CONTENTS

Also by Sherwin B. Nuland

Copyright

TO MANNY PAPPER
wisdom, equanimity, caritas

Father Time is not always a hard parent, and, though he tarries for none of his children, often lays his hand lightly upon those who have used him well.

—Charles Dickens, *Barnaby Rudge*, 1841

ONE

AN INCIDENT IN THE SUBWAY

About five years ago, I had a brief experience that since then has helped me to tell the difference between nurturing a sense of vibrant good health and nurturing the delusion of being still young. Put somewhat differently, I learned that a man of advanced years who has never felt himself hemmed in by chronology should nevertheless not allow himself to forget his chronology entirely.

The event took place late on a September afternoon when I, along with my wife and younger daughter, had just entered a New York subway car at the Times Square station. Pushed forward by the advancing throng of rush hour passengers, we were crammed together single file, with nineteen-year-old Molly in the middle and me packed in behind her. Between my back and the doors stood someone whom my peripheral vision had recognized only as a tall, broad-shouldered man, perhaps in his late thirties. No sooner had the train gotten under way than the fellow's bare right arm reached around past me, its hand extending forward in an obvious attempt to make contact with Molly's buttocks. As taken aback as I was by the man's brazenness, I did have the presence of mind to do what any father might: I pressed my body rearward just firmly enough to push him up against the car's door, putting Molly beyond the reach of his outstretched fingers. As though by some form of unspoken New York agreement, both he and I acted as though nothing had happened, and the train continued on its clattering way over the subterranean tracks.

But I was wrong to think that the episode was over. Scarcely half a minute had passed before I became aware of a barely perceptible creeping thing, surreptitiously entering the right-hand pocket of my khaki trousers. Any thought that imagination was playing tricks on me was dispelled a moment later when I was able to feel an unmistakable sensation through the fabric, of fingertips moving around inside the empty pocket.

In the flashing eyeblink of time that followed, it never occurred to me that I should consider the consequences of what I instantaneously decided must be done. In fact, "decided" is hardly the word—my next actions were virtually automatic. I plunged my hand into the pocket, transversely surrounded the bony knuckles of a palm wider than my own, and squeezed down with every bit of force I could muster. Aware that I was gritting my teeth with the effort, I did not let go until I felt more than heard the sickening sensation of bone grating on bone and then something giving way under the straining pressure of my encircling fingers. A baritone roar of pain brought me back to my seventy-one-year-old self, and made me realize that I had gone too far.

What had I let myself in for? Would not the simple act of removing the intruding extremity have sufficed? Or perhaps I should have done nothing—the pocket was, after all, as empty as it always is when I anticipate being in a crowded, chancy place. Made overconfident by hundreds of hours spent pumping iron in a local gym, I had succumbed to an unthinking impulse dictating that I crush the felonious hand. As the first flush of instinct faded, I all at once became certain that my victim's revenge would now swiftly follow. Alarmed by that thought, I relaxed my grip and felt the mauled appendage whip out of my pocket.

But who could have predicted that the response would take the form that it did? With his torso still pressed up between my back and the train's doors, my antagonist inexplicably shouted out a garbled accusation for all to hear, about my having "...TRIED TO STEAL MY BAG!" Being certain that I had misheard and anticipating a powerful assault, I awkwardly turned my body around in those compressed quarters, in order to confront the expected assault as effectively as my acute attack of nervous remorse might allow. Having managed that, I found myself looking up into the anguished but nevertheless infuriated face of a thuggish-looking unshaven tough three inches taller than I, and quite a bit broader. I noted with some relief that the injured right hand hung limply alongside his thick-chested body. Tucked up into his left armpit was a bulging deep-green plastic portfolio, its top barely held closed by a tightly stretched zipper. This, no doubt, was the pouch in which was held the loot of a day's pocket pilfering.

Seeing the flaccid, useless hand dangling from the muscular but now inactivated forearm momentarily revived my unthinking and foolhardy courage.

Looking directly into the bloodshot eyes glowering at me (and now able to smell liquor on the thick breath blowing down into my face), I roared back as though I were Samson, "YOU HAD YOUR HAND IN MY POCKET!" Something stopped me before I added "you son of a bitch," which was a lucky thing because as soon as the first words were out of my mouth, I regretted them. Fearful once more, I prepared for the violent response that would surely follow.

But the fates were with me: Just at that moment, the train pulled into the next station and my foeman charged out through the doors as they slid open, clumping off toward an exit staircase as fast as he could, until his forward motion was slowed by a bunched-up throng of passengers tumbling out of the next car. He was swallowed up among them until only the top of his bobbing head could be seen. In a moment he was gone, leaving me standing there—thinking of how close I had come to my own annihilation.

I turned toward Molly and my wife, who later told me that my face was pale and bloodless. I felt as though rescued from certain death by a last-second reprieve. My hands were shaking and my knees seemed just a bit uncertain about whether they intended to continue holding me up. It was several minutes and another station's traveling before they steadied themselves. But everything finally stabilized and I was then faced with the embarrassment of having to withstand the two women's justifiably withering comments about how foolish I had been. During the short period of Sturm und Drang, they later told me, not a single person in that overcrowded subway car had so much as glanced in my direction or otherwise acknowledged that anything unusual was taking place.

