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JUDITH HORSTMAN

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The Neuroscience of Making the Most of Your Mature Mind

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CONTENTS

To all who went there before us,
and showed us the way
to age well

ACKNOWLEDGMENTS

A bit more than four years ago, I received an e-mail from Alan Rinzler, an eminent editor I knew by reputation but had never met, asking if I'd be interested in writing a book in collaboration with *Scientific American* about a day in the life of your brain. That was the beginning of what would turn out to be a challenging series of four brain books in four years. He edited three and set the tone for this one before retiring from Jossey-Bass last year. Thank you, Alan. And here's to all of those at Jossey-Bass and John Wiley & Sons who made these books possible, most of whom have worked with me on all four books: Paul Foster, who started it all with an idea about a day in the life of your brain; my editors, Nana Twumasi and Marjorie McAneny, who proffered calming support as well as edits; Carol Hartland, the production genius who pulled it all together; Bev Miller, an extraordinarily insightful copyeditor; Paula Goldstein, the terrific book designer; and the marketing crew who put my books in your hands, including Jennifer Wenzel, Samantha Rubenstein, and Jeff Puda.

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PREFACE: LIVE LONG, AND LIVE WELL

Most of us would agree we are happier being older. As they say, it's better than the alternative. If only we didn't have to endure all the physical issues that go along with aging.

The aversion to aging has created a multibillion-dollar-a-year anti-aging industry (estimated to be $291 billion by 2015), supported by those who believe they can turn back the clock on body and mind. Alas, it's just not so. We age at different rates, and some of us may look, feel, and act younger than our age—and, yes, some healthy choices may actually keep us younger in mind and body.

But there is no such thing as anti-aging, and aging is not a disease: it's what happens if you are lucky enough to live long enough.

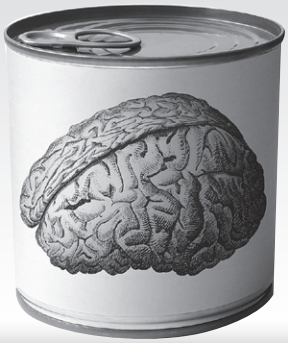
So here's a spoiler alert about this book. It is not about anti-aging. It's about how and why your brain grows older; the normal changes to expect in a healthy aging brain; some conditions and diseases that may challenge you and your brain, including Alzheimer's disease and other dementias; and what neuroscience is showing you can do to optimize healthy aging.

For if you can't thwart aging, there is plenty you can do to age well. Research shows, for openers, that your brain most likely will not deteriorate rapidly with age but rather will recede more subtly. Alzheimer's disease is terrible and affects millions, but it is not

inevitable. Indeed, some healthful and commonsense practices are connected with lower risks of dementia.

For most of us, older is indeed happier, and researchers are finding that happiness may be its own reward: living an active, optimistic life with many friends and lots of leisure-time activities increases not only the quality of your life but the longevity of you and your brain.

The SCIENTIFIC AMERICAN HEALTHY AGING BRAIN



INTRODUCTION

Welcome to the New Old Age

In all of history, there has never been a better time to grow old.

First, we *can* grow old. At the start of the twentieth century, the average life span was 47. Today the global average is 68, and for those born today in Western developed countries, it's around 80, nearly double in little more than a century.

The longer you live, the longer you may live. Consider this: for a 65-year-old woman today, the average—average!—life span is 84.8, or 19.8 more years. And at age 75, that jumps to 87.6 years. A man who is 75 years old today can expect to live to 85.5. If you're taking care of yourself, there could easily be more years.

Second, thanks to modern medicine and technologies, we don't look or act as old as our ancestors did. Those of us past the midcentury mark who can recall our grandparents know that with the outstanding

exception, they were not usually participating in an active lifestyle. If they were still alive by their 70s, often they were sedentary, ill, or failing.

True, the absolute life span has not increased, with 122 being the oldest age recorded. But more of us are living longer than at any time in the past, and living better.

What's Old, Anyway?

Today in developed countries, it seems to be accepted that young old age begins in the late 60s and that old old age comes after the age of 80.

The answer depends, of course, on who you ask. There's a remarkable generation gap when it comes to determining when old age begins according to a 2009 national survey, Growing Old in America, by the Pew Research Center. Among the nearly three thousand surveyed, those between ages 18 and 29 said they believed that the average person becomes old at age 60, middle-aged respondents put it closer to 70, and those ages 65 and above say that old begins at age 74. The researchers' conclusion after massaging the data: old age begins at 68.

