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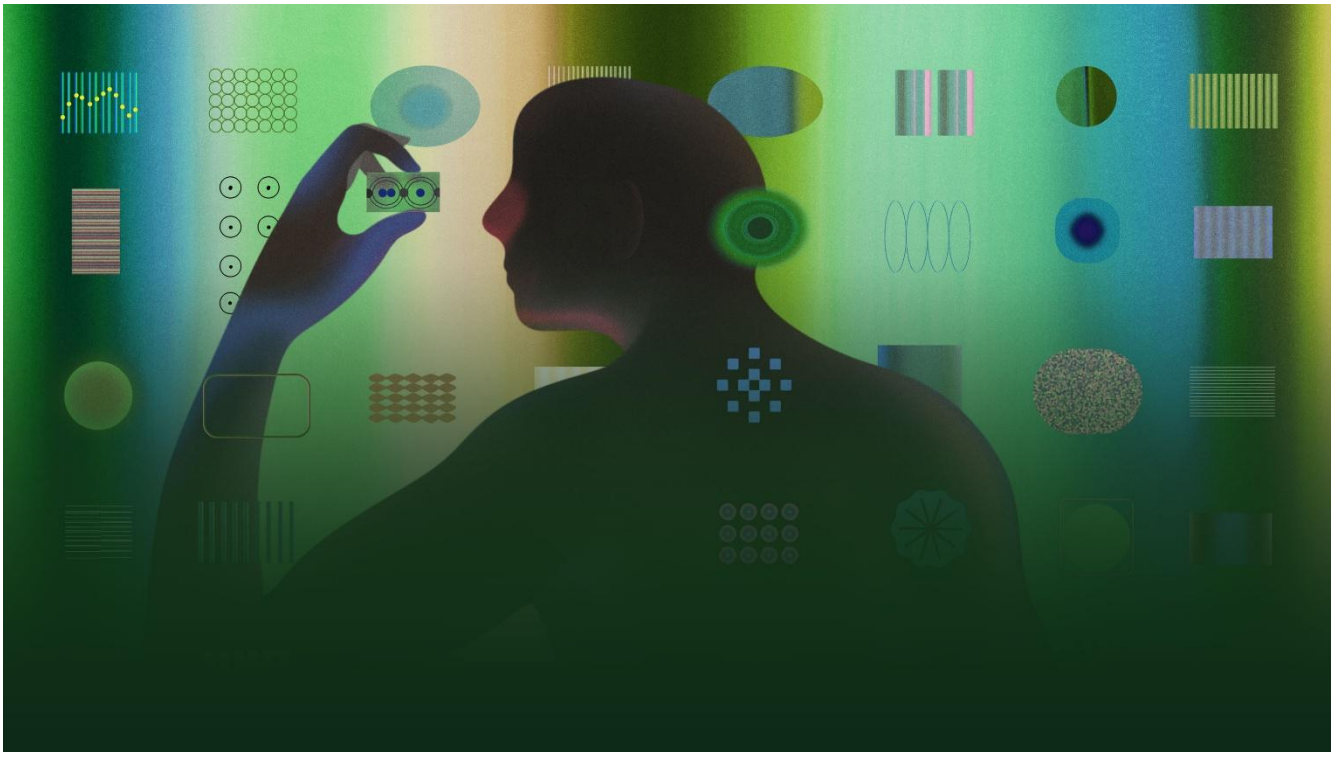

IBRAHIM RAYINTAKATH by **David Ewing Duncanarchive page**
October 9, 2025

The story is a collaboration between MIT Technology Review and Aventine, a non-profit research foundation that creates and supports content about how technology and science are changing the way we live.

It's not often you get a text about the robustness of your immune system, but that's what popped up on my phone last spring. Sent by John Tsang, an immunologist at Yale, the text came after his lab had put my blood through a mind-boggling array of newfangled tests. The result—think of it as a full-body, high-resolution CT scan of my immune system—would reveal more about the state of my health than any test I had ever taken. And it could potentially tell me far more than I wanted to know.

"David," the text read, "you are the red dot."

Tsang was referring to an image he had attached to the text that showed a graph with a scattering of black dots representing other people whose immune systems had been evaluated—and a lone red one. There also was a score: 0.35.

I had no idea what any of this meant.

The red dot was the culmination of an immuno-quest I had begun on an autumn afternoon a few months earlier, when a postdoc in Tsang's lab drew several vials of my blood. It was also a significant milestone in a decades-long journey I've taken as a journalist covering life sciences and medicine. Over the years, I've offered myself up as a human guinea pig for hundreds of tests promising new insights into my health and mortality. In 2001, I was one of the first humans to have my DNA sequenced. Soon after, in the early 2000s, researchers tapped into my proteome—proteins circulating in my blood. Then came assessments of my microbiome, metabolome, and much more. I have continued to test-drive the latest protocols and devices, amassing tens of terabytes of data on myself, and I've reported on the results in dozens of articles and a book called *Experimental Man*. Over time, the tests have gotten better and more informative, but no test I had previously taken promised to deliver results more comprehensive or closer to revealing the truth about my underlying state of health than what John Tsang was offering.

Over the years, I've offered myself up as a human guinea pig for hundreds of tests promising new insights into my health and mortality. But no test I had previously taken promised to deliver results more comprehensive or closer to revealing the truth about my underlying state of health.

It also was not lost on me that I'm now 20-plus years older than I was when I took those first tests. Back in my 40s, I was ridiculously healthy. Since then, I've been battered by various pathogens, stresses, and injuries, including two bouts of covid and long covid—and, well, life.

But I'd kept my apprehensions to myself as Tsang, a slim, perpetually smiling man who directs the Yale Center for Systems and Engineering Immunology, invited me into his office in New Haven to introduce me to something called the *human immunome*.

John Tsang has helped create a new test for your immune system.
JULIE BIDWELL

Made up of 1.8 trillion cells and trillions more proteins, metabolites, mRNA, and other biomolecules, every person's immunome is different, and it is constantly changing. It's shaped by our DNA, past illnesses, the air we have breathed, the food we have eaten, our age, and the traumas and stresses we have experienced—in short, everything we have ever been exposed to physically and emotionally. Right now, your immune system is hard at work identifying and fending off viruses and rogue cells that threaten to turn cancerous—or maybe already have. And it is doing an excellent job of it all, or not, depending on how healthy it happens to be at this particular moment.

Vaccines aimed at dampening the immune response could revolutionize the treatment of autoimmune diseases

Yet as critical as the immunome is to each of us, this universe of cells and molecules has remained largely beyond the reach of modern medicine—a vast yet inaccessible operating system that powerfully influences everything from our vulnerability to viruses and cancer to how well we age to whether we tolerate certain foods better than others.

Now, thanks to a slew of new technologies and to scientists like Tsang, who is on the Steering Committee of the Chan Zuckerberg Biohub New York, understanding this vital and mysterious system is within our grasp, paving the way for powerful new tools and tests to help us better assess, diagnose and treat diseases.

Already, new research is revealing patterns in the ways our bodies respond to stress and disease. Scientists are creating contrasting portraits of weak and robust immunomes—portraits that someday, it's hoped, could offer new insights into patient care and perhaps detect illnesses before symptoms appear. There are plans afoot to deploy this knowledge and technology on a global scale, which would enable scientists to observe the effects of climate, geography, and countless other factors on the immunome. The results could transform what it means to be healthy and how we identify and treat disease.

It all begins with a test that can tell you whether your immune system is healthy or not.

Reading the immunome

Sitting in his office last fall, Tsang—a systems immunologist whose expertise combines computer science and immunology— began my tutorial in immunomics by introducing me to a study that he and his team wrote up in a 2024 paper published in *Nature Medicine*. It described the results of measurements made on blood samples taken from 270 subjects—tests similar to the ones Tsang's team would be running on me. In the study, Tsang and his colleagues looked at the immune systems of 228 patients diagnosed with a variety of genetic disorders and a control group of 42 healthy people.

To help me visualize what my results might look like, Tsang opened his laptop to reveal several colorful charts from the study, punctuated by black dots representing each person evaluated. The results reminded me vaguely of abstract paintings by Joan Miró. But in place of colorful

splotches, whirls, and circles were an assortment of scatter plots, Gantt charts, and heat maps tinted in greens, blues, oranges, and purples.

It all looked like gibberish to me.

Luckily, Tsang was willing to serve as my guide. Flashing his perpetually patient smile, he explained that these colorful jumbles depicted what his team had uncovered about each subject after taking blood samples and assessing the details of how well their immune cells, proteins, mRNA, and other immune system components were doing their job.

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The results placed people—represented by the individual dots—on a left-to-right continuum, ranging from those with unhealthy immunomes on the left to those with healthy immunomes on the right. Background colors, meanwhile, were used to identify people with different medical conditions affecting their immune systems. For example, olive-green indicated those with auto-immune disorders; orange backgrounds were designated for individuals with no known disease history. Tsang said he and his team would be placing me on a similar graph after they finished analyzing my blood.

Tsang's measurements go significantly beyond what can be discerned from the handful of immune biomarkers that people routinely get tested for today. "The main immune cell panel typically ordered by a physician is called a CBC differential," he told me. CBC, which stands for "complete blood count," is a decades-old type of analysis that counts levels of red blood cells, hemoglobin, and basic immune cell types (neutrophils, lymphocytes, monocytes, basophils, and eosinophils). Changes in these levels can indicate whether a person's immune system might be reacting to a virus or other infection, cancer, or something else. Other blood tests—like one that looks for elevated levels of C-reactive protein, which can indicate inflammation associated with heart disease—are more specific than the CBC. But they still rely on blunt counting—in this case of certain proteins.

Tsang's assessment, by contrast, tests up to a million cells, proteins, mRNA and immune biomolecules—significantly more than the CBC and others. His protocol is designed to paint a more holistic portrait of a person's immune system by not only counting cells and molecules but also by assessing their interactions. The CBC "doesn't tell me as a physician what the cells being counted are doing," says Rachel Sparks, a clinical immunologist who was the lead author of the *Nature Medicine* study and is now a translational medicine physician with the drug giant AstraZeneca. "I just know that there are more neutrophils than normal, which may or may not indicate that they're behaving badly. We now have technology that allows us to see at a granular level what a cell is actually *doing* when a virus appears—how it's changing and reacting."

Tsang's measurements go significantly beyond what can be discerned from the

handful of immune biomarkers that people routinely get tested for today. His assessment tests up to a million cells, proteins, mRNA and immune biomolecules.

Such breakthroughs have been made possible thanks to a raft of new and improved technologies that have evolved over the past decade, allowing scientists like Tsang and Sparks to explore the intricacies of the immunome with newfound precision. These include devices that can count myriad different types of cells and biomolecules, as well as advanced sequencers that identify and characterize DNA, RNA, proteins, and other molecules. There are now instruments that also can measure thousands of changes and reactions that occur inside a single immune cell as it reacts to a virus or other threat.

Tsang and Spark's' team used data generated by such measurements to identify and characterize a series of signals distinctive to unhealthy immune systems. Then they used the presence or absence of these signals to create a numerical assessment of the health of a person's immunome—a score they call an "immune health metric," or IHM.

Clinical immunologist Rachel Sparks hopes new tests can improve medical care.

To make sense of the crush of data being collected, Tsang's team used machine-learning algorithms that correlated the results of the many measurements with a patient's known health status and age. They also used AI to compare their findings with immune system data collected elsewhere. All this allowed them to determine and validate an IHM score for each person, and to place it on their spectrum, identifying that person as healthy or not.

It all came together for the first time with the publication of the *Nature Medicine* paper, in which Tsang and his colleagues reported the results from testing multiple immune variables in the 270 subjects. They also announced a remarkable discovery: Patients with different kinds of diseases reacted with similar disruptions to their immunomes. For instance, many showed a lower level of the aptly named natural killer immune cells, regardless of what they were suffering from. Critically, the immune profiles of those with diagnosed diseases tended to look very different from those belonging to the outwardly healthy people in the study. And, as expected, immune health declined in the older patients.

Faults in a certain part of the immune system might be at the root of some long covid cases, new research suggests.

But then the results got *really* interesting. In a few cases, the immune systems of unhealthy and healthy people looked similar, with some people appearing near the "healthy" area of the chart even though they were known to have diseases. Most likely this was because their symptoms

were in remission and not causing an immune reaction at the moment when their blood was drawn, Tsang told me.

In other cases, people without a known disease showed up on the chart closer to those who were known to be sick. “Some of these people who appear to be in good health are overlapping with pathology that traditional metrics can’t spot,” says Tsang, whose *Nature Medicine* paper reported that roughly half the healthy individuals in the study had IHM scores that overlapped with those of people known to be sick. Either these seemingly healthy people had normal immune systems that were busy fending off, say, a passing virus, or their immune systems had been impacted by aging and the vicissitudes of life. Potentially more worrisome, they were harboring an illness or stress that was not yet making them ill but might do so eventually.

These findings have obvious implications for medicine. Spotting a low immune score in a seemingly healthy person could make it possible to identify and start treating an illness before symptoms appear, diseases worsen, or tumors grow and metastasize. IHM-style evaluations could also provide clues as to why some people respond differently to viruses like the one that causes covid, and why vaccines—which are designed to activate a healthy immune system—might not work as well in people whose immune systems are compromised.

Spotting a low immune score in a seemingly healthy person could make it possible to identify and start treating an illness before symptoms appear, diseases worsen, or tumors grow and metastasize.

“One of the more surprising things about the last pandemic was that all sorts of random younger people who seemed very healthy got sick and then they were gone,” says Mark Davis, a Stanford immunologist who helped pioneer the science being developed in labs like Tsang’s. “Some had underlying conditions like obesity and diabetes, but some did not. So the question is, could we have pointed out that something was off with these folks’ immune systems? Could we have diagnosed that and warned people to take extra precautions?”

Tsang’s IHM test is designed to answer a simple question: What is the relative health of your immune system? But there are other assessments being developed to provide more detailed information on how the body is doing. Tsang’s own team is working on a panel of additional scores aimed at getting finer detail on specific immune conditions. These include a test that measures the health of a person’s bone marrow, which makes immune cells. “If you have a bone marrow stress or inflammatory condition in the bone marrow, you could have lower capacity to produce cells, which will be reflected by this score,” he says. Another detailed metric will measure protein levels to predict how a person will respond to a virus.

Tsang hopes that an IHM-style test will one day be part of a standard physical exam—a snapshot of a patient's immune system that could inform care. For instance, has a period of intense stress compromised the immune system, making it less able to fend off this season's flu? Will someone's score predict a better or worse response to a vaccine or a cancer drug? How does a person's immune system change with age?

Or, as I anxiously wondered while waiting to learn my own score, will the results reveal an underlying disorder or disease, silently ticking away until it shows itself?

Toward a human immunome project

The quest to create advanced tests like the IHM for the immune system began more than 15 years ago, when scientists like Mark Davis became frustrated with a field in which research—primarily in mice—was focused mostly on individual immune cells and proteins. In 2007 he launched the Stanford Human Immune Monitoring Center, one of the first efforts to conceptualize the human immunome as a holistic, body-wide network in human beings. Speaking by Zoom from his office in Palo Alto, California, Davis told me that the effort had spawned other projects, including a landmark twin study showing that a lot of immune variation is not genetic, which was then the prevailing theory, but is heavily influenced by environmental factors—a major shift in scientists' understanding.

Shai Shen-Orr sees a day when people will check their immune scores on an app.
COURTESY OF SHAI SHEN-ORR

Davis and others also laid the groundwork for tests like John Tsang's by discovering how a T cell—among the most common and important immune players—can recognize pathogens, cancerous cells, and other threats, triggering defensive measures that can include destroying the threat. This and other discoveries have revealed many of the basic mechanics of how immune cells work, says Davis, "but there's still a lot we have to learn."

One researcher working with Davis in those early days was Shai Shen-Orr, who is now director of the Zimin Institute for AI Solutions in Healthcare at the Technion-Israel Institute of Technology, based in Haifa, Israel. (He's also a frequent collaborator with Tsang.) Shen-Orr, like Tsang, is a systems immunologist. He recalls that in 2007, when he was a postdoc in Davis's lab, immunologists had identified around 100 cell types and a similar number of cytokines—proteins that act as messengers in the immune system. But they weren't able to measure them simultaneously, which limited visibility into how the immune system works as a whole. Today, Shen-Orr says, immunologists can measure hundreds of cell types and thousands of proteins and watch them interact.

Shen-Orr's current lab has developed its own version of an immunome test that he calls IMM-AGE (short for "immune age"), the basics of which were published in a 2019 paper in *Nature Medicine*. IMM-AGE looks at the composition of people's immune systems—how many of each type of immune cell they have and how these numbers change as they age. His team has used this information primarily to ascertain a person's risk of heart disease.

Shen-Orr also has been a vociferous advocate for expanding the pool of test samples, which now come mostly from Americans and Europeans. “We need to understand why different people in different environments react differently and how that works,” he says. “We also need to test a lot more people—maybe millions.”

Tsang has seen why a limited sample size can pose problems. In 2013, he says, researchers at the National Institutes of Health came up with a malaria vaccine that was effective for almost everyone who got it during clinical trials conducted in Maryland. “But in Africa,” he says, “it only worked for about 25% of the people.” He attributes this to the significant differences in genetics, diet, climate, and other environmental factors that cause people’s immunomes to develop differently. “Why?” he asks. “What exactly was different about the immune systems in Maryland and Tanzania? That’s what we need to understand so we can design personalized vaccines and treatments.”

“What exactly was different about the immune systems in Maryland and Tanzania? That’s what we need to understand so we can design personalized vaccines and treatments.”
John Tsang

For several years, Tsang and Shen-Orr have advocated going global with testing, “but there has been resistance,” Shen-Orr says. “Look, medicine is conservative and moves slowly, and the technology is expensive and labor intensive.” They finally got the audience they needed at a 2022 conference in La Jolla, California, convened by the Human Immunome Project, or HIP. (The organization was originally founded in 2016 to create more effective vaccines but had recently changed its name to emphasize a pivot from just vaccines to the wider field of immunome science.) It was in La Jolla that they met HIP’s then-new chairperson, Jane Metcalfe, a cofounder of *Wired* magazine, who saw what was at stake.

“We’ve got all of these advanced molecular immunological profiles being developed,” she said, “but we can’t begin to predict the breadth of immune system variability if we’re only testing small numbers of people in Palo Alto or Tel Aviv. And that’s when the big aha moment struck us that we need sites everywhere to collect that information so we can build proper computer models and a predictive understanding of the human immune system.”

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Following that meeting, HIP created a new scientific plan, with Tsang and Shen-Orr as chief science officers. The group set an ambitious goal of raising around $3 billion over the next 10 years—a goal Tsang and Metcalfe say will be met by working in conjunction with a broad network of public and private supporters. Cutbacks in federal funding for biomedical research in

the US may limit funds from this traditional source, but HIP plans to work with government agencies outside the US too, with the goal of creating a comprehensive global immunological database.

HIP's plan is to first develop a pilot version based on Tsang's test, which it will call the Immune Monitoring Kit, to test a few thousand people in Africa, Australia, East Asia, Europe, the US, and Israel. The initial effort, according to Metcalfe, is expected to begin by the end of the year.

After that, HIP would like to expand to some 150 sites around the world, eventually assessing about 250,000 people and collecting a vast cache of data and insights that Tsang believes will profoundly affect—even revolutionize—clinical medicine, public health, and drug development.

My immune health metric score is …

As HIP develops its pilot study to take on the world, John Tsang, for better or worse, has added one more North American Caucasian male to the small number of people who have received an IHM score to date. That would be me.

It took a long time to get my score, but Tsang didn't leave me hanging once he pinged me the red dot. "We plotted you with other participants who are clinically quite healthy," he texted, referring to a cluster of black dots on the grid he had sent, although he cautioned that the group I'm being compared with includes only a few dozen people. "Higher IHM means better immune health," he wrote, referring to my 0.35 score, which he described as a number on an arbitrary scale. "As you can see, your IHM is right in the middle of a bunch of people 20 years younger."

This was a relief, given that our immune system, like so many other bodily functions, declines with age—though obviously at different rates. Yet I also felt a certain disappointment. To be honest, I had expected more granular detail after having a million or so cells and markers tested—like perhaps some insights on why I got long covid (twice) and others didn't. Tsang and other scientists are working on ways to extract more specific information from the tests. Still, he insists that the single score itself is a powerful tool to understand the general state of our immunomes, indicating the absence or presence of underlying health issues that might not be revealed in traditional testing.

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I asked Tsang what my score meant for my future. “Your score is always changing depending on what you’re exposed to and due to age,” he said, adding that the IHM is still so new that it’s hard to know exactly what the score means until researchers do more work—and until HIP can evaluate and compare thousands or hundreds of thousands of people. They also need to keep testing me over time to see how my immune system changes as it’s exposed to new perturbations and stresses.

For now, I’m left with a simple number. Though it tells me little about the detailed workings of my immune system, the good news is that it raises no red flags. My immune system, it turns out, is pretty healthy.

A few days after receiving my score from Tsang, I heard from Shen-Orr about more results. Tsang had shared my data with his lab so that he could run his IMM-AGE protocol on my immunome and provide me with another score to worry about. Shen-Orr’s result put the age of my immune system at around 57—still 10 years younger than my true age.

The Coming age of the immunome

Shai Shen-Orr imagines a day when people will be able to check their advanced IHM and IMM-AGE scores—or their HIP Immune Monitoring Kit score—on an app after a blood draw, the way they now check health data such as heart rate and blood pressure. Jane Metcalfe talks about linking IHM-type measurements and analyses with rising global temperatures and steamier days and nights to study how global warming might affect the immune system of, say, a newborn or a pregnant woman. “This could be plugged into other people’s models and really help us understand the effects of pollution, nutrition, or climate change on human health,” she says.

“I think [in 10 years] I’ll be able to use this much more granular understanding of what the immune system is doing at the cellular level in my patients. And hopefully we could target our therapies more directly to those cells or pathways that are contributing to disease.”
Rachel Sparks

Other clues could also be on the horizon. “At some point we’ll have IHM scores that can provide data on who will be most affected by a virus during a pandemic,” Tsang says. Maybe that will help researchers engineer an immune system response that shuts down the virus before it spreads. He says it’s possible to run a test like that now, but it remains experimental and will take years to fully develop, test for safety and accuracy, and establish standards and protocols for use as a tool of global public health. “These things take a long time,” he says.

The same goes for bringing IHM-style tests into the exam room, so doctors like Rachel Sparks can use the results to help treat their patients. “I think in 10 years, with some effort, we really could have something useful,” says Stanford’s Mark Davis. Sparks agrees. “I think by then I’ll be able to use this much more granular understanding of what the immune system is doing at the cellular level in my patients,” she says. “And hopefully we could target our therapies more directly to those cells or pathways that are contributing to disease.”

Personally, I'll wait for more details with a mix of impatience, curiosity, and at least a hint of concern. I wonder what more the immune circuitry deep inside me might reveal about whether I'm healthy at this very moment, or will be tomorrow, or next month, or years from now.

APRIL 24, 2025

Build muscle strength if you want to live longer and healthier, experts say

by Alena Kuzub , Northeastern University

Credit: CC0 Public Domain

Building and maintaining muscle strength is one of the most important factors to living a long and healthy life, according to Northeastern University experts.