I present this story as an example of a conflict within myself, a conflict that I suspect exists in the minds of many men and women beyond the age of perhaps their middle fifties. On the one hand, we recognize that age is ever increasing its effects on us and now requires not only acceptance but a gradually changing way of thinking about ourselves and the years to come; on the other, some narcissistic genie within us cannot give up clinging to bits of the fantasy that we can still call on vast wellsprings of that selfsame undiminished youth to whose ebbing our better selves are trying to become reconciled.

The same formula that enhances our later years—continued mental stimulation,

strenuous physical exercise, and unlessened engagement in life's challenges and rewards—sometimes fosters an unrealistic confidence that the vitality thus maintained means that we are virtually the same as we were decades earlier, even in appearance, ready to challenge youth in its own arenas. In outbursts of denial and bad judgment that are virtually instinctual, we at such times discard an equanimity that has taken years to develop, and indulge ourselves in behavior foolhardy and foolish, as though using it as an amulet to stave off the very process to which we have so successfully been accommodating by consciously sustaining our bodies and minds.

The tension between the two is very likely stronger in the case of men, but nonetheless common in women as well, though manifesting itself in somewhat different forms. This rivalry within ourselves reflects a rivalry with youth, and it serves neither youth nor age at all well. Self-images from an earlier time are not easy to give up, even when giving them up is in our own best interest. Those whose calling is to work with an older population know that the ability to adapt, to learn and then accept one's limitations, is a determinant of what the professional literature of geriatrics calls "successful aging."

Adapting is not mere reconciling. Adapting brings with it the opportunity for far greater benisons and for brightening the later decades with a light not yet visible to the young. Even the word itself is insufficiently specific to convey what is required. In the subtle but nevertheless enormously significant shades of meaning that characterize the English language, "attune" may, in fact, better describe the process than "adapt": "attune," in the sense of being newly receptive to signals welcome and unwelcome, and to a variety of experiences not previously within range, while achieving a kind of harmony with the real circumstances of our lives.

This book is about attuning to the passage of years, and finding a new receptiveness to the possibilities that may present themselves in times yet to come—possibilities conveyed in wavelengths perceptible only to those no longer young.

And the book is also about traps for the unwary, into which all of us fall from time to time and from which we must teach ourselves to emerge with a refreshed sense of purpose. The very word—"attune"—sounds like another word to which it has a not coincidental connection: "atone," originally a contraction of "at one,"

meaning "to be in harmony," most cogently with oneself. To become attuned to an evolving perspective on a life is to be at one with the reality of the present and of the future years. Achieving such attunement can bring a form of serenity previously unknown, and perhaps unsuspected. The process begins with an acknowledgment that the evening of life is approaching. But with that approach come foreseeable possibilities. We have only to take advantage of all that those coming decades have in their power to offer. It is incumbent on each of us to cultivate his or her own wisdom.

So gradual a progression is the onset of our aging that we one day find it to be fully upon us. In its own unhurried way, age soundlessly and with persistence treads ever closer behind us on slippered feet, catches up, and finally blends itself into us—all while we are still denying its nearness. It enters at last into the depths of one's being, not only to occupy them but to become their very essence. In time, we not only acknowledge aging's presence within us, but come to know it as well as we knew—and still covet—the exuberant youth that once dwelt there. And then, finally, we try to reconcile ourselves to the inescapable certainty that we are now included among the elderly.

Realizing how much of our dreams we must concede to that unalterable truth, we should not only watch our horizons come closer but allow them to do precisely that. If we are wise, we draw them in until their limits can be seen; we confine them to the possible. And so, the coming closer can be good, if by means of that closeness—that limiting of expectations—we begin to see those vistas more clearly, more realistically, and as more finite than ever before. For aging can be the gift that establishes the boundaries of our lives, which previously knew far fewer confines and brooked far fewer restrictions.

Everything within those boundaries becomes thus more precious than it was before: love, learning, family, work, health, and even the lessened time itself. We cherish them more, as the urgency increases to use them well. Many are the uses of the newly recognized limits. Among their advantages is that our welcoming acceptance of them adds to the value, adds to our appreciation, adds to our ability to savor—adds to every pleasure that falls within them. The good is easier now to see; it is closer to the touch and the taking, if we are only willing to look truthfully at it there and gather it up from amid the cares that may surround it. There is

much to savor during this time, magnified and given more meaning and intensity by the very finitude within which it is granted to us.

Aging has the power to concentrate not only our minds but our energies, too, because it tells us that all is no longer possible, and the richness must be more fully extracted from the lessened but nevertheless still-abundant store that remains. From here on, we must play only to our strengths. Some of the more meaningful of those strengths may be not at all less than they once were. The later decades of a life become the time for our capabilities to find an unscattered focus, and in this way increase the force of their concentrated worth.

