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BEST LIFE

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"I want to raise the stakes."

(Mr. Burns wears Ralph Lauren Purple Label. Details on p. 147)

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antiaging cocktail
Many scientists believe drugs that slow down aging will exist within 25 years.

COULD HE LIVE TO 2150?

by carl zimmer
photographs by bill diodato

Two preeminent aging experts are on opposing sides of a bet that someone living today will be alive in 2150. At stake is not only a wager but also the answer to fundamental questions about the biology of aging and the ability we have to stretch our life span.

COULD HE LIVE TO 2150?

If he hadn't been savaged by a lion, Steven Austad might never have discovered the elasticity of aging. Just out of college, he became friends with a lion trainer who rented animals to movie studios. Soon he was in Hollywood, working with exotic felines. One morning, he was walking Orville, a 300-pound lion, when a duck darted out from some reeds. The 2-year-old lion pounced, and Austad disciplined the big cat with a slap on the head. Orville released the duck, but then pounced on Austad. He knocked Austad down and sunk his teeth into Austad's knee. Austad didn't struggle because he knew lions are possessive of their food and Orville might lunge for his neck next. So he waited...for 15 minutes... with the lion gnawing on his leg. Finally, another trainer spotted him and sprayed Orville with a fire extinguisher. Austad spent six days in the hospital and realized that he needed to find a safer, more rewarding way to work with animals. He became a biologist and traveled the world, ending up on the remote savannas of Venezuela, studying a less frisky animal, the opossum.

While trapping female opossums, attaching radio collars, and catching them again every month to count the babies in their pouches, Austad noticed something bizarre. "They were falling apart at an incredible rate," he says. "I'd catch one that would look great, and then I'd catch her a couple of months later and she'd have cataracts and arthritis." *Why*, he wondered, *did they age on such a fast schedule? Why did they get old at all?* As animals age, their cells show increasing signs of damage. But animals also have the ability to repair their cells. So why weren't the opossums keeping their bodies in good working order until they were killed by a predator or a parasite? "That question doesn't strike enough people as a mystery on its own," he says. "Just about everything we are familiar with ages, so people just accept it as a given. But I don't."

Austad scoured the scientific literature for ideas about why we age, and he found a hypothesis that explained it: Aging is an inescapable by-product of evolution. Repairing damaged cells may let an animal live longer, but it also requires a lot of energy that could be used for other things—like maturing faster and having bigger litters. In Venezuela, Austad proposed, living fast and dying young was the best way for the opossums to pass on their genes. Stalked by jaguars, they were likely to be killed anyway, so staying youthful was a waste of effort. If Austad was right, opossums that enjoyed a safer life might also enjoy a slower, longer one.

THE COMBATANTS Steven Austad doing research in Venezuela in 1986 (left); S. Jay Olshansky in his office last year (right)

On Sapelo Island, off the coast of Georgia, Austad found a population of predator-free opossums. They had it so easy that he often found them sunbathing in the road. He tagged and tracked them for the next few years. The chilled-

HOW TO LIVE A LONGER—AND HEALTHIER—LIFE

You know you should listen to your doctor, eat right, exercise, and never

1 FLOSS DAILY. The consequence of not flossing (and the majority of men don't) is more than bad breath. There is increasing evidence that the gums serve as an early warning system for a range of serious diseases. Earlier this year, researchers writing in *The New England Journal of Medicine* found that aggressive treatment of gum disease leads to improvements in blood-vessel function, which lowers the odds of having a heart attack. Another recent study of 51,529 men linked gum disease to pancreatic cancer. Other scientists have tied gum disease to diabetes and stroke.

2 EAT SMARTER. Okinawa has more centenarians than anywhere else on earth, and five times as many on a per capita basis as the United States. One reason is their antioxidant-rich diet of fish, tofu, and vegetables. Not just any antioxidant will do though: A recent Johns Hopkins Bloomberg School of Public Health study found that taking vitamin C or E or beta-carotene pills had no significant effect on mortality. But eating fruits and vegetables—particularly deeply colored ones such as spinach, sweet potatoes, and blueberries—helped prevent cancer and heart disease. Restrict yourself to supplements with proven health benefits, such as sterol products that can lower "bad" cholesterol and fish-oil pills that contain heart- and brain-protecting omega-3 fatty acids.