"Muscle mass really is the key to longevity. It really is our insurance policy for how long we want to stay functional," says Elaina Manolis, assistant clinical professor of physical therapy, human movement and rehabilitation sciences at Northeastern University.

"To live a long and healthy life, you want to be as functional and independent as possible, and that's going to depend on how well you move."

Muscles not only move our bodies. They store glucose that can be used for energy and movement, Manolis says, rather than being stored as fat. Exercising our muscles helps regulate blood sugar, which is especially important for those with insulin sensitivity.

However, our muscle mass typically peaks around age 30 and decreases by 3% to 8% per decade afterward.

A sedentary lifestyle especially depletes our muscle mass, Manolis says. Rebuilding lost muscle takes significantly more time than losing it.

Never too late to start

The good news is that it's never too late to start building your muscle mass, according to Carmen Castañeda Sceppa, professor of health sciences and dean of Bouvé College of Health Sciences at Northeastern.

"Muscle is very plastic and responsive to exercise," she says. "It's a very forgiving tissue. It will be lost if there is no activity or bed rest, or any condition like that, but it can very quickly get back on track with exercise."

While strength training is crucial, optimal health requires a well-rounded routine, Manolis says, including resistance training, cardio exercise and flexibility.

Bone and joint health

Resistance training strengthens bones, Manolis says, as they respond to stress and the pull of the muscles by putting down more tissue layers and reinforcing bone structure.

Weight-bearing exercises like walking, running, jumping and push-ups contribute to bone density.

Strong muscles also protect joints from excessive load. When muscles fail to properly support the body, Manolis says, joints degenerate faster, leading to knee or hip replacements.

Regular cyclical or elliptical movements help keep joints lubricated and healthy.

How to build muscle mass

How to start depends on your general health and your age.

Building muscles requires safely and progressively overloading your body, Manolis says, with external resistance. Body weight exercises or yoga alone won't be enough because our bodies are already accustomed to carrying that weight.

"Doing yoga is great, but you're not going to necessarily build strength and power because you don't have that external resistance," Manolis says.

That is why the terms "strength training" and "resistance training" are used interchangeably.

Any tools that add resistance can be used for strength training: dumbbells, kettlebells or resistance bands. Beginners should start with two days of training per week, which is enough to maintain muscle mass.

Building additional muscle requires four to five days of strength training, which could be split between upper and lower body days.

A good tool for beginners to establish a routine is resistance bands.

"You can adjust the tension by simply changing your position or how much you're pulling on them," Manolis says. "They're also easy to travel with."

Eventually, you'll need to progress to heavier weights—around 30 to 50 pounds for deadlifts.

"You have to lift heavy for your body to respond," Manolis says. "We totally underestimate our ability. Our legs are so strong and so powerful."

In general, resistance exercises should prepare muscles for functional movements such as push, pull, lift and squat.

For specific exercises, consider consulting a physical therapist who can recommend strength training programs tailored to everyday life.

Those interested in competitive powerlifting should work with a specialized personal trainer.

Benefits for chronic conditions

Age-related changes in muscle mass, Sceppa says, can get exacerbated by chronic conditions such as arthritis, autoimmune conditions, heart disease and diabetes.

Sceppa studied resistance exercise in people with diabetes who had significant muscle mass loss. She found that strength exercise not only reversed muscle loss but also improved blood sugar levels better than diabetes medications alone.

"In my research, I wanted to show that with resistance training I could not only revert the age-related change in muscle mass but also improve their glucose levels and, as a result, improve the outcomes of diabetes," she says.

Many participants of her research needed much less medication as a result, and some were able to stop taking medication entirely.

However, with the rise of weight-loss drugs like Ozempic, a popular diabetes medication, Sceppa says, she is concerned that many people will experience muscle mass loss as a side effect. These medications cause non-selective weight loss—reducing both fat and muscle.

To selectively target fat, she says, strength training must be added to the regimen.

Strength training in older adults

With age, people move less and are afraid of injuries, so they avoid strength training, Manolis says, which results in muscle wasting.

"It really just takes education to teach them actually how to move, and then they feel totally empowered," she says.

For seniors, even light resistance can be effective.

Sceppa's research on physical activity interventions for older adults demonstrates numerous benefits.

One successful approach involved training peer leaders to lead group exercises at community health centers and other community-based organizations.

"This can be done on a low budget, and it's an opportunity to bring people together to address loneliness, particularly in older adults who are living alone and not socializing as much," she says.

Being physically active makes older adults feel better, which motivates them to continue exercising. As people get stronger, they start taking walks or steps instead of an elevator. They cook healthier food and perform their daily activities better.

"Their outlook on life improves," Sceppa says. "So there is this psychosocial component of exercise that reduces loneliness, depression and anxiety."

Exercising with a family member or a friend creates a buddy system and puts some good "peer pressure," Sceppa says, encouraging regular workouts.

"My research over the years has been about lifestyle as preventative medicine, which can only happen at scale," she says. "If you have individuals, families and communities coming

together to lead their own healthy lives, they can be an example for their children and grandchildren, role-modeling healthy behaviors."

Provided by Northeastern University

MAY 15, 2025

Why walking may be the key to a long and healthy life by Thomas E. Yates, The Conversation

Credit: Daniel Reche from Pexels

Throughout history, few things have inspired as much quackery as the pills, potions and promises to slow aging, boost vitality, or extend life. Yet, amid the hype and hollow claims, a few golden truths remain. As far back as 400 BC, Hippocrates, widely considered the father of modern medicine, famously said, "Walking is man's best medicine." More than two millennia later, science is finally catching up with that wisdom.

People who walk more than 8,000 steps a day reduce their risk of premature death by half, compared to those who walk fewer than 5,000 steps—the threshold for a sedentary lifestyle.

But beyond 8,000 steps, the benefits tend to plateau, which challenges the long-held belief in the magic of 10,000 steps a day.

In fact, that benchmark wasn't born of science, but of marketing. The 10,000-step goal originated from a 1960s Japanese advertising campaign for the world's first commercial pedometer called the *manpo-kei*, which literally translates to "10,000 steps meter."

Lately, researchers have been exploring a simple but important question: does every step count the same, or can walking faster—at a brisk pace of more than 100 steps a minute, or around three to four miles per hour—actually give you more health benefits?

For aging and heart health there is mounting evidence that pace really matters. Simply converting a 14-minute daily stroll into a seven-minute brisk walk has been associated with a 14% reduction in heart disease.

An analysis of more than 450,000 adults in the UK used a genetic marker of biological age to reveal that by middle age, a lifetime of brisk walking reduces biological age by up to 16 years compared to a lifetime of slow walking.

A follow-up study suggested it is never too late to benefit from brisk walking. An inactive 60-year woman or man was modeled to gain around an additional year of life expectancy through simply introducing a ten-minute brisk walk into their daily routine.

The power of brisk walking can also be seen in its ability to predict future health outcomes. It has been shown to be a stronger predictor of the risk of dying from heart disease than traditional predictors such as blood pressure and cholesterol, while also being a more powerful predictor than many other measures of lifestyle—including diet, obesity levels, and total physical activity.

In fact, perhaps the single most informative question a doctor could ask their patient is: "How fast is your walking pace in comparison to other people?"

Halo of benefits

But brisk walking may not provide additional benefits for all outcomes or in all contexts. For example, the benefit of brisk walking over light-intensity walking in lowering cancer risk is less certain.

A recent study suggested that although total walking was associated with reduction in 13 different types of cancers, there was no added value from brisk walking. Breaking prolonged sitting with light-intensity pottering around has also been shown to have profound impacts on metabolic effects.

Importantly, walking has a halo of benefits beyond physical health. It can help with brain activity, doubling creative idea production. Indeed, the systems in the brain that support

memory and imagination are also the same as those activated during whole body movement.

Many of us already harness this very phenomenon, using walking to mull over problems and arrive at solutions or insights that would otherwise remain elusive. Context is also important here, with the mental health and cognitive benefits of walking thought to be enhanced when walking through nature.

So called "nature prescriptions" for clinical populations have harnessed these principles to increase walking activity and improving both mental and physical health.

Physical inactivity is a major driver of the modern epidemic of long-term conditions, such as diabetes and heart disease, that are now observed in industrialized and developing economies alike. It has been estimated that 3.9 million premature deaths could be averted annually through targeting physical inactivity.

However, instead of prevention, medical systems are largely based on management—people get ill and are then prescribed medicines to treat the illness. On average it takes $1 billion to bring a new drug to market which, despite these research and development costs, still go on to generate sizeable profits for shareholders showing the scale of the health economy.

If just a fraction of these costs were diverted into public health initiatives aimed at increasing walking and physical activity opportunities for all, the need for an ever more sophisticated medical management ecosphere may retreat.

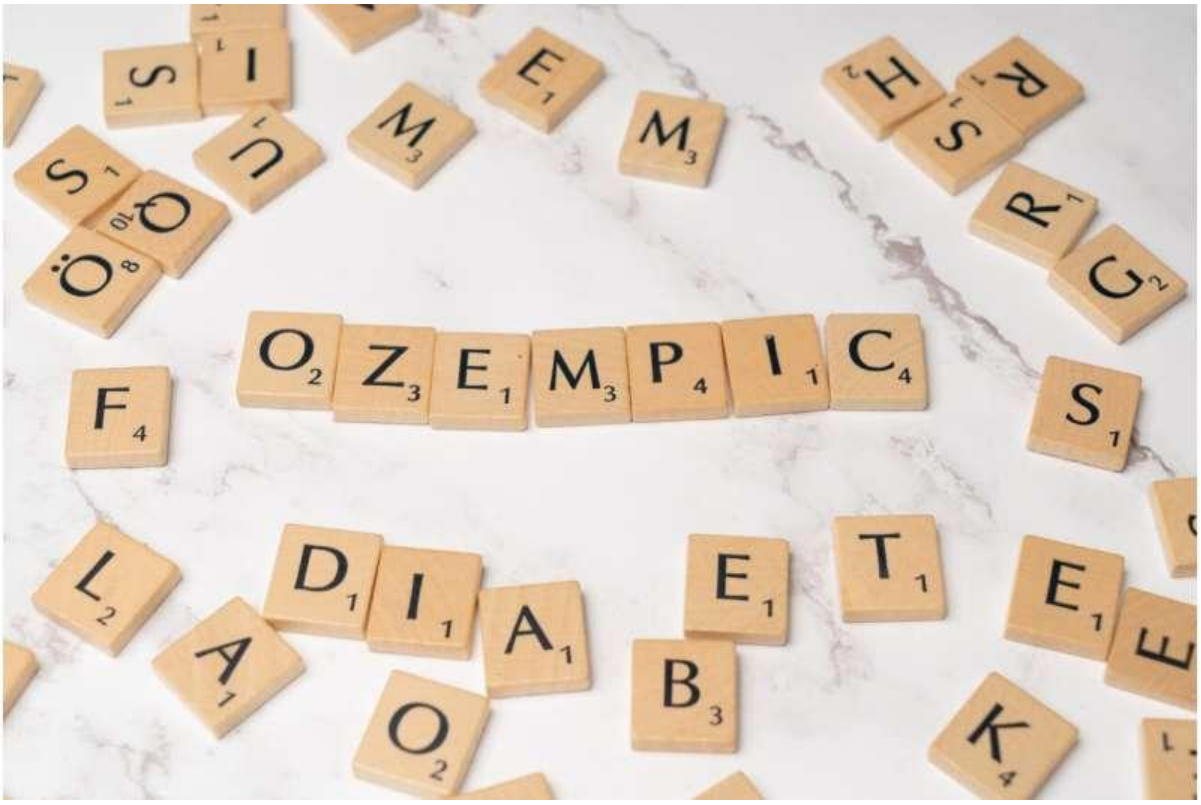
In short, when searching for the elixir of life, you could do worse than looking down at your feet.

Provided by The Conversation

MAY 15, 2025

Nature's Ozempic: What and how you eat can increase levels of GLP-1 without drugs

by Mary J. Scourboutakos, The Conversation



Credit: Pixabay/CC0 Public Domain

Despite the popularity of semaglutide drugs like Ozempic and Wegovy for weight loss, surveys suggest that most people still prefer to lose weight without using medications. For those preferring a drug-free approach to weight loss, research shows that certain nutrients and dietary strategies can naturally mimic the effects of semaglutides.

Increased intakes of fiber and monounsaturated fats (found in olive oil and avocados)—as well as the time of day when foods are eaten, the order that foods are eaten in, the speed of eating and even chewing—can naturally stimulate increased production of the same hormone responsible for the effects of semaglutide drugs.

As a family physician with a Ph.D. in nutrition, I translate the latest nutrition science into dietary recommendations for my patients. A strategic approach to weight loss rooted in the latest science is not only superior to antiquated calorie counting, but also capitalizes on the same biological mechanisms responsible for the success of popular weight-loss drugs.

Semaglutide medications work by increasing the levels of a hormone called GLP-1 (glucagon-like peptide 1), a satiety signal that slows digestion and makes us feel full. These drugs also simultaneously decrease levels of an enzyme called DPP-4, which inactivates GLP-1.

As a result, this "stop eating" hormone that naturally survives for only a few minutes can survive for an entire week. This enables a semi-permanent, just-eaten sensation of fullness that consequently leads to decreased food intake and, ultimately, weight loss.

Nevertheless, medications aren't the only way to raise GLP-1 levels.

What you eat

Fiber—predominantly found in beans, vegetables, whole grains, nuts and seeds—is the most notable nutrient that can significantly increase GLP-1. When fiber is fermented by the trillions of bacteria that live in our intestines, the resultant byproduct, called short chain fatty acids, stimulates the production of GLP-1.

This may explain why fiber consumption is one of the strongest predictors of weight loss and has been shown to enable weight loss even in the absence of calorie restriction.

Monounsaturated fats—found in olive oil and avocado oil—are another nutrient that raises GLP-1. One study showed that GLP-1 levels were higher following the consumption of bread and olive oil compared to bread and butter. Though notably, bread consumed with any kind of fat (be it from butter or even cheese) raises GLP-1 more than bread alone.

Another study showed that having an avocado alongside your breakfast bagel also increases GLP-1 more so than eating the bagel on its own. Nuts that are high in both fiber and monounsaturated fats, like pistachios, have also been shown to raise GLP-1 levels.

How you eat

However, the specific foods and nutrients that influence GLP-1 levels are only half the story. GLP-1 is a good example of how it's not just what you eat that matters, it's also how you eat it.

Studies show that meal sequence—the order foods are eaten in—can impact GLP-1. Eating protein, like fish or meat, before carbohydrates, like rice, results in a higher GLP-1 level compared to eating carbohydrates before protein. Eating vegetables before carbohydrates has a similar effect.

Time of day also matters, because like all hormones, GLP-1 follows a circadian rhythm. A meal eaten at 8 a.m. stimulates a more pronounced release of GLP-1 compared to the same meal at 5 p.m. This may partly explain why the old saying "eat breakfast like a king, lunch like a prince and dinner like a pauper" is backed by evidence that demonstrates greater weight loss when breakfast is the largest meal of the day and dinner is the smallest.

The speed of eating can matter, too. Eating ice cream over 30 minutes has been shown to produce a significantly higher GLP-1 level compared to eating ice cream over five minutes. However, studies looking at blood sugar responses have suggested that if vegetables are eaten first, the speed of eating becomes less important.

Even chewing matters. One study showed that eating shredded cabbage raised GLP-1 more than drinking pureed cabbage.

Not as potent as medication

While certain foods and dietary strategies can increase GLP-1 naturally, the magnitude is far less than what is achievable with medications. One study of the GLP-1 raising effects of the Mediterranean diet demonstrated a peak GLP-1 level of approximately 59 picograms per milliliter of blood serum. The product monograph for Ozempic reports that the lowest dose produces a GLP-1 level of 65 nanograms per milliliter (one nanogram = 1,000 picograms). So medications raise GLP-1 more than one thousand times higher than diet.

Nevertheless, when you compare long-term risk for diseases like heart attacks, the Mediterranean diet lowers risk of cardiac events by 30%, outperforming GLP-1 medications that lower risk by 20%. While weight loss will always be faster with medications, for overall health, dietary approaches are superior to medications.

The following strategies are important for those trying to lose weight without a prescription:

- Eat breakfast
- Strive to make breakfast the largest meal of the day (or at least frontload your day as much as possible)
- Aim to eat at least one fiber-rich food at every meal
- Make olive oil a dietary staple
- Be mindful of the order that you eat foods in, consume protein and vegetables before carbohydrates
- Snack on nuts
- Chew your food
- Eat slowly

While natural approaches to raising GLP-1 may not be as potent as medications, they provide a drug-free approach to weight loss and healthy eating.

MAY 19, 2025

Four lifestyle habits that might just help you live to 100

by Bradley Elliott, The Conversation

edited by Lisa Lock, reviewed by Andrew Zinin

A 115-year-old Surrey woman named Ethel Caterham has officially been handed the title of the oldest living human alive.

Many people reading this news may wonder what Caterham's secret is.

While it isn't usually a good idea to take health and longevity advice from supercentenarians (as they're often the exception rather than the rule), there are some lifestyle pointers that we can take from research on groups of long-lived people that might help us increase our chances of living a longer life.

1. Physical activity

Physical activity is good for you—who knew? Research shows that people who are more physically active each day tend to live longer, healthier lives. One study found that going from no physical activity to about 75 minutes per week of brisk walking increased life expectancy by about two years.

But perhaps less well known is just how bad inactivity is for your health and longevity. It's a tad difficult to explain, but the positive effects of exercise are actually different from the negative effects of inactivity. That means that you can have a positive influence on your health by being both more active and avoiding being inactive.

Yet as good as structured exercise is for you, it can't by itself offset the harms of inactivity and sitting all day. Research even shows that being sedentary is associated with higher risk of premature death from any cause.

If you want to live longer, you should try to avoid sitting for long periods of time if possible. Practical tips for this include standing up every 30 minutes, going to see someone in the office instead of calling or emailing them and standing on public transport during

commuting. This, plus the aim to do about 30 minutes moderate exercise most days will help maximize your odds of a long, healthy life.

2. Eat your veggies

The advice many kids dread: eat your vegetables if you want to live a long time.

A recent study that followed around 100,000 people over a 30-year period found that people who made it to 70 years of age in good health (meaning they had no chronic diseases) typically ate more fruits, vegetables, whole grains, nuts and legumes, and fewer trans-fats, red or processed meats, fried foods and sugary foods. Importantly, this study doesn't say that you must be a vegan, or never eat red meats—it only identifies trends within diets associated with healthy aging.

When and how much you eat may also play a role when it comes to aging. Research on caloric restriction and intermittent fasting in animals has shown both can increase lifespan. Our preliminary work in humans has also shown that following a fasting diet for three weeks can cause similar, positive metabolic shifts that match what we've seen in animals that will live longer. However, larger studies over longer time-frames are needed to establish effects on healthspan and lifespan in humans.

3. Sleep

Regular, good quality sleep is also important for lifelong health and overall longevity.

In a study of about 500,000 British people, irregular sleep patterns were associated with a 50% higher risk of early death compared to those with regular sleep patterns. Shift workers showed higher risk for strokes, and nurses who worked rotating shifts for decades were less healthy and had earlier deaths at retirement compared to nurses who didn't work shifts.

While this data suggests that good quality, regular sleep is important for good health, how much sleep you need and when you should go to bed appears to be highly individualistic. This makes giving population-wide recommendations difficult—which is why the NHS recommends adults get between 7–9 hours of sleep.

4. Stress

Stress has many effects on your health.

For instance, increasing evidence shows that early-life stressors (such as loss of a parent, neglect or abuse) can negatively affect health later in life—even down to a molecular and cellular level by increasing inflammation levels in ways that could increase the risk of poor health and premature death in older age.

Conversely, older adults that show increased psychological resilience to stress are less likely to die from any cause. As little as eight weeks of regular yoga is enough to improve psychological resilience in older adults.

Possibly linked is the effect of social connections. Those that live more socially active lives also tend to live longer. In fact, people over 65 who are socially active daily are three times more likely to live for five more years compared to those that almost never engage in social activities.

It's a common finding that strong social networks appear to enhance longevity. This may be due to the way social connections help us alleviate stressors in our lives.

The role of genetics

While there are many lifestyle habits we can change, one thing we can't control when it comes to our lifespans is genetics. Some research suggests that naturally-occurring mutations in genes associated with longevity are more common in long-lived people.

Although it's hard to tease out the role of genetics versus lifestyle when it comes to lifespan, current predictions suggest that longevity is between 20% and 40% related to genetics.

But good genetics aren't everything. Although Ethel Caterham has made it to the remarkable age of 115—and one of her sisters lived to be 104—Caterham's two daughters pre-deceased her at 71 and 83 years of age.

And even if you do win the genetic jackpot and follow a good lifestyle, you would still be very lucky to make it to Caterham's grand old age of 115. Cells mutate, clots form, biological luck runs out. Still, if you want to maximize your odds of living longer and staying as healthy as possible, aim to be more physically active each day, eat a good diet, get a good night's sleep and keep stress levels low.

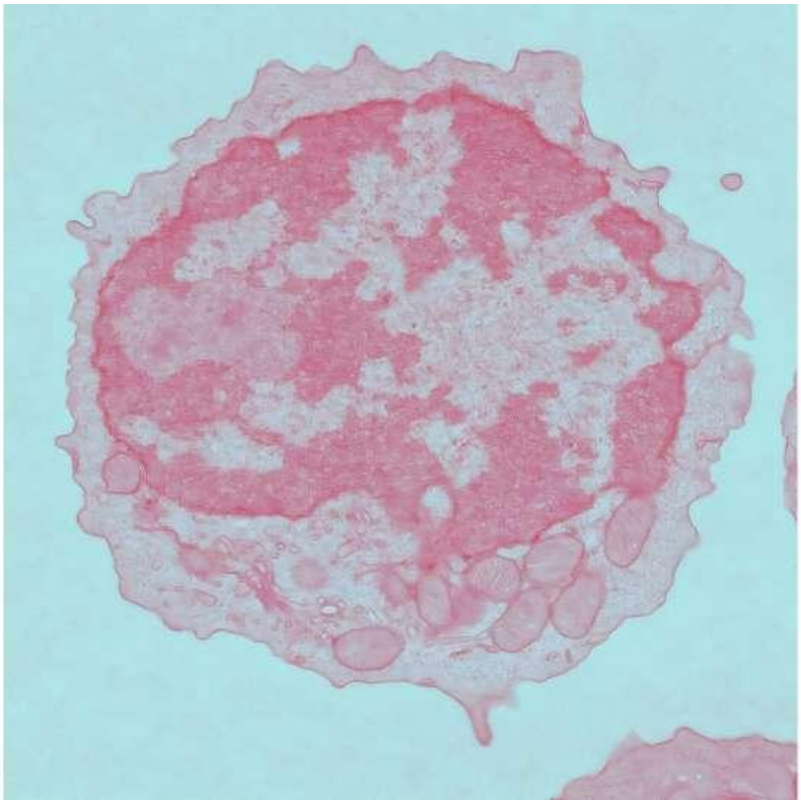
Provided by The Conversation

MAY 20, 2025

Aging reduces CAR-T cell effectiveness by impairing metabolism, study shows

by University of Lausanne

edited by Stephanie Baum, reviewed by Robert Egan



Electron microscopy image of young naïve $CD8^+$ T cells. Credit: Helen Hope / UNIL (2025)
As people age, their immune systems become less efficient, posing a challenge for cancer therapies that rely on harnessing immune cells.