Even as age licks our joints and lessens our acuities, it brings with it the promise that there can in fact be something more, something good, if we are but willing to reach out and take hold of it. It is in the willingness and the will that the secret lies, not the secret to lengthening a life but to rewarding it for having been well used. For aging is an art. The years between its first intimations and the time of the ultimate letting go of all earthly things can—if the readiness and resolve are there—be the real harvest of our lives.

It is the purpose of this book to tell of human aging and its rewards—and also of its discontents. And the book has as its purpose as well to tell of how best to prepare for the changes that inevitably demand accommodation, demand a shift in focus, and demand a realistic assessment of goals and directions, which may be new or may be a rearrangement of the trajectory of a lifetime. We do this at every stage of life without noticing the new pattern to which we are becoming attuned, whether it be in adolescence, the twenties, or middle age. Though the changes may be more obvious as we approach our sixties and seventies, they are, in fact, only a continuation of everything that has come before. For becoming what is known as elderly is simply entering another developmental phase of life. Like all others, it has its bodily changes, its deep concerns, and its good reasons for hope and optimism. In other words, it has its gains and it has its losses. The key word here is "developmental." Unlike most other animals, the human species lives long beyond its reproductive years, and continues to develop during its entire time of existence. We know this to be true of our middle age, a period of life that we consider a gift. We should recognize and also consider as a gift that we continue to develop in those decades that follow middle age. Living longer allows us to continue the process of our development.

Each of us concedes the onset of aging at our own moment; every man and woman acknowledges its beginnings and, finally, its fullness at a different time and for different reasons. As distinctive individuals, we experience it through our own bodies and the events of our own journeys. At fifty-two, Robert Browning already knew enough of such things to understand that their process was the accompaniment of their recompense. Aware that he had already exceeded the life expectancy of his era but not knowing that he would be granted twenty-seven remaining years in which to follow his own counsel, he famously had Rabbi Ben Ezra tell his congregation to:

> *Grow old along with me!*
> *The best is yet to be,*
> *The last of life, for which the first was made:*

And advised them that age is the time to:

> *...take and use thy work:*
> *Amend what flaws may lurk,*

But perhaps most important of all:

> *Look not thou down but up!*

It would hardly be realistic to paint the process of aging with a brush that Pollyanna or Pangloss might have used. The benisons of advancing age come with its burdens, and in some ways are the result of them. The one cannot exist in the absence of the other, and we should not hesitate to acknowledge the losses that accompany the gains. Nothing is accomplished by soft-pedaling the physical and emotional realities of aging. Were I to close my own and the reader's mind to all that is there, I would be unable to accomplish my aim, which is to tell of how to prepare for and face those realities, not only with equanimity but with the means

to impede or lessen the most baleful effects of aging's onslaught—and, in fact, to use these losses when using them is a means to accomplishing the goals we may set for ourselves.

I have spent a career of almost forty years in a branch of surgery in which by far the greatest and most frequent challenges occur in treating men and women in late middle age and beyond. Their response to physical, emotional, and spiritual crises has been the stuff of my daily observations, and I have come to know both the frailty and the strength, the vulnerability and the resilience, that is theirs. They have been my patients, my friends, and my teachers, even when I was a young physician. Most recently, they have been me. In writing this book, I hope to return some of the gifts of knowledge and understanding that these men and women have given me over many years, and to share with others what I have learned. In all of this, my theme is Browning's "Grow old along with me!"—exclamation mark and all—for I am taking the journey even while I describe it, and I intend that my readers and I will continue to look up, while never forgetting to look down now and then.

But why look down? After all, the poet admonishes us against it, and dozens of self-help volumes tell us of the glories of that perpetual image of youth that can be ours if we but follow some simple directions. But all manner of promissory notes on an anti-aging future tend to ignore the obvious fact that, optimism or no optimism, steps are most sure when watchfully taken. We must see where our feet are truly placed and where they can still take us; we must not only gaze upward at the beckoning promise of retained intellectual and physical vigor, but we must be sensible and cautious, with a realization: What the unextinguished youthful spirit wills or imagines is not always what the aging flesh allows. The admonition "Act your age" has been applied to every stage of life, but it is in the older decades that it takes on a meaning beyond the mere avoidance of making a fool of oneself. These are lessons we must learn as the years pass. Prudent reality is a secret of vibrant survival, to temper the whiff of yesterday that sometimes urges us toward yearnings for what is beyond the possible. We must teach ourselves to recognize residual instinct that was useful at an earlier time of life, and rein it in with the bridle of good sense. The aim is to tell the difference between fact and fantasy; the aim is to guide oneself toward fulfillment of the reasonable.

There is a tyranny in decades; life should not be measured in ten-year packages.

Moving on from one to the next is fraught with artificial implications. Whether the number of the supposed turning point is thirty or seventy, it comes with the expectation that we will thereafter be different from how we were before—that we are all at once somehow altered. We treat those seemingly defining moments in what is actually a process of imperceptible transition as though they bear a significance they do not in fact have—as though they are catalysts for an abrupt physical and mental transformation, when they are in reality no such thing. The truth is that the day of transition from one ten-year interval to another is merely a milestone, but we use it instead as a signal that somehow something has changed, or should change. A new set of expectations is inflicted on us—and we inflict it on ourselves—as we leave one cohort and enter another.

