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STAY YOUNG FOREVER
(OR DIE TRYING)

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BILL GIFFORD



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NEW YORK BOSTON



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I think the most unfair thing about life is the way it ends. I mean, life is tough. It takes up a lot of your time. What do you get at the end of it? A death! What's that, a bonus? I think the life cycle is all backwards. You should die first, get it out of the way. Then you live in an old age home. You get kicked out when you're too young, you get a gold watch, you go to work. You work for forty years until you're young enough to enjoy your retirement! You go to college, you do drugs, alcohol, you party, you have sex, you get ready for high school. You go to grade school, you become a kid, you play, you have no responsibilities, you become a little baby, you go back into the womb, you spend your last nine months floating—and you finish off as a gleam in somebody's eye.

—Sean Morey

For my parents

Prologue

THE ELIXIR

You are never too old to become younger.

—Mae West

In his final moments of consciousness, as the young scientist crumpled to the laboratory floor, he may have realized that perhaps covering himself with varnish was not the best idea he had ever had in an experiment-wise. But he was a man of science, and curiosity could be a cruel mistress.

He had been wondering for a while about the function of human skin, so durable and yet so delicate, so sensitive to burns from sun and flame, and so easily sliced open by knives much less sharp than his surgeon's blades. What would happen, he wondered, if you covered it all up?

So, on what was otherwise a slow day at the lab, at the Medical College of Virginia in genteel Richmond, Virginia, in the spring of 1853, Professor Charles Edouard Brown-Séquard—native of Mauritius, citizen of Britain, late of Paris (via Harvard)—stripped off all his clothes and went to work on himself with a paintbrush and a pail of top-quality flypaper varnish. It didn't take long before he had coated every square inch of his naked body with the sticky liquid.

This was still an era when a scientist's primary guinea pig was generally himself. In one experiment, the thirty-six-year-old Brown-Séquard had lowered a sponge into his own stomach to sample the digestive juices within, which caused him to suffer gastric reflux for the rest of his life. Such practices distinguished him as “by far the most picturesque member of our faculty,” as one of his students would later recall.

The varnish episode would only add to his legend. By the time a random student happened to stumble across him, the professor was huddled in a corner of his lab, trembling and apparently near death. His body was so brown that it took a moment for the student to realize that he was not a wayward slave. Thinking quickly, the young man frantically began to scrape off the brown gunk, only to receive a tongue-lashing from the victim, who was furious that “some obtrusive individual [had] extracted him from the corner into which the varnish had tumbled him, and, just as he was fetching his last gasp, maliciously sandpapered him off.”

Thanks to that quick-witted medical student, though, Brown-Séquard would go on to become one of the greatest scientists of the nineteenth century. Today he is remembered as a father of endocrinology, the study of glands and their hormones. As if that were not enough, he made major contributions to our understanding of the spinal cord; a particular type of paralysis is still called Brown-Séquard syndrome. Yet he was far from an ivory-tower academic. He once spent months

battling a deadly cholera epidemic on his native Mauritius, a lonely archipelago in the middle of the Indian Ocean. True to form, he intentionally infected himself with the disease by swallowing the vomit of patients, in order to test a new treatment on himself. (That nearly killed him, too.)

His Richmond professorship did not last the year; the Frenchman's eccentric ways and darkish skin proved too much for the Southern capital, so he moved back to Paris, to spend the remainder of his career shuttling between France and the United States. All told, he spent six years of his life at sea, which would have made his late sea-captain father proud. Yet despite his near-constant state of motion, he could not outrace old age. By his sixties, Brown-Séguard had fetched up once more in Paris, as a professor at the Collège de France. His friends included Louis Pasteur, as in *pasteurization*, and Louis Agassiz, one of the forefathers of American medicine. The poor orphan from far Mauritius was inducted into the French Legion of Honor in 1880, followed by a slew of other prestigious prizes, culminating with his election as president of the Société de Biologie in 1887, confirming his status as one of the leading men in French science.

He was seventy years old by then, and he was tired. Over the previous decade, he had noticed certain changes overtaking his body, none of them good. He had always buzzed with frenetic energy, bounding up and down stairs, talking a mile a minute, then interrupting himself to scribble down his latest brilliant idea on the nearest scrap of paper, which would vanish into a pocket. He slept just four or five hours a night, often beginning his workday at his writing desk at three in the morning. It had been suggested, by his biographer Michael Aminoff, that he may have been bipolar.

But now his once-boundless vigor seemed to have abandoned him. He had evidence, too, because he had long kept track of his body, measuring things like the strength of his muscles and keeping careful records. In his forties, he had been able to lift a 110-pound weight with one arm. Now the best he could do was eighty-three pounds. He got tired quickly, yet he slept poorly if at all, and he was tormented by constipation. So naturally, being the scientist he was, he decided to try to fix the problem.

On June 1, 1889, Professor Brown-Séguard stood before the Société de Biologie and delivered a keynote address that would forever change his career, his reputation, and popular attitudes toward aging. In the talk, he reported on a stunning experiment that he had performed: He had injected himself with a liquid made from the mashed-up testicles of young dogs and guinea pigs, which he had augmented with testicular blood and semen.

His idea was simply that something in younger animals—specifically, in their genitals—seemed to give them their youthful vigor. Whatever that was, he wanted some. After a three-week cycle of injections, he reported a dramatic turnaround: “To the great astonishment of my principal assistants he claimed, “I was able to make experiments for several hours while standing up, feeling no need whatever to sit down.”

There were other benefits. His strength seemed to have returned, as his tests confirmed: Now he could hoist a hundred-pound weight, a significant improvement, and he was once again able to write late into the evenings without fatigue. He even went so far as to measure his “jet of urine,” and found that it now traveled 25 percent farther than it had prior to the injections. With regard to his constipation issues, he noted proudly that “the power I long ago possessed had returned.”

His colleagues in the audience were torn between horror and embarrassment. Extract of... *de testicles*? Had he gone mad in his old age? Later, one of his colleagues sniped that Brown-Séguard's outlandish experiment had proved only “the necessity of retiring professors who have attained the

threescore and ten.”

Undeterred, he made his magic mixture (now fashioned from the testes of bulls) available for free to other doctors and scientists, in the hope they could repeat his results, which some did. The reviews from his peers were still scathing. Harrumphed one Manhattan MD in the pages of the *Boston Globe*: “It is a return to the medical systems of the middle ages.”