3 LIFT WEIGHTS. Increased muscle mass speeds up metabolism, strengthens bones, and boosts heart health. In May, scientists at the Buck Institute for Age Research showed for the first time that resistance training can also cause cellular-level changes in muscle, pushing genes back to a younger level of function. Two 45-minute sessions of weight lifting a week is all you need.

"JUST ABOUT EVERYTHING WE ARE FAMILIAR WITH AGES, SO PEOPLE JUST ACCEPT IT AS A GIVEN. BUT I DON'T," SAYS AUSTAD.

out island opossums, he discovered, lived 25 percent longer than their cousins on the mainland. They also enjoyed better health for a longer time. It was as if Austad discovered an isolated Pacific island on which people regularly lived to 100.

Austad started to formulate an idea that would inform his research for the next 20 years: Aging isn't set in stone. It's more like Silly Putty, stretched and squashed as animals adapt to their changing world. In fact, Austad and other researchers found they could make animals live longer, either by changing their diets or tinkering with their genes. These experiments led Austad to a startling conclusion: It might be possible for man to take over where evolution left off and slow the rate at which we age, stretching our life span.

It wasn't an idea he embraced lightly. As one of the nation's preeminent experts on aging, Austad, a professor of cellular and structural biology at the Sam and Ann Barshop Institute for Longevity and Aging Studies, at the University of Texas, spends a lot of time debunking the many bogus claims that float around about how to live forever. Yet he could not ignore the possibility that someone would eventually develop a drug that could slow the aging process, adding healthy years to people's lives. By February 1999, Austad was ready to go on the record. At a gerontology symposium, a reporter asked him if, and when, someone would live to the age of 150.

"I think that person is alive already," he replied.

That remark caught the attention of another aging expert, S. Jay Olshansky, who had spent the previous 15 years poring over historical data on human longevity. "You've got to be kidding," Olshansky told Austad over the phone. Olshansky didn't think anyone was going to live to 150 anytime soon. But Austad was quite serious, and so the two men made a wager. They each put up $150, which Olshansky invested in a fund. The winnings will be handed out in the year 2150. If there is a 150-year-old alive on earth—someone of sound mind and body—Austad's descendants will get the pot, which Olshansky has calculated will grow to $1 billion thanks to his shrewd, but secret, investments. If no such Methuselah can be found, Olshansky's offspring will win.

In the years since the bet, the two scientists have closely monitored new evidence, and, somewhat remarkably, neither has seen any reason to budge on the bet. This fall, they're even debating each other before an audience of insurance executives like two prizefighters. In one corner, Austad, the swashbuckling adventurer and optimist, points to

THE FUTURE OF AGING

Six experts prognosticate on what we can expect in 2150

1 THE BIOTECH PROPHET

David Sinclair *Cofounder of Sirtris Pharmaceuticals*

"It is feasible that our research could lead to a single daily pill that can delay the aging process. Unless you're hit by a bus, you should live 50 years longer. The first such pill could be available within our lifetime, and possibly within the next decade."

2 THE FUTURIST

Ray Kurzweil *Author of* The Singularity Is Near: When Humans Transcend Biology

"I predict radical life extension thanks to organ regeneration [scientists at Wake Forest University have grown a bladder in a Petri dish and transplanted it into a patient] and microscopic 'nanobots' that will cruise through our bodies to repair defective cells and clean out cellular waste products [researchers at the Massachusetts Institute of Technology have developed a technique that allows nanoparticles to group together inside tumors]. That's just the beginning: I also envision nanobots that interface directly with the brain, making possible 'brain-to-brain' communication and, eventually, brain mapping that enables us to 'download' the brain into an indestructible robot body."

continued >

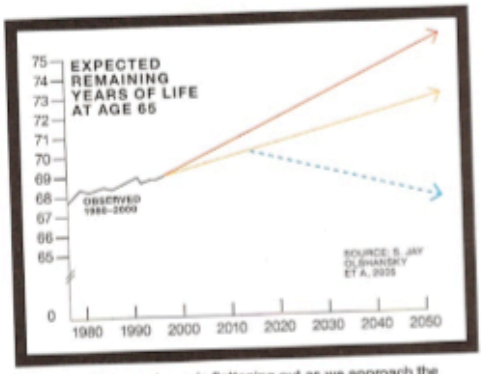
smoke, but here are **12 other tips** from the frontier of aging science to extend your active life span