Our bodies, for example, do not know the difference. From the viewpoint of their biology, the final morning of fifty-nine is very much like the first morning of sixty. And yet, our minds have already set themselves to a new rhythm. We think we are older. That this calendar-driven self-image is an artifice of culture is not permitted to have bearing on how we perceive ourselves. We give in to this self-image without thinking, as though the jolting acceleration into a new pattern is an inevitability.

What would life be like if we somehow had no way to mark the passage of years? How old would any of us think we were if we had no idea how old we were? We could not act our age if we did not know our age. We could not categorize ourselves into packaged groups of packaged interests and packaged capabilities. We would be much more what we really are: individuals of infinite variation at any age. The lockstep would end.

I am not arguing here for ignoring the passage of time. Nor am I suggesting an insensitivity to internal and surrounding reality. I am merely stating simple biological truth: We live in the biochemistry of our bodies, and not in years; we live in the interaction between that biochemistry and its greatest product—the human mind—and not in a series of decades marked by periodic lurches of change. Each of us exists therefore in a physical, mental, spiritual, and social individuality molded by everything that has come before and that is now brought to this moment of our lives. Each of us is the product of a cavalcade of living, whose sum is in every encounter in which we partake. Each of us is his or her own cohort. No number can define us as middle-aged, or elderly, or the oldest old. We can be

defined only by what we have become. Whatever else aging may represent to us, it is first and foremost a state of mind.

And yet all of this is accompanied by that caveat, which needs reiteration here: Age does sometimes forget its own limitations, and inappropriately tries to be youth. Moments of sudden stress are known to encourage such behavior. Refusing to be hemmed in by a number does not mean the number is entirely without significance. Danger can lie in such unguarded spontaneity. Again, think of me, and the incident in the subway.

Many are the reasons for which we try to keep our bodies and minds at their optimal levels of functioning. Among the themes of the forthcoming chapters is the message that the ancient admonition of the Roman satirist Juvenal applies to all of us, no less at eighty than at eight, which becomes more meaningful with each passing year beyond forty. *Mens sana in corpore sano,* Juvenal advised, or as John Locke would put it a millennium and a half later in a treatise on the education of the young, "A sound mind in a sound body." But a foolish misapprehension of what is possible must not be allowed to lead one into error.

The danger of forgetting what should be expected of oneself is magnified when reserves have not been maintained, reserves that can respond to the unanticipated demands of everyday life. Though the full vigor of an earlier time is long gone, inner resources may burst forth when an older person has maintained a degree of fitness and self-confidence. We do not necessarily have to conform to society's traditional notion of what a man or woman should become when the middle years have been overtaken by the years associated in the minds of many with the downward arc of life's trajectory. I have several times been grateful that I have not been among the conformists, though a few episodes, like the one just described, have occurred because I have overreached, and forgotten to look down.

And so I am offering here what may seem to be a confusing mix of caution and advice: caution about the error of not looking down, and advice about one of the most crucial reasons for maintaining the physical and mental fitness that remains possible as we become older, namely, the possibility of having to call on powers whose use is rarely if ever necessary—whether in a situation of acute danger or in the case of illness. I do not mean to introduce or reveal ambivalence about the relative importance of looking up and looking down—both are equally important. Instead, what I do mean to introduce is the necessity to recognize that as we age,

like at any other time of life, we must learn to live with contradictions—and not only contradictions, but uncertainties. The roadway is hardly clear as we attempt to find our way between retaining vigor and a realistic accommodation to its loss, any more than it has ever been clear in any previous era of our lives. That roadway is paved with uncertainty, and in this, too, each of us must find his or her own way, as we always have.

We elders maneuver through uncertainty by paying attention to our minds and bodies more carefully than ever in the past; we must make ourselves keen observers of their needs and their abilities. And in this, the developmental phase that we call aging is indeed different from those that preceded it. We are no longer at a stage where things will care for themselves; nothing can now be taken for granted. We have arrived at a time and place in our lives where we must study ourselves as we have never done before, take care of ourselves, and be attuned to ourselves in ways that are new to us and sometimes burdensome. This requires attention, reflection, and action, not only in regard to ourselves but in regard to the world around us as well. In these ways, we older men and women must all become philosophers.

TWO

HOW WE AGE: BODY AND MIND

So accustomed have we become to the portrait of infirmity associated with nursing homes that many of us imagine it to be the norm, and a grim likeness of the waiting future: exhaustion to the point of listlessness, asthenia to the point of sickness, senility to the point of dementia. Visiting those grim holding pens for death, we have become familiar with their sights, sounds, and smells of incontinence, both physical and mental. These are the invariable colors in which life's final slow decline are commonly painted.