Outside the halls of academe, though, Brown-Séquard became an instant hero. Almost overnight mail-order entrepreneurs began selling “Séquard’s Elixir Of Life”: twenty-five injections for \$2.50, using the good doctor’s name but with no other connection to him. The newspapers, predictably, had a field day; at last, they could print the phrase *testicular liquid*. A professional baseball player, Jim “Pud” Galvin of Pittsburgh, openly used the elixir in the hope that it would help him pitch better against Boston—the first recorded modern use of a performance-enhancing substance by an athlete. The old professor was even feted in a popular song:

*The latest sensation’s the Séquard Elixir
That’s making young kids of the withered and gray
There’ll be no more pills or big doctor bills,
Or planting of people in churchyard clay.*

Sadly, this last line proved to be wishful thinking: On April 2, 1894, five years after his address to the Société de Biologie, Charles Edouard Brown-Séquard was dead, six days shy of his seventieth birthday. Despite his fame, he had not profited one franc from his elixir. And while his fellow scientists ultimately concluded that the miraculous revival that Brown-Séquard had attributed to his “orchitic liquid” was due to little more than a placebo effect, he had kicked off a rejuvenation craze that seemed to cause even the most rational men and women to lose their minds.

The next fad was something called the Steinach operation, which promised to restore a man’s vitality but really amounted to nothing more than an ordinary vasectomy. It nevertheless became hugely popular among the male intelligentsia of Europe, including the poet William Butler Yeats, who at sixty-nine had married a twenty-seven-year-old; even Sigmund Freud, so attuned to phallic states, pronounced himself satisfied with the results.

In the United States, rejuvenation fever exploded in the 1920s, when a patent-medicine salesman named John Brinkley popularized an operation that basically involved implanting fresh goat testicles into the scrota of worn-out middle-aged men. Brown-Séquard had actually tried similar experiments on dogs back in the 1870s, but even he hadn’t dared try a cross-species transplant. Brinkley had no such qualms, perhaps because he was unencumbered by an actual medical education. He did, however, own a radio station, and he broadcast nonstop testimonials about the wonders of the operation, interspersed between performances by the Carter Family and even a young Elvis Presley.

Over the decades, he operated on thousands of patients, making himself one of the richest men in America. Meanwhile, dozens of people died on his operating table, and hundreds more were left crippled or maimed by his clumsy surgeries. And still they kept flocking to him: the tired, the worn out, the flagging, impotent, aging men of America, and even a few brave women, desperate for one more chance at youth.

They had no idea how lucky they were, just to be alive.

Chapter 1

BROTHERS

Old age isn't a battle; old age is a massacre.

—Philip Roth

The wave reared up, green and foaming, and slammed into my grandfather. For a too-long instant, he disappeared under the water. I watched from the shore, holding my breath. I was ten years old. Finally, he staggered to his feet on the shallow sandbar, wiped the spray from his eyes, and turned to face the next rising wall of water.

Lake Michigan has days when it thinks it's an ocean, and that day was one of them. All morning long, it had been hurling five-foot swells at the beach in front of my family's old frame cottage, which my great-grandfather had built with his own hands, cheap lumber, and sheer Anglo-Saxon will back in 1919. Bodysurfing on this beach was one of my favorite things on earth, and I prayed for wavy days. Unfortunately, on this day the waves were too big, and I had been forbidden to go in the water. So I sat on the porch, sulking.

With me on the porch was my great-uncle Emerson, who was my grandfather's older brother and it's fair to say, not my favorite relative just then. Stiff and somewhat humorless, he only spoke to us children to scold us for running around or making noise. He didn't swim, so he couldn't watch us on the beach, which rendered him pretty much useless to us. He never joked or played with us, either, the way the other uncles did. He just sat there, staring vacantly out at the lake. To my ten-year-old mind, he just seemed ancient, and not in a good way like a fossil or a dinosaur.

Meanwhile, out in the water, my grandfather was frolicking in the head-high waves. His name was Leonard, and even in his sixties, the old navy man still loved the rough surf. Enviously, I watched him plunge into one foaming breaker after another, emerging to wipe the water from his eyes before turning to face the next one. I adored him.

The family had gathered to celebrate his birthday, which he had mock-grandiosely dubbed St. Leonard's Day. A homemade banner proclaiming it as such fluttered from the porch railing, to the puzzlement of beach walkers. The house was a kind of landmark because it was so much older than its neighbors. It had survived the Great Depression and countless brutal winter storms, including a blizzard one during the 1930s that had washed out the sand dune on which it had been built. Nearly all the neighboring cottages were completely destroyed. The family drove out from Chicago and repaired it by themselves, and after that it was known as The Ark.

The adults gathered for cocktails at six. It may have been closer to five. Afterward the aunts fixed

dinner in the downstairs kitchen, built to hold up the house after we lost the dune. When dinner was done, ~~the men lit a bonfire on the beach, and we kids scorched marshmallow after marshmallow until~~ we were sent to bed, to the sound of crashing waves. It was just another beautiful childhood day at the lake, and it would stay lodged in my memory for years before I recognized its true significance.

Though they almost seemed like they came from different generations, my grandfather Leonard was mere seventeen months younger than his brother Emerson, a slender gap bordering on scandalous for upright Midwestern Protestants circa 1914–15, when they were born. They were nearly twins, with the same genes and upbringing, and they remained very close throughout their adult lives. Yet their fates could hardly have been more different.

Still that image haunts me: Emerson in his rocker on the porch while his only-slightly-younger brother is out there ducking major waves. Not too long after that day, Emerson began showing signs of the Alzheimer's disease that would eventually devour his mind; he died in a nursing home at the age of seventy-four. Meanwhile, my grandfather's idea of retirement was to buy a small citrus orchard in the mountains north of San Diego, where he toiled alongside the migrant farmhands until his mid-seventies. He was still going strong when a random infection felled him at age eighty-six.

The difference between the two brothers was at least partly the result of one unlikely factor: religion. Like my great-grandparents, Emerson and his wife were devout believers in Christian Science, which is a misnamed faith if ever there was, because its followers actually reject medicine and science in the belief that human ailments can be healed through prayer. So they almost never went to the doctor, for anything. As a result, Emerson had piled up biological damage like a Cadillac in a demolition derby. A succession of skin cancers that he refused to treat had eaten away at his left ear, leaving it deformed and cauliflower-like. Later, he suffered a series of minor strokes that also went unattended. Every time he had an infection that could have been cleared with antibiotics, but wasn't, that took a toll on him, too.

My grandfather had shed his Christian Science beliefs early, at the insistence of his wife, and his most consistent religious observance was a steadfast devotion to the daily cocktail hour: one Scotch-based beverage on the rocks at 6 p.m. sharp every day. He availed himself of modern medical care, which had made crucial advances against infectious illnesses, and even heart disease and cancer. Just as importantly, he had quit smoking in 1957 (unlike his brother), and he got daily exercise in the form of vigorous and often highly ambitious gardening projects, which he worked on every day before the cocktails. The result was that he enjoyed a longer life—and a much longer *healthy* life—than his brother.

Public-health experts now call this *healthspan*, one's span of healthy years, and it will be an important concept in this book: While my grandfather's *lifespan* was only about fourteen years longer than his brother's, his *healthspan* was at least thirty years greater. If I've done my job, *Spring Chickadee* will help you understand how to end up more like my grandfather, with his long healthy life, and less like his unfortunate brother.