In a new study published in *Nature Cancer*, researchers from the University of Lausanne (UNIL), the Lausanne University Hospital (CHUV), the Geneva University Hospitals (HUG)

and the Ecole Polytechnique Fédérale de Lausanne (EPFL), show that this age-related immune decline has a measurable impact on CAR-T cell therapy, one of the most advanced forms of cancer immunotherapy.

CAR-T therapy works by engineering a patient's T cells to recognize and destroy cancer cells. But the study found that CAR-T cells from aged mice had poor mitochondrial function, lower "stemness," and reduced antitumor activity. The culprit: a drop in levels of nicotinamide adenine dinucleotide (NAD), a molecule essential for cellular energy and metabolism of mitochondria.

"CAR-T cells from older individuals are metabolically impaired and significantly less effective," said first author Dr. Helen Carrasco Hope. "What's exciting is that we were able to rejuvenate these aged cells by restoring their NAD levels—reviving their antitumor function in preclinical models."

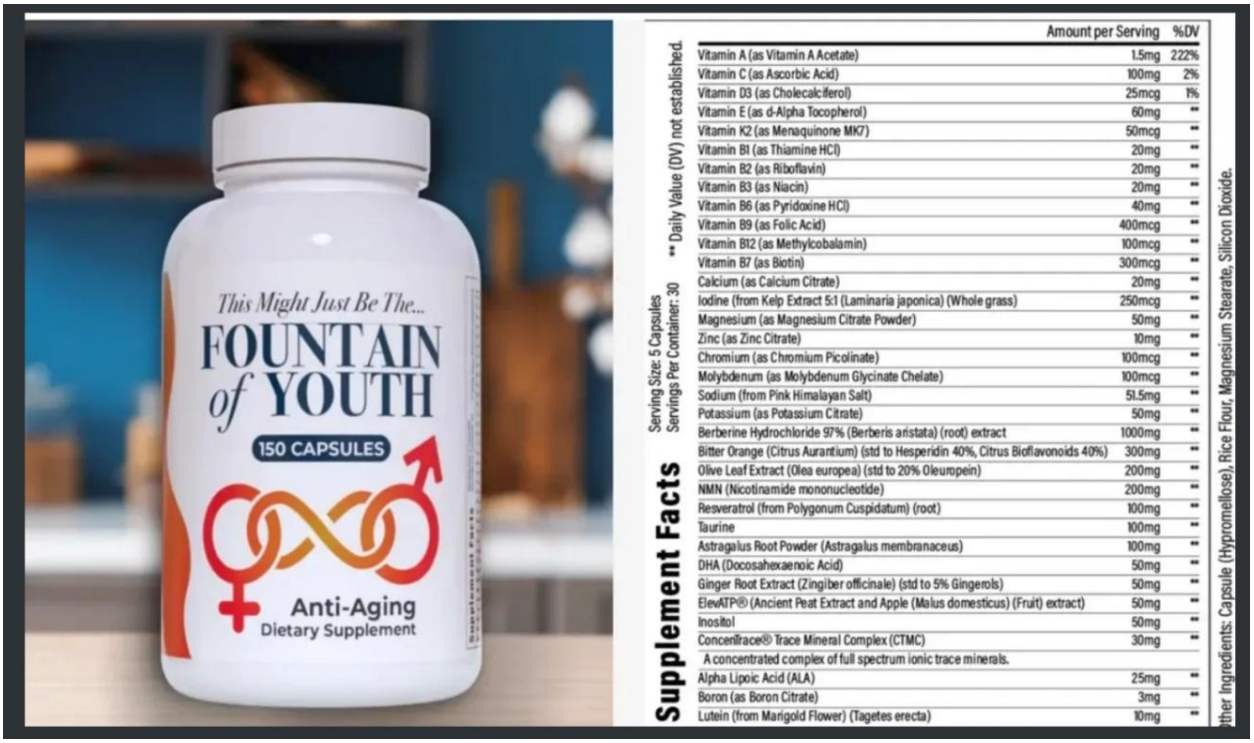
"Our findings strengthen the growing recognition that aging fundamentally reshapes immune cell function and metabolism," she added. "They highlight the urgent need to model age more accurately in preclinical studies, so that therapies are developed with the real-world cancer population in mind—where most patients are older adults."

The team used NAD-boosting compounds currently under clinical investigation for other conditions, demonstrating that this approach is translatable and potentially applicable in humans.

"This is a major step toward personalized and age-conscious immunotherapy," said senior author Dr. Nicola Vannini. "By correcting age-related metabolic defects, we could improve outcomes for a large segment of cancer patients."

The study adds to a growing body of work showing that age is not just a chronological number, but a biological factor that can shape therapy response. The authors call for age to be systematically considered in the development and evaluation of cell-based immunotherapies.

More information: Age-associated nicotinamide adenine dinucleotide decline drives CAR-T cell failure, *Nature Cancer* (2025). DOI: 10.1038/s43018-025-00982-7
Journal information: Nature Cancer
Provided by University of Lausanne



Supplement Facts

Serving Size: 5 Capsules
Servings Per Container: 30

** Daily Value (DV) not established.

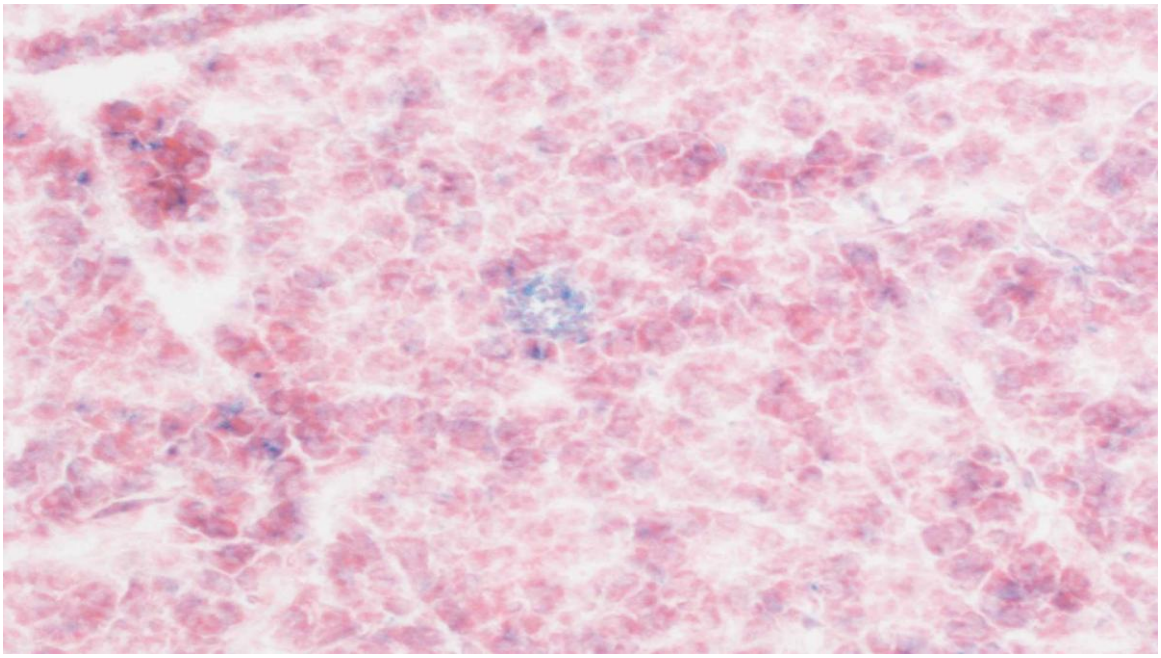
	Amount per Serving	%DV
Vitamin A (as Vitamin A Acetate)	1.5mg	222%
Vitamin C (as Ascorbic Acid)	100mg	2%
Vitamin D3 (as Cholecalciferol)	25mcg	1%
Vitamin E (as d-Alpha Tocopherol)	60mg	**
Vitamin K2 (as Menaquinone MK7)	50mcg	**
Vitamin B1 (as Thiamine HCl)	20mg	**
Vitamin B2 (as Riboflavin)	20mg	**
Vitamin B3 (as Niacin)	20mg	**
Vitamin B6 (as Pyridoxine HCl)	40mg	**
Vitamin B9 (as Folic Acid)	400mcg	**
Vitamin B12 (as Methylcobalamin)	100mcg	**
Vitamin B7 (as Biotin)	300mcg	**
Calcium (as Calcium Citrate)	20mg	**
Iodine (from Kelp Extract 5:1 (Laminaria japonica) (Whole grass)	250mcg	**
Magnesium (as Magnesium Citrate Powder)	50mg	**
Zinc (as Zinc Citrate)	10mg	**
Chromium (as Chromium Picolinate)	100mcg	**
Molybdenum (as Molybdenum Glycinate Chelate)	100mcg	**
Sodium (from Pink Himalayan Salt)	51.5mg	**
Potassium (as Potassium Citrate)	50mg	**
Berberine Hydrochloride 97% (Berberis aristata) (root) extract	1000mg	**
Bitter Orange (Citrus Aurantium) (std to Hesperidin 40%, Citrus Bioflavonoids 40%)	300mg	**
Olive Leaf Extract (Olea europea) (std to 20% Oleuropein)	200mg	**
NMN (Nicotinamide mononucleotide)	200mg	**
Resveratrol (from Polygonum Cuspidatum) (root)	100mg	**
Taurine	100mg	**
Astragalus Root Powder (Astragalus membranaceus)	100mg	**
DHA (Docosahexaenoic Acid)	50mg	**
Ginger Root Extract (Zingiber officinale) (std to 5% Gingerols)	50mg	**
ElevATP® (Ancient Peat Extract and Apple (Malus domesticus) (Fruit) extract)	50mg	**
Inositol	50mg	**
ConcenTrace® Trace Mineral Complex (CTMC)	30mg	**
A concentrated complex of full spectrum ionic trace minerals.		
Alpha Lipoic Acid (ALA)	25mg	**
Boron (as Boron Citrate)	3mg	**
Lutein (from Marigold Flower) (Tagetes erecta)	10mg	**

Other Ingredients: Capsule (Hypromellose), Rice Flour, Magnesium Stearate, Silicon Dioxide.

The fountain of youth is a T cell?

Senescent cells (blue) accumulate as we age. CAR T cells can be programmed to seek them out and destroy them. The image above shows healthy pancreatic tissue samples from an old mouse treated with CAR T cells as a young pup.

24 January 2024



The fountain of youth has eluded explorers for ages. It turns out the magic anti-aging elixir might have been inside us all along.

Cold Spring Harbor Laboratory (CSHL) Assistant Professor Corina Amor Vegas and colleagues have discovered that T cells can be reprogrammed to fight aging, so to speak. Given the right set of genetic modifications, these white blood cells can attack another group of cells known as senescent cells. These cells are thought to be responsible for many of the diseases we grapple with later in life.

Senescent cells are those that stop replicating. As we age, they build up in our bodies, resulting in harmful inflammation. While several drugs currently exist that can eliminate these cells, many must be taken repeatedly over time.

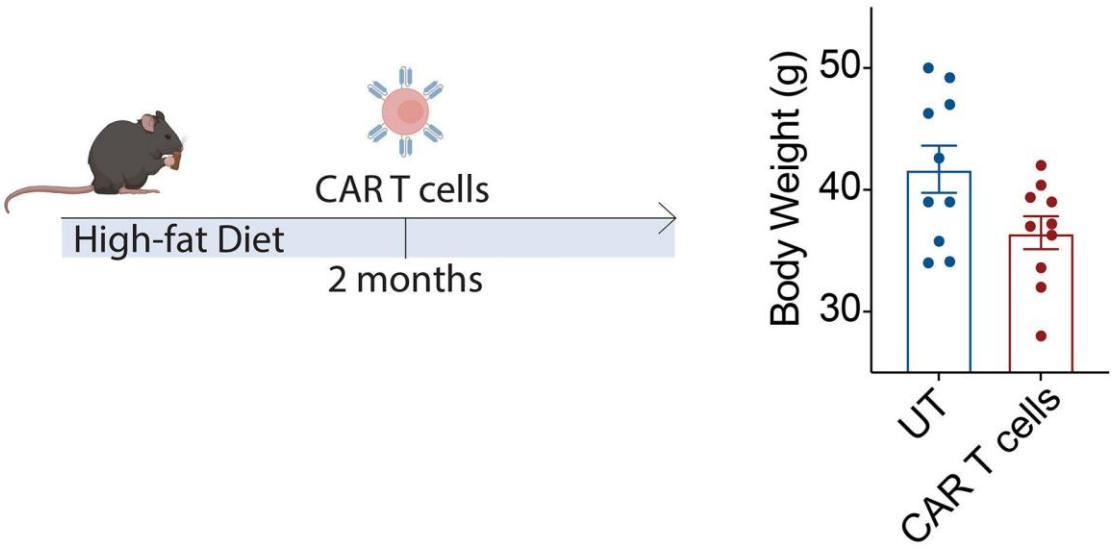
As an alternative, Amor Vegas and colleagues turned to a “living” drug called CAR (chimeric antigen receptor) T cells. They discovered CAR T cells could be manipulated to eliminate senescent cells in mice. As a result, the mice ended up living healthier lives. They had lower body weight, improved metabolism and glucose tolerance, and increased physical activity. All benefits came without any tissue damage or toxicity. Amor Vegas says:

“If we give it to aged mice, they rejuvenate. If we give it to young mice, they age slower. No other therapy right now can do this.”

Perhaps the greatest power of CAR T cells is their longevity. The team found that just one dose at a young age can have lifelong effects. That single treatment can protect against conditions that commonly occur later in life, like obesity and diabetes. Amor Vegas explains:

“T cells have the ability to develop memory and persist in your body for really long periods, which is very different from a chemical drug. With CAR T cells, you have the potential of getting this one treatment, and then that’s it. For chronic pathologies, that’s a huge advantage. Think about patients who need treatment multiple times per day versus you get an infusion, and then you’re good to go for multiple years.”

CAR T cells have been used to treat a variety of blood cancers, receiving FDA approval for this purpose in 2017. But Amor Vegas is one of the first scientists to show that CAR T cells’ medical potential goes even further than cancer.



Young mice treated with CAR T cells age slower and have protection from natural aging-associated conditions like obesity and diabetes. The cartoon above shows a young mouse, treated with CAR T cells, who ate a high-fat diet for two months. The charts show that compared to untreated mice on the same diet, the treated mouse had lower body weight.

Amor Vegas' lab is now investigating whether CAR T cells let mice live not only healthier but also longer. If so, society will be one mouse step closer to the coveted fountain of youth.

Written by: Luis Sandoval, *Communications Specialist* | sandova@cshl.edu | 516-367-6826

LONGER LIFE NEWS

‘Fountain of youth’ pill shows ability to dramatically increase longevity in mice

StudyFinds Dec 08, 2021

SHANGHAI, China — Anti-aging treatments come in all shapes and sizes, from oxygen chambers to simple diets and exercises. Now, researchers say a flavonoid-based pill to fight aging and improve longevity could be on the horizon after scientists found the treatment dramatically extended the lifespans of mice.

A team from the Chinese Academy of Sciences in Shanghai says injecting elderly rodents with a grape seed extract increased their remaining time by more than 60 percent. It also boosted overall lifespan by nine percent, equivalent to more than a decade in a human.

Corresponding author Dr. Yu Sun says the plant chemical has “high potential” as a clinical intervention to delay, alleviate, and even prevent illnesses. The flavonoid known as PCC1 flushes out “zombie” or “senescent” cells that have stopped dividing. These aging cells accumulate naturally as people get older and release chemicals that cause inflammation.

“Ageing-associated functional decline of organs and increased risk for age-related chronic pathologies is driven in part by the accumulation of senescent cells,” Dr. Sun and researchers write in the journal *Nature Metabolism*.

“Here we show that procyanidin C1 (PCC1), a polyphenolic component of grape seed extract (GSE), increases the health span and lifespan of mice through its action on senescent cells.”

Longevity pill a new way to improve cancer therapies?

Study authors screened a panel of natural compounds in a model of cultured human prostate cells. They found PCC1 selectively killed senescent cells, leaving healthy ones alone. In mouse

models of disease – including exposure to radiation – the compound again lowered unhealthy accumulations of cells and boosted health. The therapy also improved the effect of chemotherapy among animals with compromised immunity systems.

The team administered injections of PCC1 to 91 male and female mice between 24 and 27 months-old. In human years, that would be between 75 and 90 year-olds, the researchers say.

Results show that the treatment appears to be safe, with the mice tolerating the injections well. Scientists still need to establish a safe dose before human clinical trials can begin. Aging is one of the biggest risk factors for cardiovascular diseases, metabolic disorders, neurodegenerative illnesses, and cancer.

“Considerable progress has been made over recent years to develop specific agents to treat individual age-related conditions, such as type 2 diabetes, osteoporosis, skeletal fragility and vascular dysfunction,” the researchers write. “However, the combined effect of these drugs in controlling morbidity and mortality of chronic diseases has been modest”

“These diseases tend to occur in synchrony as multi-morbidities, with prevalence increasing exponentially after 70 years of age,” the researchers continue.

The findings offer hope for prolonging health and lifespan and treating age-related conditions with a therapy derived from natural sources.

“The potential anti-ageing effects of PCC1 demonstrated in our preclinical assays provide good support for further translational and clinical development of PCC1, with the overall aim of achieving a longer and healthier life,” Dr. Sun concludes.

South West News Service writer Mark Waghorn contributed to this report.

Try the Fountain of Youth Herbs

Plant hormones can help trick your 50-plus body into thinking it's still 30-something

BY DOUGLAS SCHAR, DIPPHYT, MCPP, MNIMHPUBLISHED: NOV 3, 2011

Intro

While doing herbal field research in mountainous northern Spain, I came upon an 80-year-old villager building a stone fence. As he toted a mammoth stone, I asked the obvious: How do you stay so well? He motioned to an herb growing nearby, then winked brightly. I have found time and time again that, like the man with the rock, ageless people usually use a special herb as part of their daily routine. The particular "vitality herb" changes as you travel the globe, but whether it's the healthy Hunzas in Pakistan or the ageless Austurians of Spain, many cultures use herbs to stay young. In China, it's often angelica; in the US, it's saw palmetto and sarsaparilla; in India, it's fenugreek. So what's up with these herbs? Do they really work? My answer is yes, but to really appreciate how they work, a basic understanding of hormones helps.

Hormones 101

Along with the sex hormones estrogen and testosterone, which activate our reproductive system, the human body contains other hormones that activate the digestive tract, bone marrow, skin, and muscle growth. At puberty, hormones help our body change dramatically. As we age, hormone production slows, and our body again changes in response. What I've learned through research is that certain vitality-boosting herbs are rich in hormonelike compounds that enable hormones to work. These herbs perpetuate youthful vigor by helping keep hormone levels up.My clinical experience indicates that these herbs support the hormones that build muscle (androgens), stimulate blood cell production (erythropoietin), speed metabolism (thyroxin), regulate energy (adrenaline), and support blood sugar levels (insulin). When taken over time, these herbs can help diminish the symptoms of aging and improve general well-being. My patients come back saying that they feel better and stronger, and they even look younger.

When looking for an herb to power up a stay-young regimen, you need to find the one that combats your weaknesses with strength. Here are a few that I find especially promising.[pagebreak]

The Menopause Herb

Black cohosh (Cimicifuga racemosa) was called squawroot by American settlers because it was a favorite herb of Native American women. Used by doctors until the 1950s to treat various gynecological complaints, today the herb is primarily used to banish menopausal problems, especially hot flashes. Significant scientific evidence confirms its traditional uses. I have found that, when used regularly, black cohosh reduces my patients' complaints about hot flashes and other menopausal symptoms. **Stimulate Hormone Production** In a study on animals, black cohosh stimulated the pituitary gland, the grand master of hormone production. The pituitary gland stimulates the adrenal glands (the adrenaline, androgens, and cortisone factory), the thyroid gland (the thyroxin factory), and the sex glands (the estrogen and testosterone factories). Indeed, black cohosh contains at least three different compounds that appear, in the lab at least, to turn on hormone production at the pituitary level. **Herbal HRT Alternative** When estrogen levels decrease, certain tissues, including the skin and vaginal lining, lose their elasticity and suppleness. During a woman's childbearing years, estrogen attaches to these cells and turns them on, so to speak, which helps keep them youthful. But at menopause, the decline in estrogen causes these cells to turn off, which leads to a decline in elasticity. Research reveals black cohosh to be a hormonal treasure chest. Its compounds attach to cells and turn them on. Indeed, fukilonic acid, a black cohosh constituent, has been found to increase proliferation of estrogen-dependent cells.In 1998, the *Journal of Women's Health* published a review of eight black cohosh studies conducted on menopausal women. Their conclusion? Black cohosh relieved their menopausal symptoms and is a realistic alternative for those women who choose not to take hormone replacement therapy (HRT). **Stay Sexy Longer** In a randomized, double-blind, placebo-controlled comparative clinical trial involving 80 menopausal women, researchers found that black cohosh was as effective as HRT at lessening the severity of hot flashes, memory loss, depression, and mood swings, as well as improving the thickness and elasticity of vaginal tissues. **Lessen Signs of Aging** In another human clinical trial, black cohosh and estrogen tablets were compared for their ability to reduce signs of aging. The study showed that black cohosh improved vaginal mucous membranes, hair, and skin. Menopausal vaginal dryness caused by poor mucous membrane lubricant production is remedied with the herb. **Using Black Cohosh** Take the herb twice a day. Dried root--two 500-mg. Tablets/capsules Tincture 1:1--20 drops Tincture 1:5--1 teaspoon]5 milliters (ml)] **Caution:** Black cohosh should not be taken by

women with estrogen-dependent cancer, including breast, cervical, uterine, and ovarian cancer. Women taking HRT should avoid taking this herb.[pagebreak]

Find a Friendly Angel

Angelica (Angelica sinensis) is used by Chinese women to keep them strong and vibrant from puberty on. Practitioners of Traditional Chinese Medicine believe that angelica makes periods less painful, enables conception, eases childbirth, and helps ensure an easier menopause. Though the herb is used specifically to maintain healthy, young-looking skin, hair, and nails after menopause, research and clinical experience reveal that angelica's activity is more than skin deep. **Digestive Stimulant** Digestive difficulties can arise as we age, with the culprit often being insufficient digestive enzyme production. Angelica turns on the digestive juice glands, from the mouth to the stomach. **Sex Hormone Booster** For some women, menopause is more than just hot flashes and mood swings. Skin may become less supple, muscles less resilient, and joints less forgiving. Angelica is used to treat symptoms of diminishing estrogen levels. In clinical practice, women have reported reduced hot flashes, increased sex drive, and improved skin quality. In studies done on animals, researchers have noted that angelica activates estrogen-dependent cells, which suggests that this herb may have an estrogen-like action. **Immune System Stimulant** Immune function lessens with age. With fewer immune cells patrolling the body for foreign invaders (bacteria and viruses) and cancer cells, we become more vulnerable to infection and cancer. Researchers have found that angelica stimulates the production and activity of immune cells.**Free Radical Scavenger** Free radicals are highly reactive chemicals produced by the body that can accelerate the aging process by damaging the body inside and out. Angelica compounds have been shown to bind to circulating free radicals, thereby rendering them harmless. **Using Angelica** Women should consider taking angelica at menopause, then continuing for life. Take it three times a day. Dried root--two 500-mg tablets/capsules Tincture 1:1--20 drops (1 ml) Tincture 1:5--1 teaspoon (5 ml) **Caution:** Angelica thins the blood. Do not use this herb if you have bleeding disorders and/or take medication that thins the blood. Since it may be estrogenic, follow the caution for black cohosh.[pagebreak]