4 INDULGE YOURSELF. Have more sex: Frequent orgasms (at least two a week) cut the risk of death in half, according to a long-term study of men ages 45 to 59 in the *British Medical Journal*. Eat more dark chocolate: Just 30 calories' worth a day (about six grams of chocolate or three grams of cocoa) lowers blood pressure, according to a recent study in *The Journal of the American Medical Association*. Sip more red wine: Two glasses a day not only benefits your heart, but also could have other positive effects, because red wine is the best natural source of resveratrol, a chemical that has been proved to extend the life spans of yeast, worms, fish, and mice.

5 EAT LESS...WAY LESS. Researchers have known for decades that ratcheting down what rats eat by a third extends their lives. Few people are willing to try such a radical diet: Can you imagine skipping lunch for the rest of your life? But a more modest test of a calorie-restriction diet reviewed in *The Journal of the American Medical Association* showed that cutting between an eighth and a fourth of calories lowered metabolism and insulin levels and also appeared to limit damage to cellular DNA—all markers for the harmful effects of age. Teach yourself to push away your plate when you're 80 percent full.

6 TRAIN YOUR BRAIN. Scientists once thought that age-related mental decline was inevitable and irreversible, but no longer. You can teach old neurons new tricks, thanks to a variety of activities that force the brain to reprogram itself, according to research by Michael Merzenich, PhD, a neuroscientist at the University of California at San Francisco. Traditional mental challenges such as solving crossword puzzles and playing »

he accelerating pace of discoveries about aging: cientists have identified the genes that prolong he lives of animals and discovered ways to switch hose genes on, and researchers are launching harmaceutical start-ups to create the first real ntiaging drugs that could slow the cellular lamage. In the other corner, Olshansky, the umber-crunching realist, sees too many hurdles n the way. In fact, he suspects that any benefit ntiaging drugs might bring could be wiped out by a set of rising threats to public health, such as the epidemics of obesity and diabetes. Even with antiaging drugs, the average American life span may shrink over the next generation—one of the few times since the influenza pandemic of 1918 that this has ever happened. Despite their diverging perspectives on life expectancy, both men share a belief that science is finally catching up with aging, and this has ramifications for us all.



= How life expectancy is flattening out as we approach the maximum human life span

= A linear—and erroneous—extrapolation of life expectancy

= The potential decline in life expectancy caused by disorders of obesity

While Austad has spent his career trekking through jungles and capturing animals, Olshansky has spent it swimming in data—health surveys, actuarial tables, historical records. A professor of epidemiology at the University of Illinois, he is one of the founders of a science called biodemography, which uses biology to explain changing patterns of longevity. He explores these figures to find the rules of aging. When insurance companies and the Social Security Administration want to find out how long people will live, Olshansky is the man they call.

Olshansky, 53, has a trim gray beard and a high bald dome. Somewhat surprisingly, he's a Cubs fan, and describes himself as an eternal optimist. He even has a bet that the Cubs will win this year's World Series. "You know what death rates look like?" asks Olshansky. He's sitting in a booth at Max and Benny's Restaurant, not far from his house in Deerfield, Illinois. In front of him sits a half-eaten plate of hoppel poppel, a barge of scrambled eggs with chunks of salami the size of Swiss Army knives. ("Rare indulgences won't kill you," he says.) He grabs a napkin and draws a falling and rising curve to illustrate how hard it is to make people live longer.

In the past century, the average life expectancy in America has increased dramatically. A girl born in 1900 had a life expectancy of 49 years. A girl born in 2003 can expect to live 80 years. Many demographers think this trend will continue, and within a few decades, the average life expectancy will push beyond 100 years.

Olshansky dismisses such predictions. "I sort of chuckle whenever I see that done," he says. "The people who come up with these numbers have blinders on." To demonstrate why these extrapolations don't make sense, Olshansky once analyzed the world record for the mile. Since the mid-1800s the record has fallen from about four and a half minutes to the current record of three minutes and 43 seconds. If you simply project that trend into the future the way many demographers extend life expectancy, you'd predict that in the year 2580, someone would be able to run the mile in precisely zero seconds. There are fundamental limits to how fast a human can run, argues Olshansky, and there are fundamental limits to how long people can live.