Decades later, on another perfect summer day, I found myself again sitting on the porch of The Ark. It had been a long time since I'd visited. My grandfather's generation had moved on, and the house had been sold to a distant cousin. We didn't go there much anymore, so this was a rare treat, a return to the site of some of my happiest childhood memories. Only now I was in my early forties, and naturally I had been thinking gloomy thoughts about getting older.

This was in part thanks to my thoughtful work colleagues, who had marked my fortieth birthday by giving me a cake adorned with a single candle. Shaped like a tombstone, it read:

RIP
MY YOUTH

Which was awfully kind of them. But it was also rather brutally true: In the media world in which I've worked all my professional life, forty *is* considered old. Even though you aren't actually old—far from it—our culture nonetheless labels you middle-aged. Demographically undesirable. On the way out, career-wise. Possibly even an AOL user. My own mother had already pronounced me “no spring chicken.”

She did have a point. Inside, I could tell something was changing. I'd been more or less athletic since college—sometimes more, sometimes less—but lately I'd noticed that it had become a lot more difficult to keep in shape. If I took a few days off from running or cycling or going to the gym, my muscles would turn to Jell-O, as though I'd been sitting on the couch for weeks. When I finally did get out for a jog, I'd feel the unmistakable bounce of nascent man-boobage.

Hangovers now seemed to last for days, my wallet and my keys liked to go AWOL, and as for reading a restaurant menu by romantic candlelight, forget about it. I seemed to be tired all the freaking time. A handful of friends had already died of cancer, or come close. In idle moments, I found myself dwelling more and more on middle-aged regrets, stuck on the idea that my best years were behind me and that God was checking his watch. Right on schedule: Some scientists believe that the woes of midlife reflect the fact that we have reached a kind of biological “tipping point,” where the damage aging has begun to outpace the ability of our body and our mind to repair themselves.

When I went in for a physical exam, somewhere around age forty-three, I learned that I had mysteriously gained fifteen pounds, and my cholesterol levels now approximated those of chocolate milk. For the first time ever, I had the beginnings of a beer belly, which shouldn't have been surprising since I love beer, but it bummed me out nonetheless. All of this my doctor chalked up to “normal aging.” She smiled as she said it, as if it were nothing to worry about, and certainly no reason to take action. Nothing to be done, her slight shrug said.

Really? I wanted to know more. Like, can we make it stop? Or at least slow down? A little? Please

Finding a “cure” for aging, a way to defeat death, has been the dream of humankind literally since we began writing down our dreams. The oldest existing great work of literature, the nearly four-thousand-year-old *Epic of Gilgamesh*, in part chronicles a man's quest for the elixir of eternal life. He actually finds it, in the form of a mysterious thorny plant that he retrieves all the way from the bottom of the sea, only to have it stolen by a serpent (spoiler alert). “When the gods created man they allotted him death,” the hero Gilgamesh is told, “but life they retained for their own keeping.”

Staying young, or at least looking young, has been much on our minds. One of the oldest known medical texts is an Egyptian papyrus dating from circa 2500 BC that contains a “Recipe for Transforming an Old Man into a Youth.” Unfortunately, the recipe turns out to be a face cream made from fruit and mud, probably not all that different from the pomegranate- and melon- and milk-infused “anti-aging” creams that Americans spent an estimated eleven billion dollars on last year. My favorite is a seaweed-based potion called Crème de la Mer that sells for more than \$1,000 a pound; a British cosmetic chemist named Will Buchanan determined that its actual ingredients co

about \$50.

When *Gilgamesh* was written, relatively few humans lived long enough (or well enough) to die old age; life expectancy hovered around twenty-five years, as it had for millennia. On the day you are reading this, ten thousand Baby Boomers will celebrate their sixty-fifth birthdays. Tomorrow, another ten thousand will crank up the Jimmy Buffett and float across the Rubicon of “old age”—and so on and so on for the next two decades. At this rate, we will run out of birthday candles well before 2060 when the number of Americans older than sixty-five will have doubled to more than ninety-two million, making up 20 percent of the U.S. population. For comparison’s sake, over-sixties make up just 17 percent of the population of Florida right now.

The entire planet is turning into Florida. There are more older people on earth right now than ever in history, even in recently “developing” nations like China, where the one-child policy has skewed the population balance in a breathtakingly short period of time. For most of human history, the age distribution of the human race has resembled a pyramid, with a great many young people at the base and relatively fewer oldsters as you move up toward the peak. Now, as lifespans get longer and birthrates get smaller, the industrialized countries have become top-heavy with old folk, more like mushrooms than pyramids. According to the *Nikkei* newspaper, Japan will soon sell more adult diapers than diapers for children. Instead of succumbing to tuberculosis or polio or the plague, as previous generations, these “new old” will die of heart disease, cancer, diabetes, and Alzheimer’s—the four horsemen of the geriatric apocalypse.

These chronic diseases have become so common as to seem inevitable. Four out of five American sixty-five-year-olds are now on medication for one or more long-term ailments—for high cholesterol, blood pressure, diabetes, and sundry other complaints. Increasingly, our old age is a highly medicated one, which means that we are likely to spend the latter decades of our lives as patients—that is to say, as sick people. Public-health experts call this the period of morbidity, the portion of our lives when we suffer from chronic disease. Right now, for most people, that period consists of, basically, the second half of their lives, which is a scary thought. Scariest still is how much these legions of aging Baby Boomers are going to cost to keep around, with their medications and knee replacements and artificial heart valves—and how lousy many of them are still going to feel.

If there were ever a time when humanity needed the magic flower of Gilgamesh, this would be it.

As Montaigne observed, the real cruelty of aging is not that it kills an old person, but that it robs a young person of his or her youth. That is the greater loss, he wrote. The only mercy is that it works slowly, almost imperceptibly. Nevertheless, he wrote, Nature “step by step conducts us to this miserable state... so that we are insensible of the stroke when our youth dies in us, though it be really a harder death than the final dissolution of a languishing body, than the death of old age.”

Though I missed the Baby Boomer cutoff (1964) by three years, I did share in their grand generational delusion, that they would somehow never get old. Aging was something that happened to old people, our parents and grandparents. We, somehow, would be immune. So much for that, obviously, but what made aging real for me, finally, was not my parents hitting seventy, or even my own impending cage-match with middle age; what brought it home, at last, was what happened with my dogs.

There were two of them, a matched pair of redbone coonhound mixes, the Southern breed featured in the children’s classic *Where the Red Fern Grows*. I’d had Theo from puppyhood, and Lizzy since she was very young, and now they both qualified as canine senior citizens. The interesting thing was

that while Theo had stayed sort of puppyish, Lizzy had gone gray in the muzzle at seven or eight, and had developed a stiff-legged, lady-truck-driver walk. People would approach us on the street and ask with no regard for her considerable vanity, “Is she the mother?”

