Our brains are seventy-year clocks. The Angel of Life winds them up once for all, then closes the case, and gives the key into the hand of the Angel of the Resurrection.
Oliver Wendell Holmes

The arrival of grey hairs can signify both the attainment of wisdom and the accumulation of age. In the words of Solomon of old, grey hair "is a crown of splendor; it is attained by a righteous life." (Proverbs 16:31, NIV) Grey hair is also a visible reminder of the uncertainty of maintaining mental faculties in old age. For many people, the prospect of deterioration in brain function is feared more than any other ailment of aging. Joints may give way and vision dim without eroding personal integrity. The brain, however, is essential to who we are. Its grey matter is the centerpiece of the living tapestry of personal identity.

Some neurological diseases cause sudden loss of brain function, while others bring about slow disintegration of cognitive faculties. Depending on the site and extent of disease, the loss of neurons and their connections can impair one’s ability to participate mentally and physically in the world. Cognitive disorders may erode creative expression, wipe away biographical memories, disrupt language, and render the patient increasingly dependent on caregivers. Age is the primary risk factor for developing neurodegenerative diseases. An estimated 4 million Americans have Alzheimer’s disease, which is the most common type of dementia. Its prevalence is expected to grow to 14 million by the year 2050. An estimated 12 million Americans have milder
forms of cognitive impairment that may precede the development of dementia.  

Subtle cognitive decline occurs also in normal aging. Brain volume decreases at a rate of 0.1-0.2%/year during middle age and even more rapidly at a rate of 0.3-0.5%/year over the age of 70 years. Physiologic aging in the brain is characterized by a loss of synaptic connectivity and neuronal apoptosis. Some of the factors responsible for neuronal aging include oxygen free radical damage, mitochondrial calcium dysregulation, and a host of genetic, dietary, and environmental influences, many of which remain to be fully defined.

Our finite brains are winding down. There are, of course, some notable countercurrents. Mental engagement and physical fitness have been shown to improve cognitive function. Drugs that increase the level of acetylcholine in the brain provide symptomatic benefit in the treatment of Alzheimer's disease. The discovery that neuronal progenitor cells in the adult brain proliferate and differentiate in the subventricular zone and dentate gyrus has overturned the long-held view that neurons, once lost, cannot be replaced. Such findings have encouraged research into enhancing the brain's ability to repair and regenerate damaged areas. These lines of research are praiseworthy, provided that they are pursued ethically.

Gains in cognitive function, though worthwhile, are partial and temporary. Completely rejuvenating or preserving the brain indefinitely is not simply a problem to be solved by better biomedical engineering. Even if neuroscience were to achieve the capability to grow new neurons or replace whole sections of human brain, the replacement tissue would not reestablish exactly the original labyrinth of neuronal interconnections. The brain patch could not know what the original tissue knew. Inevitably, the brain must yield, after its brief moment in the universe's billions of years, to the cold rule of time. The body likewise must surrender to mortality.

And yet, despite the certainty of death, human history abounds with expressions of a longing for permanence. Authors and composers pen works that they hope will endure. Scientists test theories that they hope will not be disproven. Philosophers expound ideas that they hope will stand the test of time. Individuals and families leave legacies. Virtually all religions speculate on an afterlife. Considering the evidence from history and culture, C. Ben Mitchell observes that, "the impulse for immortality is a deeply human impulse."  

The impulse to immortality is distinctly human in that nonhuman animals do not exhibit this inclination. Natural appetites such as hunger, thirst, and the desire for shelter, and natural instincts for survival and procreation all seek after what is seen or known. While analogous to basic biological drives, the longing for immortality transcends them. It looks to what can be glimpsed only through faith. The spiritual longing that looks beyond mortality is common to all people. This longing often finds expression through religious faith. Christians believe that the answer to this longing lies in a personal relationship with Jesus Christ, in whom is life (John 1:4, 14:6), and who as God incarnate in human form, bridges the terrible divide between deity and humanity. For the Christian, eternal life is to know the one true God (John 17:3), and faith in the hereafter is united with belief in God as Creator, Redeemer, and Sustainer. Christian faith in restoration beyond death is "being sure of what we hope for and certain of what we do not see" (Hebrews 11:1, NIV). Our hope in Christ is premised on the understanding that we, as individuals, are incomplete, that our communal human story is unfinished, and that suffering and injustice in this life are not
absurd but will find meaning when, in the fullness of time, evil is banished and the creation is renewed. Jesus says of himself, "I tell you the truth, whoever hears my word and believes him who sent me has eternal life and will not be condemned; he has crossed over from death to life." (John 5:24, NIV).