At the same time, each of us prefers to believe that he or she will somehow escape the catalogue of decrepitudes. No matter how close to our lives have been the acquaintances or relatives—including, sometimes, our own parents—who have succumbed to these decrepitudes' seeming inevitabilities, we cherish the conviction that we can avoid them, not only on account of some magical personal immunity, but also because times are changing so rapidly that such scenes of decline are fast fading from view. We tell ourselves that modern-day medical therapies and increasing knowledge of prevention are markedly lessening the likelihood that we will end our days in a way that Shakespeare's Jaques in *As You Like It* described as:

> *...second childishness and mere oblivion,*
> *Sans teeth, sans eyes, sans taste, sans everything.*

But despite reassurances, the specter of dotage does have a way of returning now and then to haunt our darker hours. Even the optimists seem at least occasionally beset by imaginings of themselves tottering unsteadily and oh so

slowly toward the grave, finding their grim way by a flickering light barely recognizable as life. Alzheimer's, Parkinson's disease, strokes, cardiac crippling, and a generality of similar dwindlings—such are the fears that arise in the minds of those who allow themselves to ruminate on the possibility of end-stage affliction. We encounter the victims of these scourges everywhere, and it is sometimes impossible not to allow the intrusion of their images into one's own feared future.

Some of us are more resistant than others to such thoughts, but certain among us are virtually obsessed by them. In attempting to relax the hold these thoughts can have, it helps to know that relatively few of us will ever be confined to a nursing home. In the United States, only 4.5 percent of people over the age of sixty-five are denizened in such places, according to the 2000 census, and the number is gradually declining—in 1982, the figure was 6.3 percent. Not only is the number declining, but the average age of nursing home residents is going up, which means, at least in part, that people are entering such facilities later in life. The decrease in institutionalization may be used as an index of helpless debility in the general population; though plenty of old people are just as infirm in their own homes or the homes of their children, the general statistical trend of dependency appears to be downward, and there are good reasons for the decline.

Whatever other factors may have combined to decrease the frequency of infirmity and institutionalization (such as increased availability of assisted living facilities and adult day care), there seems little question that a changed attitude toward what had always been seen as inevitability has played a significant role. More of physiological loss than was previously realized falls into the category that might be called the atrophy of disuse, a concept clearly stated by Oliver Wendell Holmes more than 150 years ago: "Men do not quit playing because they grow old; they grow old because they quit playing." Recent clinical studies have confirmed Holmes's insight. We know important things nowadays about the role played by continued exercise of the body and mind in keeping our machineries running smoothly, whether they be joints, muscles, organs, or the cells and interconnections in our brains.

Advocates of one of several of the major schools of medical thought that existed in the seventeenth and eighteenth centuries called themselves iatromechanists (from the Greek *iatros,* physician) because they viewed the body as a vast machine

made up of innumerable smaller machines. Their philosophy was expressed in a statement made by the Italian medical theorist Giorgio Baglivi in his 1704 book, *Opera omnia medicopractica et anatomica:*

> Whoever examines the bodily organism with attention will certainly not fail to discern pincers in the jaws and teeth; a container in the stomach; water-mains in the veins, the arteries and other ducts; a piston in the heart; sieves or filters in the bowels; in the lungs, bellows; in the muscles, the force of the lever; in the corner of the eye, a pulley and so on.... It remains unquestionable that all these phenomena must be seen in the forces of the wedge, of equilibrium, of the lever, of the spring, and of all other principles of mechanics. In short, the natural functions of the living body can be explained in no other way so clearly and easily as by means of the experimental and mathematical principles with which nature herself speaks.

This simplistic view of bodily functioning would in later centuries be superseded by the realization of biochemical complexity and cellular dynamics, but it retains a certain metaphoric truth that has continued to appeal to scientists and teachers. The most popular small textbook on human structure and function during my medical student days in the 1950s bore the title *The Machinery of the Body.* Its authors, two physiologists named Anton Carlson and Victor Johnson, chose their title because it reflected with a certain clarity their sense of how best to convey an overall impression of the multitude of physical activities constantly at work within us. First published in 1930, the book required repeated printings of each of its five editions, culminating in the final one in 1961. Even today, a search on the Internet, under "The Machinery of the Body," lists what are described as "40 Million Books in One Web site. Used, New, Out of Print. Low Prices." The metaphor continues to be useful.

Especially in relation to running smoothly, the imagery of the body as machine will always apply. With respect to aging, the parallels are particularly apt: Aging parts work better when heed is paid to their maintenance; they require more attention than they did when they were new; they must be not only well cared for, but kept in active, albeit judicious, use.

Such analogies with machinery are hardly perfect, but they can nevertheless be carried just a bit further. As with machines, some human bodies are inherently built to last far longer than others, not only in respect to individual parts but pertaining also to their entire structure. In much the same way, inherited DNA influences longevity of each of our organs and the whole, but proper maintenance and appropriate use will maximize not only function but life expectancy as well.