Nope: They were brother and sister, born in the same litter. But they looked so different, it was like my grandfather and Emerson all over again: One seemed so much older, yet they were exactly the same age. Only with the dogs, there was no obvious explanation, like Christian Science. They had basically the same genes, and had eaten the same food and gone for the same walks since they were young. Like my grandfather and his brother, they could not have been more similar—or more different.

Everyone has noticed this, how people seem to age at vastly different rates. We go to a school reunion, and some classmates have turned into their parents, while others look like they just got home from Beach Week. What makes the difference? Is it only “good genes,” as most people seem to think? Or is it something you can control, like what you eat? How much you moisturize? Answering this big question—why some people age more slowly than others—will be a key mission of this book.

With Theo and Lizzy, I chalked it up to random chance—which actually does play a significant role in aging, scientists believe. But that wasn’t quite it, and as it turned out, appearances were deceiving. One October Sunday, I came home from a bike ride to find Theo waiting on the porch of our cabin in Pennsylvania, all excited. He used to love racing with me on the trails, and even now that he was nearly twelve, he was still up for a quick trot around the block. So I opened the gate, and he cantered alongside me for a lap, then two, then three. He seemed fine, ready for more, so it was a shock when I took him to the vet four days later and found out that he had cancer.

Our vet is a kindly man named Tracy Sane, a country boy marooned in Manhattan, and whenever he saw the two redbones, he would get a little wistful and say something like, “Those are *real* dogs.” I’d brought Theo in to have a small skin growth removed, which should have been no big deal. The surgery would require him to go under anesthesia, so Dr. Sane donned his stethoscope to listen to his heart. As he worked his way down Theo’s chest, his expression darkened. “Theo’s got a bit of a heart murmur,” he said.

The murmur meant that Theo’s heart was enlarged, and weakened. It happens to humans as well, and is one of the most common signs of aging. And it usually means there is something else wrong. The chest X-ray revealed what it was: The space where his spleen and liver should have been was occupied by a large, fuzzy blob, about the size of a toy Nerf football. “This,” said Dr. Sane, “is a problem.” He called it a “splenic mass,” which was a soft way of saying “tumor.” It needed to come out—if it could be removed safely, he said. We made an appointment to come in first thing Monday morning. “Theo’s looking at a tough road,” he warned grimly.

Over the weekend, my girlfriend Elizabeth and I tried not to think about Theo and his tumor. The news was all about a hurricane called Sandy that was preparing to slam into the city. It was supposed to be one of the strongest storms ever to hit New York. On Saturday we walked to the neighborhood farmer’s market, where Theo and Lizzy tugged us toward their favorite stand, the one that sold turkey sausages and gave free samples to dogs. Then we snuggled up on the couch with the TV on, watching the tall sailing ship *Bounty* as she sank off North Carolina. Sandy was coming.

On Sunday we hunkered down for the storm, reading the paper and drinking coffee and then switching to wine. After dinner, we tried to get the dogs out for one last walk, but Theo wouldn’t go. This wasn’t unusual. He hated storms, and he had been known to hold out for hours rather than venture out in the rain to pee. He was a stubborn guy, and there was no dragging him. I gave him a sort of doggy massage to try to relax him, rubbing up and down his back as he lay in his bed. But we didn’t

think there was anything terribly wrong, other than the weather. The next morning, when the storm had passed, we'd take him in for his operation. He was three weeks short of his twelfth birthday.

But Theo had other plans, and they didn't include surgery. We found him before dawn, lying beside his bed, still warm except for his lips. I closed his eyes, Elizabeth pulled a blanket around his body, and we wept together.

In the weeks after Theo died, more than one friend confided that they had cried harder over the death of a dog than when their own fathers had passed away. It's not that they loved their fathers any less (and at least, not entirely that). But our parents grow old in slow motion, and we expect it. There's something about a beloved animal's short life and quick passing that hits too close to home. It reminds us too much of our own tenuous lease on this existence. In Theo's lifetime, I had gone from being a still-pretty-young man, with thirty just in the rearview, to one who was no longer quite so young, even pushing fifty.

I was so old that I was actually working on a book about aging. Theo's death pushed me into overdrive. Now I wanted to know *everything* about aging, this universal but still little-understood process that affects practically every living thing. I decided to approach it as a reportorial investigation, following the evidence wherever it led. I would read every study, every book on the subject of aging that I could find. I'd worm my way into the underfunded laboratories where the hard science was done, and I would ferret out the leaders of the field. But I would also seek out the mavericks, the rebels of science, the ones who had the courage to push novel insights, regardless of current dogma or fashion. I'd also look for the older people who are showing the way to the rest of us: the ones who are pole-vaulting in their seventies, thought leaders in their eighties; even picking stock market winners past a hundred.

I had big questions: How does time transform us? What was happening to me, as I slid into middle age, and beyond? How was my mid-forties self different from my teenage self? What would change between forty and seventy? For that matter, why is my ten-year-old niece "young," but my twelve-year-old dogs are old? What is this invisible force called aging that affects everyone I know? Everyone reading this? Everyone who has ever lived?

More to the point: How much of aging is under our control, and how much determined by fate, or random chance? My motivation was personal. Straight up, I wanted to hang on to my youth, or what was left of it, for as long as possible. I want to end up like my grandfather, diving into the waves and pruning fruit trees in his old age—and not bound to the rocking chair, like his poor brother Emerson.

And while I'd feared, early in my research, that I'd only learn a bunch of depressing stuff, that turned out not to be the case at all. Scientists are discovering that aging is far more malleable than we had ever thought—that, in effect, it can be hacked. You don't have to endure your grandfather's old age (or in my case, my great-uncle's). How well you grow old is at least partially under your control. Two of the major diseases of aging—cardiovascular disease and diabetes—are largely avoidable, and even reversible in some cases. A third, the dreaded Alzheimer's disease, may be up to 50 percent preventable.

The story of the dogs told me that there is more to longevity than simply whether or not you go to the doctor and get a weekly facial. The mystery goes much deeper than that. What's really cool and surprising, though, is how many aspects of aging can be modified, even delayed, at the cellular level. Science has discovered secret longevity-promoting pathways and mechanisms, embedded deep within our cells, that can help beat back or slow down some of the effects of aging—if we can only figure out

how to unlock them. Some of these evolutionary pathways are so ancient that we share them with the lowest life-forms, such as microscopic worms and even yeast; others we are only beginning to identify, through the enormous power of genomic sequencing.

Already, we know that certain genes seem to be linked to extreme longevity and good health, and hundreds more such genes are on the brink of being discovered. Some of them may even be able to be triggered, or mimicked, by drug compounds that are already in the research pipeline. But not everything is pie-in-the-sky: Major longevity-promoting mechanisms, hardwired into our biology, can be triggered right now, by simply going out for a short jog, or even just by skipping a meal or two. A little bit of knowledge and prevention, it turns out, may even make the difference between bodysurfing your way through the rest of your life, and spending it on the rocker on the porch.

Chapter 2

THE AGE OF AGING

The days of our years are threescore years and ten; and if by reason of strength they be fourscore years, yet is their strength labor and sorrow; for it is soon cut off, and we fly away.