The curve Olshansky draws on his napkin is a graph. It tracks the odds that a person will die at any given age, calculated from the life spans of millions of actual people. From birth, it falls until about age 10, whereupon it begins to climb, soaring exponentially over the decades. In the early 1900s, explains Olshansky, the young end of the curve was much higher than it is today. Babies died of diarrhea and other infectious diseases. Young women died in childbirth. Thanks to clean water, better public health, and medical innovations like antibiotics, many of those early deaths have been eliminated. The increase in the average life expectancy in the United States is thanks mainly to the young lives that have been saved in the past century.

"But we could only achieve that once," he says. "Once you've used it up, you're done. You then have to focus in on what happens at older ages. At the older ages, it's no longer diphtheria and tuberculosis. You've got aging. You can treat diphtheria and tuberculosis. You can't treat aging—yet."

As we grow older, our bodies change. Our skin wrinkles, our backs stoop, our brains fill with plaque, and our blood vessels stiffen. Changes take place within our cells as well, including damage from environmental toxins and oxygen free radicals, the shortening of telomeres (the tips of chromosomes) as cells divide, and other things that scientists still don't fully understand. All these changes raise our odds of dying, if not of one disease, then of another. Those odds double every seven years or so. That pace is the same from one culture to the next, Olshansky and his colleagues have found, and from one period of history to another. "No matter where we looked, it's the same," he says. Aging, in other words, is deeply etched in our biology. In fact, the same pattern turned up when Olshansky looked at other species. Dogs, for example, live only 10 years on average. But if you draw a dog curve and a human curve on the same scale, they are practically identical.

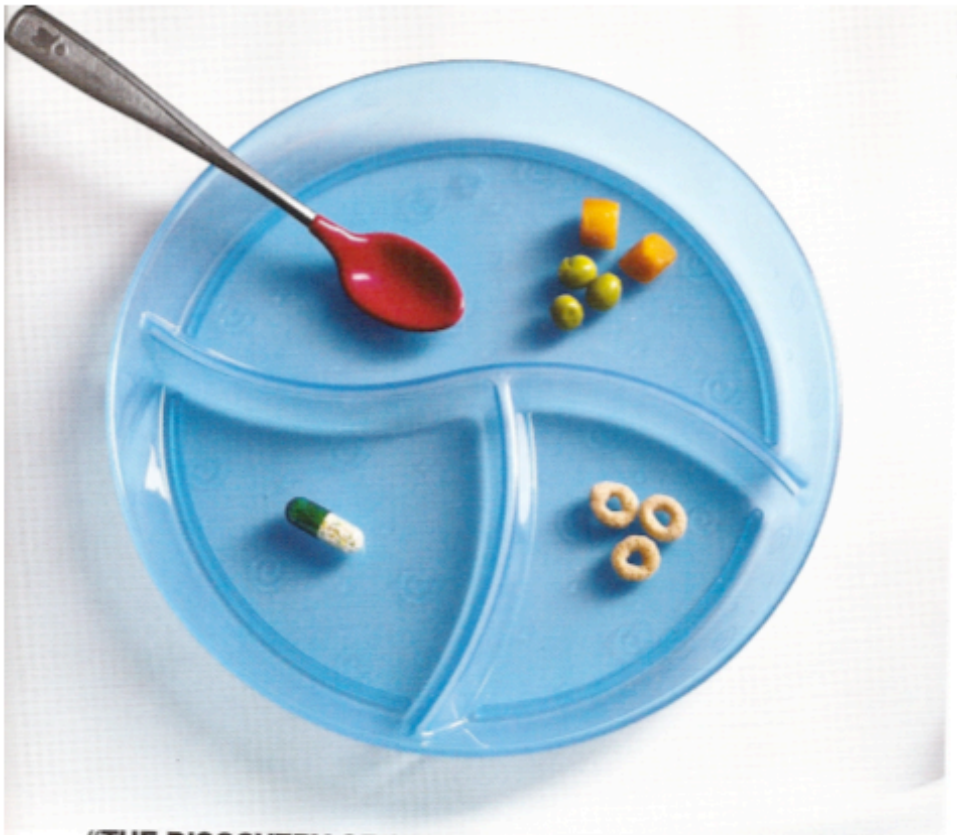
bridge can create new neural connections and improve memory, but so can a broad range of new learning experiences—anything from studying a new language or dance steps to learning how to juggle or play tennis.

