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Authors

Nguyen, Tanya T
Jeste, Dilip V

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STRIKING BACK AGAINST

AGEISM

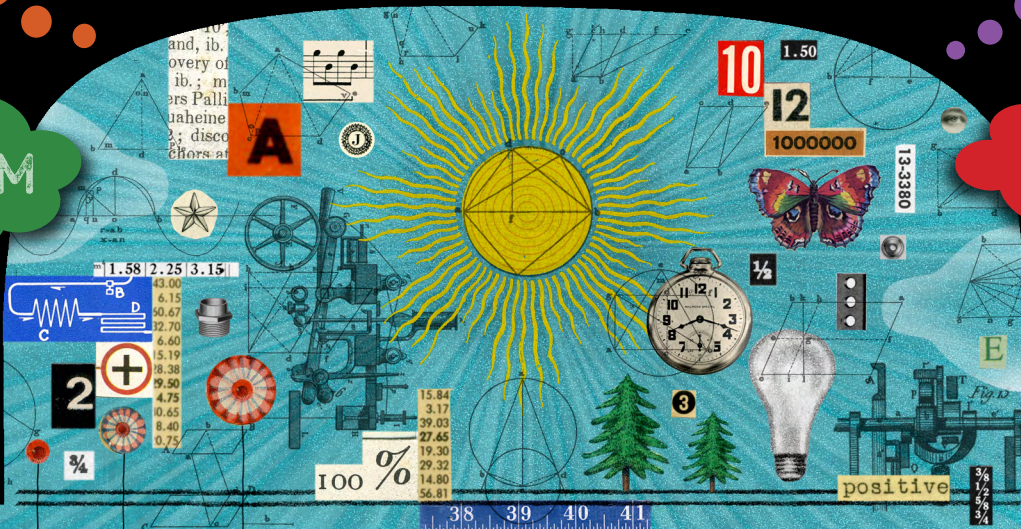
TOLERANCE

EXPERIENCE

PLASTICITY

WISDOM

EMPATHY





AGE STRIKES THE BRAIN BACK!

Our authors, who study successful aging and mental illnesses at the [University of California, San Diego](#), address the much-debated, complicated question that many of us have long wondered about: Does the brain improve with age?

By Tanya T. Nguyen, Ph.D. and Dilip V. Jeste, M.D.

ILLUSTRATIONS BY DAVID PLUNKERT



IN JAMES HILTON'S 1933 NOVEL *LOST HORIZON*, SHANGRI-LA WAS A MAGICAL utopia where people lived well beyond 100 years. But now, less than a century later, it seems we are well on our way to making Hilton's vision a reality. The [US Census Bureau](#) reported in 2020 that the average life expectancy has increased from 47 in 1900 to over 80 years today, while the number of people over age 60 exceeds children under 15 for the first time ever. By 2060, the average lifespan will approach 90 years. Astonishingly, more than half of the babies born today will live to age 100 and beyond, which will make Hilton's seemingly far-fetched vision come to pass.

One might think that people living longer would represent an enormous, thrilling milestone. But unfortunately, aging is rarely perceived that way. The increase in older people—metaphorically termed a “silver tsunami” since the 1980s—has economic implications, including unimaginable healthcare costs. Certain segments of western culture sadly equate aging with such “d” words as degeneration, decline, disability, diseases, dementia, depression, and death. Policy makers and economists are outspoken in their fear that spending money on older people's care will mean less money for children and younger adults, who represent the future.

This attitude—commonly labeled ageism—is analogous to such phenomena as sexism, racism, and bias against certain sexual orientations. Ageism has made many older people feel guilty about living longer and becoming a potential burden. They think—and are encouraged by society to think—that aging is an incurable disease.

Ageism also rears its ugly head in more practical ways. It is often said that the longer people put off retirement and keep working, the fewer opportunities there are for

young people in the workforce. As a result, senior workers are often forced to retire at an arbitrary age, even if they are functioning well. Many are dismissed because they can be replaced by cheaper labor. When they attempt to re-enter the workforce, age, rather than competence, is often the deciding factor.