—Psalm 90:10

The divergent fates of my great-uncle Emerson and my grandfather Leonard reflect the vast increase in human lifespan that has occurred over the last century. Emerson lived his life like a man of the late nineteenth century, when Christian Science was founded: a brief, flourishing youth, followed by a long, painful decline, beginning in middle age. Frankly, it's sort of amazing that he made it past seventy. My grandfather, meanwhile, was very much a twentieth-century man: Forward thinking and science-minded, he availed himself of the best that modern medicine had to offer. No surprise that he lived a much longer and healthier life than his brother.

And yet both men, even Emerson, had vastly outlived their predicted life expectancies at birth. When they were born, in 1914–15, a typical white American male could look forward to about fifty-two years on this earth. The leading killer of Americans, then as now, was heart disease—which had only just displaced tuberculosis and pneumonia, in retreat thanks to the advent of antibiotics. Influenza would briefly top the charts during the pandemic of 1918, but for the first time in history more people were dying from a disease of aging than from any other cause. The Age of Aging had begun.

Today American males enjoy a life expectancy of about seventy-seven years, with another five bonus years for women, according to the World Health Organization. Globally, though, that's nothing to brag about: We're only ranked thirty-second, behind Costa Rica, Portugal, and Lebanon, despite spending far more per person on health care. And we keep falling behind: For some subgroups of the American population, life expectancies may already have begun to decline. Meanwhile, according to some estimates, half of all German children born this year will live to see their 105th birthdays.

This explosion in longevity has no precedent in human history. Take a walk around an old cemetery sometime, and read the headstone dates: You'll find a tragic overrepresentation of infants and children, and young women who died in childbirth, while the luckier men generally lived to see their forties, and a few exceptional individuals made it past seventy—their biblical allotment threescore and ten. It was still possible to live a very long time: The first English child born in Massachusetts in 1621, a girl named Elisabeth Alden Pabodie whose parents came over on the *Mayflower*,* managed to live for nearly a century, dying in 1717 at the age of ninety-six. Back the

particularly in the rugged realm of the Massachusetts Bay Colony, growing old was an accomplishment, not an affliction. As Montaigne put it, “To die of old age is a death rare, extraordinary, and singular, and, therefore, so much less natural than the others; tis the last and extremest sort of dying.”

Things began to change in the mid-1800s, with the appearance of urban sewers and semi-modern medicine; just the widespread adoption of hand washing by doctors reduced death rates enormously. In 1881, for example, President James Garfield died not from his assassin’s bullet, but from the massive infection that his dirty-fingered doctors gave him. Deaths in childbirth, once commonplace, became more and more rare thanks to the miracles of anesthesia, antibiotics, and the cesarean section without which both I and my mother would surely have died from the trauma of bringing a nine-pound, eight-ounce child into the world. As clean water became more available (and raw sewage more distant), as medicine made progress against infectious disease, and as infant mortality plunged, life expectancies climbed rapidly. And more people than ever experienced the bizarre, inexplicable natural phenomenon called aging.

If you happen to stroll through Westminster Abbey in London, you might spot a rather extraordinary marble gravestone in the south transept. It marks the resting spot of one Thomas Parr, who according to the marker had lived for 152 years and through the reigns of ten kings. That is not a typo. Parr was a laborer in the Shropshire countryside who was famed for having lived well more than a century; indeed, he had reputedly fathered a child at the age of 122. Some earl heard about Parr and invited him to the court of King Charles I in 1635, where he enjoyed a brief celebrity that included having his portrait taken by Peter Paul Rubens. But his ride on the celebrity gravy train was cut short when, after a few weeks’ exposure to disease-ridden London and its horrific pollution, he died.

Old Parr would have been the oldest human ever to have lived—if his claimed age were even remotely close to the truth. Doubts began to arise not long after his autopsy by famed surgeon William Harvey, who noted that his internal organs were in rather good condition for being a century and a half old. Notwithstanding the age on his tombstone, modern scholars now believe “Old Parr” was actually the grandson of the *original* Old Parr, and the title was simply passed on down the line. Birth records in Shropshire were pretty spotty in the 1500s, so who can know for sure?

More recently, in the 1960s, it was claimed that residents of the Abkhazia region of the then Soviet Union, deep in the Caucasus Mountains, also routinely lived past the age of 140. Their longevity was attributed to their consumption of yogurt, which has been hugely popular ever since, despite the fact that their claims have been thoroughly debunked. Just in the last few years there’s been a resurgence of highly wizened individuals popping up in places like Bolivia and rural China, claiming to be 120 years old or more. One thing these wrinkled shysters all have in common with Old Parr is that they lack trustworthy birth certificates, so their claims cannot be verified.

The longest-lived documented human being in history was an otherwise unremarkable Frenchwoman named Madame Jeanne Calment, who was born in Arles in 1875 and claimed to have met Vincent van Gogh in the art shop of her uncle. (Not a nice man, in her opinion.) When she was around eighty, Madame Calment made a deal to sell her apartment to a lawyer friend who was then in his late forties. Under the deal, common in France, the buyer would pay her 2,500 francs per month for the rest of her life, and would take possession of the place after she died. There was only one hitch, which was that she failed to die, year after year after year. She rode a bicycle until she was 100, and smoked until she was 117; quitting might have been a mistake, because she only lasted 5 more years.

before she gave up the ghost at the age of 122. By that time, the poor schnook himself had died having paid her twice what her place was actually worth.

“I’ve only ever had one wrinkle,” she famously said, “and I’m sitting on it.”

So that’s *lifespan*. Nobody has topped Madame Calment, before or since. Period.

Life *expectancy*, on the other hand, is a statistical prediction of how long a baby born this year is likely to live, based on a dull-seeming document known as the life table. To you and me, the life table looks like an eye-glazing compendium of random numbers, about as exciting as the phone book. It lists current mortality rates—that is, the risk of dying for individuals at every single age, over the life span of a year. So, for example, the chance that a forty-year-old American woman would die in 2010 was 1.3 out of 1,000, or 0.13 percent; for a sixty-year-old female, it was 6.5 out of 1,000, a fivefold increase. If you take our hypothetical infant, and march her through this statistical gauntlet, you’ll come up with her average life expectancy.