7 SLEEP RIGHT. Sleeping for fewer than six hours or more than eight hours is associated with a significantly higher risk of death, according to a landmark 2002 study at the University of California at San Diego. Researchers are still not quite sure why, but too little sleep is associated with high blood pressure, greater stress, memory problems, and weight gain. Too much sleep, by contrast, leads to breathing interruptions known as sleep apnea, which can be fatal. The sweet spot, researchers say, is seven hours a night, on average.

8 GET A DOG. Pet ownership can ward off depression, speed recovery from surgery, and even reduce the amount of time you spend with doctors in the first place, according to a range of studies. Elderly dog owners are even likely to be slimmer than their dogless peers, according to a recent study at the Johns Hopkins Medical Institutions.

9 NURTURE YOUR SENSITIVE SIDE. Women tend to live five years longer than men, and one reason may simply be that they're better at forming and maintaining emotional connections with relatives and friends, according to a growing body of research, says Robert Butler, MD, former head of the National Institute on Aging. This means you should nurture strong bonds with your family and friends now. Maintain rituals, whether it's as simple as a weekly Sunday night phone call or a yearly stay in a beach villa, and make a habit of social and sporting outings.

10 ENGAGE IN AN ISSUE. People who lead optimistic, "purpose-driven" lives tend to stick around longer—up



"THE DISCOVERY OF A WAY TO SLOW AGING WOULD BE LIKE FINDING A CURE FOR CANCER *AND* OSTEOPOROSIS *AND* HEART DISEASE—ALL AT THE SAME TIME," SAYS OLSHANSKY.

While the odds of dying have dropped dramatically for babies, they have dropped far less for the elderly. The maximum life span of humans has barely budged over the decades, even as the average life expectancy has soared. Simply attacking this or that disease won't extend the human life span any further, says Olshansky. "Eliminating cancer would only get about three and a half extra years," he says. If tomorrow no one ever died of a heart attack again, three years. In fact, the mortality curve suggests that ordinary medical advances would be unlikely to push the average life span of Americans past 85 years. A tiny fraction will live beyond 100.

In the seven years since the bet, obesity has exploded into a nationwide epidemic. Obesity can lead to heart disease, diabetes, and other potentially fatal disorders. Olshansky and his colleagues have built demographic models to project the effect obesity will have on the average life expectancy in the United States. The picture is grim. "We're losing between two and five years within the next 50 years," he says, "which is huge."

Steven Austad, now 60 years old, still has the stocky body of a college wrestler, and there are creases on his face from field seasons in the sun. Although the malaria he contracted in Papua New Guinea still flares up, he rarely finds himself in the jungle these days. He has traded traps and radio collars for microscopes and centrifuges. In fact, he has brought the field to his lab near San Antonio: There's a colony of naked mole rats in the basement. He and his colleague are now searching for the molecular differences between species that die young and others that live long.

In the years since the bet, Austad has grown even more certain that he's right. Scientists now have a much more detailed understanding of how shutting down certain genes and restricting calories slow aging. *Continued on page 142*

3 THE GLOBE-TROTTING DOCTOR

Sanjay Gupta, MD *Neurosurgeon, CNN's chief medical correspondent, and author of* Chasing Life: New Discoveries in the Search for Immortality to Help You Age Less Today

"I envision a world in which vaccines ward off Alzheimer's disease, new drugs enhance or restore memory, and gene therapies eliminate cancer and obesity. We're going to live like incandescent lightbulbs: We'll be healthy for 125 years, and then we're out. There won't be any flickering at the end."