We are also seeing effects of ageism in medicine and psychiatry. Fewer medical students are pursuing geriatric medicine or geriatric psychiatry careers today compared to 15 years ago, due partly to relatively low reimbursement from health insurance and partly to our society's focus on youth, health, and beauty. So, while the need for healthcare will continue to increase along with the aging population, fewer experts will be available to meet the demand.

And if further proof is needed, look no further than an entire anti-aging industry built around prevention and cure—an industry now valued at almost [\\$60 billion globally](#).

Ageism Fact and Fiction

But research does not support the perspective that equates aging with gloom and doom. To use a phrase

popularized by recent politics, it is a question of facts versus “alternative facts.” There is unquestionably some decline in a number of body structures and functions with age; but this is far from universal. There is considerable heterogeneity within and across older individuals, particularly when it comes to the brain.

We generally think of childhood as the period of brain development, and old age of brain degeneration. But this is a simplification, and it

is inaccurate. Both development and degeneration occur throughout life—from childhood almost until death. Loss of formed synapses in adolescence (via pruning) and the formation of new synapses continue to occur throughout life. It is the balance between the two that leads to maturation of the brain—like a Grand Cru wine evolving from bitterness to perfection.

Aging is not simply a physical process—it also entails psychosocial change. And herein lies a paradox: As we grow older, our physical functioning declines, but our mental and social functioning tends to improve. “Successful aging” is not an oxymoron. Sure, with age we slow down physically, and we may have difficulty remembering names and faces, and problems learning new things. Physical capacity and mental speed begin to decline around age 30, and even more noticeably after age 50. But not all mental functions deteriorate. “Crystallized” cognitive skills at age 75 are roughly equivalent to those at age 20. These are the intellectual abilities based on the accumulation of knowledge, facts, skills, and experiences throughout life, such as verbal skills and inductive reasoning.

While neurocognitive disorders like dementia become increasingly prevalent with aging, the majority of older people do not develop them. The [overall prevalence](#) of dementia (of all types) is just one to three percent at age 65, with the prevalence doubling approximately every six years, to 30 percent by age 85. Other mental illnesses, such as major depression and anxiety disorders, are less common in older than in younger adults.

This was part of the findings in our Successful Aging Evaluation

(SAGE) [study](#) at the [UC San Diego Center for Healthy Aging](#), where we reported that mental well-being improved in an almost linear fashion from age 20 until the 90s. Young adults in their 20s and 30s suffered the most from depressive symptoms, anxiety, and stress. As the years progressed, most people felt they were [aging successfully](#)—a sense of well-being that includes attainment of goals, positive attitudes toward oneself and the future, social connectedness, and adaptation—despite worse physical functioning and social stresses. We saw this phenomenon not only in healthy older adults living in communities but also in those with and being treated for serious mental and medical illnesses, including [schizophrenia](#), [AIDS](#), and [cancer](#).

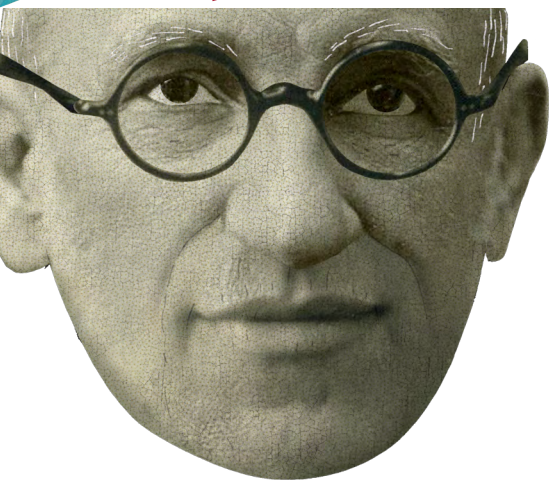
In early 2020, as Covid-19 began to spread worldwide, it quickly became apparent that older adults were vastly more likely than younger adults to develop serious physical complications, to require hospitalization, and to die. Many people also worried about a mental health crisis among [the elderly](#) whose social life practically disappeared due to social distancing and isolation. The [data](#), however, suggested the opposite: The mental health of older adults was less adversely affected than that of other adult age groups. In other words, older adults were more resilient and less fearful of dying than younger ones.

