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# NEW YORKER

# INSIDE THE HEALTH, MEDICINE & THE BODY ISSUE

## Silicon Valley's Quest for Eternal Life

In the April 3, 2017, issue of *The New Yorker*, in "The God Pill" (p. 54), **Tad Friend** reports on Silicon Valley's quest to live forever, and considers whether billions of dollars' worth of high-tech research can succeed in making death optional. Friend travelled to Los Angeles, where Norman Lear hosted the kickoff event for the National Academy of Medicine's Grand Challenge in Healthy Longevity, which will award at least twenty-five million dollars for breakthroughs in the field. Attendees included Goldie Hawn; Sergey Brin, the co-founder of Google; Liz Blackburn, who won a Nobel Prize for her work in genetics; Martine Rothblatt, the founder of a biotech firm that intends to grow new organs from people's DNA; and Joon Yun, a doctor who runs a health-care hedge fund. Yun told Friend that if we hack the code of aging correctly, "thermodynamically, there should be no reason we can't defer entropy indefinitely. We can end aging forever."

The great majority of longevity scientists are healthspanners, who want to give us a healthier life followed by a quick and painless death. Immortalists, who'd like us to live indefinitely, see centuries of wild theorizing (that aging could be reversed by breathing the same air as young virgins, for example) swiftly replaced by computer-designed drugs and gene therapies. Research efforts have attracted funding from such investors as Jeff Bezos and Peter Thiel, billionaires eager to stretch our lives, or at least their own, to a span that Thiel has pinpointed as "forever."

Bill Maris, the founder of Google Ventures, decided to build a company that would solve death, and in 2013 Google launched Calico with a billion dollars in funding. "Calico added a tremendous amount of validation to aging research," George Vlasuk, the head of a biotech startup called Navitor, told Friend. "This is not about Silicon Valley billionaires living forever off the blood of young people," Maris said. "It's about a 'Star Trek' future where no one dies of preventable diseases, where life is fair."

In December, Juan Carlos Izpisua Belmonte, of the Salk Institute, announced that he had figured out a way to trigger the Yamanaka factors, four genes that appear able to rejuvenate stem cells. Belmonte told Friend, "The idea is not to increase life span but to have yourself working better." He added, "Obviously, if you improve all the cells in your body, as an indirect consequence you will live longer." But, even if Belmonte finds a practical method to use in humans, there will likely be unexpected side effects. "To repair tissue, you need to rejuvenate stem cells. But stem cells need to divide to do their job, and the division process invites random mutations—which drive cancer," Friend writes.

Some immortalists believe that we can retool our biology and remain in our bodies; others believe that we'll eventually merge with mechanical bodies or with the cloud. Ray Kurzweil—the futurist and director of engineering at Google, who hopes to create a virtual avatar of his late father—has a backup plan if neither course of research advances as quickly as he expects: when he dies, he will be frozen in liquid nitrogen, with instructions left to reawaken him once science has finished paving the road to immortality. For Kurzweil, the acceptance of inevitable death is no saner than the acceptance of early death. "It's a common philosophical position that death gives meaning to life, but death is a great robber of meaning," he said. "It robs us of love. It is a complete loss of ourselves. It is a tragedy."

#### Why Are Refugee Children Falling Unconscious?

In "The Apathetic" (p. 68), **Rachel Aviv** reports from Sweden, where every year dozens of children are diagnosed with *uppgivenhetssyndrom*, or resignation syndrome—an illness that is said to exist only in Sweden, and only among refugees. The patients—whose applications for asylum are in limbo or have been denied—have no underlying physical or neurological disease, but they seem to have lost the will to live. The Swedish refer to them as *de apatiska*, the apathetic. The Swedish Board of Health and Welfare advises that a patient will not recover until his family has permission to live in Sweden. Elisabeth Hultcrantz, a doctor who volunteers for the charity Doctors of the World and has treated more than forty children with apathy, told Aviv, "I think it is a form of protection, this coma they are in." Hultcrantz continued, "They are like Snow White. They just fall away from the world."