4 THE RADICAL

Aubrey de Grey, PhD *Head of the Methuselah Foundation and author of* Ending Aging

"I believe that within 25 to 30 years, advances in regenerative medicine could slingshot the human race to 'longevity escape velocity'—the moment when antiaging science begins to outpace the aging process itself. I imagine the augmentation of our inbuilt repair and maintenance processes with ones that repair the various types of molecular and cellular damage that the body can't fix, and figure that people might need to be topped off with fresh infusions of stem cells every decade or so. It's not likely to be cheap, but if scientists can produce firm evidence that they can combat aging effectively in mice, public demand for government money for a war on aging will do the rest."

to seven and a half years longer—than those who live for the moment, according to research from Yale University. Your purpose could be as simple as caring for your grandchildren, improving your golf game, or organizing a neighborhood watch, says Henry Lodge, MD, an assistant professor at Columbia University.

But don't be afraid to think big—even save-the-world big. Long-term ventures such as an environmental project or a mentoring relationship can yield the biggest rewards.

11 TEST YOUR GENES. With advances in genomics, you can now be tested for a variety of hereditary diseases, although the results can be frustrating to interpret. Most tests, for instance, will tell you only the percentage chance that you'll eventually develop a health problem. Because each test can cost hundreds or even thousands of dollars, and may not be covered by insurance, it's best to be selective. Your goal should be to identify life-threatening conditions that you can head off at the pass. Let your family history guide you. If close relatives have developed a hereditary form of cancer, then it makes sense to test yourself so that you can plan preventative action.

12 SCAN YOUR GENOME. Within a year, it will be possible to order a kind of abbreviated scan of your entire genome from Silicon Valley start-up 23andMe. Researchers are rapidly associating particular DNA patterns with disease risk, which will let you fine-tune your lifestyle to accommodate your genetic predispositions. Further down the road, your DNA is also likely to guide your doctor in prescribing drugs and treatments that are most likely to work for you. The procedure, of course, isn't without risk: You could also get some unexpected bad news. Confer with a genetic counselor—you can find one at *geneticheal th .com*—before and after the scan.

DAVID HAMILTON

Continued from page 113

Scientist Edward Masoro, at the University of Texas, pioneered research in the 1990s that showed that calorie restriction in animals leads to a longer, healthier life span. It turns out that a low-calorie diet switches on a key gene called SIRT1, which controls a network of dozens of other genes. They create an army of proteins that protect a cell from damage. Related versions of SIRT1 trigger the same response in mammals, insects, and even yeast. Scientists in laboratories across the country were performing similar experiments on spiders, mice, and worms. For example, researchers at the University of California shut down a gene called daf-2 in a microscopic worm known as *Caenorhabditis elegans* and it lived twice as long. The scientists weren't sure what daf-2 actually did, but the results were undeniable. Researchers at Brown University found that manipulating a gene known as IGF-1 had a similar effect on flies.

Discovering genes like SIRT1, daf-2, and IGF-1 opens up a new way to fight aging. After all, human biology isn't all that different from the biology of mice or worms. We share many genes, such as daf-2, and they do similar things for us. So if scientists are already figuring out how to slow aging in animals, it might be possible to do the same for people. Instead of going hungry for the rest of your life, you might be able to take a pill containing molecules that are able to switch on SIRT1 in your cells. In recent years, scientists have launched a large-scale search for those molecules. One molecule that switches on SIRT1, known as resveratrol, is produced by grapes and other plants. Harvard University's David Sinclair, PhD, and his colleagues have found that, as predicted, resveratrol shows signs of slowing aging. They fed resveratrol to 1-year-old mice that ate a high-fat diet that would normally cause them to drop dead after about a year. But with regular doses of resveratrol, the badly fed mice enjoyed a mortality rate as low as mice on a normal diet—three years.

Resveratrol may turn out to be the first anti-aging drug (Sinclair took a purified form of resveratrol for four years but cautions others against doing so until more studies are done), but others are in the running as well. Sinclair and his colleagues have founded a company called Sirtris Pharmaceuticals to search for other compounds that may do an even better job of switching on SIRT1. Elixir Pharmaceutical, another pharmaceutical hatchery, is following up on the discovery of daf-2's life-extending powers. About a dozen others are pursuing molecular-based antiaging drugs. It's also possible that antiaging drugs may emerge from other investigations of old age, like the one going on in Austad's lab. Other scientists are studying aging-linked genes found in all animals. Austad is curious about genes that evolved only in the lineages that gave rise to long-lived species.