An Old-Fashioned Tonic for Today

Nineteenth-century doctors believed that the fire of life burned brighter when people took sarsaparilla (Smilax spp.). The root contains 3 percent steroids, which are probably responsible for the boost in general vitality experienced by people who use this herb regularly. **The Muscle Builder** If muscle weakness is an issue, sarsaparilla may be the answer. Bodybuilders use it to increase muscle growth. In

one study, cows fed corn and a sarsaparilla extract were found to produce lean muscle more efficiently. Increased muscle formation under the influence of sarsaparilla suggests that it may act as a muscle growth hormone. **Good Medicine for Creaky Joints** Some think creaky painful joints are part of the retirement package--but sarsaparilla may counter the problem. Researchers investigated its effect in rats and found that it significantly reduced joint inflammation. **Using Sarsaparilla** Take the herb three times a day. Tableted root--two 500-mg tablets/capsules Tincture 1:1--20 drops (1 ml) Tincture 1:5--1 teaspoon (5 ml)[pagebreak]

The His and Hers Herb

Saw palmetto (Serenoa repens) is a vigorous palm that's native to the southeastern US. Colonial planters noticed that cows and pigs that reached beyond their corrals to eat the berries grew unusually healthy and fat. They resisted illness, had richer coats, and readily put on flesh. In time, doctors started to use it to increase the strength and weight of patients who needed to put on pounds after an illness. Doctors now use saw palmetto to normalize sex hormones; they found that it increases sex drive in women and revitalizes their reproductive organs. The herb has been called "old man's friend" because it slims down an overgrown prostate. It's used in younger men to increase sex drive and remedy atrophied testicles. Oddly, it's prescribed both for people who crave sex too much and for those with no sexual appetite at all. I rely on saw palmetto in my clinical practice. I find that my patients turn up looking sleek and well and feeling, shall we say, fully operational. **Male Sex Hormone Helper** Shifting hormone levels in men can lead to a swollen prostate and declining libido. A string of convincing human clinical trials suggests that saw palmetto relieves conditions caused by changing hormone levels, most notably symptoms of benign prostatic hyperplasia (BPH) and poor sex drive. **Good Medicine for Muscles and Joints** As we age, our joints are prone to painful inflammation. One study revealed that saw palmetto contains compounds that directly inhibit inflammation. Aging muscles also tend to lose suppleness and vigor. When saw palmetto is used regularly, muscles plump up. I find that saw palmetto makes an ideal supplement for those whose moving parts are not moving so well.**Lose the Fur** The female body produces male and female hormones. Some women overproduce male hormones (androgens); this can lead to hirsutism, or excessive hair growth. As estrogen levels drop off at menopause, the condition can worsen. Saw palmetto has been shown to block the effects of androgen and may be a solution for women experiencing excessive hair growth. **Bonus: Fountain of Essential Fatty Acids** If the Fountain of Youth really existed, I'd bet that it would flow with essential fatty acids (EFAs). These oils are critical for skin, hair, nail, and organ health. The body requires EFAs to build new cells. Replacing old, worn-out

cells efficiently is the key to youthfulness, and the good news is that research reveals that saw palmetto berries are rich in EFAs. **Using Saw Palmetto** Take the herb twice a day. Dried berry--two 500-mg tablets Tincture 1:1--20 drops (1 ml) Tincture 1:5--1 teaspoon (5 ml) Capsule--160 mg standardized to 8:1 liposterolic extract[pagebreak]

The Vitality Herb

From North Africa to China, fenugreek seed (Trigonella foenum-graecum) is used as the ultimate vitality-enhancing tonic. Traditional Chinese Medicine practitioners give fenugreek to people recovering from serious illness. It's also used to boost poor sex drive and stop weight loss. Fenugreek contains a variety of hormonelike steroids, some of which (trigofoensides, trigonellosides) exist nowhere else in nature. Surprisingly, fenugreek also contains two compounds, dioscin and diosgenin, which are also found in sarsaparilla. As a general vitality booster, fenugreek has some very specific actions--namely, blood sugar and cholesterol reduction--that should interest baby boomers and their elders. **Cholesterol Reduction** As we age, blood fat levels inch up. Our bad cholesterols (LDL and VLDL) and triglycerides rise, increasing the risk of heart attack and stroke. In my experience, fenugreek counters this tendency. In a human clinical trial involving 20 people between ages 50 and 65, taking either 12.5 g or 18 g of fenugreek for 30 days resulted in a significant reduction in total cholesterol levels--specifically LDL. Fenugreek was found to greatly reduce cholesterol levels in two animal studies as well. Interestingly, the researchers observed a specific decrease in LDL and VLDL levels. **Diabetes Aid** Diabetes (both type 1 and type 2) is caused by insufficient insulin, the blood sugar-regulating hormone produced by the pancreas. Along with age often comes rising blood sugar problems as a result of poor insulin production. Fenugreek is a traditional treatment for diabetes that's been substantiated by contemporary science.The fenugreek compound 4-hydroxy-isoleucine was found to stimulate pancreatic insulin production in rats. In a human trial looking at the effect of fenugreek seed on insulin-dependent (type 1) diabetes, the seed was found to reduce fasting blood sugar levels. People with diabetes who were given it were better able to handle glucose in glucose tolerance tests. Sugar in the urine is one of the defining features of diabetes, and the same trial showed a 54% reduction in 24-hour urinary glucose reduction. In another human study, researchers found that people with type 2 (non-insulin-dependent) diabetes who took fenugreek had reduced postmeal blood sugar levels. **Using Fenugreek** Take the herb three times a day. Seed--two 500-mg tablets/capsules Tincture 1:1--20 drops (1 ml) Tincture 1:5--1 teaspoon (5 ml) **Caution:** If you have diabetes, consult your doctor before taking fenugreek, and have her monitor your blood sugar levels on a regular basis.

Harvard university researchers may have developed a “Fountain of Youth” pill

The researchers have isolated six unique chemical mixtures with the potent ability to reverse the aging process

Published Jun 24, 2024

In a monumental step forward towards achieving what many may call the 'fountain of youth', a team of scientists from Harvard University have recently released their extensive research on age reversal. As written in their recent paper, published in the renowned scientific journal Aging, the researchers have isolated six unique chemical mixtures with the potent ability to reverse the aging process in both human and mice skin cells.

"We see this as a 'breakthrough'," stated Dr. David Sinclair, a molecular biologist at Harvard Medical School and a co-author of the study. It is seen by Dr. Sinclair and his team as a significant milestone on the road towards "affordable whole-body rejuvenation."

Considering the seismic implications of such a discovery, it is unsurprising that the news has captured the interest of numerous influential figures, including business magnate and futurist, Elon Musk, who inquisitively queried, "Ok, so what exactly is it?"

The research team employed a high-throughput cell-based screening technique to differentiate younger cells from their aging, senescent counterparts. Senescent cells, those which have ceased their multiplication process, stand as a distinct marker of aging.

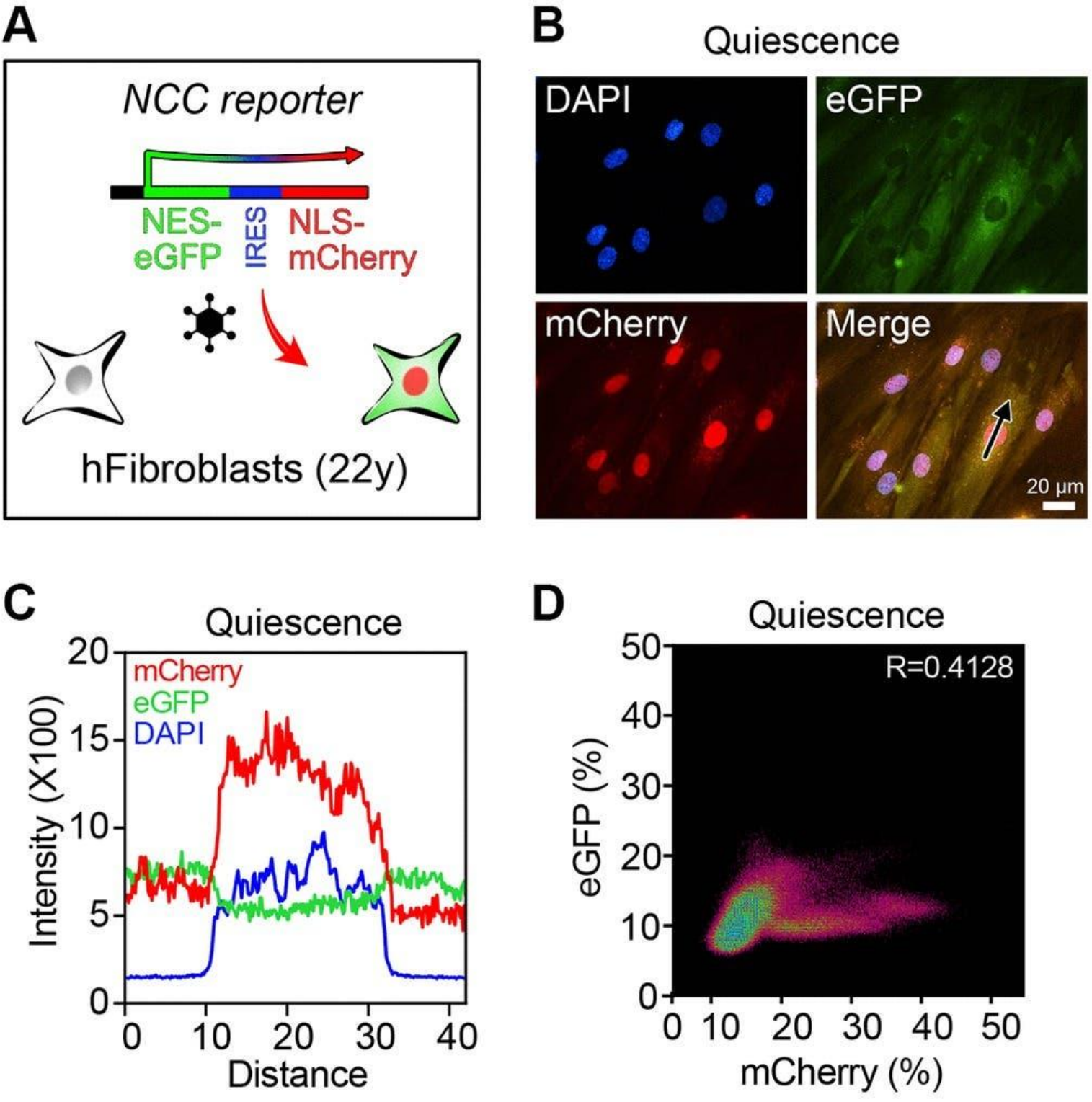
With the ability to swiftly test an astronomical range of samples, from thousands to millions, for biological activity at various levels (from model organisms to molecular levels), the high-throughput screening method proved instrumental in this ground-breaking study.

To discern the specific markers of aging, the scientists used a combination of transcription-based aging clocks and real-time nucleocytoplasmic protein compartmentalisation (NCC) assays. NCC is a crucial function in diverse cell types, including stem cells, bone cells, and muscle cells.

The product of this extensive research is the identification of six chemical concoctions which, as per the press release, "restored NCC and genome-wide transcript profiles to youthful states and reversed transcriptomic age [biological age] in less than a week." The testing of these mixtures on mice and human cells yielded promising results, suggesting a rejuvenating effect across all six combinations.

"The effect of this four-day treatment is comparable to the total change seen after a year of a regenerative treatment described in a landmark study from 2019, which also focused on restoring epigenetic information," the researchers affirmed. The change in age was evaluated using both rodent and human transcriptomic clocks, predictive models of biological age utilizing gene expression data.

"This new discovery offers the potential to reverse aging with a single pill, with applications ranging from improving eyesight to effectively treating age-related diseases," projected Dr. Sinclair.



However, as with any scientific breakthrough, the study has its share of skeptics. Biogerontologist Matt Kaeberlein acknowledged the potential of the innovative

screening method to catalyze significant discoveries but also expressed reservations about the preliminary nature of the study.

Kaeberlein suggested that the team ought to have validated at least one of the concoctions through an animal model and demonstrated improvements in age-related health metrics or lifespan before making such impactful claims regarding biological aging.

Another voice of concern was that of Dr. Charles Brenner, a metabolism researcher, who raised apprehensions about three compounds featured in the study: CHIR99021, which inhibits glycogen formation during sleep; tranylcypromine, an antidepressant; and valproic acid, a treatment for bipolar disorder with potential liver-related side effects. "The study overlooked the potential risks of these compounds. These are generally not safe alone or in a combination," Brenner warned. Further, he criticized the study for its lack of single-cell sequencing to evaluate cell identity. Noting that these chemical concoctions were initially reported back in 2013, Brenner argued that the compounds are not new discoveries and this is "not a groundbreaking study on reversal of aging."

Thus, while the study has sparked wide-ranging responses, the consensus remains clear: further research and meticulous analysis are indispensable before the advent of a bona fide Fountain of Youth pill can be declared.

The term 'Fountain of Youth' is derived from an age-old legend, a mythological spring believed to bestow the boon of youth upon those who drink or bathe in its waters. The concept has found a place in countless narratives for thousands of years, featuring in the writings of the ancient historian Herodotus, the Alexander romance, and the tales of Prester John.

While its exact location remains a subject of debate, the Fountain of Youth has been famously associated with Florida, purportedly discovered by Spanish explorer Juan Ponce de León, the first recorded European to land there, although there is no concrete historical evidence supporting this claim.

Today, the term 'Fountain of Youth' is used metaphorically to represent anything offering the potential to extend life span or reverse the effects of aging, ranging from scientific innovations to novel skincare products or beneficial lifestyle changes. As the Harvard research continues to unfold, one can only speculate whether the dream of the legendary Fountain of Youth is inching closer to reality.

Researchers discover new enzyme that can stop cells from aging

Researchers show that an enzyme complex named HTC (hydride transfer complex) can inhibit cells from aging.

Researchers at Université de Montréal and McGill University have discovered a new multi-enzyme complex that reprograms metabolism and overcomes "cellular senescence," when aging cells stop dividing.

In their study published today in *Molecular Cell,* the researchers show that an enzyme complex named HTC (hydride transfer complex) can inhibit cells from aging.

"HTC protects cells from hypoxia, a lack of oxygen that normally leads to their death," said senior author Gerardo Ferbeyre, an UdeM biochemistry professor and principal scientist at the CRCHUM, the university's affiliated teaching hospital research centre.

"Importantly, HTC can be hijacked by certain cancer cells to improve their metabolism, resist to a hypoxic environment and proliferate," said Ferbeyre, who made the discovery with Sebastian Igelmann, a PhD student in his lab and first author of the study.

HTC is made up of three enzymes: pyruvate carboxylase, malate dehydrogenase 1 and malic enzyme 1. They were all highly expressed in samples from a prostate cancer mouse model generated at the University of Veterinary Medicine Vienna, in Austria, and in tissue samples from prostate cancer patients.

"Most interestingly, inhibition of these enzymes stopped the growth of prostate cancer cells, suggesting that HTC could be a key target to develop new therapeutics for a variety of cancers, including prostate cancer," said Ferbeyre.

Most key metabolic cycles were identified more than 50 years ago, but HTC remained hidden to researchers. "We found it by performing state-of-the art metabolomic analysis, the study of chemical processes of cell metabolism," said co-author Ivan Topisirovic, a McGill researcher and medical professor.

The scientists were able to assemble the enzyme complex from purified proteins and obtain biophysical data about its composition. Their next step will be to generate a detailed high-resolution structure of the enzyme complex in order to design drugs able to modulate its functions.

Hypothalamus: Brain region may hold key to aging

Albert Einstein College of Medicine
Summary:
While the search continues for the Fountain of Youth, researchers may have found the body's "fountain of aging": the brain region known as the hypothalamus. For the first time, scientists report that the hypothalamus of mice controls aging throughout the body. Their discovery of a specific age-related signaling pathway opens up new strategies for combating diseases of old age and extending lifespan.

While the search continues for the Fountain of Youth, researchers may have found the body's "fountain of aging": the brain region known as the hypothalamus. For the first time, scientists at Albert Einstein College of Medicine of Yeshiva University report that the hypothalamus of mice controls aging throughout the body. Their discovery of a specific age-related signaling pathway opens up new strategies for combating diseases of old age and extending lifespan.

The paper was published today in the online edition of *Nature*.

"Scientists have long wondered whether aging occurs independently in the body's various tissues or if it could be actively regulated by an organ in the body," said senior author Dongsheng Cai, M.D., Ph.D., professor of molecular pharmacology at Einstein. "It's clear from our study that many aspects of aging are controlled by the hypothalamus. What's exciting is that it's possible -- at least in mice -- to alter signaling within the hypothalamus to slow down the aging process and increase longevity."

The hypothalamus, an almond-sized structure located deep within the brain, is known to have fundamental roles in growth, development, reproduction, and metabolism. Dr. Cai suspected that the hypothalamus might also play a key role in aging through the influence it exerts throughout the body.

"As people age," he said, "you can detect inflammatory changes in various tissues. Inflammation is also involved in various age-related diseases, such as metabolic syndrome, cardiovascular disease, neurological disease and many types of cancer." Over the past several years, Dr. Cai and his research colleagues showed that inflammatory changes in the hypothalamus can give rise to various components of metabolic syndrome (a combination of health problems that can lead to heart disease and diabetes).

To find out how the hypothalamus might affect aging, Dr. Cai decided to study hypothalamic inflammation by focusing on a protein complex called NF-κB (nuclear

factor kappa-light-chain-enhancer of activated B cells). "Inflammation involves hundreds of molecules, and NF-κB sits right at the center of that regulatory map," he said.

In the current study, Dr. Cai and his team demonstrated that activating the NF-κB pathway in the hypothalamus of mice significantly accelerated the development of aging, as shown by various physiological, cognitive, and behavioral tests. "The mice showed a decrease in muscle strength and size, in skin thickness, and in their ability to learn -- all indicators of aging. Activating this pathway promoted systemic aging that shortened the lifespan," he said.

Conversely, Dr. Cai and his group found that blocking the NF-κB pathway in the hypothalamus of mouse brains slowed aging and increased median longevity by about 20 percent, compared to controls.

The researchers also found that activating the NF-κB pathway in the hypothalamus caused declines in levels of gonadotropin-releasing hormone (GnRH), which is synthesized in the hypothalamus. Release of GnRH into the blood is usually associated with reproduction. Suspecting that reduced release of GnRH from the brain might contribute to whole-body aging, the researchers injected the hormone into a hypothalamic ventricle (chamber) of aged mice and made the striking observation that the hormone injections protected them from the impaired neurogenesis (the creation of new neurons in the brain) associated with aging. When aged mice received daily GnRH injections for a prolonged period, this therapy exerted benefits that included the slowing of age-related cognitive decline, probably the result of neurogenesis.

According to Dr. Cai, preventing the hypothalamus from causing inflammation and increasing neurogenesis via GnRH therapy are two potential strategies for increasing lifespan and treating age-related diseases. This technology is available for licensing.

'Fountain of Youth' pill created by Harvard scientists reverses aging

Is eternal youth within our grasp? A team of scientists at Harvard University believes so as they edge closer to discovering the famed Fountain of Youth.

Their recent publication in the scientific journal *Aging* unveils the identification of six chemical concoctions capable of reversing the aging process in both human and rodent skin cells.

Meet Dr. David Sinclair

Dr. David Sinclair, a molecular biologist at Harvard Medical School, and co-author of the study, hails this as a "breakthrough". He sees it as a step towards "affordable whole-body rejuvenation."

Sinclair's audacious prediction that human trials could commence within the next year got people talking, including none less than the tech titan Elon Musk, who curiously asked: "Ok, so what exactly is it?"

Understanding the "Fountain of Youth"

The Fountain of Youth is a legendary spring that reputedly restores the youth of anyone who drinks or bathes in its waters.

People have recounted tales of such a fountain across the world for thousands of years. Mention of a Fountain of Youth appear in writings by Herodotus, the Alexander romance, and the stories of Prester John.

The exact location of the mythical fountain has been described differently in various stories and legends. One of the most famous associated locales is Florida.

Tradition says that Spanish explorer Juan Ponce de León, the first recorded European to reach Florida, discovered Florida while he was searching for the Fountain of Youth. However, there is no contemporary evidence to support this claim.

In modern times, people often use the Fountain of Youth metaphorically to represent anything that has the potential to increase longevity or reverse aging. This can be anything from a scientific breakthrough, to a new skincare product, or a healthful lifestyle.

Cramming the Fountain of Youth into a Pill

The Harvard researchers used high-throughput cell-based assays to differentiate young cells from their older, non-dividing, or senescent counterparts — a characteristic of aging.

They tested thousands to millions of samples rapidly for biological activity, resulting in the identification of six chemical mixtures that "restored genome-

wide transcript profiles to youthful states and reversed transcriptomic age in less than a week."

"Miraculous" aging reversal

Testing these mixes on mice and human cells suggested a de-aging effect for all six combinations.

The effect of this four-day treatment is comparable to the total change seen after a year of a regenerative treatment described in a landmark study from 2019, which also focused on restoring epigenetic information.

Researchers evaluated age changes using rodent and human transcriptomic clocks, which predict biological age using gene expression data.

"This new discovery offers the potential to reverse aging with a single pill, with applications ranging from improving eyesight to effectively treating age-related diseases," said Dr. Sinclair.

Word of caution: Not all are convinced

However, other biologists are skeptical of this enthusiastic claim. Matt Kaeberlein, a biogerontologist, offered cautious praise.

He noted that while the innovative screening method could lead to significant discoveries, the study is still preliminary.

Kaeberlein suggested the team should have validated at least one of the concoctions in an animal model and shown improvements in age-related health metrics or lifespan before making claims about effects on biological aging.

Dr. Charles Brenner, a metabolism researcher, raised concerns about three compounds in the study. CHIR99021 blocks glycogen formation during sleep to store energy; tranylcypromine is an antidepressant; and valproic acid treats bipolar disorder but can harm the liver.

The study didn't mention these risks, and Brenner warned, "These are generally not safe alone or in combination."

Brenner also criticized the study for not using single-cell sequencing to evaluate cell identity. He pointed out that researchers initially reported these cocktails in 2013, suggesting the compounds aren't new discoveries.