No country has responded to refugees "with greater diligence and conscientiousness than Sweden. The apathetic children embody the country's worst fantasy of what will become of the most vulnerable if Sweden abandons its values," Aviv writes. "People think they are coming to the promised land," Lars Joelsson, the president of the Swedish Association for Child and Adolescent Psychiatry, told Aviv. "We don't live up to our high ideals." No apathetic patients are known



to have died, but a few have been bedridden for as long as four years. Karl Sallin, a pediatrician at Karolinska University Hospital, who is writing a Ph.D. dissertation on apathy, said that he finds it disturbing that doctors seem content to let children dwell in a coma-like state for months or years, until Sweden grants them residency. "There's been this resistance to look into the brain and acknowledge that there is a biological system at work," he said. "People have built this sort of belief system around these children, and this is where the residency permit comes in—it's the symbol in this battle."

Georgi, a Russian refugee who was diagnosed with *uppgivenhetssyndrom*, in 2015, after Sweden's Migration Board rejected his family's final appeal for asylum, recalled his months in bed, when he felt as if he were in a glass box with fragile walls, deep in the ocean. If he spoke or moved, he thought, it would create a vibration, which would cause the glass to shatter. "The water would pour in and kill me," he said. In May, 2016, Georgi's family was granted permanent residence in Sweden—and he began to recover.

#### When It Comes to Diagnosis, Will A.I. Replace the M.D.?

In "The Algorithm Will See You Now" (p. 46), **Siddhartha Mukherjee** considers how doctors learn to diagnose—and whether machines can learn to do it, too. Sebastian Thrun, a computer scientist, became convinced that he could outdo first-generation diagnostic devices, such as computer-assisted electrocardiograms and mammograms, by moving away from rule-based algorithms to learning-based ones. In 2015, he put together a team that taught a machine to classify images of potentially cancerous skin lesions into diagnostic categories more accurately than expert dermatologists. But the internal adjustments and processing that allow the network to learn happen away from our scrutiny—we can't know exactly how it determined that a lesion was a melanoma. Thrun said, "You cannot tell what they are picking up. They are like black boxes whose inner workings are mysterious." The "black box" problem is endemic in deep learning.

Thrun insists that deep-learning devices will not replace dermatologists and radiologists—they will augment the professionals, offering them expertise and assistance. "Just as machines made human muscles a thousand times stronger, machines will make the human brain a thousand times more powerful," he told Mukherjee. Thrun envisions a world in which we're constantly under diagnostic surveillance—our cell phones would analyze shifting speech patterns to diagnose Alzheimer's, a steering wheel would pick up incipient Parkinson's through small hesitations and tremors, a bathtub would perform sequential scans as you bathe.

Geoffrey Hinton, a computer scientist at the University of Toronto, told Mukherjee that the future of automated medicine is based on a simple principle: "Take any old classification problem where you have a lot of data, and it's going to be solved by deep learning." In the near-term, he wants to use learning algorithms to read X-rays, CT scans, and MRIs of every variety; in the future, they might read Pap smears, listen to heart sounds, or predict relapses in psychiatric patients. The new intelligent systems, Hinton stressed, are designed to learn from their mistakes. "We could build in a system that would take every missed diagnosis—a patient who developed lung cancer eventually—and feed it back to the machine. We could ask, What did you miss here? Could you refine the diagnosis? There's no such system for a human radiologist." Hinton expects the role of radiologists to "evolve from doing perceptual things that could probably be done by a highly trained pigeon to doing far more cognitive things."

An algorithm of this kind, however, cannot investigate cause. Mukherjee shadowed Lindsey Bordone, a physician at Columbia University's dermatology clinic, and, in almost every case, Bordone spent the bulk of her time investigating causes. The most powerful element in her clinical encounters "was not mastering the facts of the case, or perceiving the patterns they formed. It lay in yet a third realm of knowledge: knowing why," Mukherjee writes. "Knowing why—asking why—is our conduit to every kind of explanation, and explanation, increasingly, is what powers medical advances." When asked about our automated future, David Bickers, the chair of dermatology at Columbia, said, "We have to think hard about how to integrate these programs into our practice. How will we pay for them? What are the legal liabilities if the machine makes the wrong prediction? And will it diminish our practice, or our self-image as diagnosticians, to rely on such algorithms? Instead of doctors, will we end up training a generation of technicians?"