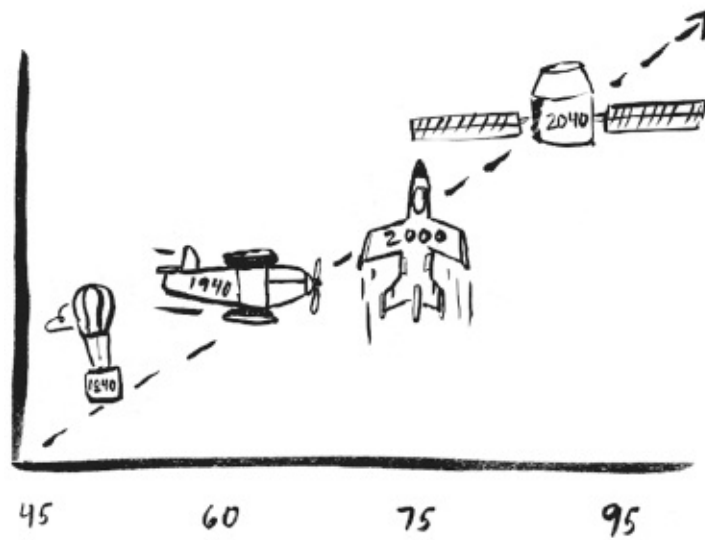
Demographers treat the life table with Talmudic reverence. It is the foundation on which the life insurance industry and the retirement system are built. And it also affords a sort of window into the future. According to the life table compiled by the U.S. Social Security Administration, and used as the basis of its online calculator, a forty-seven-year-old white American male (that is, me) can expect to live for another thirty-five years. That gets me to eighty-two. Not bad, but not even as good as my grandfather. So I sought a second opinion. I downloaded an app (for real) called Days of Life that also purports to calculate one’s remaining life expectancy, based on gender, age, and country of residence. Unfortunately, it said I had even *less* time left, more like thirty years—and for the next several weeks my phone buzzed with daily reminders: “You have 10,832 days of life remaining...”

Needless to say, I deleted it. In the real world, we can’t know whether we’ll die at eighty-two, sixty-two, or 2 p.m. tomorrow afternoon. And, luckily, the only reliable thing about life-expectancy predictions, like weather forecasts, is that they will change.

Back in the 1920s, a prominent American demographer named Louis I. Dublin, who was chief actuary of the Metropolitan Life Insurance Company, declared that average human life expectancy would peak at precisely 64.75 years—coincidentally, just three months shy of the official retirement age of 65, designated in the Social Security Act of 1933. Back then, a typical sixty-five-year-old man would have looked, felt, and smelled rather old. But it was by no means the limit. When Dublin was informed that women in New Zealand were already topping sixty-six years, he revised his estimate upward, to nearly seventy. But that also proved to be too low; even my poor great-uncle Emerson beat it.

Around the world, life expectancies have been going up relentlessly for nearly two centuries. About a decade ago, another noted American demographer named James Vaupel compiled all of the known—and reliable—historical lifespan statistics he could find, going all the way back to eighteenth-century Sweden, which kept excellent birth and death records. For each year, Vaupel and his coauthor, Jim Oeppen, and their Herculean research team, identified the country where people were living the longest, according to available data—the lifespan leaders, if you will. To their astonishment, it plotted out to a straight, unbroken line, ascending steadily as an airliner out of JFK.

LIFE EXPECTANCY



Beginning in about 1840, Vaupel's graph showed, average female life expectancy in the world's longest-lived country has increased at a steady rate of about 2.4 years per decade. And while the status of leading country has changed hands a few times, from Sweden to Norway to New Zealand to Iceland to now Japan, one thing has held true: Every four years, humans have steadily gained one extra year of potential life expectancy. Or if you prefer, every day buys us another six hours.

"The straight line absolutely astonished me," says Vaupel, from his office at the Max Planck Institute for Demographic Research in Germany. "The fact that it's held for two centuries is really amazing." Not only that, but the line plowed through many smart people's predictions that lifespan would plateau, from Dublin's to the various UN agencies to those of rival demographers, with no sign of slowing. Provocatively, he titled his study "Broken Limits to Life Expectancy."

The explanations for this relentless rise in lifespan invariably come back to the handful of factors we have already discussed: better sanitation and better medical care. Things like penicillin, sterilization, and even blood-pressure medicine have let us live longer by escaping the early deaths that plagued our ancestors. And in the developing world, this change is still happening: Globally, according to the World Health Organization, average life expectancy has increased by six years since 1990.

But in the developed world, Vaupel argues that the steady increase in lifespan actually reflects much deeper environmental changes that are affecting the way all of us age. "Before 1950, most of the gain in life expectancy was due to large reductions in death rates at younger ages," he wrote in his seminal *Science* paper in 2002. "In the second half of the 20th century, improvements in survival after age 65 propelled the rise in the length of people's lives."

It started with better medical technology: The mere fact that former vice president Dick Cheney is still alive, after his multiple heart attacks and surgeries, has to count as a marvel. Even if we're not getting new heart valves put in, we all enjoy cleaner water, cleaner air, better housing, and fewer major epidemics than even fifty years ago. That helps explain why my grandfather's brother Emerson made it into his early seventies without any medical care at all: His world was much cleaner and safer than that of his ancestors. In fact, if he hadn't smoked—his one break with Christian Science orthodoxy—Emerson might have survived almost as long as his brother.

Indeed, widespread smoking bans have reduced everyone's exposure to tobacco smoke, a potent

carcinogen, likely pushing up life expectancy even farther (although a few puffs didn't seem to hurt Madame Calment). Thanks to our ever-more-protected environment, Vaupel argues, we not only escape early death, but we are actually aging more slowly than our dirty, uncomfortable, smoke-breathing, disease-battling ancestors. "Lifespan is amazingly plastic," he says. "Seventy-year-olds today are about as healthy as sixty-year-olds were a few decades ago. They get disease and disability later; those bad five years at the end of life are now occurring at age eighty or eighty-five instead of age seventy."

Old isn't so old anymore, in other words. People are living less like Emerson, who was already ancient by the time he turned sixty, and more like my grandfather, who stayed relatively youngish into his seventies. The boundary of "old" keeps getting pushed out, by people like Diana Nyad, who swam from Cuba to Key West at the age of sixty-four, just months shy of traditional retirement age. "Sixty is the new forty" was practically her mantra. She's not that much of an outlier, either: Two of my regular bike-riding partners are guys who are on Medicare, and they make me suffer to keep up with them. And yet when Humphrey Bogart played the world-weary, decrepit-seeming Rick in *Casablanca* (filmed in 1942, he was all of forty-two years old. (Maybe it was all the smoking?))

If sixty is the new forty, then ninety-five might also be the new eighty: A recent Danish study on cognitive aging showed that the current crop of ninety-five-year-olds had reached that age in marked better possession of their marbles than the cohort just a decade older than them. Vaupel, and others believe that these older people are actually aging more slowly than people in previous generations. "What has become apparent over the last thirty years is that a completely new and completely unforeseen driver of the continuing increase in longevity has emerged," says Thomas Kirkwood, a prominent biologist at the University of Newcastle in England who heads up a study of the "oldest old," those older than eighty-five, "and that is the fact that people are reaching old age in better shape than they ever did before."

But can this two-century increase in lifespan continue? Will the Vaupel slope keep climbing?

Not everyone thinks so, and one leading expert believes human longevity is about to take a huge step in the wrong direction.