Of course, when you find that older people are doing better than younger people in anything, an explanation that immediately springs to mind is survivor bias—that is, sicker people die younger, and people who live into old age are a biased sample. While this is certainly true, it is not the only



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reason for age-linked improvement in mental health. For example, several long-term **studies** have shown that mental health improves progressively with aging even in people with serious mental illnesses such as schizophrenia.

Recognizing Wisdom

In eastern cultures, older people are respected for being wiser. But does wisdom really increase with age? Is this why older adults have better mental well-being? More fundamentally, what is wisdom and how is it related to the brain?

The concept of wisdom goes back to the beginning of most religions and philosophies. The word “**Homo sapiens**” means a wise man (or person). Verses about wisdom are prominent in the Bible and in the Bhagavad Gita of Hinduism. Greek and Eastern philosophers—from Socrates, Aristotle, and Plato to Confucius and Buddha—described

wisdom throughout their texts.

Empirical studies in wisdom started in the 1970s, but the field has grown markedly in the last couple of decades: Since 2010, PubMed has added 2,000 papers on wisdom. Still, many scientists dismiss it as a fuzzy construct. Wisdom cannot be defined or measured, so how can one study it, they argue. However, the same logic was used for decades, if not centuries, to ignore consciousness, emotions, cognition, stress, resilience, and well-being. Today, we accept them as scientifically characterized, biologically based entities.

Wisdom is a personality trait whose principal components are empathy, compassion, emotional regulation, and self-reflection. It includes qualities that are in notably short supply in today’s highly polarized world: acceptance of uncertainty and of diverse perspectives, and socially focused decision-making. Wisdom is associated with superior well-being, quality of life, and life satisfaction. Indeed, it has a greater impact on mental well-being than objective factors such as physical health and socioeconomic status.

The basic conceptualization of wisdom, as described above, has not varied materially across times and cultures, though there are some cultural differences. This suggests that wisdom is largely biologically based and influenced by culture. Since the early 20th century (thanks to the pioneering work of the German neurologist Korbinian Brodmann), we have been able to localize sensory and motor functions, as well as

the production and comprehension of speech, to specific areas of the brain. While it is harder to localize complex behaviors such as compassion and emotional regulation, brain imaging, neuroanatomical, neuropathological, genetic, and other neurobiological **studies** strongly associate the prefrontal cortex and the limbic striatum with aspects of wisdom.

Neuroplasticity of Aging

Consider Yoda from *Star Wars*, Gandalf from *The Lord of the Rings*, and Albus Dumbledore from *Harry Potter*—popular mythical icons of wisdom who are in the twilight of their long lives. A number of empirical **studies** show key components of wisdom to be superior in older adults, compared to their younger counterparts: more **prosocial behaviors** such as empathy and compassion, better **theory of mind**, and greater emotional regulation. Elders also demonstrate more self-reflection and insight, tolerance of others’ perspectives and awareness of their own limitations, and a superior ability to facilitate compromise and maintain positive relationships. Put simply: As they age, people tend to become wiser. (Of course, this doesn’t apply to everyone. As Oscar Wilde said wryly, “With age comes wisdom, but sometimes age comes alone.”)

More generally, experience—both good and bad—comes with aging and affects people differently, depending on the person and the circumstances. A disaster leads to post-traumatic stress disorder in some, post-traumatic growth in others.