The impulse to immortality also influences secular decisions regarding the application of science. It comes as no surprise, in an age when science has triumphed over so many of the conditions of nature that diminish or threaten life, that society would apply the tools of technology to serve the human impulse to surpass the limits of mortality. In place of oral tradition, modern civilization also utilizes printing, video recording, digital archiving, and other durable media to pass its story along to later generations. In place of the stone carvings of antiquity, modern technology has planted a flag on the moon and sent into deep space Voyager's Golden Record inscribed with pictures and sounds of life on Earth. Modern medicine, sanitation, and public health measures have greatly extended life expectancy by reducing preventable early death. Modern biotechnology can now rewrite genomes, permanently altering the genetic code of all subsequent progeny.

The human impulse to transcend the brevity of human life is both personal and communal, spiritual and technological. The comedian Woody Allen famously remarked, "I don?t want to achieve immortality through my work?. I want to achieve it through not dying." His words strike a common chord in the human spirit. Hence, the quest for immortality has placed its faith in all manner of emerging technologies. Occasionally the ambition of these pursuits is immoderate. Anticipated prospects, for example, for precise reengineering of tissue at the molecular level have inspired nanotechnology pioneer Robert Freitas to declare that, "Natural death is an outrage" to be overcome through technology.11

So deeply human is the impulse to immortality that futurist Ray Kurzweil?s hyperbolic prophesy of uploading the brain into a computer and living forever in cyberspace has attracted a curious popularity. According to Kurzweil,

At that point the longevity of one?s mind file will not depend on the continued viability of any particular hardware medium (for example, the survival of a biological body and brain). Ultimately software-based humans will be vastly extended beyond the severe limitations of humans as we know them today. They will live out on the Web, projecting bodies whenever they need or want them, including virtual bodies in diverse realms of virtual reality, holographically projected bodies, foglet-projected bodies, and physical bodies comprising nanobot swarms and other forms of nanotechnology.12

Such prospects remain, for now, distant to technology?s reach. Extrapolating from the rate of acceleration of computer processing speed, which historically has doubled every 18 months, once computational power exceeds human intelligence, and provided that it were even possible to copy the information content of a human brain to an electronic medium, it is not clear that such a process would preserve the continuity of personal identity. An intelligent computer would be a different entity that would only disappoint the desire for living forever in the subroutines of endless cyberspace.
For those whose anticipated life expectancy falls short of Kurzweil's predicted date for the "Singularity," when computers might rescue human minds by replacing them, or for those who have a preference for continuing in human form, there is cryonics. In the heart of the Sonoran Desert, an Arizona company has developed the means to suspend the body in an ultra-cold tank until such time as future medicine develops the hypothetical technology to reverse the cryonic procedure, revive and reconstruct the frozen tissue, and restore the person to health. The cryonic intervention has many of the appearances of a medical procedure. Immediately following the moment of cardiac cessation and medicolegal declaration of death, but before the brain has undergone irreversible hypoxic damage (an unproven claim), the body's water is surgically replaced with cryoprotectants such as glycerol to inhibit the formation of ice crystals, and then the body, or in many cases just the severed head, is immersed in a tank of liquid nitrogen at a temperature of minus 120 degrees Celsius. Cryonic practitioners hold to the astonishing hope that, "The emerging science of nanotechnology will eventually lead to devices capable of extensive tissue repair and regeneration, including repair of individual cells one molecule at a time? [and] theoretically recover any preserved person in which the basic brain structures encoding memory and personality remain intact." In contrast to the ancient Egyptians, who preserved the bodies of their pharaohs after discarding their brains, which they thought to be unimportant, a common practice in cryonics is to preserve just the brain of the patient, leaving the brain's accompanying head intact "as a practical matter." According to the cryonicists, "Brains are compact, inexpensive to store, easy to move, and are a single organ for which cryopreservation protocols can be completely optimized."

