, grows old, is in contact with more or fewer germs, is happy or depressed, is married or divorced, enraged or calm. And the germs evolve as well.

The maintenance of health is a remarkable balancing act. In this book we will try to look at the center of this balancing act, the brain, and consider why seemingly unrelated factors like the strength of one's social relationships increase the strength of one's resistance to disease. This is not a new approach: "It is much more important to know what sort of patient has the disease than what sort of disease the patient has," wrote Sir William Osler around the turn of the century. But it is an approach for which there is now a new convergence of evidence: from studies on the role of medicine; from research on brain chemistry; from the discovery of missing links between the immune and cardiovascular systems and mental states; from an understanding that the brain is more like a collection of messy and wet glands than it is like a cool computer; and from a renewed appreciation that the human organism is not a mindless machine.