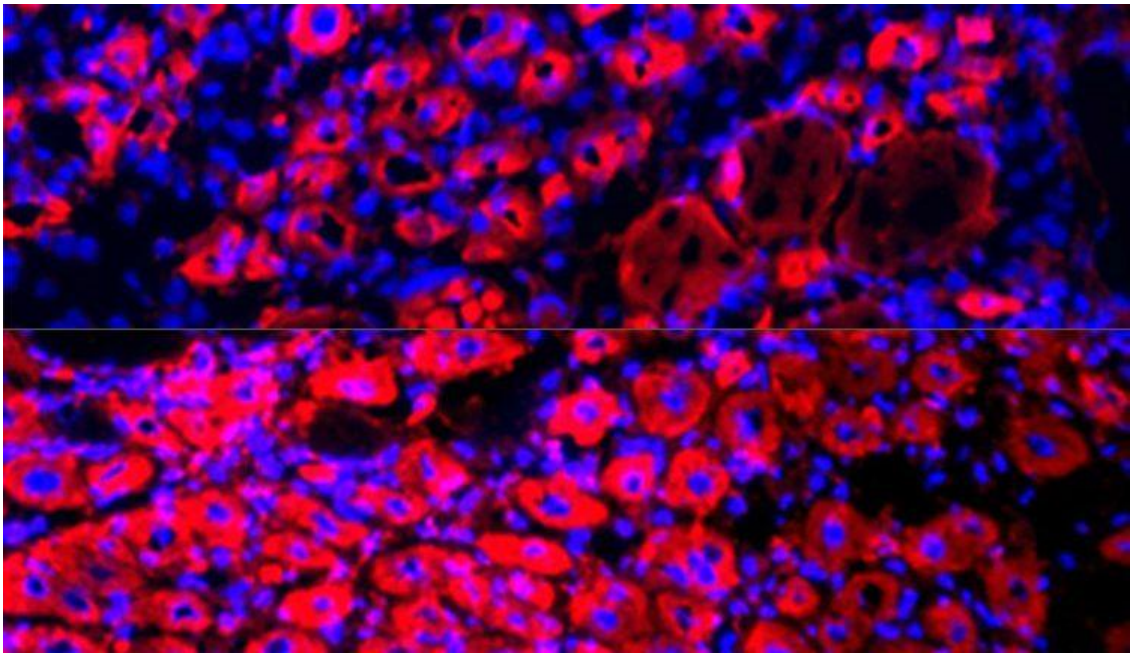
"Getting these readouts on cells is not a groundbreaking study on the reversal of aging," said Brenner.

Forever young? Not quite yet

The pursuit of eternal youth has taken a significant step forward with Harvard scientists identifying six chemical mixtures that show promise in reversing the aging process in human and rodent cells.

While Dr. David Sinclair and his team hailed this as a breakthrough towards potential whole-body rejuvenation, skepticism remains among other biologists regarding the safety and preliminary nature of the findings.

As the scientific community awaits further validation and research, the dream of a Fountain of Youth in pill form remains tantalizingly close yet still elusive.



FEATURE ARTICLES, SPRING 2023

Have We Found the Fountain of Youth?: New Research into Blood Dilution Proves Promising for Rejuvenation Therapies

berkeleymedicaljournalDecember 1, 2023

By: Nitya Sriram

For thousands of years, adventurers from across the globe traveled in search of the Fountain of Youth: a spring that would supposedly grant eternal life to those who drink from it. While not quite as thrilling as a magical Fountain of Youth, researchers at UC Berkeley's Conboy lab in the bioengineering department have discovered a plasma dilution rejuvenation method that could very well be our modern-day version of the Fountain.

Dr. Irina Conboy's research into the effects of delivering young blood to older mice has made her a founding leader in rejuvenation medicine. The field of rejuvenation medicine focuses on reversing mechanisms of aging (i.e cellular senescence, or permanent cell growth arrest), resulting in younger cells or tissues. In an interview with Drs. Irina and Michael Conboy, they stated that the parameters they studied to determine whether a person was really "younger" at the molecular level included diminished inflammation and fibrosis, improved liver health/regeneration, improved muscle repair, improved cognitive function (i.e. better short memory in mice), and also improved agility, balance, and strength.

The goal of age-reversing therapeutics is to reduce the biological age of an organism rather than their chronological age. Chronological age refers to the actual years a person has lived, while biological age is related to the epigenetic alteration and DNA methylation a person undergoes. Epigenetics, to put it simply, is the change in expression of genes based on our surroundings. Moreover, during an interview with Dr. Conboy, she stated that, although there is disagreement over this in the scientific community, she believes that a person's biological age is different in different parts of their body.

Conboy's earlier work focused on sharing blood between older and younger mice via parabiosis as a means of rejuvenation. Parabiosis is a procedure by which two organisms are surgically joined, resulting in a shared physiological system. Having this shared system allows factors from the young individual to activate pathways in the old system to allow for tissue regeneration. In this study, researchers from the Conboy lab present a novel approach to rejuvenation that doesn't involve blood-sharing. Instead, rejuvenation occurs by plasma dilution of older organisms' blood. There are certain proteins that are known to "interfere with the maintenance and repair of multiple tissues." Plasma dilution works to offset the increase of these protein levels over time.

In humans, plasma dilution is known as therapeutic plasma exchange, or TPE. "[I]t replaces a patient's plasma [the liquid component of blood] with saline and purified albumin," the researchers note. Albumin is a protein in the body that helps move molecules through the blood and prevents fluid in blood vessels from leaking into tissues in the body. Once the plasma is replaced or "diluted," the patient's red blood cells are returned to the body. An important point is that TPE does not actually change the cellular profile of a person. It only lowers the concentration of certain proteins in their blood such as "cytokines, autoreactive antibodies or toxins," all of which are determinants of age-related disorders. In the study, the researchers conducted multiple rounds of TPE in mice as well as humans. Blood samples were separated into plasma and cells. The plasma was analyzed before and after rounds of TPE for a decrease in hallmarks of biological aging such as "DNA damage and cellular senescence."

The study reports several different results suggesting TPE could actually be a viable rejuvenation method. Some of the most important results indicating this were one, a decrease in DNA damage and cellular senescence, two, restoration of youthful lymphoid/myeloid markers," and three, long-term stable rejuvenation.

Decrease in DNA damage was determined by assessing 8-OHdG levels before and after TPE rounds. 8-OHdG is a biomarker that is used to measure oxidative damage to DNA. High levels of 8-OHdG indicate substantial DNA damage. 8-OHdG levels significantly decreased across all patients in the study after multiple rounds of TPE. In order to assay senescence, mRNA was isolated from PBMCs (a type of immune cell) and analyzed for p16 (a biomarker measuring cellular senescence). A significant decrease in p16 across the samples indicated a decrease in cellular senescence. Researchers also found an increase in markers associated with youthful lymphoid markers

(used to track cells of lymphoid lineage), indicating an improved immune system. Perhaps most important, however, was the discovery that these results were stable and lasted for the entirety of the month between rounds of TPE. All of these results suggest that TPE is viable in the long-term.

So why is rejuvenation therapy even necessary? What causes us to be at a higher risk of disease as we age? As humans age, their immune system begins to deregulate resulting in chronic inflammation. Additionally, older adults experience a significant decrease in "adaptive immunity," or the ability to fight novel infections. This is brought on by changes in self-renewal and differentiation of hematopoietic stem cells or HSCs. HSCs are a type of blood stem cell that have the potential to develop into any kind of blood cell, including blood cells involved in the immune system. Thus, a limitation in the function of these cells causes a limited immune response, preventing a person from getting rid of oncogenetic cells for example. In the interview, Dr. Conboy noted a common misconception about aging in humans. We often think that, as a person ages, their bodies begin to lack something (i.e. vitamins, cellular components, etc.). In reality, our bodies actually have too much of certain proteins that are related to age-related diseases. The goal of TPE is to get rid of this excess.

Rejuvenation medicine has the potential to serve as a therapeutic for a wide variety of age-related diseases. One of the most prevalent diseases that TPE could potentially treat is cancer. This is done through creating a "younger systemic proteome" with features such as "restored pro-regenerative, anticancer, and apoptotic regulators." The study also cited TPE as a potential treatment for "autoimmune and neurological diseases such as [...] Alzheimer's Disease, and Guillain-Barre Syndrome." Additionally, something interesting Dr. Conboy noted in the interview is that she sees TPE as a preventative measure rather than a treatment. Thus, it could serve as a sort of catch-all for all age-related diseases.

Dr. Conboy also points out the importance of rejuvenation medicine from an economic perspective. The global elderly population is expected to triple in the next two to three years, resulting in a "socio-economically unsustainable" world. Understanding aging and exploring therapies to reverse aging are becoming increasingly important to combat the global aging epidemic. Additionally, Dr. Conboy notes that aging is a phenomenon that affects everyone regardless of gender, race, etc. Thus, it's even more important to study age-related mechanisms for this reason. Further research into this field could yield the Fountain of Youth we've been looking for.

Scientists May Have Found the Secret to Staying Young

Feb, 2019

Although the fountain of youth might not exist, as more research emerges, scientists may have uncovered the secret ingredient to slow down aging. Glycine, an amino acid providing a building block for protein, has all sorts of proven benefits, from treating metabolic disorders and sleep problems to reducing fatigue and protecting the liver from the harmful effects of alcohol.

If that wasn't enough, a recent study now indicates that the amino acid can slow down the process of aging. Professor Jun-Ichi Hayashi and his team at the University of Tsukuba in Japan published their compelling research in Nature Scientific Reports demonstrating that glycine treatment can reverse signs of aging.

How does it work exactly? That requires a bit of a scientific explanation.

Glycine Under the Microscope

In the past, scientists generally supported the mitochondrial theory, an idea that aging results from the accumulation of mutations in the mitochondrial DNA. According to this idea, the build-up of these mutations results in a shorter lifespan and aging-related characteristics like weight and hair loss and osteoporosis.

Professor Hayashi and his researchers decided to put that theory to the test. They looked at the mitochondria in human fibroblast cell lines from fetuses and children up to age 12. Then the team compared those cells with ones derived from elderly people between the ages of 80 to 97. When comparing younger cells to the older, scientists saw hardly any difference between the DNA damage in the mitochondria of the two groups. This calls to question the original mitochondrial theory of aging.

So if aging doesn't occur because of the accumulation of DNA damage in the mitochondria, then how does it happen? Hayashi and his team decided to keep looking. They discovered that, contrary to previous assertions, "the aging process in the mitochondrion is controlled by epigenetic regulation, not by mutations." In other words, the process of aging does not actually change the DNA sequence itself.

Through their research, the team found the two genes that regulate glycine production in mitochondria, CGAT and SHMT2, hold the answer to staying young. To test their idea, they changed the regulation of these genes. Astonishingly, they found that the addition of glycine for 10 days to the 97-year-old fibroblast cell line restored damages caused by getting older. The results suggest that glycine treatments could reverse signs of aging and help older populations live longer.

Benefiting from the Anti-Aging Effects of Glycine in the Diet

Hayashi and his research team aren't the only ones proposing that glycine has the power to reverse aging. Harvard graduate and founder of the Tahoma Clinic, Dr. Jonathan Wright, suggests that consuming enough of the amino acid can improve sleep and keep you looking younger.

Glycine is an important, natural component of collagen, a protein that forms part of the body's connective tissues like the tendons, ligaments, skin, cartilage, bone, and blood vessels. These areas tend to undergo constant physical stress and eating more foods and supplements containing glycine can keep collagen in good shape, a sign of healthy aging.

People may ask, "Why bother taking supplements if you can consume glycine naturally?" In the past, our ancestors tended to eat the entire animal, "nose-to-tail", which included areas like the joints and skin of animals which naturally consist of high levels of collagen, and therefore, glycine. However, the modern diet tends to lack collagen. Today, people opt for boneless or skinless cuts of meat rather than collagen-rich foods like chicken gizzards, chitlins (intestines), or tripe (stomach lining). To balance glycine intake, Dr. Wright recommends eating more of those nasty bits and taking supplements in order to restore tissue and benefit from other anti-aging effects of the amino acid.

While scientists continue to test the benefits of glycine, many studies seem to point to the same conclusion. With the fountain of youth still nowhere in sight, simply adding a bit of glycine to your diet could keep you looking and feeling younger.

Have scientists finally found the way to the 'fountain of youth'?

Six chemical cocktails may help reverse aging in cells, but what does this really mean? Image credit: Noushad Thekkayil/NurPhoto via Getty Images.

- **The discovery of ways to induce pluripotency of stem cells has allowed the advancement of stem cell, embryo, and organoid research.**
- **However, while pluripotency can be induced, the reversal of aging has proved more difficult.**
- **A group of researchers has claimed to have discovered cocktails of chemicals that reverse aging in cells.**
- **According to other researchers, the markers used to measure this could be an important breakthrough.**

One of the most significant breakthroughs in biology in the past 2 decades was the discovery of how to induce stem cells to regain their pluripotency Source.

Stem cells are cells that are able to change into many different cells, and this process allows cells and tissues in the body to replace cells that have died or create cells needed in response to certain conditions, such as immune cells.

Being able to return differentiated cells to their previous pluripotent state and create induced pluripotent stem cells (iPSCs) was first achieved by Prof. Shinya Yamanaka in 2006, and saw him and Sir John B. Gurdon awarded the 2012 Nobel Prize in Physiology or Medicine for their breakthrough.

Since then, understanding how to create induced pluripotent stem cells has been harnessed to allow for the development of embryo models to allow us to study the very earliest stages of human development and develop organoids for research into different conditions.

Can we really measure age accurately?

Despite the ability to make individual cells return to a state of greater pluripotency, returning cells to a younger state has proved challenging.

This is partly because the concept of an organism's biological age and how that age affects it at the cellular level is complex and depends on many factors.

Telomeres are a segment of DNA at the end of a chromosome that shortens each time a cell divides, meaning the older an organism, the shorter the telomeres in its cells are.

Methyl groups are a molecule found attached to DNA that plays a role in how it is read by the cell machinery. The configuration of these molecules, known as epigenetics, can change with age.

In fact, epigenetic clocks have been developed, such as GrimAge, which purport to be able to provide a "biological" age for humans, not based on chronological age. It has been used to suggest that stress can accelerate aging.

Recently a team of researchers from the United States and Russia developed an "aging clock" based on information they had gleaned on age-related gene expression changes they had quantified from studies.

They used this transcription-based aging clock to demonstrate that cell reprogramming had occurred following genetic engineering to knock out and overexpress genes associated with aging. Their findings are published in a preprint version, which has not yet undergone peer review.

6 chemical cocktails to reverse aging?

More recently, the research team used this same “transcriptomic aging clock” to demonstrate that genes they had found to be associated with aging were downregulated in cells that had been treated with one of six chemical cocktails, in a paper published in the journal *Aging*, led by Prof. David Sinclair, a professor in the Department of Genetics at Harvard Medical School.

This paper also demonstrated that as cells age, the nucleus of the cell becomes leakier, meaning that the more molecules that are normally found in the cell nucleus are found in the rest of the cell, the older the organism the cell is likely to be from.

Researchers used a fluorescent marker to measure the nuclear barrier’s breakdown to determine the cell’s age.

Dr. Zachary Harvanek, instructor of psychiatry in the Yale Department of Psychiatry, who has carried out research into the impact of aging on epigenetics, but was not involved in this study, told *Medical News Today* in an interview:

“I think the biggest advance in this paper is the method for quickly testing these drugs in cell culture. I think that could be a quite important development in terms of being able to discover new medications, or new drugs that might be useful.”

Claims of turning back the clock by 3 years

The researchers who conducted the recent study exposed skin cells in the laboratory to cocktails of chemicals that had already been shown to have an effect on the transcription of genes associated with aging. Compounds included valproic acid, which is used to treat epilepsy and other neurological and psychiatric conditions.

They claim their results demonstrate that the age of cells exposed to the chemical cocktails was reversed by 3 years in 4 days, which previously has only been demonstrated with over a year of regenerative treatment in humans in previously published studies.

However, these experiments were not carried out in humans and instead were carried out in the lab. These cells were taken from a 22-year-old donor, a 94-year-old donor, and a patient with an aging disease known as progeria. Information on their sex and ancestry, which could affect findings, were not included in the paper.

Can these findings be applied to humans?

Dr. Xiaojing Yang, the lead scientist for direct-to-consumer biological age test *myDNAge*, not involved in the current study, told *MNT* in an email: “This is a good initial study and something we will follow with interest, but concerning the claims about reversing aging by 3 years in 4 days, it’s crucial to interpret these results within the context they were generated.“

“This study used a cell culture model to screen for potential anti-aging compounds, which is a fundamental part of the drug development process,“ she explained. “That said, it’s important to remember that the transition from successful in vitro results to effective therapies in humans is a long and uncertain path.“

“So, while this research is an exciting step in the study of aging, it’s just one piece of a complex puzzle. More research and validation, especially in whole organisms, are needed before these findings can be translated into practical anti-aging interventions,” said Dr. Yang.

Dr. Harvanek echoed this sentiment and added: “I think the finding that this specific cocktail seems to reverse aging in cell culture is a very preliminary finding. I don’t think there is any evidence right now that this is going to reverse aging in humans or other animals.“

“So I think the methods they use are the biggest takeaway from this paper and not necessarily the subsequent findings,” he emphasized.

How to maximize your healthy life years

Although longer telomeres are associated with longevity in cells, the evidence is not conclusive that they are the key to longer, healthier lives. However, many of the lifestyle factors that reduce the risk of disease also result in longer telomeres.

The National Institutes of HealthTrusted Source (NIH) advises the following to promote healthy aging:

- get moving — according to one studyTrusted Source, taking around 8,000 steps a day reduced mortality from any cause by 51% compared to taking 4,000 steps.
- eat a healthy diet, such as the Mediterranean diet, with plenty of fresh fruit and vegetable
- maintain a healthy weight — exercise and a healthy diet will help with this
- get a good night's sleep
- do not smoke, or stop smoking if you are a smoker
- limit your alcohol intake
- get regular health checks
- look after your mental health by socializing and managing stress levels.

Dr. Berkowitz echoed this advice: "While genetics play a role in determining lifespan, environmental and lifestyle factors also significantly influence an individual's health and longevity. By making healthy choices and adopting a healthy lifestyle, individuals can reduce their risk of age-related diseases and improve their chances of living a long and healthy life."

Longer telomeres may have some influence on your lifespan, but it is a factor you cannot control, and the evidence for their benefit is not conclusive. However, a healthy diet and lifestyle can increase lifespan and reduce the likelihood of diseaseTrusted Source even in those with a genetic predisposition.

While research into what is going on in our cells can give us pointers, the tools for healthy aging are largely in our own hands.

Grant Award Announcement: Rejuvenating the Aging Brain Study *May 22, 2025*

The Longevity Science Foundation (LSF), a nonprofit organization dedicated to funding research aimed at extending the healthy human lifespan, is proud to announce a grant award to the University of Copenhagen's Center for Healthy Aging within the Department of Cellular and Molecular Medicine, for the study "Rejuvenating the Aging Brain." The research is led by Dr. Morten Scheibye-Knudsen, a globally recognized expert in aging and neurodegeneration. The Foundation's grant will fund a key project component over three years beginning in 2025.

The research aims to reverse brain aging by developing compounds that selectively eliminate senescent astrocytes, which are damaged brain cells that accumulate with age while preserving healthy neurons. These senescent cells are believed to contribute to cognitive decline and neurodegenerative diseases. Combining AI-driven screening with high-throughput compound testing, the research team will identify promising molecules, refine their specificity and pharmacokinetics, and validate their therapeutic potential through rigorous in vitro and in vivo testing.

The LSF's support is essential in enabling this groundbreaking work, which could lead to the development of entirely new classes of treatments for age-related brain conditions. The project also reinforces the Foundation's commitment to funding translational science that bridges the gap between laboratory discovery and real-world medical application.

"We are thrilled to support Dr. Morten Scheibye-Knudsen and his team at the University of Copenhagen," said Joshua C. Herring, President and CEO of the Longevity Science Foundation. "This project reflects our belief that targeted, innovative research can lead to meaningful interventions in aging and neurodegeneration. We are committed to enabling discoveries that extend life and enhance its quality."

This partnership is a step in achieving the Foundation's broader mission of democratizing access to cutting-edge longevity research and ensuring that the most promising science receives the resources it needs to thrive.

If you are interested in supporting the groundbreaking research conducted by the Scheibye-Knudsen Lab, donating to the LSF, or supporting our other research initiatives, please reach out to our COO, Lev Dvornik, at **ld@longevity.foundation**, and our CEO, Joshua Herring, at **jh@longevity.foundation**. All donations are tax-deductible up to IRS limits and directly fund research, dollar for dollar.

About the Longevity Science Foundation

The Longevity Science Foundation (LSF) is a nonprofit organization advancing human longevity by funding research and development of medical technologies to extend the healthy human lifespan. The long-term mission of the Foundation is to prevent all chronic and age-related diseases and to help make longevity-focused care accessible to everyone, no matter their background, by bringing cutting-edge science on aging out of the laboratory and into the mainstream. To learn more, visit **www.longevity.foundation**. Our work is made possible by our generous donors. To donate to the Longevity Science Foundation, visit **https://longevity.foundation/support-us#donate**.

Department of Cellular and Molecular Medicine, University of Copenhagen

The focus of the department is the functional cell, its genetic components and molecular cellular mechanisms in a medical context. With a firm foundation in the basic function of the normal and differentiating cell an understanding of the molecular, cellular and genetic mechanisms behind disease and aging is sought. Learn more at **healthyaging.ku.dk**.

Vitamin D slows ageing by nearly 75 percent in first large-scale trial

Researchers at Mass General Brigham find vitamin D3 supplements prevented almost 3 years of telomere shortening (ageing factor) over 4 year trial period, slowing biological aging.

From Mass General Brigham 24/05/25 (first released 21/05/25)

Results from the VITAL randomized controlled trial reveal that vitamin D supplementation helps maintain telomeres, protective caps at the ends of chromosomes that shorten during aging and are linked to the development of certain diseases.

The new report, which is published in *The American Journal of Clinical Nutrition*, is based on data from a VITAL sub-study co-led by researchers at Mass General Brigham and the Medical College of Georgia, and supports a promising role in slowing a pathway for biological aging.

"VITAL is the first large-scale and long-term randomized trial to show that vitamin D supplements protect telomeres and preserve telomere length," said co-author JoAnn Manson, MD, principal investigator of VITAL and chief of the Division of Preventive Medicine at Brigham and Women's Hospital, a founding member of the Mass General Brigham healthcare system.

"This is of particular interest because VITAL had also shown benefits of vitamin D in reducing inflammation and lowering risks of selected chronic diseases of aging, such as advanced cancer and autoimmune disease."

Telomeres are made of repeating sequences of DNA, or base pairs, that prevent chromosome ends from degrading or fusing with other chromosomes.

Telomere shortening is a natural part of aging and is associated with an increased risk of various age-related diseases.

A few short-term, small-scale studies have suggested that vitamin D or omega 3 fatty acid supplementation may help support telomeres, but results have been inconsistent.

VITAL is a randomized, double-blind, placebo-controlled trial of vitamin D3 (2,000 IU/day) and omega 3 fatty acid (1 g/day) supplementation that tracked U.S. females aged 55 years and older and males aged 50 years and older for five years.

The VITAL Telomere sub-study included 1,054 of these participants, whose telomere length in white blood cells was assessed at baseline and at Year 2 and Year 4.

Compared with taking placebo, taking vitamin D3 supplements significantly reduced telomere shortening over four years, preventing the equivalent of nearly three years of aging compared with placebo.

Omega 3 fatty acid supplementation had no significant effect on telomere length throughout follow-up.

“Our findings suggest that targeted vitamin D supplementation may be a promising strategy to counter a biological aging process, although further research is warranted,” said Haidong Zhu, PhD, first author of the report and a molecular geneticist at the Medical College of Georgia, Augusta University.

Authorship: In addition to Manson, Mass General Brigham authors include Nancy R. Cook, William Christen, and I-Min Lee.

Additional authors include Haidong Zhu, Bayu B. Bekele, Li Chen, Kevin J. Kane, Ying Huang, Wenju Li, and Yanbin Dong.