Though aging is typically associated with a loss of neurons and cognitive decline, the effect is not homogenous across brain regions and domains. One of the most exciting developments in neuroscience during the past two decades is the discovery that our brain continues to evolve into old age through “plasticity,” i.e., strengthening of existing synapses and formation of new ones, in the context of appropriate physical, cognitive, and psychosocial stimulation. Scientists have **shown** that in old mice (and various other species), physical activity accompanied by psychosocial stimulation can increase the number of synapses as well as neurons in such subcortical brain areas as the dentate gyrus of the hippocampus, and areas around brain ventricles.

This neuroplastic response may

underlie the brain benefits of an active and stimulated life. People who stay active physically, cognitively, and socially tend to maintain their vocabulary, their ability to recognize events, objects, and people they’ve encountered before, and the motor skills learned during early childhood, such as swimming or bicycling. Their brains are likely to escape the atrophy that occurs in the brains of sedentary, lonely, inactive seniors. Brain imaging and neurophysiology studies have shown that **physical exercise** as well as **mindfulness and meditation** increase gray matter volume and white matter brain cells and synaptic connections, respectively, and their activation in the anterior regions that support positive emotions and wisdom.

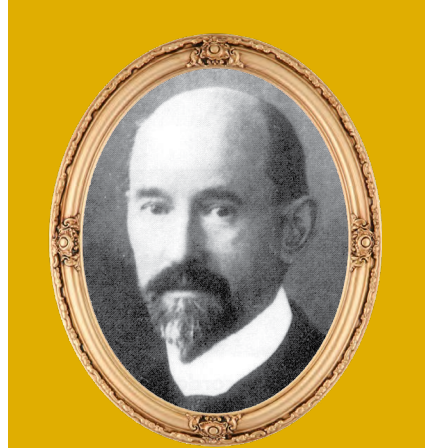
There is a phenomenon called **PASA** (Posterior-Anterior Shift in Aging) that may help explain why wisdom improves over the life course. Our brains develop in a back-to-front manner; the prefrontal cortex, the last portion to mature, is not fully formed until one’s early 20s. PASA mirrors that sequence: With age, neural activity shifts from the occipital lobes in the back of the brain, which are centers for processing sensory stimuli, to the prefrontal cortex, which is responsible for executive functions. Therefore, while sensory processing may decrease over the years, the brain may recruit higher-order networks in the prefrontal cortex that are associated with wisdom development.

Another aspect of the aging process, **HAROLD** (hemispheric asymmetry reduction in older adults), involves reduced lateralization of the

brain. This means that in younger people, the brain’s right and left hemispheres specialize in somewhat different tasks. Age reduces this asymmetry: Tasks previously managed by a neural circuit housed in a single hemisphere now call on both sides of the brain. Their ability to recruit neuronal networks from both hemispheres for a given mental activity offsets, to an extent, the loss of synapses and neurons in older people.

Finally, aging changes the way the brain responds to emotions. This might explain the “**positivity effect**” of aging, a tendency to favor positive emotions and memories. Older people pay attention to and remember pleasurable and gratifying events better than sad, frightening, regrettable ones, whereas younger individuals retain positive and negative information equally well. It is as if young minds are like Velcro® for negative experiences,

PHOTO: ALAMY.COM



German neurologist Korbinian Brodmann (November 17, 1868–August 22, 1918) mapped the cerebral cortex, defining 52 distinct regions known as Brodmann areas, based on their cytoarchitectonic (histological) characteristics.



FIGURE 1: Perceptions of how older people are portrayed in the media

Research conducted by the [Australian Human Rights Commission](#) revealed that the most common words used to describe older adults in the media are forgetful, slow, frail, vulnerable, burden, grumpy and sick. The size of each word is directly proportional to the number of mentions of that theme. Responses were based on the question: “Thinking about everything you see and hear in the media (including on TV, online, on the radio, and in newspapers and magazines), how does the media portray older people?”

IMAGE: “FACT OF FICTION? STEREOTYPES OF OLDER AUSTRALIANS” RESEARCH REPORT 2013*

and older minds like Teflon®. Older adults more easily dispel feelings of disappointment, regret, and remorse, and worry less about events or issues they cannot change.