But that doesn't mean you're old at 68—at least in your own mind. Other questions revealed that while young people in the survey felt their chronological age or older, oldsters don't: only 21 percent between ages 65 and 74 and 35 percent over age 75 said they feel old. In fact, a third of those aged 65 to 74 said they feel ten to nineteen years *younger* than their age, and one in six said they feel at least twenty years younger than their actual age.

There's evidence to back that up. Today's 60 and 70 year olds are to a large extent out in the workforce: 16 percent of us are still on the job (and 55 percent of those full time) because we want to be or perhaps because economics demand it. At the age that our grandparents were getting dentures and new rocking chairs (if they didn't

already), we're getting braces on our teeth and investing in gym memberships, starting new businesses, trekking in Nepal, running silver marathons—and having sex: even those in their 80s report they are sexually active. And the bar has been rising. Increasingly "old old age" refers to those who have reached one hundred and up. Centenarians, in fact, are the fastest-growing demographic group in the world.

Our bodies do need more maintenance, but the specter we face and most fear is not the onslaught of bodily infirmities or even an untimely death. For most of us, it's the fear we will outlive our brain's useful life. What good are twenty extra years if our brains and minds are not able to enjoy them? If we become a burden on those we love or live out those years in institutional care?

Fortunately there's some good news about the continued health of the mature and aging brain and about how to increase your potential for an active and alert elder mind. It's going to take some work and perhaps self-discipline, two items some retirees tend to think they shed along with their jobs.

Research is showing that dementia, depression, and delusions are not normal parts of aging. Rather, they are diseases that in some cases can be averted or treated. Yes, your aging brain will slow and lose some of its edge, but it will still be able to serve you quite well. The elder brain remains plastic—able to learn new things and create new networks and memories. And the older brain is the happier brain: less prone to react in anger, more likely to recall pleasant memories than the negative past.

Indeed, there's much to enjoy in those final decades, especially if you put some effort into a healthy lifestyle, diet, and attitude.

How Scientists Are Researching Your Brain

Every day scientists are finding out more about your aging brain. This book is chock full of information from some of those research

TOOLS FOR LOOKING INSIDE YOUR BRAIN

Today's array of sophisticated technologies has come a long way since the X-ray was discovered in 1895. Here's what that alphabet soup of acronyms means:

EEG (electroencephalograph). This direct reading of the brain's electrical activity, taken from multiple electrodes placed on the scalp, is displayed as squiggly lines on a chart. It has been in use since the 1920s and is relatively inexpensive and effective. But it can't detect activity deep inside the brain very well or produce an image

CAT (computed axial tomography); also CT (computed tomography). Special X-ray equipment and computers create cross-sectional pictures of the body at different angles (*tomography* means imaging by sections). It has been used since the 1970s and has the advantage over X-rays of being able to show body sections behind other parts and in much more detail.

PET (positron emission tomography). A small amount of radioactive material is given and then detected by special cameras in images that allow researchers to observe and measure activity in different parts of the brain by monitoring blood flow and other substances such as oxygen and glucose.

MRI (magnetic resonance imaging). Magnetic fields generate a computer image of internal structures in the body. This technique is particularly good for imaging the brain and soft tissues.

fMRI (functional magnetic resonance imaging). Today's favorite, it has contributed much to our understanding. The fMRI can measure blood flow and other activity in a living, thinking brain in action and in real time, showing abnormalities, mapping functions and anatomy, and showing activity in your brain as it is happening.

MEG (magnetoencephalography). This measures the magnetic fields created by electric current flowing within neurons and detects brain activity associated with various functions in real time.

SPECT (single photon emission computed tomography). Similar to PET, it uses a small amount of radioactive tracer to measure and monitor blood flow in the brain and produce a three-dimensional image.

DTI (diffusion tensor imaging). This new technology measures the flow of water molecules along the white matter, or myelin, that makes up nearly half of your brain and connects many regions. We're just learning the importance of myelin, and this technology is not yet easily interpreted.

A word of caution: Although it is tantalizing to draw conclusions from new technologies in brain imaging, announcements about how the sources of some emotions and functions have been "mapped" in the brain need to be interpreted with care: brain-imaging technology is still very new and relatively crude, and we need to be careful about deducing cause and effect from what is now still mostly correlating observations. Although brain scans can indeed show what parts of your brain become active at certain times, scientists say they don't yet know exactly what that activity means, or even if they are seeing all the action going on. Brain researchers are still trying to figure out much of what goes on between your ears.