Jay Olshansky met me at the door of his house in suburban Chicago, and we drove to a popular hot dog joint called Superdawg, because if there's one thing Chicago does well, it's cased-meat products. Olshansky admitted to loving hot dogs, and although he claimed he rarely ate them, he seemed to know a great deal about where to get the best ones. "As long as you don't eat like this every day, you're fine," he assured me as we pulled into the parking lot.

Which was interesting, because one thing he is known for is his firm conviction that things like "healthy lifestyles" don't ultimately affect longevity all that much. In the life-expectancy business, he is known as a strong skeptic. On the drive over, he was complaining about a billboard from the Prudential financial-services company that warned, "The first person to live to be 150 is alive today. Better be prepared."

"They're using made-up numbers," he fumed. "It has no basis in science."

Worse, if Prudential is right, then Olshansky will have lost a major bet. In 2000, he made a wager with a colleague, an evolutionary biologist named Steven Austad (whom we'll meet later on). Austad bet that in the year 2150, there will be at least one 150-year-old living on earth—in other words, that Prudential is right. Olshansky said no way. They each put up a symbolic \$150—but thanks to his shrewd investments in gold, Olshansky bragged, their original \$300 has grown to more than \$1,200.

By 2150, if this rate of return continues, the pot will be worth around \$1 billion, which he fully expects his great-grandchildren to collect.

Olshansky believes that Madame Calment's 122 years represents the *upper* limit of human lifespan, a limit programmed into our genome and perhaps our very biochemistry. And that maximum figure has not changed; if anything, the old Frenchwoman was a bit of an outlier. Nobody has come close since she died in 1997. At this writing, the world's oldest person is a 116-year-old Japanese woman named Misao Okawa, born in 1898, followed closely by Gertrude Weaver, an African American woman born in Arkansas to sharecropper parents; both are among the top ten oldest people ever, but they seem unlikely to steal the crown from *La Calment*.

As for *average* life expectancy, Olshansky expects that to plateau around eighty-five, for most of the world—and, if anything, to begin to decline in some countries, such as ours.

But what about the Vaupel chart?

"It's a fantasy, a pure fantasy," he growled, between bites of meaty goodness. He explained his reasoning: "If we extrapolate historical records for running the mile, using the same methodology you'd come to the conclusion that in a couple hundred years from now, people will be running a mile instantaneously. Which is ridiculous."

Of course it is, although there is one important difference: Record times in the mile are getting shorter, while lifespans are getting longer. "There's a reason why you can't run a mile in zero, but there's no limit to how long you can live," Vaupel insists. And nobody is arguing that lifespans will someday be infinite. (Well, actually, one guy *is* arguing that, and we'll meet him soon.)

The Olshansky-Vaupel debate has gotten so heated and so personal that for a while, the two men would take pains to avoid attending the same conferences, lest they inadvertently run into each other. But at the core of their rivalry lies an important question: How flexible, exactly, is human longevity? What are the limits, if any?

Olshansky's basic point is worth investigating: "There are biological forces that influence how fast we can run, and biological forces that limit how long we can live," he insisted. "It's like putting air in a tire," he continued, breaking out another user-friendly analogy. "When you start pumping, it's easy, but as the tire fills up, it gets harder and harder."

For example, he said, even if we somehow cured half of all fatal cancers—the second-leading cause of death in the United States—average life expectancy would rise by a little more than three years. That's all. And even if we managed to cure heart disease, cancer, *and* stroke, the top three killers, we'd still only earn about ten years—a substantial jump, but one that still puts us short of the century mark. "You don't come close to 100," he said, "and 120 is even crazier, by several orders of magnitude."

But plenty of his colleagues would disagree—starting with Vaupel, who gleefully notes that his famous slope has already blown past Olshansky's predicted life expectancy limits. In 1990, Olshansky had confidently declared that life expectancies would soon top out around age eighty-five. Within a decade, though, Japanese women were already pushing eighty-eight. Men and women in Monaco, the world's wealthiest "nation," are already butting up against the threshold of ninety.

"You can think of the slope as the frontier of possibility, the frontier of what humans can do in terms of achieving life expectancy," Vaupel had told me.

Yes, Olshansky replied, the frontier is one thing; but how people are actually living, and more important dying, is quite another. If anything, he believes lifespans will soon begin to *decline* in many

areas of the developed world—something else that has rarely been seen in modern history, except for times of war and widespread disease. “There are lots of things you can do to shorten your life, but lengthening it is a different issue,” he said.

One good way to shorten your life, statistically, is by becoming obese. Olshansky believes that the epidemic of tubbiness that began in the United States in the early 1980s has already slowed the growth in life expectancy. A third of the population is officially obese, with another third clocking in as overweight, meaning with a body-mass index (BMI) between twenty-five and thirty. As a result, in nearly half of all U.S. counties, many of them in the rural Southeast, female mortality rates have already started rising again, after dropping for decades. In some parts of Mississippi and West Virginia, life expectancy for men and women is lower than in Guatemala.

The problem is not limited to country folk: A recent *Journal of the American Medical Association* (JAMA) study showed that the Baby Boom generation is the first in centuries that has actually turned out to be less healthy than their parents, thanks largely to diabetes, poor diet, and general physical laziness. The percentage of women who said they never engaged in physical activity has tripled since 1994, from 19 percent to nearly 60 percent. Younger generations are faring even worse, succumbing to obesity at ever younger ages, particularly women between nineteen and thirty-nine. Another study compiling data from autopsies of people who died in accidents prior to age sixty-four, showed that their cardiovascular risk factors were actually much worse than expected, meaning the long-running improvement in Americans’ heart health that has been going on since the 1960s appears to have stalled. For these folks, sixty is not the new forty; forty is the new sixty.

“The overall health of the population is growing worse, not better,” Olshansky asserted. “And it’s getting worse faster than we thought.” By his estimate, overall U.S. life expectancy could decline by between two and five years over the next couple of decades—a steep drop away from the Vaupio slope.

It’s not just in the United States, either: Obesity and diabetes rates are soaring in places like India and even in the Japanese island of Okinawa, famed as a “Blue Zone” because of its large numbers of centenarians. Thanks in part to the heavy U.S. military presence, middle-aged Okinawans eat a fast-food-heavy diet and are now some of the least healthy people in Japan. The Blue Zone is turning into a red zone.

Everyone ages, but not everyone ages equally. In poorer countries, poorer states, and poorer neighborhoods, life expectancies tend to be far shorter than average; one study of London residents even showed that where you get off the Tube can make a huge difference in how long you live. Low education levels, Olshansky says, are an even stronger predictor of early mortality. Still other research suggests that the educational level of one’s mother is a key determinant of late-life health. “America is diverging,” he said. “We’re going to see breakthroughs in longevity for some, along with a drop in life expectancy for large subgroups of the population.”

He eyed the last bite of my WhoopskiDawg, a massive Polish sausage buried in mustard and grilled onions. “How was that?”

“Jay Olshansky is a smart guy, and a friend of mine,” says Aubrey de Grey, his extravagant beard twitching with each sharp syllable. “But he says some *incredibly* stupid things. I mean, it’s almost embarrassing.”