This may reflect changes in sensitivity of the brain area central to the processing of emotions—the amygdala. In younger people, amygdala activity increases in response to both positive and negative visual images; in their elders, negative images trigger much less activity than positive ones.

One caveat must be kept in mind: No age-linked increase in wisdom can continue indefinitely. It ends when neurodegeneration surpasses the aging brain’s ability to compensate. The age when this happens is not fixed and likely varies subject to a number of factors.

Evolutionary Value of Human Wisdom of Aging

In evolutionary terms, prolonged human longevity would seem to make no sense. Darwin’s theory of evolution is predicated on survival of the fittest, which depends on the ability to procreate. Older people cannot reproduce, so they cannot promote species survival. Among primates, humans are unique in regularly outliving their loss of reproductive capacity by decades. For example, when a person who had menopause or andropause at age 45 lives to age 90, they would have spent the entire second half of their life without fertility.

While human life span is increasing, fertility span is not. The average age at menopause or andropause has remained

unchanged (45-50) over millennia. So, how can we explain exceptional human longevity despite unchanged loss of fertility and physical health in old age?

Homo sapiens is the only species able to produce offspring years before its brain is fully mature. Biologically, we humans are primed to conceive children with the arrival of puberty around age 12 or 13, while our brains continue to undergo considerable refinement, via processes such as synaptic pruning, until the early 20s. How can adolescents with incompletely developed brains (who are not even legally deemed fully responsible adults), care for their own children and make them fit to survive in potentially risky environments?

Here is where data suggests

that wisdom of aging may have evolutionary value for humans, both by compensating for loss of fertility (through the Grandmother Hypothesis—i.e., grandmothers helping their adult daughters live longer and be more fertile) and by transmitting the culture’s knowledge and traditions to younger generations.

The Grandmother Hypothesis is based on [research](#) in several mammalian species. Orcas or killer whales, one of the few non-human species in which females have menopause, derive extraordinary bonding and other benefits by having multiple generations within a pod (an extended family unit that travels and hunts together). The death of a post-reproductive female orca in the pod increases the risk of death up to fivefold for female babies, and 14-fold for males.

Research suggests similar phenomena among humans. In a remarkable study of complete multigenerational records of about 2,800 Canadian and Finnish women born before 1900, the daughters of older mothers reproduced earlier, more frequently, and more successfully. Maybe “wise” behaviors of these grandmothers helped their own health and longevity and also aided their offspring’s fertility and longevity successes.

Other studies suggest specific ways in which interactions with grandparents, perhaps via sharing of life experiences and the imparting of wisdom, might benefit younger generations. One found that children in households with three generations (i.e., children, parents, and grandparents) had fewer behavioral problems than children in other households. Other [studies](#) link the involvement of grandparents

to fewer emotional problems and adjustment difficulties, and more prosocial behaviors in middle school students, especially among those living in single-parent or stepfamily households.

Biologically, old-age-supporting “grandparent genes” may have evolved to enable older adults to retain the physical and mental abilities to help their grandchildren, by protecting elders from neurodegenerative and cardiovascular diseases. Variants of two particular genes, CD33 and APOE, are associated with better brain and cognitive functioning, possibly through less accumulation of beta-amyloid, a peptide involved in Alzheimer’s disease. These variants are expressed at higher levels in humans than in chimpanzees, our closest living relatives.

Enabling older individuals to stay active, have a purpose in life, and transmit wisdom to younger generations will promote healthy lifestyle in everyone, lowering the prevalence of pathology, and reducing societal costs of physical and mental healthcare. Going forward, age-friendly intergenerational communities will hopefully offer generative opportunities for older adults and help them feel (and be perceived) less as social and economic burdens, and more as productive assets and resources. Instead of an ominous silver tsunami, an aging society will consist of a golden wave of healthy and happy seniors who will lean on practical wisdom, helping younger generations to thrive and flourish. ●