5 { THE POLICY MAKER }

Robert Butler, MD *CEO of the International Longevity Center, former director of the National Institute on Aging, and Pulitzer Prize–winning author of* Why Survive? Being Old in America

"The study of the human genome will finally lay bare the body's mysteries, making possible a host of better, more focused treatments. Doctors will use stem cells to grow you a new heart when your old one wears out, while better control over the immune system could largely vanquish disease. We may have huge numbers of people surviving into their hundreds—not just sick, but healthy. That will change the whole dynamic of society. I call it the longevity dividend, paid out to society in the form of wealth generated by a much healthier, longer-lived population."

Consider his naked mole rats, which usually live in subterranean tunnels in Africa. A mouse lives three years or so. Naked mole rats, by contrast, live more than three decades. He wants to know what the naked mole rat has that ordinary rodents don't. It may be the same thing that other long-lived animals have as well. Austad and his colleagues are examining the cells of long-lived animals and comparing them with their short-lived cousins. So far, only one thing seems to unite all the long-lived animals: They do a much better job of fixing their DNA. As our cells are damaged over time, tiny patches of our genes become garbled. Some

QUACK WATCH

The following controversial treatments are all being touted as antiaging miracle cures. Here's what you need to know about each one. DAVID HAMILTON

1 Human Growth Hormone

Ever since a 1990 *New England Journal of Medicine* study reported that human growth hormone built muscle and burned fat in elderly men, hucksters at antiaging spas such as Cenegenics have promoted it as a cure to old age. "Growth hormone is not the fountain of youth," says S. Mitchell Harman, MD, PhD, director and president of the nonprofit Kronos Longevity Research Institute. HGH can affect human metabolism, which is why it's approved for treating AIDS patients and children with unnaturally short stature, but it can also cause carpal tunnel syndrome, diabetes, and heart problems. Scientists continue to research ways to harness HGH's beneficial attributes, while limiting its negative ones.

2 Resveratrol Supplements

Last year, a team of Harvard researchers found that resveratrol, a chemical found in red wine, countered the effects of aging in mice. Resveratrol is now available as a dietary supplement at various Web sites. But its effects on humans are unknown, and you can't count on the purity of unregulated supplements either, according to the National Institutes of Health. To duplicate the doses used in the mouse study, a 175-pound man would need to take close to 1,800 mg of resveratrol every day at a cost of $1,800 a year. Sirtris Pharmaceuticals does have a resveratrol drug in clinical trials (as a diabetes treatment), and it delivers concentrated resveratrol to patients in doses of 2,500 mg and 5,000 mg a day.

3 Stem-Cell Treatments

You can't be legally treated with stem cells in the United States outside a formal clinical trial. Doctors in China, Eastern Europe, and Latin America offer stem-cell injections that they claim can reverse aging, at a cost of $10,000 to $15,000 per treatment. EmCell, a clinic in Kiev, Ukraine, says its stem-cell transplants can restore your energy, improve your mood and memory, and eliminate wrinkles. The rub, of course, is no one has yet proved that these injections work or if they're safe. Stem cells hold tremendous potential for future medical treatments, which is why it's crucial to establish ethical and legal protocols and to ensure that treatments take place in scientifically sophisticated and regulated environments.

4 Cryonics

The corpse of Ted Williams may be bobbing around in a vat of liquid nitrogen in Arizona, but there's zero evidence he'll be swinging the bat again anytime soon. Cryonics, the process of freezing a body immediately after death in hopes that future technology can reanimate it, is still little more than science or Hollywood fiction—something even its proponents admit. Alcor Life Extension Foundation, the outfit allegedly storing Williams's body, notes that "no adult human" has ever been revived after being frozen (Han Solo doesn't count) and suggests that the technology for doing so is a century or more away. And then you have to hope that future generations are ready to welcome the legally dead back to life.