Disclosures: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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The parent VITAL trial is supported by R01 AT011729.

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report as well as in the decision to submit the paper for publication.

Growing Young:
6 Powerful Exercises for Initiating DNA Repair and Cellular Rejuvenation

BY SONDRA BARRETT

epigenetic research has shown that cellular rejuvenation and DNA repair can be stimulated by our behavior, our environment and our mental and emotional state. photo: robert zunikoff

Each day about a hundred billion cells in the human body divide, making new cells. Recall what happens to the DNA as a cell divides—the paired strands of DNA separate, unwind, and then are copied, letter by letter, serving as the template for an identical partner to be created.

While this is happening, a mistake can be made by mismatching the triplets, omitting or adding in a wrong letter; such a mistake is a mutation.
A mutation of a single code letter can change which amino acid is placed in the scripted protein. Even one change can alter the shape and function of the protein being produced—an incorrect code can make the protein stiffer or too flexible or a totally different shape from the original. The protein may no longer work the way it is supposed to.

Since even a single, minuscule error such as this can affect the health of the cell, a potent DNA repair mechanism must be available to protect the cell from damage and instigate cellular rejuvenation. In fact, in nature's wisdom, multiple DNA repair systems are present in our cells.

At the genesis of this growth of cells, self-correction is insured by the wavy strands of molecular intelligence held tight unwinding and letting go only after perfection is created.

— Christopher Vaughan, How Life Begins

Much of the time, our cells get it right, yet sometimes they don't. In fact, it's been estimated that at least a thousand errors are committed inside our cells every day. Fortunately, the cell possesses innate wisdom and cellular rejuvenation mechanisms, built into the architecture of the DNA helix, that recognizes when an error has been made. Damage or errors in DNA trigger an astonishing sequence of events as a gene called p53 rides to the rescue in the interest of DNA repair.

The p53 system is both a "spell-checker" and an emergency brake on cell growth, and it has other genes under its command. If an error is created, the p53 gene orders other genes to stop being copied until repairs can be made to the DNA. Once the damaged DNA is repaired and the cell has essentially been rejuvenated, p53 turns on the green light and allows the cell reproduction cycle to continue. But what if the damage is beyond repair? In that case, p53 activate genes that direct the cell to self-destruct; this is known as programmed cell death or apoptosis, which comes from the Latin for "falling leaves." Apoptosis, in contrast to traumatic or necrotic cytotoxic death, is a relatively gentle process in which parts of the cell slough off and are recycled or removed by the scavenger cells—falling leaves are an apt metaphor, with their ability to decompose, be recycled into the earth, and even nourish the tree that once sustained them.

A traumatic or cytotoxic death, by contrast, is one in which the cell is acutely damaged and basically explodes, releasing its contents into the cellular environment. This type of cell death can damage the surrounding tissues as it sets free potentially dangerous substances from the cell. Cells contain numerous substances that, if released, can harm other molecules; however, within the cell they are compartmentalized to protect against their damaging effects. Apoptosis is a slower process that allows the neighborhood to reclaim or eliminate cell parts, one step at a time, without damaging the area.

To sum up the role of p53, it's the damage-control specialist with the capability to correct gene errors, prevent amplification of unruly DNA, suppress tumor cell growth, and when necessary, push cells into programmed self-elimination. Our cells have other numerous backup systems as well to ensure healthy survival.

How to Increase DNA Repair Rates

The rate of DNA repair—how quickly errors can be fixed—influences our vulnerability to cancer and other illnesses affected by genetic mutations. Long-term stress slows down DNA repair, as does cancer. In China, a study on improving the rate of DNA repair and cellular rejuvenation offers tantalizing and hopeful results. Researchers found that the DNA repair rate of people with cancer in remission compared to healthy people was much slower. The patients in remission were then taught qigong stress-

reducing techniques. Following three months of practice, their cell repair rate had nearly doubled.

"Following three months of practice, their cell repair rate had nearly doubled."

It is conceivable that the "new" energy medicines of qigong and vibrational sound can affect the erratic energy of DNA and stimulate cellular rejuvenation. Ancient qigong, tai chi, yoga, and the dance of the whirling dervishes all use spiral movements as part of their energy healing exercises—do they help realign our DNA? Prolonged stress damages the immune system, reproduction, digestion, memory, and even our bones. That is why stress reduction practices, which include the practices just mentioned as well as meditation and imagery, are important to our health at every level.

Imagine That!

The use of guided visualization and imagery is growing in acceptance as a complementary healing modality, particularly in stress reduction, and easing pain, suffering, and other consequences of cancer and its treatment. Significant data indicate that the miserable feelings associated with a cancer diagnosis and the side effects of treatment can be minimized in some people who practice imagery. Many of the first popularized imagery scripts had people visualizing their immune cells coming to the rescue and killing cancer cells. What we have learned since is that the immune cells are not the primary removers of "demon" cells. So what if we instead base our imagery on a new, spiral model of fixing genetic errors? Here I offer two different suggestions for eliminating any abnormal cells in your body, enhancing DNA repair and cellular rejuvenation. They are only suggestions; feel free to use your imagination.

1. Visualization Exercise: Eliminating Unhealthy Cells

1. Take some time to relax and pay attention to your breath. Feel all the places your body touches: the chair, floor, or other surface you rest upon. Allow your breathing to be peaceful.

2. If you know that you have cancer cells in your body, imagine what they look like. Biological accuracy is not necessary—how do you perceive them?

3. Now allow yourself to imagine something that will eliminate those cells.

4. For example, you might imagine the cancer cells as dust mites and the eliminator as a vacuum cleaner. Make sure the eliminating force is larger and stronger than the tumor cells.

5. Once all the abnormal cells are removed, picture new, healthy tissue developing as DNA repair and cellular rejuvenation processes take hold. Take as long as you need for the process and then bring your awareness back to your breath and this present moment.

2. Visualization Exercise: Repair and Cover Up

Since our cells make errors all the time and abnormal cells do exist in our bodies, this script focuses on changing abnormal genes.

1. Take time to relax the same way as for the previous exercise. Now imagine or intend that any errors in your genes or cells are corrected. Picture the spiral DNA pairs being made to match perfectly, removing or correcting all the errors in your genetic repertoire.

2. Alternatively, you can envision preventing these genes from being expressed by covering them up with new proteins that adhere to them, keeping them hidden.

3. Allow your imagination to guide you in the way abnormal genes are taken out of action. See all of your genes as healthy and whole. Take as long as you need for the process and then bring your awareness back to your breath and the present moment.

4. Draw or write what you experienced.

The divine choreography of our DNA—its spiraling strands and ability to program both reproduction, repair, rejuvenation and self-sacrifice—brings us once more to life and death. Embedded within our cells is the ability to detect and correct errors in coded genetic messages. When correction is impossible, a gentle death is initiated. We know that ultraviolet radiation from the distant sun can penetrate and mutate the gene. And what about cigarette smoke that somehow is breathed into the cell, altering the gene structure so that faulty proteins are made? If invisible agents can initiate damaging changes, can we use the invisible laser of our energy or imagination to cut out or hide the damaged sections? Ancient healing practices including walking the labyrinth and

chanting may provide valuable assistance for transforming our inevitable cellular errors.

3. Healing Energy Exercise: The Basic Posture: Standing Home Alignment

1. Feel your feet on the earth, grounded and anchored. Place your feet shoulder-width apart, parallel to each other. You can imagine roots from the soles of your feet that reach deep into the earth. To help find that solid and centered place on your feet, rock back and forth and then sideways until you feel yourself grounded in the earth. You can gain strength from the earth's energy when you feel your feet upon her. You may also perceive or imagine that you are drawing up the earth's energy through your feet.

2. Your knees are slightly bent, your butt tucked under. Your shoulders are dropped and relaxed. Your arms hang loose at your sides. Your tongue rests softly on the roof of your mouth behind your teeth. (This is called the inner smile, and you can practice it anytime.) Your chin is parallel to the floor; you can imagine a golden cord connecting your head to heaven, a link to another source of energy.

3. Rock a bit until you feel solid on the ground. All movements of this series start with taking this basic stance.

4. Another option of Standing Home is to assume this posture and then bend your elbows and place them at your sides by your waist. Hands are open and palms are facing each other at the level just below your belly button. This now becomes the Standing Stake, a standing meditation in which you begin to generate qi. Remember to keep your knees gently bent, and when you want to explore this, do it for a few minutes. With some teachers, this is the very first practice a student will be taught. They will work up to standing thirty minutes. It certainly strengthens your legs, body, and resolve.

4. Healing Energy Exercise: Energy Wash

This part of the sequence is perfect to do when you want to relieve the mind of unwelcome thoughts or stress, the act of which plays an important role in cellular rejuvenation and DNA repair.

1. Stand rooted with arms loose at your sides. Raise your arms at your sides, elbows slightly bent and palms facing up, fingertips pointing outward away from the body. Inhale while you are raising your arms until

2. they are directly above your head. Palms now face each other, elbows softly bent. When hands are above your head, fingertips are gently curved, facing up toward the sky.

3. Pause and exhale while you imagine receiving Qi from heaven or the universe.

4. When you are ready, inhale and turn your palms down, toward the crown of your head. Spread open your fingers and with your palms facing downward, slowly lower your hands in front of the midline of your body, imagining clear new qi flowing from your fingertips while the energy you don't need is being washed out. You might imagine that new energy is being sent to every cell. Take as long as you need to lower your hands while you "wash."

5. If you come to a place where you can't feel the energy or it feels dense, keep your hands there until you notice a change. And you may not feel anything at all.

5. Healing Energy Exercise: Integration: Balancing Yin and Yang, Right and Left Hemispheres

This is another tensegrity movement useful for initiating cellular rejuvenation and DNA repair. It also balances the right and left hemispheres of the brain and is equivalent to alternate nostril breathing in yoga.

1. Beginning in the same Standing Home posture as all the other poses, bring your right hand in front of your belly, palm down. Your elbow is gently bent. Your left hand is hanging straight, not rigid, at your side, palm down.

2. Raise both your arms simultaneously. Extend the left arm out to your side while the right rises along the midline of your body. Continue until they both reach above your head, fully extended, palms facing one another. Pause.

3. Turn both palms down, with your left palm now going down the midline and the right arm extended out to the side. Slowly lower both arms.

4. Now reverse the sequence. When your arms reach the level of your belly, raise your left arm up the center while your right arm rises to the side. Repeat this three times on each side or until you get the rhythm of the movement.

This sequence took me weeks to learn, so be easy on yourself. When I recently taught this series, most in the class got it on the first try while one person never got it.

Tip: This is an exercise you have to let your body learn without your mind trying to figure it out.

6. Healing Energy Exercise: Gathering and Storing the Qi: Closing the Circuits

When you are finished practicing qigong, you always gather in the qi and "close the circuits."

1. Take the Standing Home pose and cup your hands in front of your lower dantian, your belly. Now widen your stance and reach behind and around you, gathering the qi in a circular embrace. Embrace this qi in front of your belly and then press your palms close to your body, forming an upside down V with your hands. Remain in this position for a few moments. This is another position in which you can simply stand, relaxed, with gently bent knees and inner smile. Close your eyes and let the qi move you, fill you, and replenish your cells. This can be another form of a standing meditation.

If you've never practiced tai chi or qigong, it's always useful to work with an experienced teacher. You may also find it worthwhile to keep a journal and occasionally map your energy and watch what happens.

Boyang Wang on Targeting Underfunded Longevity Projects

This company also offers sponsorships and grants.

- Immortal Dragons focuses on important cutting-edge projects that larger companies may ignore.
- It has invested a few million dollars in ten projects so far.
- The founder is pushing towards greater investment in the longevity sector.

In this interview, Boyang Wang of Immortal Dragons discusses the kinds of projects he wants to fund, ways in which the industry can be encouraged to develop, relationships between the East and West in longevity research and development, and what got him involved in longevity.

Hello, and welcome to this Lifespan interview, where today, I have the pleasure of interviewing Boyang Wang, who is the founder of Immortal Dragons, a fund operating in the longevity research

space in Singapore. Can you start, Boyang, by describing yourself a bit? How did you get into this field, and what led you into founding Immortal Dragons?

Thanks for having me, Keith. This is Boyang, I'm the founder of Immortal Dragons, a purpose-driven longevity fund. We invest in longevity biotech, life extension projects beyond conventional capital investments; we also do advocacy work like translating and publishing books. We do podcasts in Chinese for the Chinese longevity community. We do sponsorship and grants for organizations and events, all to further the research and advancement of the sector.

What got me into longevity? This is actually a recurring theme; it's not only that I've been thinking about why we must age and die, I never figured out the puzzle of existence or consciousness, so I feel like we need more time to think this through. It's fundamental to extend lifespan and healthspan so that we have more time to figure out the meaning of life, to do whatever you want, to achieve our goals. Also, there is a theme of survival. I've had interesting encounters with the healthcare system. I've had interesting medical conditions since I was young, so I've always witnessed firsthand the limitations and, of course, the marvels of our modern healthcare system, so it's very natural for me to work on longevity.

It definitely sounds like you have a lot of reasons for entering this field and a lot of passion. Picking up on that point, Immortal Dragons is described as a purpose-driven fund focused on life extension, prioritizing impact over economic returns. How is this different from other funds?

We say we are a purpose-driven fund, and the key implication is that Immortal Dragons values impact over economic returns. This is a more rational, more concrete concept than it sounds; when we say we do not prioritize economic returns, it is pretty practical. I'm coming from a tech entrepreneur background, so I'm not from a biomedical background. If I wanted to maximize economic return, I should have been investing in technology or things that I'm more familiar with, the computer science-related tech sector.

I'm investing in the field of longevity because I want to see things happening: I want to see progress and breakthroughs in the sector. When we make investments, we are less focused on the potential economic returns. For example, if we wanted to invest in a pharma company that could make the most money for us, we might not do a good job, because this is the game that big pharma companies are playing, and they know their games. Rather, we invest in companies that might be working on cutting-edge, moonshot,

high-risk technologies that are probably very meaningful for the sector but might not bring the most economic returns.

How do you measure this? Is there a formal, codified investment thesis, where you quantify impact versus economic returns and weigh those things when you're looking at an investment? Is it more of a feeling based on your due diligence, or are there specific impact metrics that you look at?

Quantifying impact is not easy, but we do have some working themes that we are focused on, such as replacement. We feel like replacement, not repair, is an interesting direction as an anti-aging strategy. There are recent papers on it that we draw this analogy from. One comparison is electrical engineering, where it's hard to fix a smartphone; if you smash it, even the best engineers might have a hard time fixing the chips and the screen LED, but what the engineers would do is replace the screen, the motherboard, and so on.

In terms of biology, we see replacement as a very promising direction for intervention, so we look at xenotransplant companies. We look at companies that work on cryopreservation, which is related to transplantation. We look at companies that work on 3D bioprinting for tissues and human organs ex vivo, and we even look at companies that work on whole-body replacement. This is one of the working themes, and we then measure the rarity, the importance of the work, to hopefully partially quantify the impact of the investment.

Are there other factors that determine what you might fund? For example, if there was a therapy that was more repair than replacement, are there other elements of a potential project that would bring it into the sphere of things that you might fund? Is anybody else focusing on rarity? You mentioned evangelism in the past; is the ability for a project to inspire the public something that you might factor into potential impact?

Indeed, if there's a deal that is highly sought after, then we will probably not be so keen to make an investment, because there will be plenty of capital and resources flowing into the project. Rather, if we see a project that's unique and important, a puzzzle piece that is not getting the required funding, we'll be more interested in it. If there's a project that can hopefully inspire the public or at least inspire a few mission-aligned groups of people, that is also interesting for us.

Is this affected by the different kinds of systems in the body? For example, replacement might be a more challenging strategy to pursue in terms of neuroscience. Do you have neuroscience projects

that you're looking to fund as well, or is that something that's deprioritized? Are you looking at other modalities involved in the neuroscience side of things, because I imagine it's a little bit more difficult to replace your brain?

Yes, absolutely. The brain is tied to the very existence of our being, so it's more tricky. When it comes to the brain and neuroscience, we look at other modalities. We look at companies that are working on nurturing brain tissue and then transplanting that created tissue into your brain and integrating it into your existing systems. Hopefully, that will enhance and rejuvenate your brain tissue and your nervous system rather than replacing it. In this area, we look at other modalities more of a gradual enhancement, but when it comes to other body parts, we are more interested in the replacement strategy.

That intersects with some work that the ARPA-H is doing with Jean Hébert's project. Do you look at any other programs like ARPA-H for inspiration or guidance to see what other funds or other governmental agencies are looking to fund, and is that something that gives you an indication of what you would like to explore or is that something that you would rather deprioritize, because you feel like they are taking care of that side of things?

We are certainly interested in what public sector or other organizations might be sponsoring, ARPA-H being one. Of course, there's XPRIZE. There are the Middle East, MENA countries, where sovereign funds are looking to fund such efforts as well. We are based in Singapore, so we also see that there have been some initiatives from the Singaporean government and universities. We have the first longevity research center set up in Singapore by the National University of Singapore headed by Professor Brian Kennedy, which has been around for a few years. These are great initiatives.

We have communications with them, but government agencies often have the mission of advancing public health, so they really look at things that improve lifespan on average and impact a large proportion of the population, such as diabetes, metabolic diseases, and neurodegenerative cardiovascular diseases.

I feel like nimble and independent organizations like ours have the responsibility to work on the cutting edge. Instead of improving the average life expectancy, we want to set an example and inspire the sector by making a few people live to 120 or 150. One example would be Larry Ellison. He's apparently pretty successful, at least seemingly in his anti-aging and longevity effort, in inspiring high-net-worth individuals by showing his achievements and so putting resources to work on this sector.

You're saying that if you could succeed in having a few significant outliers, that will serve as a powerful signal to the world to say "Hey, we can actually get gains here", and that would catalyze more funding.

Yes, absolutely. We believe in the power of role models. After the Wright Brothers, there are so many who succeeded in creating powered aircraft; after Tesla, there are so many companies who successfully built very good electric vehicles. The power of role models is invaluable.

Have you received any kind of challenges on that sort of thesis, by people saying "Hey, you should really be working on doing that sort of blanket minimum median raising as opposed to this"? Or, does everyone that you've interacted with understand the points that you've just made?

The field of longevity can be controversial at times. There are actually criticisms coming from different perspectives, one being that everything that we're talking about is pretty far-fetched if not pseudoscience. When you talk about creating organs or organoids that will be usable for humans, or you talk about therapeutic plasma exchange, which is also a replacement strategy, many coming from a more traditional background would totally oppose it. There are other times when it's criticized for being unrealistic or unhelpful for the general public, who might benefit more from statin dosage for their cardiovascular health or less sugar intake. There's criticism from all different perspectives, but to work on something that's controversial will be meaningful. If there's an aligned interest, if there's already consensus, then it's more suitable for bigger organizations than a small fund like us.

Given that you're approaching this from the perspective of moonshots like this, can you speak more about the thesis of being focused on impact more than economic returns, and how does that inform your team? Does everybody feel the same? What is the structure of the fund. What's your team size, and how many investments have you made?

We are a 40 million AUM fund. Our structure is a bit special in that we are more of a CVC, a corporate VC structure. We only have one external LP, and the majority of our fund is coming from our previous businesses, so we have total flexibility in terms of making investments. We don't have a stringent LP mandate; we don't need to call capital, we have our capital ready.

We have five or six teammates who are working full time on our fund. There's also departments like finance, legal, and human resources, that we share with our larger group of companies. We've been investing as an organization for almost two years by now. We have funded more than 10 investment projects so far, and we deployed a few million US dollars. We plan to continue or accelerate as we see more breakthroughs and progress in the sector.

What are your thoughts on the current funding landscape in general? Instead of simply being an LP for other funds, why did you choose to do this yourself? What are the biggest gaps or unmet needs in the field that you hope Immortal Dragons will address?

We do also invest in other funds as an LP, but the reason why I have to work on it myself is because this mission is very important to me, and I have to work on it full time rather than just sit on the sideline and watch others work on it.

We feel like there's definitely not enough attention, resources, or talent. Everything in this direction is so fundamental, so important, and yet it's not getting the kind of attention that it deserves. Partially, we feel that he reason is complicated. There's a mentality shift required, where people have internalized the idea of aging and death. There is an economic flywheel that's not there yet.

For the past many decades, investing in anti-aging has been a not-so-fruitful endeavor, but we believe it's now at an inflection point. There is also a moral implication in that the argument for longevity and anti-aging is not established, especially not for the general public, and thought leaders have been working on this as well. Notably, Nick Bostrom is a philosopher influential in this area, and he has famously written The Fable of the Dragon Tyrant to address many of the moral arguments around anti-aging, longevity, and longer lifespans. We also translated the book The Case Against Death by Patrick Linden into Chinese and published it in the Chinese market. It's also a pretty compelling and comprehensive discussion on the morality of longevity. So many of these need to be addressed, and investors need to see returns, and we need to make our voice heard to move the needle and turn the tide.

On that subject, there's obviously a lot of different steps in the pipeline of realizing healthspan-extending technologies. There's the research itself, there's government issues and funding,

there's the ecosystem of investment, and there's public sentiment. Are any of these a critical bottleneck that needs addressing, or is it an all-of-the-above strategy?

It's not easy to find the one key factor that's the most important, and that's why, from Immortal Dragons' perspective, we try to work on a few of these factors. We look at the economic flywheel. Currently, it's not very attractive to fund longevity projects or work on them because there's fewer success stories, for founders, for large investors, and for the general public to invest in. We are looking to help; we're really looking forward for a wave of longevity and anti-aging companies to reach a turning point where they get publicly listed, they will generate returns for retail investors in the public market, and that will be a powerful motivational incentive for more people to invest in and to turn the tide.

We don't emphasize economic return as a fund, but as a mechanism, it's really one of the most powerful: capitalist, free market return on investment is the most important motivational incentive structures that we have discovered to push the sector further. We have seen this kind of hyper growth in the tech sector in the last few decades. If this can happen in longevity, in anti-aging, that will really accelerate its development.

Is there any room in the fund to support or invest in projects that aren't strictly biotechnology? For example, there's a movie project to make Fable of the Dragon Tyrant; that went through our Longevity Investor Network by Protostellar Media, for example. There's also a Dragon Tyrant blockchain game that's being built by SkillCap that is working with the Lifespan Research Institute. Would you ever consider funding projects like this that are not biotechnology but related to the overall goal of potential economic return and inspiring the public?

These are very interesting projects, and this kind of effort will be a perfect candidate for sponsorship or grants by Immortal Dragons. We are one of the early major sponsors of Vitalist Bay, and we're happy to see the team pulled off a pop-up city/conference that attracted the best minds in the sector and individuals from all over the world, and some of them might be new to longevity. That would be a better candidate for sponsorship or grants instead of equity investment.

Can you explain a little bit more about what that looks like operationally? Is there like a separate tranche of funding within the fund that's allocated for grants, or is it like a separate granting mechanism that functions somehow alongside the primary fund?

We are pretty flexible, so we make decisions as they come. There's no strict division of the fund into a sponsorship tranche and an equity investment tranche. In general, the ticket

size for sponsorship will be less than then an investment check. 50,000-ish is the maximum we go to for sponsorship grants so far, but we are flexible, and we will evaluate projects as they come. Interested parties can approach us: our website is **ID.life**, and **contact@ID.life** is the email address where proposals can be sent.