The point is that individual men and women age at different rates, and much of the difference is dependent upon their inborn genetically determined constitution. Coming from a line of nonagenarians makes one prone to long life, for example, but does not guarantee it. There is, however, a flip side to this: Because of the way DNA does its somewhat haphazard mix-and-match, and because genes can express themselves in different ways depending on various internal and external influences, the predisposition to a long life not infrequently appears within a family whose members have been known to die early or at normative ages. Unfortunately, the opposite is true as well.

And also as with machines, a distinction must be made between parts that are frankly broken and parts that are merely showing the physical evidence of normal long usage. In regard to ourselves, it is important to recognize the distinction between aging and actual sickness. In some respects, this is no simple matter, even for physicians. But in other respects, the difference, once pointed out, is easily appreciated. Though aging does bring with it an increased vulnerability to certain illnesses, they are hardly its inescapable accompaniments. Aging is not a disease. It is a risk factor for many diseases—in the sense that older men and women are progressively less able to marshal the forces to withstand the encroachments of sickness—but it is not in itself a form of pathology.

Another way to look at the relationship between aging and disease is to imagine the later decades as a long continuum whose final destination is one or several named sicknesses—such as stroke, diabetes, or heart disease—but whose intervening points consist of relatively normal, though somewhat modified, functioning.

Stroke, for example, is a pathological condition, and not a normal consequence of aging. Its occurrence is made more likely by certain changes that are part of the ordinary growing older of blood vessels, but it is, most emphatically, a disease. Not only do the vast majority of people in their eighties and nineties not fall victim to

strokes, but measures can often be taken to prevent strokes or lessen their effects, by applying awareness that their incidence increases with the passage of time. Alzheimer's, Parkinson's disease, coronary heart disease, cancer, diverticulitis, osteoporotic fractures—all of these and many more are examples of pathological conditions to which the older body is more prone than the younger, but which are nevertheless not to be expected as a consequence of normal aging.

Many men and women reach great age without sickness; more remarkably, many men and women reach great age without significant disability, though their machinery has lost some of its previous efficiency. For such men and women, the disease that finally comes along and kills them is likely to be of relatively short duration.

Everyone who has ever owned an automobile knows the importance of maintenance, but its application to the human body has become fully appreciated only within perhaps the last generation. In this as in all other considerations involving ourselves, biology is not necessarily destiny. Take, for example, the predisposition to obesity. Recent research indicates that obesity is largely determined by DNA. But despite that, it is also well known that lifestyle changes can modify—often substantially—what would appear to be the ordained consequence of heredity.

Sometimes, of course, the most scrupulous of maintenance will not add an hour to the life of an automobile whose parts are not built for long wear, but the opposite is far more likely to be the case: Taking good care of parts extends their usefulness and the usefulness of the whole machine. We now know this to be applicable to ourselves. Of the many reasons why a sixty-year-old of today looks, feels, and acts younger than a sixty-year-old of half a century ago, one is improved attention to upkeep.

Of all the factors that constitute human maintenance, improved methods of medical therapy appear to be among those of lesser importance, at least for any one individual. Responding to breakdown or its imminence is far less effective than prevention and attention to self-improvement, which have become increasingly recognized as the keys to healthy longevity. Even as the relentless inroads of time on our cells, tissues, and organs are taking place, their effects can be mitigated, slowed, and sometimes even reversed by proper attention to the kinds of maintenance that bodies routinely carry out on their own when they are

deteriorations appear less inevitable when they are closely examined. Such changes are in certain ways susceptible to modification, in response to modifications in our daily lives, and here is how:

The accumulation of errors in the regulation of gene function does lie at the basis of that portion of the aging process that is strictly biological. Some of these errors probably occur because they are predetermined by inherited controlling mechanisms—what might be called a "genetic tape"—that begins to run at conception and ends at death. Others are due to wear-and-tear factors in the environment within and around the cell as well as the environment within and around the entire body—such as diet, ultraviolet radiation, air pollutants, absorbed toxins like nicotine, and, very likely, stress. And, of course, time itself takes a toll. There is the decreasingly efficient removal from within the cell of toxic by-products of the cell's own metabolism; the cumulative oxidizing damage caused by the infamous free radicals; the occurrence of so-called cross-links between protein molecules that make them less flexible; the progressive collection of the yellow-brown pigment called lipofuscin within cells; the gradual aggregation of clumplike protein material, such as amyloid, in the extra-cellular fluid—and there are others. Such wear and tear affects not only genes, but protein molecules, biochemical interactions, and general cellular and organic function. To varying extents, we have some control over them.

Within each of our approximately seventy-five trillion cells, mechanisms exist to correct these errors as they occur, whether the errors are caused by relentless rolling of the genetic tape or by wear and tear. The longevity of any of us is largely determined by the ability of such cellular corrective mechanisms to counteract the baleful influence of time on our genetic functioning. But these mechanisms decline with age. As noted earlier, some of us are hereditarily better gifted for longevity than others, but all of us could be capable of helping our hereditary predisposition if only we knew how. Some of the "hows" that lie within the ability of all of us are well known. They consist of those lifestyles and environmental factors that maximize the cell's genetic battle against progressive deterioration. This means that we do have some control even at the level of our deepest biology.