### High-Tech Hope for the Hard of Hearing

In "Pardon?" (p. 38), **David Owen** reports on the efforts of scientists to restore hearing, and reflects on his personal experience with hearing loss. According to the National Academy of Sciences, hearing loss is, worldwide, the "fifth leading cause of years lived with disability," and the National Center for Health Statistics has estimated that thirty-seven million adults have lost some hearing. Unlike taste buds and olfactory receptors, which the body replenishes continuously, the most delicate elements of the human auditory system—hair cells—don't regenerate. Damage to hair cells or to the nerve synapses they're attached to is the most common source of hearing loss, and aging and noise are the leading causes. In recent years, scientists searching for ways to restore hearing have made a number of promising discoveries. David Corey, a neurobiology professor at Harvard Medical School, and his colleague Bence György are studying how genetic mutations delivered to the cochlea of mice by a harmless virus could treat hearing loss. Albert Edge, a researcher at the Eaton-Peabody Laboratories, part of Massachusetts Eye and Ear, is studying how a drug that had been developed for treating Alzheimer's could trigger the regeneration of hair cells in mice, thus recovering some hearing. "The ear is maybe a little bit behind the eye, in terms of treatment, but there has been a lot of progress, and between the soldiers and the baby boomers there's a lot of interest," Edge tells Owen.

Owen writes about his own experience with tinnitus, or ringing of the ears, which is almost always accompanied by hearing loss. "The ringing in my ears is constant, high-pitched, and fairly loud," Owen writes, "but I'm usually able to ignore it, unless I'm lying awake in

bed or, as I discovered recently, writing about tinnitus." There's no cure for tinnitus; treatment often includes hearing aids, which can disguise the problem by bringing up the volume of everything else. Owen visits the hearing-aid manufacturer Starkey Hearing Technologies, in Minnesota. He undergoes a standard hearing test, called an audiogram, and is fitted for a pair of Starkey's Muse hearing aids. "My main reaction when I first put them on was mild annoyance at the sound of my voice," he writes. The Starkey line with the most features is Halo. Halo wearers can stream music, phone calls, recorded books, television shows, and other radio content via Bluetooth directly into their hearing aids from all current Apple devices. The wearing of hearing aids has long been stigmatized in a way that the wearing of eyeglasses has not, and, because it has, hearing-aid manufacturers have invested heavily in inconspicuousness—one of a number of reasons that hearing aids like Halo sell for more than three thousand dollars each. Owen also tests a new Bose product called Hearphones—high-fidelity headphones designed, in part, to help people cope with conversations in places like crowded, noisy restaurants. With a smartphone app, users can raise and lower background sound levels, and adjust the range of focus. "In the past five years, there's been an explosion of biotech companies getting serious about the inner ear for the first time," Charles Liberman, the director of Eaton-Peabody, says. "I think most people in the field would say it's no longer a question of if we will be able to unlock enough of the secrets, but merely a question of when."

Plus: In Comment, Jeffrey Toobin reflects on the Supreme Court Justice nominee Neil Gorsuch's confirmation hearing, and considers his past decisions, which suggest that he would be at least as conservative a judicial activist as Samuel Alito (p. 33); in the Financial Page, Adam Davidson examines the implications of President Trump's declaring employment numbers "very real" or fake news based solely on how they reflect on him (p. 37); in Shouts & Murmurs, Ethan Kuperberg lists what he has in common with Donald Trump (p. 45); Margaret Talbot reads Carol Sanger's new book, "About Abortion," and considers why it has become so hard to get an abortion, and why so few women discuss their own experiences (p. 86); Jerome Groopman reads two new diet and health books that investigate what we do and don't know about fat and sugar (p. 92); Dan Chiasson writes about the career of the late poet Bill Knott (p. 98); Emily Nussbaum reviews "Riverdale," on the CW (p. 100); comic strips by R. Kikuo Johnson (p. 40, p. 58, p. 64, p. 76); poetry by Jill Bialosky (p. 60) and Danielle Chapman (p. 73); and new fiction by John Lanchester (p. 78).

**Podcasts: Dorothy Wickenden** speaks with **Ryan Lizza** about the scandals plaguing the Trump Administration; **Jill Lepore** discusses how the Supreme Court uses historical research to bolster its decisions; and **John Lanchester** reads his short story "Signal."

**Digital Extras:** Photographs by Saul Leiter from the nineteen-forties of Fay Ennis, a retired market-reasearch executive who is now ninety-two; additional photographs of refugee children in Sweden suffering from resignation syndrome; additional photographs of Unity Biotechnology's efforts to combat aging; and poetry readings by **Jill Bialosky** and **Danielle Chapman**.

The April 3, 2017, issue of *The New Yorker* goes on sale at newsstands beginning Monday, March 27.



"I'm sorry, but refusing to use an Oxford comma isn't really grounds for divorce."