Got it, and speaking of your website, I noticed that there's you have a project focused on visualizing digital twins on the website. Is the aim of this type of work evangelism-related as well or purely scientific in nature?

This is another demonstration of how our fund is slightly different. We do such a collaborative project with researchers and other companies when we feel that there's a value proposition and when we feel that there's an area where we can contribute. Our team is pretty strong in computer graphics, in 3D modeling, so we created this digital twin project where the functionality is to visualize organs, different systems that vessels, neurons, muscle, skeletal structures, especially it will highlight any issue that there might be in the body.

The purpose of this system is multifold; for many who are not coming from biomedical backgrounds, they probably have not seen such a model of themselves, so it's interesting for them to explore and enhance their understanding of their bodies. According to some clinics that we talk to, this is a valuable tool to keep clients compliant with doctors' prescriptions, because the moment they step out from the clinic, the connection between patients and doctors can become pretty weak. We are still exploring the possible collaborations and use cases for this system. We probably will open source this soon, when it reaches a certain maturity level. Right now, it's just our research project.

If patients can see what a healthier version of themselves will look like if they comply with the specific therapy, that will induce them to be more compliant?

We want this to serve as a motivational tool for clients, so they can see a healthier version of themselves already in the system, which drives the patients to work towards that goal.

That kind of technology can intersect with the notion of digital biomarkers, technologies that might be able to non-invasively scan your face, your walking gait, your voice. Are you invested or interested in any such projects? You mentioned the NUS earlier, and I believe some of these technologies and approaches might be of interest to the groups working there.

We have seen a few products that are already out in the market that non-invasively detect biomarkers with pretty high precision and accuracy. So far, we have not invested in this direction. We feel like this is probably more of a improvement over the technology we already have. It's good to have, but it's not screaming for investment, and it's less of a moonshot, but we find it to be meaningful. There are other funds out there interested in such projects.

Just an observation, the traditional blood drawing process has been improved a lot. There are currently gadgets that can draw your blood pretty painlessly. There is also continuous glucose monitoring that is pretty much painless. The progress in this direction seems to be pretty good.

In the past, you've spoken about connecting Eastern and Western longevity communities. What do you see as the most significant benefits of East-West collaboration, and what practical steps is Immortal Dragons taking to bridge these ecosystems?

There are many areas where collaborations can happen between the East and the West. I can at least think of four possible directions, one being capital. There's an enormous amount of wealth generated in the East with economic development and progress in the past few decades.

In bioscience, we've already seen plenty of progress made by Eastern researchers and scientists. Without naming a comprehensive list, there's Professor Yamanaka, who received a Nobel Prize for his iPSC research. There is one Chinese-American scientist, Zhang Feng, who is a pioneer in CRISPR and gene editing. In terms of cloning for mammals and primates, Eastern researchers and scientists are also pretty advanced and have been doing interesting work in the past years. In xenotransplants, both China and the US are leaders in this area. These researchers write in English, they publish in Cell and Nature, but there's still gaps at times.

Clinical trials and research efforts are pretty expensive and sometimes are hard to organize in some developed countries due to strict regulations and probably bureaucracy and red tape, and that is one area where some Asian countries are more flexible.

With a huge population in the East, there comes market size and market potential. These are all areas where the East and West can collaborate. We feel like such collaboration is

not as much as we want it to be, especially in the current geopolitical climate with more bridges getting burnt down. For some organizations and individuals, making that connection is even more important than before.

You've also noted in the past that Eastern cultures may be more conceptually open to life extension. How do you see such potential differences in cultural attitudes influencing things like regulatory environments, patient adoption, or investment trends in Asia versus the West?

That's an interesting topic. Of course, there is criticism, there are people arguing against the idea of longevity, both in the West and the East. These concerns are coming from different angles. In the West, there is a strong religious influence such that there's worry about playing God and "We probably shouldn't linger too much on this life but rather live the best life and then go to heaven." I'm not an expert on theology or these theories, but that's the cultural connotation that I felt.

Whereas in the East, there's less of a religious concern but a more practical concern that it might only be for the rich and about the problems that can come from longer lifespan, like limited resources. Societal classes might freeze once you give longer lifespans and healthspans to those who already have resources. There are different issues to be addressed, but I feel like Eastern cultures are more receptive to the idea of longevity. There is a tradition in Taoism, from emperors in history that have pursued longer lives, of course failed attempts, but such an idea has been there all the time. I would say that they're at least more open to the idea that it's not unfathomable to think of a future of our civilization where people can live and work for up to a few hundred years and that we'll be able to achieve great things with our longer lifespans, like traveling to other planets.

I'm assuming that you haven't imbibed mercury like certain Chinese emperors of legend, but you have personally undergone procedures such as follistatin gene therapy and tissue banking. Would you say that these experiences relate in any way to your investment thesis in terms of risk tolerance, for example?

These are personal attempts, not exactly tied to the fund, but this does reflect on some ideas of risk profile, things that we feel are promising and the actions we think need to be taken. Prototype gene therapy, for example, is experimental. To say that a gene therapy is traditional is a bit weird, because this is a new field, but gene therapies are generally used for very serious medical conditions and are carried by a virus factor, a lentivirus or

AAV, and this is often irreversible. The kind of gene therapy that I received is more for general health or anti-aging purposes instead of treating an immediate condition. It is carried by a nanolipid, or in my case, a PEI polymer, which is not as transmittable: it will not go to all my cells and will not be inherited. It's a one-off shot that will gradually die out.

Many experts in the field are pretty against such a gene therapy, criticizing its efficacy, but they also agree that the possibility for an adverse event is also low because of its low dosage and low efficacy. From my perspective, I feel like this is definitely an early mover in creating gene therapy that's more transient and more for a larger audience. I want to support the cause. I want to make the pioneers of longevity biotech make money, so that with their role model, there will be more companies that work on this. If you feel like this gene therapy is not efficacious or you feel like this technology isn't good enough, why not build a company and develop a better therapy? After all, they're charging a high price, but they also already see some traction.

There are people such as Brian Johnson, who publicly stated that he received a gene therapy, so there's definitely a market for it. Why not iterate and produce a better product? We want to see such an economic flywheel to attract more resources and talent, so my follistatin gene therapy is also a signal. I don't believe it had much of a noticeable effect on me, but fortunately, there's also no side effect or adverse event.

You've expressed both enthusiasm and caution about AI's role in longevity. What specific intersections between those two areas are you most excited about, and what do you think are the greatest risks?

AI is a big trend and is influencing everything that we do; there are a few interesting directions, and there are companies already exploring those. There's AI drug discovery for smaller molecules as well as biologics. There's a idea of an AI doctor that can commoditize diagnosis and medical advice to an unprecedented level. There are also worries about hallucination and accountability that an AI doctor really cannot provide at the moment. There are ideas about a clinical intelligence system where AI could really assist a doctor to make a diagnosis and medical decisions, and we can imagine how AI might be more comprehensively knowledgeable than our imperfect but marvelous biological brain, so they can work hand in hand.

These are all very interesting directions, and we feel like funds both from the tech sector and from the pharma or biotech sector are interested in such projects. I would say there's no better time to start a company, to work on longevity. You have AI at your disposal, you have biotech and longevity research at an inflection point, and more capital, talents, attention, and resources will be drawn into the field.

On your LinkedIn, I noticed that you are a gamer and a dev, and your background is in computer science and being a tech entrepreneur. How do you think that background in other fields has shaped your approach to investing in longevity? Would you say this is a challenge, an advantage, or both?

I've been a hardcore gamer growing up, and I do feel that such experiences shaped my work and my perspective in many things. When I was very young, I got my first Game Boy, and then I started to play games like Pokemon. In the first few generations of Pokemon, there are glitches that you can exploit to catch a very rare Pokemon and so on. At first, I didn't believe in such wild rumors, like you first need to smash your game cassette a few times and blow on it, then you can catch Mew or Mewtwo.

These glitches are real, because at that time, developers had limited RAM space to cram in the data. You can make the game behave unexpectedly to catch the Pokemon you want or duplicate important items in game, and that was a big shock to the young version of myself. I didn't believe it could be real, but understanding that it is real gave me a sense of believing that we can achieve things.

The world that we live in, a simulation or not, is just another very realistic, very complicated game. It is not without glitches; it all works by code or by some law that we shall discover and conquer in order to make great things happen. We can make advanced science happen that is indistinguishable from magic. That probably gave me the idea that both the game world and the real world are malleable places.

What drives you personally for this mission? You mentioned earlier the various ways in which you're passionate for this, but is there anything specific that you attribute this passion to? What's your 'why'?

Other things are limited: if you have a goal in life, you achieve the goal, and then the prince and the princess live happily ever after. However, at the end of the day, life extension is an infinite game that we might not win immediately. There's a possibility that

we do not win the game in this generation, but we will pass on this torch, and you either win the game and stay in the game or die trying. This gives me motivation to work on this every day. I just want to see how much we can push the boundary. This makes the work that we are working on pretty unique.

Great. Thank you for sharing, Boyang, and thanks for joining us in this Lifespan interview.

Thank you. Thank you so much.

Lipid Metabolite Rejuvenates Muscle Stem Cells in Mice

The effect of a single treatment persists weeks later.

Jun 24, 2025

- PGE2 and its receptor are required for muscle maintenance and repair.
- PGE2 decreases with age, and restoring PGE2 is effective against sarcopenia in older mice.

A recent study investigated the effect of a single treatment of **prostaglandin E2 on improving muscle strength and rejuvenating muscle stem cells in mice**. The researchers explored the molecular and epigenetic aspects underlying this rejuvenation [1].

Aging muscle stem cells

Sarcopenia, a loss of skeletal muscle mass and strength, is an age-related disorder that leads to increased risks of other conditions such as osteoporosis, heart failure, and cognitive decline.

Its sources include significant decreases in both the number and function of muscle stem cells, which are typically needed to regenerate skeletal muscles. Aging also causes changes in the microenvironment of muscle stem cells, leading to disrupted signaling that results in reduced self-renewal and increased senescence. Identifying ways to reverse these processes would be a promising avenue for both ameliorating sarcopenia and accelerating recovery after injury.

In a previous study, this study's researchers reported that a lipid-derived metabolite, prostaglandin E2 (PGE2), which is located in membranes, responds to muscle injury [2], and a transient increase in PGE2 signaling is necessary for muscle stem cells to regenerate muscles.

Muscle repair is also delayed in mice that do not have either a functioning PGE2 receptor called EP4 or sufficient levels of PGE2, and PGE2 levels decrease in skeletal muscles with age. Increased levels of 15-hydroxylprostaglandin dehydrogenase (15-PGDH) cause this age-related in PGE2 levels.

Overcoming muscle loss with PGE2 and exercise

For their first experiment, the researchers used genetically engineered young and aged mice that lacked EP4 receptors in muscle stem cells. Those mice exhibited approximately 20% reduced muscle strength and muscle mass compared to control animals.

Aged, genetically engineered mice were treated for five days with a non-hydrolyzable PGE2 analog. This form of PGE2 is resistant to degradation by 15-PGDH, whose activity is increased in aged muscle. The same mice were subjected to daily downhill running. Two weeks from the start of the experiment, the researchers observed an increase in the mice's muscle strength, suggesting that even such short treatment with PGE2, when combined with exercise, can partially overcome sarcopenia.

Lasting consequences

Next, they simulated muscle injury by injecting a toxin called notexin (NTX), which causes damage to muscles, into old mice. Two days later, these mice received a single, high dose of non-hydrolyzable PGE2 to simulate the PGE2 surge that happens after injury in young mice. Assessing the mice two weeks after the toxin and PGE2 treatment, the researchers noted a significant increase in muscle stem cells expressing Pax7, a transcription factor essential for muscle development and regeneration. A single PGE2 treatment helped to regenerate muscle, increase muscle mass, and enhance strength in aged mice.

This and subsequent experiments, in which aged PGE-2-treated cells are engrafted into young animals and then treated with toxin, suggest that PGE-2 has a positive long-term

effect on the regenerative capacity of muscle stem cells that persist in the progeny of the treated cells.

Those observations were confirmed by cell culture experiments using isolated aged muscle stem cells treated with PGE2. Those cells showed a significant increase in cell proliferation compared to untreated aged muscle stem cells. The researchers observed that cell numbers increased by approximately 60%, which they believe "overcomes the deficit in proliferative capacity" of aged muscle stem cells. Apart from increased proliferation, PGE2-treated aged stem cells also showed a threefold reduction in cell death.

"What amazes me most is that a single dose of treatment is sufficient to restore muscle stem cell function, and that the benefit lasts far beyond the duration of the drug," said Yu Xin (Will) Wang, Ph.D., an assistant professor at the Center for Cardiovascular and Muscle Diseases, Center for Data Sciences, and Cancer Metabolism and Microenvironment Program at Sanford Burnham Prebys. "In addition to making new muscle, the stem cells stay in the tissue, where they sustain the effect of the PGE2 and instill the muscle with further capacity to regenerate."

Sleeping through regeneration

After observing the positive impact of PGE2 treatment, the researchers investigated age-related changes in PGE2-EP4 signaling. They isolated the myofibers (individual muscle cells) with their associated muscle stem cells from young (2-4 months) and aged (over 18 months) mice.

They observed a substantial reduction in the expression of the PGE2 receptor EP4 in the Pax7-positive muscle stem cells isolated from aged mice compared to those isolated from young mice (70% of aged cells expressed EP4 compared to nearly 100% of young cells). Even among the aged muscle stem cells that expressed this EP4 receptor, the levels of expression were lower by roughly 50% compared to cells from young animals.

"PGE2 levels in muscle also decline with age, so we see blunted signaling from reductions in both the messenger and receiver," said Wang. "PGE2 is an alarm clock to wake up the

stem cells and repair the damage. Aging essentially reduces the volume of the alarm and the stem cells have also put on ear plugs."

Further analysis of single-cell levels in young and aged muscle stem cells and myogenic progenitors showed that diminished PGE2 signaling changes gene expression during regeneration in aged muscle stem cells. The results also suggested that PGE2 signaling starts in stem cells and is propagated to their cellular progeny.

The researchers identified that the transcription factor family known as AP1, which includes transcription factors such as JUN and FOS, was persistently activated in aged muscle stem cells. AP1 is involved in various processes including cell growth, differentiation, and apoptosis. Persistent activation of AP1 family members was also observed in human muscle biopsies, suggesting conservation across species.

PGE2 treatment of aged muscle stem cells suppressed age-dependent AP1 activation. It significantly impacted gene expression levels, leading to more rejuvenated gene expression patterns.

"The genes that are upregulated during the aging process are downregulated after treatment, and vice versa," Wang said.

Molecular memory

The regenerative effects of PGE2 treatment are observed even weeks afterwards. The researchers hypothesized that some kind of "molecular memory" must be driving those changes. Most likely, this kind of memory is caused by epigenetic changes in the chromatin landscape that are propagated to the muscle stem cells' progeny.

To test this hypothesis, the researchers analyzed chromatin accessibility and correlated it with a gene expression analysis. They found differences between chromatin regions that were more accessible (open) or less accessible (closed) in aged compared to young muscle stem cells. The distribution of those differences suggested that, with aging, the activity of genes involved in muscle stem cell expansion during injury is decreased. In contrast, the activity of other regions, including AP1, is increased.

PGE2 treatment rejuvenated the aged muscle stem cells, altering the accessibility pattern of chromatin.

Beyond muscle

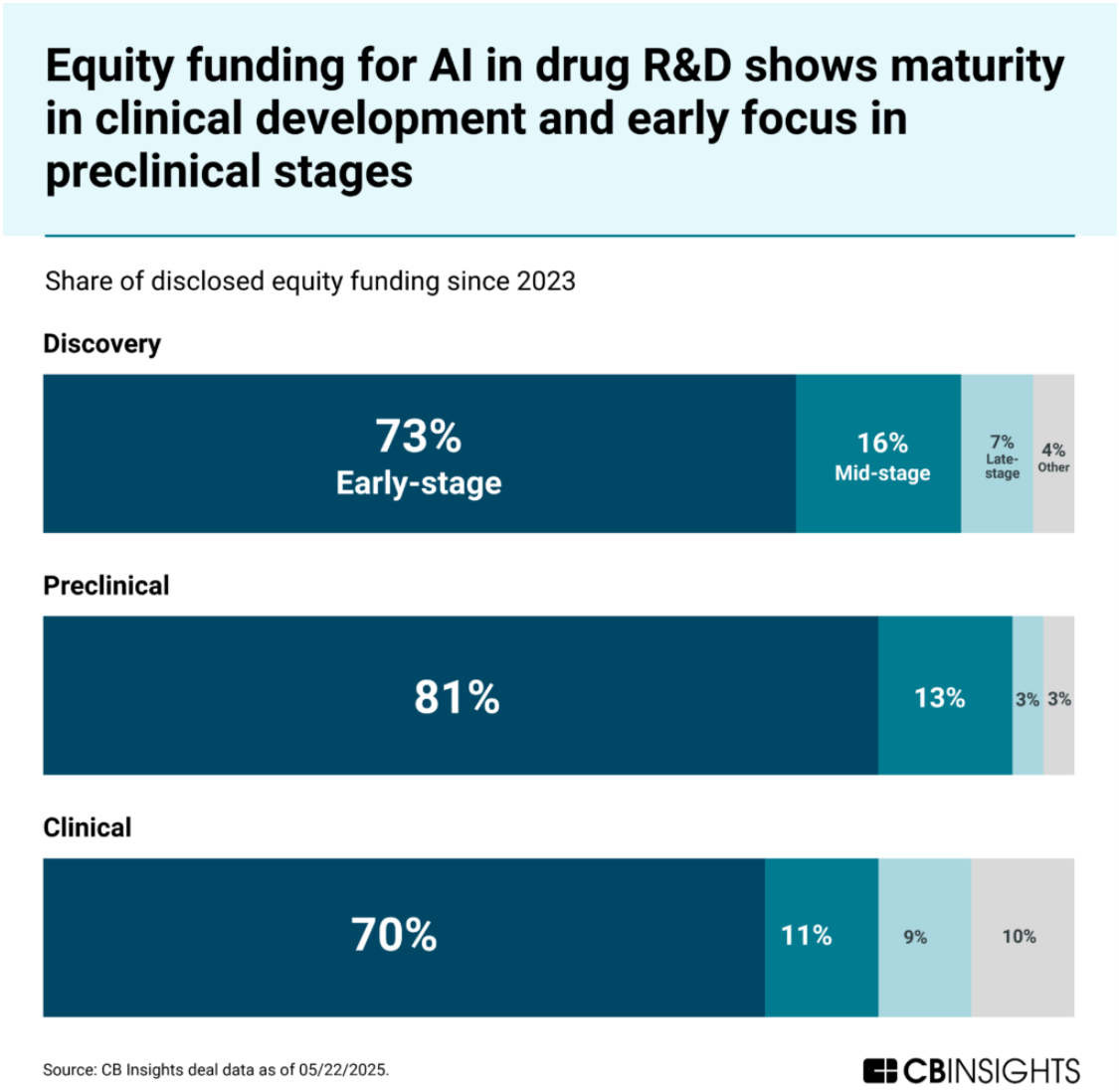
Overall, the researchers demonstrated that a single injection of PGE2 into aged muscles has a long-term rejuvenating effect, and when combined with exercise, it increases muscle strength and mass. Such results are promising for patients suffering from sarcopenia, but whether those results translate to humans is still unexplored.

However, the authors believe in PGE2's therapeutic potential, and they think it can extend beyond rejuvenating muscle cells.

"We've previously shown that PGE2 can also benefit the muscle fiber and neurons that innervate the muscle. PGE2 has been implicated in the regenerative process and signaling for the intestine, liver, and several other tissues, potentially opening up an approach that could restore the renewing capacity of other aged tissues," elaborated Wang. "The ultimate goal is to improve people's quality of life by reversing the effects of aging."

METATRENDS

AI is Compressing Decades of Longevity Research into Weeks



What it is

AI is accelerating longevity research *millions-fold*.

Harvard lab is now **completing experiments in one month that would have previously taken "hundreds of thousands of years to accomplish"** using traditional methods. **AI is virtually screening**

trillions of molecules, identifying the precise combination needed to reverse aging, and **compressing decades of research into weeks**.

"AI is changing everything. What we do now in a month would've taken thousands of years to accomplish with traditional methods."

– David Sinclair, PhD

The pace of change is making even optimistic scientists' heads spin—and it's **fundamentally rewriting the timeline** for when age reversal becomes reality.

Why it matters

The Four-Lever Solution AI Just Cracked

For decades, scientists knew aging was complex, but they didn't know exactly *how* complex. Sinclair's team has now identified "the four main levers to reverse aging"—specific enzyme pathways that control the epigenome. The winning combination: "inhibit three of those and push one."

The challenge was finding a single molecule that could pull all four levers simultaneously. **“Five years ago, even if you asked pharmaceutical company with a billion dollars can you do that? They would’ve said:**

‘No way,’” explains Sinclair. "Doing one of those lever pulls is hard enough."

But AI changes everything.

Instead of chemists spending decades optimizing molecules by hand, Sinclair's lab can now "take all known molecules and virtually screen them in a couple of months against all four targets." So far, they have found a cocktail of three molecules that can activate the four main levers. Now they are looking to see if they can find a single molecule that could replace the entire cocktail.

The Power of AI Imaging Changes the Game

AI is also revolutionizing how rapidly Sinclair can evaluate the efficacy of an epigenetic reversing molecule. Sinclair's team developed an algorithm called "dash AI" that can accurately determine a cell’s age by imaging it under a microscope. "Within nanoseconds a computer can image and screen a skin cell and determine if it’s from a 20-year-old or a 93-year-old. So when we test an epigenetic age reversing molecule we can see if it works: if the age of the cell gets reduced, for example, from 93 years old down to 20 years old." This breakthrough enables ultra-rapid screening.

The Timeline Acceleration Is Stunning

Using AI and robotics, Sinclair's lab processes "trillions of molecules through this virtual screening process." They've identified "a hundred top

candidates, some synthetic, some natural" that they can order from a chemical supply shop the same way you'd order something from Amazon.

Just five years ago, age reversal was purely theoretical. "In 2017, it was just a theory that we could reverse aging," Sinclair notes. By 2020, they proved it worked. Now, AI is accelerating the transition from the lab bench to human trials.

In success, these breakthrough compounds will reset aging in four weeks, and cost only hundreds of dollars for a four-week course of pills.

The Exponential Moment

We're witnessing something unprecedented: the convergence of AI and longevity science creating exponential progress in both fields.

"The pace of change is making my head spin off and I'm an optimist, but I just can't comprehend right now how fast things are going."

– David Sinclair, PhD

This is about compressing timelines for human benefit. Age reversal technologies that might have taken 30 years to develop are now racing toward human trials in *months*, not decades.

Psilocybin Shows Potential In Slowing Human Cell Aging And Increasing Lifespan In Mice

Psilocybin treatment even prevented the mice's fur from turning gray. - Image credit: New Africa/Shutterstock.com© IFL Science

Magic mushrooms have been extensively studied for their potential mental health benefits, yet new research suggests that the psychoactive compound in these trippy fungi may also have powerful anti-aging properties. Using cultured human cells and live mice, the study authors showed that psilocybin appears to

significantly slow down cellular aging while also keeping older rodents alive for longer.