The search for prolongevity attracts both sound science and charlatanry. Compelling arguments could be offered that limited medical resources ought first to be directed to the treatment and prevention of illness before being spent on efforts dramatically to extend life expectancy or to store fading brains in suspended animation. The purpose of this essay is not to judge matters of scientific credibility, but rather to take notice that the impulse for immortality finds universal expression. In the marketplace of ideas there is a continual demand for promising pathways to abundant, lasting, even eternal life. Ideas, moreover, have neurobiological correlates in the brain. Why does the human brain by its nature yearn for eternity? That the brain would imagine and long for something that its sensory inputs can neither see nor feel is to neuroscience a persistent puzzle. That the mind intuitively knows to reach for something completely beyond its earthly experience is to philosophy a timeless enigma. This same deeply human longing echoes in George Herbert's verse, "O that Thou shouldst give dust a tongue to cry to Thee." The neurobiological correlates of the longing for immortality are unknown. They likely involve many areas of the brain in cooperation. Neuroimaging studies have shown that thoughts of hope engage brain regions involved in cognition, language, perception, vision, audition, and emotions. Envisioning an immortal future is also likely to draw considerably from past experience. Neuropsychological and neuroimaging studies have revealed that the neural substrates for recalling the past have a parallel role in envisioning the future. Constructive episodic memory allows individuals to remember past experiences as well as simulate or imagine future experiences, events, or scenarios. Interestingly, patients with amnesia who have bilateral damage to the hippocampi and have lost the ability to recollect past events are also unable to construct new imagined experiences. Thus the brain, despite its remarkable
capability for prospection, cannot fully imagine an afterlife because its thoughts draw from and are constrained by past experience. A genuine immortal future surpasses earthly imagination.

Whereas natural biological drives can be localized to specific structures and circuits within the brain, the human longing for immortality is a spiritual longing. As such, its relationship to brain structures may be best described metaphorically. Pascal knew this when he wrote of the God-shaped void within us that can be filled only by a relationship with the inscrutable and infinite.\(^\text{20}\)

In the prayerful words of Augustine, "Thou hast made us for Thyself, and restless is our heart until it comes to rest in Thee."\(^\text{21}\)

William Hurlbut’s observation about ethics at the beginning of the 21\(^{\text{st}}\) century holds true also for speculations about immortality: "We are at the outer edge of the expanding universe of ethics. No one has ever been here before."\(^\text{22}\)

The factual record of history contains valuable lessons to guide neuroethical decisions but alone does not specify the purpose of life or the destiny of humanity. It is necessary to look beyond the past trail of human failures to the promise of a future in which all things are new (Revelation 21:5).

What science cannot explain, the most powerful technology cannot satisfy. Technology in the hands of fallible humans is a two-edged sword. Its gains provide but transitory optimism, and its harms, whether intentional or unintentional, disappoint, and in so doing, only intensify the materially insatiable human impulse to immortality. Recognizing that the impulse to immortality reflects a true yearning, during this twilight prelude to eternity, it matters which promise we believe and where we place our faith. For, to quote Solomon once more, in time, "the dust returns to the ground it came from, and the spirit returns to God who gave it." (Ecclesiastes 12:7, NIV).

References


21. Augustine, Confessions, Book One, Chapter I.


The views expressed herein are his own and do not necessarily reflect the positions of Mayo Clinic, USA. This article originally was published in Ethics & Medicine: An International Journal of Bioethics 24(1) Spring 2008, 9-14. The article is used with permission from Ethics & Medicine.

Podcast Episode:
79