5 Umbilical-Cord Blood

For $4,000, companies such as ViaCord and the Cord Blood Registry will freeze and store your newborn's umbilical-cord blood, which contains a rich supply of blood stem cells, as a genetic insurance policy. That might be a prudent investment if your family has a history of leukemia or other genetic diseases, since doctors can use the cells in place of a grueling bone-marrow transplant, if one is ever necessary. The American Academy of Pediatrics recommends against "directed banking," noting that the odds your kids will ever need the cells could be as low as one in 200,000. However, the association does encourage parents to donate umbilical-cord blood to public banks, where it can be used by anyone.

of those mutations are harmful, causing our cells to make defective proteins or even turn cancerous. Our cells manage to repair a lot of this DNA damage, but not all of it. It's possible that extreme longevity has evolved through the same path each time. Austad is figuring out how each species makes its repairs to understand how that leads to long life. "We hope we'll ultimately discover pharmaceuticals that can mimic the same thing and repair our DNA," he says.

Austad didn't imagine an army of 150-year-olds when he made the bet. People live to different ages, thanks to a mix of good genes and lucky experiences. The current record holder is Jeanne Calment, a Frenchwoman who died in 1997 at the age of 122—after smoking for almost 100 years. In the coming era of antiaging drugs, Austad thinks a 150-year-old Calment isn't too much to expect. "Only one person has to do it," Austad points out, for him to win.

Despite the fact that Olshansky is betting against any human making it to 150 years, he is impressed with the scientific progress on the biology of aging. "In our lifetime, I think you and I are going to be taking a pill to slow our aging," he predicts. "No matter when we take it, we will benefit." Antiaging drugs could, he believes, change the way doctors practice medicine. And on this count at least, he and Austad are in agreement.

Today researchers help the elderly by trying to cure one disease at a time—a medical Whac-a-Mole approach. But curing any one disease does not change the shape of the mortality curve. "If you pick off diseases one by one, it's really not a pleasant situation," says Austad. "You'd just uncover all these other diseases that lay behind them. Imagine a society full of demented people, or people who are incontinent or immobile. Not a pretty picture."

Rather than curing diseases one at a time, Austad and Olshansky agree that researchers should be focusing more of their efforts on solving the underlying problem of the elderly: being old. When scientists have succeeded in extending the longevity of animals, the animals generally became healthier even at an advanced age. Humans might enjoy the same benefit. A drug that slowed the course of aging might give a 60-year-old the same risk of developing osteoporosis as a 53-year-old, for example. The same goes for Alzheimer's disease and other diseases of the elderly. Shifting the risks back by seven years would wipe out millions of cases of these diseases, allowing people to enjoy their final years in better health.

Unfortunately, medical research these days isn't set up very well for this sort of revolution. There's no pipeline for developing and testing drugs for their ability to slow the course of aging. Sirtris Pharmaceuticals is already running clinical trials on humans to test a form of resveratrol. But they're not testing it as an antiaging drug. They're testing it as a treatment for diabetes.

Although the private sector is racing to develop these drugs, Austad and Olshansky believe a true antiaging pill will require a major governmental push, a Manhattan Project of Aging. Together with a group of prominent aging researchers, they're calling for $3 billion a year to be directed to finding compounds that slow aging. "If somebody found a cure for cancer, they'd get the Nobel Prize," says Olshansky, "but the fact is that the discovery of a way to slow aging would be the equivalent of finding a cure for cancer *and* for heart disease *and* for Alzheimer's *and* for osteoporosis—all at the same time. It makes much more sense to go after the one thing that gives rise to all these things."

Three billion dollars may sound like a steep price tag, but Olshansky points out that Medicare—which is what we have to pay as a country to treat the ailments of aging—costs $408 billion a year. What's more, the numbers of the elderly and infirm will continue to increase for decades. Consider the coming toll from just one disease of aging: Alzheimer's. Five million Americans have it today, and by 2050, that number could rise to 16 million. The economic toll of Alzheimer's and other forms of dementia will rise by a factor of 10 to $1 trillion a year. "If we succeed, it has tremendous potential to reduce costs," says Olshansky. "Not just today, but for every generation."

It's a bet, in other words, that everyone would win. ■

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Laurence J. Kotlikoff *Professor of economics at Boston University and author of* The Healthcare Fix

"An increasingly older population whose per capita health-care costs are rising exponentially is leading us to economic disaster. Higher costs and added benefits make both Medicare and Medicaid impossible to sustain; benefits grow faster than the national per capita income. I foresee a complete fiscal meltdown of Argentine proportions—it could happen overnight. We need a *new* New Deal that combines tax reform, the conversion of Social Security into a required personal-saving program, and a system of universal health care that would control overall medical spending."