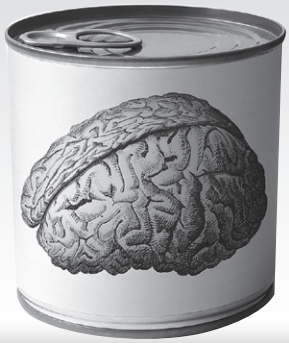
studies. To get all of this information, scientists use several research tools:

- *They ask you: Interviews.* Surveys and questionnaires tell us what people say they think and feel. Since the information is self-reported, it may not be completely objective. For example, recent studies where some elderly men said they have intercourse every week may not be true—but it shows these men are still thinking about sex in old age.
- *They watch you: Observation.* Watching animals and people as they react to situations, stimuli, or cognitive tests hints at what is going on in the brain and helps to connect the actions with the amount and location of brain activity.

- *They sample your tissue and fluids: Laboratory tests.* Humans and other mammals produce specific neurochemicals and hormones related to actions and emotions. Measuring these chemicals gives insights into what people are thinking and feeling, as well as what their brains are doing. For example, scientists have found that high levels of stress release chemicals that can age your brain.
- *They wire you up: Electroencephalography.* An older technique, it is still useful to record your brain's electrical activity from outside your skull.
- *They look inside your brain: Brain scans.* A host of imaging techniques and tools shows which parts of your brain are active when you are feeling or performing an activity and can show brain damage. But they have limits.

PART ONE

How Your Brain Grows



CHAPTER ONE

The Well-Aged Brain

Older and Happier

Growing older is a limiting of possibilities. At age 20, that's a depressing prospect. By age 60 or so, it's a relief. By 70 and beyond, it may be one of the reasons older folks are happier.

Yes, that's right: emotional well-being actually improves with age, according to studies from many different countries and cultures. Starting sometime after 60, folks tend to be happier, worry less, and have less stress. Wide-scale studies confirm it (and no, it's not a result of the forgetfulness of dementia).

Furthermore, research on creative accomplishments indicates that in some disciplines, such as the arts, history, and fiction writing, many people produce their best work in their 50s or even decades later. Philosophy, leadership, and politics are other areas in which the older person flourishes—hence, the term *elder statesman.*

The Myth of a Sad Old Age

Think of someone who is depressed, cantankerous, lonely, sexually inactive, and forgetful. Did an elderly person come to mind?

The answer, it turns out, depends on your age. Not surprisingly, a research team that surveyed adults at various ages found young adults (between ages 21 and 40) predicted that people would become less happy as they got older. In one survey, 65 percent of psychology students agreed that "most older people are lonely and isolated," and in another survey, 64 percent of medical students agreed that "major

THE MAJOR MYTHS OF AGING

There's plenty of misinformation about old age, much of it dating back to when those in their 70s and 80s were considered ancient. But quite a bit of the erroneous mythology about aging comes from media portrayals of elders. Here are a few of the myths about your brain growing older:

We Used to Think . . .	. . . But Now We Know
Older people are unhappy.	Studies show people are actually happier in their 70s than at midlife.
Depression is part of growing old.	The depression rate among healthy elders is under 5 percent—less than half the U.S. average rate of 11.26 percent (but it does increase with disability).
Retirement is terrific.	Actually, early retirement may increase the risk of death by 51 percent, and adding five years to the retirement date may lower it by 10 percent.
It's too late to improve my mind or quit bad habits.	Studies show mild cognitive impairment may be halted and perhaps reversed with exercise and other healthy activities.

depression is more prevalent among the elderly than among younger persons."

Shows how much these whippersnappers know. The truth is actually just about the opposite. Population-based surveys reveal that rates of depression are highest in those between the ages of 25 and 45, and about half as high for independently living elders.

And they are happier too. In recent studies, adults older than age 60 were actually happier than the younger respondents, and happiness continued to increase with aging. The happiest group overall is men aged 65 and older.

We Used to Think . . .	. . . But Now We Know
You can't teach an old dog new tricks.	The elder mind works differently than it did when it was younger, but it can still learn. In fact, it needs to learn new things to stay alert.
Seniors' brains are slower, and they make poor employees.	Slower perhaps—but more accurate and with better social and judgment skills than many younger workers.
Older people feel old.	A national survey shows 60 percent of those over age 65 feel ten to nineteen years younger than their chronological age.
Older people often regret their lives.	Only 1 percent of those over age 86 say their lives turned out worse than they expected.
When memory issues start, they rapidly progress to dementia.	Studies show that mild cognitive impairment doesn't always progress to dementia.
Alzheimer's disease is inevitable.	Not everyone gets dementia, and a 2011 report suggests that lifestyle changes may cut risks for some of us, perhaps as much as by half.