One of the striking findings of research into the aging of the various organ systems of our bodies is the extreme variability between individuals. The brain, the liver, or the immune system, for example, of two people of the same age are

often vastly different, with one person seeming much older than the other—much further along the continuum toward disease and death. Much of the difference is due to an inherited ability to recover from the various accumulated injuries to genetic integrity, but some of it is caused by the way an individual has lived his or her life, the environment in which one's life has been lived, and the attention paid to a healthy lifestyle—the amount of wear and tear, in other words. It is at the cellular and genetic level that we begin to find the way toward increased healthy longevity—but the cellular and genetic are influenced by the factors we encounter every day: diet, exercise, exposure to noxious agents, medications, and the like.

One example of the great individual variability of response to aging is found in the immune system, the body's complex of mechanisms that not only ward off infection but also play a large role in responding to the various agents that may cause cancer and autoimmune processes like rheumatoid arthritis and certain bowel diseases. Though the majority of the elderly have immunity that is 30 to 50 percent less than that of the young or middle-aged, some older people are able to mount an immune response almost as effectively as those much younger. Much of this responsiveness or lack of it is related to a person's general state of health, including such factors as nutrition, smoking, alcohol consumption, and environmental pollutants. The presence of intercurrent disease—what physicians call comorbidity—is also a factor, as are drugs and other medications used to treat it. So important are such influences that the ability to respond to assaults on the immune system is a good indicator of one's general state of health. The better shape we are in, the less prone we are to the condition that gerontologists call "immunosenescence"—senility of the immune system. The root *sen* is derived from the Latin *senex,* meaning "old man." No one wants to let his or her immune system become an old man.

Of all the parts of our bodies, the one in which the "let" of the previous sentence is most operative is surely the brain. The new research in neuroscience is demonstrating the remarkable ability of the human brain to influence its own aging. As astonishing as such a statement might at first seem, there is ever-increasing evidence of its validity, based not only on studies of cognition and behavior, but on equally revealing investigations into the structure and functioning of nerve cells, synapses, and the myriad networks of communications between far-flung parts of the central nervous system. Not only that, but the concept of mind—long a notion left for the most part to the ruminations of

philosophers—is emerging as the object of scrutiny in the laboratories of our most talented scientists. It is no longer enough to conceive of mind as a function only of the brain; it must be thought of as influenced by the very factors that it has long been recognized to influence, namely, the body and our perceptions of the environment in which we find ourselves. In other words, the reciprocity of communication among the brain, the body, and what has been called "the econiche" in which we are situated determines the vast range of impressions and responses that go into the entirety of mind. As we mature, our exchange with the econiche becomes gradually more sophisticated, and the tree of knowledge and experience arborizes into a vast superstructure containing increasing numbers of reference points upon which incoming new material can adhere; the older brain is a huge and wide-ranging repository of information to which additional information is widely admitted because there are so many more points of entry as time passes and learning continues. In these ways, mind is often able to compensate for any organic capacity to perceive, learn, integrate, and use information that may be lost with advancing years. Brain may age, but mind continues to grow. Used well, an aging brain can become a more useful brain, and often a wiser one.

There can be no doubt that some organic capacity is indeed lost because of aging, but—assuming the absence of neurological or other comorbidity—such losses appear to be less than has long been presumed. There is unquestionably an approximate 5 percent decrease in brain weight and volume every ten years beyond the age of about forty, but some areas are relatively invulnerable to tissue loss. Because so much of the weight and volume loss consists of supporting tissue and the insulation around nerve fibers, rather than the cells' bodies, the meaning of the 5 percent figure is obscure. What is of realistic importance is not loss of substance in the sense of tissue but loss of substance in the sense of functioning. For this reason, the following discussion focuses on how the aging brain works rather than on which of its parts change in volume.

The fact is that modern methods of counting nerve cells (also called neurons) show no definite evidence of any but perhaps minimal age-related loss, except in the hippocampus—an area involved in emotional expression, learning, and memory—and selected locations in the cortex (the prefrontal and temporal-association areas), and only in certain parts of even these. In other words, the total number of brain cells in healthy older people decreases only slightly. But

quality may influence these cells' effectiveness as much as quantity does. Like all other cells, those of the aging brain have been undergoing damage to proteins and metabolic processes throughout a long lifetime, as well as some slowing of cerebral blood flow. Decreased blood flow results in decreased metabolism of the oxygen and glucose so important in providing for the brain's enormous energy needs. It is likely that any losses in cognitive function are due to deficiencies in chemical neuro-transmission rather than to any decrease in the number of neurons.

The cumulative result of such processes is lessened function, but the amount of lessening is so variable among individuals that it ranges from inconsequential to clinically troublesome. Among the several reasons why it may be inconsequential is redundancy, by which is meant that there is so much extra brain tissue that loss of some of it is without effect on function or intellectual capacity, since there are plenty of other nerves and fibers left to do the job. In addition, the same message may be transmissible over several distinct neural pathways, so that the loss of one of them merely means that a different course will be used thereafter.