The verdict is rendered more damning by de Grey’s clipped, British-boarding-school accent, a voice he has used to dismiss, dispute, and intimidate his critics and debate opponents for more than

decade and a half. We'd been chatting on the scruffy sofa in the offices of his foundation when an emergency struck: He ran out of beer. So we decamped to a nearby pub, which is relatively empty four in the afternoon here in Mountain View, in the healthy, industrious heart of Silicon Valley.

He was referring to Olshansky's insistence that lifespan itself is finite, somehow programmed in our genome with the immutability of a Biblical Commandment: *Thou Shalt Not Live Longer than 120 Years*. For Aubrey, potential human lifespan doesn't end at 120; rather, that's just a beginning. He is famous for, in reverse order, his beer intake (prodigious, yet somehow not debilitating); his beard (Duck Dynasty meets Osama bin Laden); and his views on aging, which were once considered extreme but are increasingly, if grudgingly, accepted by some mainstream scientists.

With his London Fog complexion, red-rimmed eyes, and heroin-addict build, the fifty-two-year-old de Grey looks distinctly out of place in the robust California sunshine, like a religious hermit on a cruise ship. In fact, he's anything but reclusive: He's just returned from a TED speakers' reunion before flying back to England. He maintains a grueling schedule of meetings, lectures, conferences, and interviews like this, which he conducts while also answering emails at the rate of about one every five minutes.

You might have seen him on *60 Minutes* a few years ago when, pint in hand, he informed Morley Safer that some people who were alive now would live to be a thousand years old. In an article in a scientific journal published around the same time, he went even farther, claiming that people born at the end of this century might be able to enjoy lifespans of five thousand years or more. That is roughly equivalent to someone from the Bronze Age living long enough to open a Facebook account.

This kind of talk drives Olshansky completely bonkers—"He makes up numbers depending on what he's talking to!" he sputtered—but de Grey answers such complaints with a simple argument: "Just because something hasn't happened yet, doesn't mean it won't ever happen."

Example A: powered human flight, first proposed by Leonardo da Vinci circa 1500, realized by the Wright brothers some four centuries later, propelled by jet engines just fifty years after that, and achieving supersonic speeds within another decade. Oh, and we've been to the moon. Each breakthrough, de Grey has written, was "technologically unimaginable to the previous milestone achievers." Why should aging be any different?

The son of a single mother who styled herself an artist, Aubrey Nicholas David Jasper de Grey attended London's plummy Harrow School on scholarship and studied computer science as an undergraduate at Cambridge. He embarked on a career as a software engineer, but he soon found himself gravitating toward an even more intractable problem: aging.

His interest was more than academic. In 1991, in his late twenties, he married Adelaide Carpenter, a Cambridge professor of genetics who was nineteen years his senior. Under her tutelage, he began educating himself, devouring journal articles about aging science and posting in the online forums at the time. He proved a quick study, publishing his first journal article in 1997, a new theory about the role of mitochondria, the little power plants in all of our cells. That paper later evolved into a book that was impressive enough to earn him a Cambridge PhD, under the university's "special rules" for nonconventional students who had not actually studied there (the philosopher Ludwig Wittgenstein earned his Cambridge degree the same way). Armed with that credential, de Grey elbowed his way onto the stage of aging science, wielding a fast-talking debating style, fueled by more than enough arrogance to pull it off. "I am," he assured me over beers, "the most important figure in aging today."

Possibly. For the past decade or more, de Grey has been asking a simple but provocative question:

What if we could somehow “cure” aging itself? What if we could defeat it completely, the way we beat smallpox and polio?

In a 2002 manifesto, which he expanded into his 2007 book *Ending Aging*, de Grey outlined a seven-point program by which it would be possible—theoretically—to do just that. His plan, which he calls SENS (for “Strategies for Engineering Negligible Senescence”), would basically engineer the effects of aging out of our very cells... somehow. One way, for example, would be to clear out the “garbage” that accumulates inside our cells, over time. “Your house works fine if you take out the garbage every week, because that’s a manageable amount of garbage,” he says. “It’s only if you don’t take it out for a month that you get into a problem.”

So all we need to do, to stop or slow these particular effects of aging, is figure out how to empty out our cellular garbage. Somehow.

To call SENS ambitious is an understatement: Another one of its seven pillars entails, in effect, curing cancer. But if it succeeds, de Grey insists, the Vaupel slope will actually get steeper, until eventually we achieve what de Grey calls “longevity escape velocity,” where each year we would gain more than twelve months of additional lifespan. And thus some of us might theoretically be able to stick around long enough to enjoy whatever it is that people will be doing in 3015 instead of checking Facebook.

Which sounds crazy, maybe even a little scary. Olshansky and twenty-seven other eminent scientists got together in 2005 and published an attack on de Grey and his SENS project, basically saying *Whoa, slow down, cowboy*: “Each one of the specific proposals that comprise the SENS agenda is, at our present stage of ignorance, exceptionally optimistic,” reads one of the milder passages. Words like *nonsensical*, *fantasies*, and even *farrago* (a confused mixture, or hodgepodge) were thrown around. “Journalists with papers to sell or air-time to fill too often fall for the idea of a Cambridge scientist who knows how to help us live forever,” they huff. They also point out that, by the way, de Grey isn’t actually a “Cambridge scientist,” as he has never held an academic appointment there, anywhere else for that matter. (He was employed by the university, but as a computer technician in a genetics lab.)

Perhaps predictably, the attack had the opposite effect: It actually raised de Grey’s profile. Rather than ignoring him, the scientists had engaged him. The magazine *Technology Review*, published by MIT, offered a \$20,000 prize to anyone who could definitively refute de Grey’s theories to a panel of neutral judges. Three groups of scientists took the challenge, but none of their rebuttals was deemed sufficient to win the prize. Another victory for de Grey.

The controversy persists to this day, dividing the field of aging science into two camps: not merely pro- and anti-Aubrey, but those who think we can’t do much about aging, beyond maybe tacking on a few healthy years to our hard-won fourscore, and those like Aubrey, who think we might be able to do a lot more, perhaps even reengineering human biology to transcend all its previous limits.

As to when this might actually happen, the jury is most definitely out, and not even de Grey is expecting it to return with a verdict anytime soon. He himself has signed up to be cryonically preserved after his death, à la Austin Powers—that is, immersed in a tank of liquid nitrogen in the hope that, someday, he might be brought back to life. He’s not alone: Dozens of others, perhaps hundreds, have signed the forms and paid up to \$200,000 for the procedure. The most famous cryonically frozen person, or part of a person, is Ted Williams’s head, which now resides in a liquid nitrogen-cooled tank outside Phoenix. The only hitch is that the technology required to freeze and revive a living creature, even a mouse, does not yet exist. The idea that we might bring back Ted Williams’s head, and attach it to a new body—let alone that this would be on the to-do list of some

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