Synapses are the connections between the fibers (called axons and dendrites) that extend from the bodies of nerve cells. Messages are carried across synapses—and therefore from one neuron to another—by means of chemicals called neurotransmitters. The cortex, the brain's convoluted outer mantle that does our thinking, contains some thirty billion nerve cells, and one million billion synapses by which these nerve cells interconnect with one another in myriad ways. The aging brain may have decreased numbers of synapses in some areas, but this is compensated by such factors as plasticity: the ability of synapses to become stronger and therefore more effective, to proliferate when required by neural activity, to enlarge in size, and to change configuration in response to altered patterns of usage. Loss of synapses in some areas is accompanied by no such loss in others, and is accompanied in some places by an increased number. In this as in so many other ways, the brain is always changing.

This ability to change is also demonstrable in the case of neurotransmitters and the receptors on the surface of nerve cells onto which they attach. While some neurotransmitters and some receptors decrease with age, others increase, with the result that certain cerebral functions may be lessened, certain may be heightened, and certain may remain unaffected. Also, cell loss is at least in part

compensated by the production of new cells, as has been discovered only in the past decade. Prior to this discovery, it was believed that no such process was possible in the central nervous system.

The result of the competing and balancing influences of gain and loss manifests itself in how effectively the brain functions in any given individual. The following paragraphs should be considered a general summation of what occurs in normative healthy aging, realizing that variability is so great that far more than a few older men and women continue into extreme old age with minimal or even no demonstrable loss of cerebral ability.

It is true that learning is somewhat slower, and the amount learned with the same effort and exposure lessens, as the later years progress. But the ability to assimilate information and to learn from experience does not change appreciably. Perhaps as important to acquiring new knowledge, attention does not become impaired. Though verbal abilities do not decrease, creative thinking and problem-solving abilities slowly decline. This means that intellectual quickness and on-the-spot reasoning slow; mental agility is the province of the young. As Sir Francis Bacon put it three centuries before brain scanning had become so much as a possibility on the horizon, "Young men are fitter to invent than to judge, fitter for execution than for counsel, and fitter for new projects than for settled business."

Not only is intellectual quickness impaired with aging but so is reaction time. Aging increases reaction time because the process of cognition—the awareness and instantaneous processing of information—is somewhat slowed, as is the peripheral motor response to stimuli. Ordinarily, these changes are perceptible only under conditions of immediacy, but modern living means that immediacy is everywhere, and especially behind the wheel of an automobile going seventy miles an hour in a rainstorm at night. As drivers get into their seventies and beyond, they should choose their traveling times and conditions with increasing circumspection.

The cognitive complaint most often made by or about older men and women is loss of memory. Though long-term memory (and sensory memory too, of smells, tastes, and sounds) is not significantly disrupted—nor is vocabulary and the general store of culture- and education-based information—short-term memory is more likely to become a problem, even under the physiological conditions of healthy aging. And yet, some nonagenarians continue with memory so unimpaired

while others of the aging changes are less universal. The first category involves a decreased ability of the intestine to absorb calcium, and so the amount of that mineral in the blood tends to become lower. In an attempt to keep the level steady, the parathyroids—glands buried deep within the thyroid, whose function is to control calcium metabolism—raise their output of hormone (called parathyroid hormone, or PTH), which has the effect of drawing calcium out of the bones and into the bloodstream. The lowered concentration of calcium in the bones worsens osteoporosis, which is already being caused by a combination of (1) certain aging changes in the cells that manufacture bone and (2) the loss of significant numbers of these cells. The decreased bone density that is the result of these two factors produces few or no symptoms unless the decrease becomes advanced. Because men have higher bone density than women and also because postmenopausal deficiency of estrogen causes bone loss (the reasons why are unclear), osteoporosis tends to be more severe in women, though men are hardly free of varying degrees of it, sometimes to the point of debility. Depending on the criteria for its diagnosis, about a third of men beyond the age of seventy-five are found to have osteoporosis. Not only the severity but the frequency of osteoporosis is more marked in women, by a factor that some estimate to be as high as 4 to 1. As with the body's other aging mechanisms, individual variation results in a wide spectrum of how a person may be affected by this condition.

One's position on that spectrum is influenced by physical activity. The more stress put on a bone by the forces of the muscle attached to it, the more its cells respond by doing all they can to maintain and even add to bone mass and strength, including increasing the absorption of calcium from the bloodstream. Just as a sedentary life encourages the loss of bone, a vigorously active life encourages increase in bone density.

Like disease of the cardiovascular system, loss of bone density can be managed by a variety of means in addition to exercise; the choice depends on the cause or causes thought to be most significant. Oral supplements of calcium and the vitamin D that increases calcium's absorption from the intestine should be a standard part of the daily diet, beginning perhaps in one's early fifties. The vitamin D becomes more important with the passing of years, to counteract the age-associated decrease of the vitamin in the body.

Because age-related loss of bone density is ultimately the result of a complex of