Inspiration for this research came from the "psilocybin-telomere hypothesis", which posits that the psychological effects of psilocybin may help to protect cellular DNA by preserving the integrity of telomeres. These are protective sequences of DNA that bookend each chromosome, but which degrade and shorten as we age.

The link between mental health and telomere length is well documented, with depression and other psychological conditions being associated with accelerated shortening of these protective caps. Because psilocybin has been shown to help treat mental health disorders, the authors of the new study wondered whether it might also have an impact on telomere length and cellular aging.

To investigate, they treated human fetal lung cells with psilocin, which is the active metabolite formed when psilocybin is digested in the gut. The results showed that cellular lifespan increased by an average of 29 percent when ten micrograms of the drug were administered, and by 57 percent when the dosage was upped to 100 micrograms.

Repeating the experiment using adult human skin cells, the researchers noted a 51 percent extension in cellular lifespan following treatment with 100 micrograms of psilocin. "Overall, these results suggest that the in vitro impacts of psilocin are dose-dependent, with higher dosing ultimately leading to greater cellular life extension," they write.

Looking at the mechanisms behind this anti-aging effect, the study authors found that telomere shortening was notably reduced in treated cells compared to non-treated controls. The addition of psilocin also led to elevated levels of a protein called SIRT1, which plays a major role in regulating cellular aging and metabolism. At the same time, psilocin attenuated the release of a compound called Growth Arrest and DNA Damage-inducible 45 alpha (GADD45a), resulting in less degeneration of cellular DNA.

Taking things a step further, the researchers treated 19-month-old female mice – equivalent to 60 to 65 years of age in human terms – with psilocybin once a month for ten months. Overall, 80 percent of these mice survived until the end of

the course, compared to just 50 percent of age-matched mice that didn't receive treatment.

In addition to remaining alive for longer, mice that received psilocybin also looked younger than control mice, exhibiting "improvements in overall fur quality" and less graying. "In summary, we provide the first experimental evidence demonstrating that psilocybin treatment can enhance survival in aged mice," write the study authors.

"This is a very exciting and clinically relevant finding that suggests that even when intervention is initiated late in life, it can have dramatic impacts," said study author Dr Kosuke Kato in a statement. Encouraged by their results, the researchers now call for further studies investigating the potential of psilocybin to aid in the treatment of various age-related diseases, including cancer.

At the same time, however, Kato urges caution, stating that "there is still a lot to understand, including optimal dosing protocols that will lead to maximal efficacy. We also need to better understand the potential risks of long-term psilocybin treatment before this type of treatment is ready for public use."

The study is published in the journal npj Aging.

JULY 7, 2025

The 'Mind' diet is good for cognitive health—here's what foods you should put on your plate

by Aisling Pigott, Sophie Davies, The Conversation edited by Lisa Lock, reviewed by Andrew Zinin

Credit: Unsplash/CC0 Public Domain

There's long been evidence that what we eat can affect our risk of dementia, Alzheimer's disease and cognitive decline as we age. But can any one diet actually keep the brain strong and lower dementia risk? Evidence suggests the so-called "Mind diet" might.

The Mind diet (which stands for the Mediterranean-Dash intervention for neurocognitive delay) combines the well-established Mediterranean diet with the "Dash" diet (dietary approaches to stop hypertension). However, it also includes some specific dietary modifications based on their benefits to cognitive health.

Both the Mediterranean diet and Dash diet are based on traditional eating patterns from countries which border the Mediterranean Sea.

Both emphasize eating plenty of plant-based foods (such as fruits, vegetables, nuts and seeds), low-fat dairy products (such as milk and yogurts) and lean proteins, including fish and chicken. Both diets include very little red and processed meats. The Dash diet, however, places greater emphasis on consuming low-sodium foods, less added sugar and fewer saturated and trans-fats to reduce blood pressure.

Both diets are well-researched and shown to be effective in preventing lifestyle-related diseases—including cardiovascular disease and hypertension. They're also shown to help protect the brain's neurons from damage and benefit cognitive health.

The Mind diet follows many of the core tenets of both diets but places greater emphasis on consuming more foods that contain nutrients which promote brain health and prevent cognitive decline, including:

- flavonoids and polyphenols found in fruit, vegetables, tea and dark chocolate
- folate found in leafy greens and legumes
- N-3 polyunsaturated fatty acids found in oily fish, nuts and seeds.

Numerous studies have been conducted on the Mind diet, and the evidence for this dietary approach's brain health benefit is pretty convincing.

For instance, one study asked 906 older adults about their usual diet—giving them a "Mind score" based on the number of foods and nutrients they regularly consumed that are linked with lower dementia risk. The researchers found a link between people who had a higher Mind diet score and slower cognitive decline when followed up almost five years later.

Another study of 581 participants found that people who had closely followed either the Mind diet or the Mediterranean diet for at least a decade had fewer signs of amyloid plaques in their brain when examined post-mortem. Amyloid plaques are a key hallmark of Alzheimer's disease. Higher intake of leafy greens appeared to the most important dietary component.

A systematic review of 13 studies on the Mind diet has also found a positive association between adherence to the Mind diet and cognitive performance and function in

older people. One paper included in the review even demonstrated a 53% reduction in Alzheimer's disease risk in those that adhered to the diet.

It's important to note that most of this research is based on observational studies and food frequency questionnaires, which have their limitations in research due to reliability and participant bias. Only one randomized control trial was included in the review. It found that women who were randomly assigned to follow the Mind diet over a control diet for a short period of time showed a slight improvement in memory and attention.

Research in this field is ongoing, so hopefully we'll soon have a better understanding of the diet's benefits—and know exactly why it's so beneficial.

Mind your diet

UK public health guidance recommends people follow a balanced diet to maintain good overall health. But the Mind diet offers a more targeted approach for those hoping to look after their cognitive health.

While public health guidance encourages people to eat at least five portions of fruit and vegetables daily, the Mind diet would recommend choosing leafy green vegetables (such as spinach and kale) and berries for their cognitive benefits.

Similarly, while UK guidance says to choose unsaturated fats over saturated ones, the Mind diet explicitly recommends that these fats come from olive oil. This is due to the potential neuroprotective effects of the fats found in olive oil.

If you want to protect your cognitive function as you age, here are some other small, simple swaps you can make each day to more closely follow the Mind diet:

- upgrade your meals by sprinkling nuts and seeds on cereals, salads or yogurts to increase fiber and healthy fats
- eat the rainbow of fruit and vegetables, aiming to fill half your plate with these foods
- canned and frozen foods are just as nutrient-rich as fresh fruits and vegetables
- bake or airfry vegetables and meats instead of frying to reduce fat intake
- opt for poly-unsaturated fats and oils in salads and dressings—such as olive oil
- bulk out meat or meat alternatives with pulses, legumes chickpeas or beans. These can easily be added into dishes such as spaghetti bolognese, chili, shepherd's pie or curry
- use tinned salmon, mackerel or sardines in salads or as protein sources for meal planning.

These small changes can have a meaningful impact on your overall health—including your brain's health. With growing evidence linking diet to cognitive function, even little changes to your eating habits may help protect your mind as you age.

Provided by The Conversation

JULY 7, 2025

Mediterranean or plant-based diets may help reduce risk of chronic constipation in middle- and older-age adults

by Mass General Brigham edited by Gaby Clark, reviewed by Andrew Zinin

Graphical abstract. Credit: *Gastroenterology* (2025). DOI: 10.1053/j.gastro.2025.06.020
The incidence of chronic constipation increases as we age. A new study from Mass General Brigham researchers compares five common diets to determine the effectiveness of preventing chronic constipation in middle- and older-age adults.

The team studied over 96,000 adults for several years to understand how different eating habits affect the risk of developing the chronic gastrointestinal condition. They found people who followed a Mediterranean or plant-based diet were less likely to develop constipation. Their results are published in *Gastroenterology*.

"Chronic constipation affects millions of people and can significantly impact a patient's quality of life," said senior author Kyle Staller, MD, MPH, of the Division of Gastroenterology at Massachusetts General Hospital, a founding member of the Mass General Brigham health care system. "Our findings suggest that as we age, certain healthy diets may provide benefits to our gut beyond the known cardiovascular benefits."

It's been established that healthy diets can improve constipation symptoms, but this is the first study to show that certain diets can prevent people from developing chronic constipation. "We have always assumed that the benefits of eating a healthy diet would be driven by fiber, but our analyses showed the benefit of these healthy diets on constipation were independent of fiber intake," said Staller.

Using data from the Nurses' Health Study, Nurses' Health Study II and the Health Professionals Follow-Up Study, the researchers tracked dietary patterns in middle- and older-age adults and examined who developed chronic constipation, which was defined as having symptoms for at least 12 weeks in a year.

Diets included in the analysis were the Mediterranean diet, plant-based diet, low-carb diet, Western diet and inflammatory diet. Individuals who adhered to a Western or inflammatory diet were more likely to develop chronic constipation. In addition, participants who ate a low-carb diet didn't show a strong effect.

"Our findings suggest a diet rich in vegetables, nuts and healthy fats may help prevent chronic constipation in middle- and older-age adults," said Staller.

More information: Yiqing Wang et al, Dietary Patterns and Incident Chronic Constipation in Three Prospective Cohorts of Middle- and Older-aged Adults, *Gastroenterology* (2025). DOI: 10.1053/j.gastro.2025.06.020
Journal information: Gastroenterology
Provided by Mass General Brigham

JULY 7, 2025

Late eating is associated with impaired glucose metabolism

by Deutsches Zentrum fuer Diabetesforschung DZD edited by Lisa Lock, reviewed by Robert Egan

Credit: *eBioMedicine* (2025). DOI: 10.1016/j.ebiom.2025.105737
Our metabolic processes differ depending on the time of day and many of them are more active in the morning than in the evening. Although studies show that eating late in the day is associated with an increased risk of obesity and cardiovascular diseases, little is known about how the time we eat affects glucose metabolism and to what extent this is genetically defined.

Prof. Olga Ramich from the German Institute of Human Nutrition Potsdam-Rehbrücke (DIfE) and her team recently investigated this using data from a twin cohort from 2009–10. Their article was published in the journal *eBioMedicine*.

The circadian system is a hierarchically structured 24-hour time control system in the body that regulates behavior and metabolism via a central clock in the brain and peripheral clocks in organs such as the liver or pancreas. As a result, our metabolic processes differ depending on the time when we eat, which leads to diurnal fluctuations in glucose metabolism and the release of hormones after a meal.

Food intake itself acts as an important timer that synchronizes our internal clocks. Decoupling meal times from the natural light-dark rhythm, e.g., when working at night, can lead to an internal clock disorder and negative metabolic changes.

Does late eating make you ill?

Previous studies have shown that eating late at night is associated with an increased risk of obesity and cardiovascular diseases.

However, little is known about how exactly the timing of food intake interacts with the individual circadian rhythm and thus influences glucose metabolism and the risk of diabetes. It is also unclear which mechanisms determine one's individual eating behavior, as it depends on the interaction of cultural, personal, physiological and genetic factors.

Circadian timing of eating

When someone eats during the course of a day in relation to the individual biological daily rhythm is measured as the interval between mealtime and the midpoint of sleep. The midpoint of sleep describes the time that lies exactly in the middle between falling asleep and waking up. It is a measure of the chronotype—in other words, whether someone is an early riser or a night owl.

Nutrigenomics analysis in twins (NUGAT) study

The NUGAT study, initiated and designed by Prof. Andreas F. H. Pfeiffer, was conducted from 2009 to 2010 at the German Institute of Human Nutrition Potsdam-Rehbrücke (DIfE). The identical and fraternal twin pairs were recruited either from a twin register (HealthTwiSt, Berlin, Germany) or via public advertisements. The 92 participants (46 pairs of twins) underwent two nutritional interventions, which were not relevant to the study results shown here though.

The participants underwent detailed metabolic phenotyping, which included a physical examination, medical history, anthropometric measurements and a glucose tolerance test. The individual chronotype was determined by means of a questionnaire.

In addition, all 92 test subjects filled out handwritten food logs in which they noted the start and end of each meal as well as the amount and type of food consumed on five consecutive days. This included three working days and two days off to reflect the eating habits of the twin pairs.

More information: Janna Vahlhaus et al, Later eating timing in relation to an individual internal clock is associated with lower insulin sensitivity and affected by genetic factors, *eBioMedicine* (2025). DOI: 10.1016/j.ebiom.2025.105737
Journal information: EBioMedicine
Provided by Deutsches Zentrum fuer Diabetesforschung DZD

JULY 7, 2025

The myth of 200 daily food decisions: Study challenges widely-cited claim

by Max Planck Society edited by Gaby Clark, reviewed by Robert Egan

Do we really make more than 200 food decisions per day? Such simplistic statements can undermine people's feelings of self-efficacy. Credit: MPI for Human Development Researchers at the Max Planck Institute for Human Development have critically examined the basis for a frequently cited figure: that people make more than 200 unconscious decisions about food every day. This figure has circulated in scientific publications, the media, and health promotion campaigns for nearly 20 years without ever being empirically validated. An article published in the journal *Appetite* shows why a more nuanced view of eating behavior is needed.

Numbers play a central role in health communication, providing guidance and motivation. However, the benchmarks used are not always scientifically sound or meaningful. In health research, the claim that people make more than 200 decisions about food every day without even noticing has been around for years.

"This number paints a distorted picture of how people make decisions about their food intake and how much control they have over it," says Maria Almudena Claassen, postdoctoral fellow at the Center for Adaptive Rationality at the Max Planck Institute for Human Development.

Together with Director Ralph Hertwig and Jutta Mata, an associate research scientist at the Max Planck Institute for Human Development and Professor for Health Psychology at the University of Mannheim, Claassen has published an article that shows how flawed measurements can lead to misleading ideas about eating behavior.

Where the figure of 200 food decisions per day comes from

The figure of 200 food decisions examined in the article comes from a 2007 study by U.S. scientists Brian Wansink and Jeffery Sobal. They asked 154 participants to first estimate how many decisions they made per day about eating and drinking—an average of 14.4.

Next, participants estimated the number of "when," "what," "how much," "where," and "with whom" decisions they made for a typical meal. These estimations were multiplied by the

number of meals, snacks, and beverages they reported consuming in a typical day and summed, giving an average of 226.7 decisions made per day. The authors interpreted the difference of 212.3 between the two estimates as an indicator of unconscious or "mindless" decisions.

Why this number is problematic

Claassen and her colleagues at the Max Planck Institute for Human Development challenge this conclusion. They identify methodological and conceptual shortcomings inherent in the study's design and argue that the discrepancy in the estimated number of decisions can be explained by a well-known cognitive effect called the subadditivity effect. This effect describes people's tendency to provide higher frequency estimates when asked to assess several specific aspects of a general question separately.

The researchers conclude that the high number of "mindless" food decisions is not an empirically observed reality but rather the result of the subadditivity effect.

The research team also warns of the consequences that such simplistic statements can have on our understanding of eating behavior. "Such a perception can undermine feelings of self-efficacy," says Claassen. "Simplified messages like this distract from the fact that people are perfectly capable of making conscious and informed food decisions."

Why a methodological pluralism in researching food decisions is needed

So how can decisions about food be meaningfully defined and empirically investigated? The researchers propose defining food-related decisions in concrete, context-specific terms. What is being eaten? How much? What is being avoided? When? In what social or emotional context?

These decisions can only be understood within the context in which they are made. They are based on specific, concrete situations—such as choosing between salad and pasta, or deciding whether to skip a serving.

What matters most is focusing on the key decisions that align with one's personal goals: for someone aiming to lose weight, it might be opting for a light salad over pasta at dinner; for someone striving to eat more sustainably, it could mean choosing a vegetarian meal instead of a meat-based one.

To empirically map this perspective, the researchers advocate methodological pluralism, combining qualitative observations, digital tracking tools, diary studies, and cross-cultural research to gain a differentiated and realistic picture of people's everyday food decisions.

"Magic numbers such as the alleged 200 food decisions do not tell us much about the psychology of eating decisions, even more so if these numbers turn out to be themselves

distorted," says Ralph Hertwig, Director at the Max Planck Institute for Human Development. "To get a better understanding of eating behavior, we need to get a better grasp of exactly how decisions are made and what influences them."

Self-nudging can strengthen informed, health-promoting decisions

Armed with this knowledge and understanding of their food choices, people are in a better position to adopt healthy eating habits in their everyday lives. One useful strategy for everyday use is self-nudging. It involves designing one's environment so that healthier choices are easier to make. For example, placing pre-cut pieces of fruit within easy reach in the refrigerator or keeping sweets out of sight can help people stick to their goals without constantly having to rely on conscious control.

Self-nudging is part of the boosting approach, which, unlike nudging, strengthens individual decision-making competencies rather than relying on external environment-driven cues.

More information: Maria Almudena Claassen et al, The (mis-)measurement of food decisions, *Appetite* (2025). DOI: 10.1016/j.appet.2025.107928
Journal information: Appetite
Provided by Max Planck Society

JULY 8, 2025

Can psychedelic mushrooms turn back the clock? Study suggests psilocybin preserves telomere length

by Graciela Gutierrez, Baylor College of Medicine edited by Robert Egan

Psilocin treatment extends cellular lifespan. Human lung fibroblasts were treated continuously with vehicle (DMSO 0.02%) or 10 μM psilocin until they reached replicative senescence. Credit: *npj Aging* (2025). DOI: 10.1038/s41514-025-00244-x
A compound found in psychedelic mushrooms may have antiaging properties. Researchers at Baylor College of Medicine have found that psilocybin, the active compound in psychedelic mushrooms, may extend both cellular and organismal lifespans.

The findings, published in the journal *npj Aging*, show that psilocybin reduced multiple hallmarks of aging in cells while also improving survival in aged mice.

"There have been a number of clinical studies that have explored the therapeutic potential of psilocybin in psychiatric conditions such as depression and anxiety; however, few studies have evaluated its impacts outside the brain," said Dr. Louise Hecker, associate professor of medicine—cardiovascular research at Baylor and senior author of the study.

"The overwhelming majority of what we know about psilocybin is how it impacts the brain. Our findings suggest that psilocybin has potent effects on the entire body, including antiaging properties, which also may contribute to the plethora of observed beneficial clinical outcomes."

Telomeres, the protective caps of repetitive DNA sequences located at the ends of chromosomes, shorten as we age—telomere shortening is a classic hallmark of aging. Hecker's research suggests that psilocybin treatment preserves telomere length, which contributes to cellular life extension.

In the current study, using human cells, the team found that psilocybin extended cellular lifespan by up to 57% depending on dosages. In cells, psilocin (the active metabolite of psilocybin) delayed cellular senescence, preserved telomere length and reduced oxidative stress levels. Their findings also suggest it leads to increased SIRT1 expression, which is associated with regulating longevity, as well as other cellular markers indicating improved DNA damage responses.

The study also showed that when psilocybin was administered to aged mice (the equivalent to a 60-year-old in human age), mice showed significantly improved survival compared to control mice. Researchers also noted a visible improvement in fur quality, which suggests healthier aging, as well.

"This is a very exciting and clinically relevant finding that suggests that even when intervention is initiated late in life, it can have dramatic impacts," said Dr. Kosuke Kato, lead author of the study and assistant professor of medicine—pulmonary at Baylor.

"Our findings open an exciting new chapter in psychedelic research beyond its neurological and psychological benefits," Hecker said. "Psilocybin may represent a disruptive agent that promotes healthy aging. The next steps need to explore the therapeutic effects across multiple age-related diseases."

"It is important to note that additional research is needed to validate these findings in human studies," Kato said. "There is still a lot to understand, including optimal dosing protocols that will lead to maximal efficacy. We also need to better understand the potential risks of long-term psilocybin treatment before this type of treatment is ready for public use."

Once validated in human studies, the use of psilocybin could offer new options for healthy aging and potentially age-associated diseases.

More information: Kosuke Kato et al, Psilocybin treatment extends cellular lifespan and improves survival of aged mice, *npj Aging* (2025). DOI: 10.1038/s41514-025-00244-x

Provided by Baylor College of Medicine

JULY 8, 2025

It's never too late to start playing an instrument: Playing music may benefit memory in old age, study suggests

by Kyoto University edited by Sadie Harley, reviewed by Andrew Zinin

Participants of the study playing their instruments. Credit: KyotoU / Sekiyama lab

Those who are blessed with long lives will eventually experience a decline in cognitive functions, and working memory is particularly susceptible. However, various forms of exercise and activities that flex the brain are thought to help maintain memory function in old age.

The putamen and cerebellum are two areas of the brain prone to atrophy and reduced activity due to normal aging. Recent neuroscience research has also shown that these are the brain regions most likely affected by practicing a musical instrument. Yet most studies in this area have focused on young participants or people who have been playing an instrument since childhood.

This motivated a team of researchers at Kyoto University to investigate the effects of taking up a musical instrument in old age. The paper is published in the journal *Imaging Neuroscience*.

Previous research by this team suggested that practicing an instrument for the first time for four months may improve memory performance and the function of the putamen for the elderly. After observing these short-term improvements, the researchers shifted their focus to the long-term effects of musical instrument practice.

Their current study involves the same participants who practiced a new instrument for four months during the earlier 2020 project, in which the participants' average age was 73 years. This time, half of the participants continued practicing their musical instrument for more than three years while the other half stopped and switched to other hobbies.

After four years, the research team conducted MRI scans, focusing on the putamen and the cerebellum in particular, while participants performed cognitive function tests, including a new verbal working memory task.

While the researchers observed no initial difference in brain structure and cognitive function, four years had left a notable mark. In the group that stopped practicing music, verbal working memory performance declined and the gray matter volume of the right putamen decreased, but the group who continued playing their instruments did not experience such a decline in performance or putamen atrophy.

Furthermore, the researchers observed higher activity in the bilateral cerebellums over a wider area in the continue group than in the stop group.

"We were surprised to find that the effects on the brains of elderly people who start and continue practicing an instrument were also concentrated in these two areas of the brain, and that this was an effective way to prevent age-related decline," says corresponding author Kaoru Sekiyama.

The results of this study suggest that practicing an instrument may make it possible to prevent or postpone the decline in cognitive function that occurs with healthy aging. It's never too late to start playing an instrument, and starting in old age may have major benefits.

"For those who struggle to engage in physical activity due to body pain or other problems, playing musical instruments can be a great alternative. How fortunate that practicing music has such a positive impact on the brain and cognitive function," says Sekiyama.

More information: Xueyan Wang et al, Never too late to start musical instrument training: Effects on working memory and subcortical preservation in healthy older adults across 4 years, *Imaging Neuroscience* (2025). DOI: 10.1162/IMAG.a.48
Provided by Kyoto University

JULY 9, 2025

Genome editing enables mice to produce their own weight-loss drug for months

by University of Osaka edited by Sadie Harley, reviewed by Robert Egan

System for in vivo genome editing–mediated exenatide production and its therapeutic application in obese mice. Credit: Keiichiro Suzuki
Weight-loss drugs have surged in popularity, promising rapid results with regular injections. Now, researchers from Japan report a way for the body to make its own weight-loss drugs, doing away with injections in favor of a one-time treatment.

In the study, "Targeted In Vivo Gene Integration of a Secretion-Enabled GLP-1 receptor agonist Reverses Diet-induced Non-genetic Obesity and Pre-diabetes," published in *Communications Medicine*, researchers from the University of Osaka reveal a modified genome editing approach to tackle noncommunicable, multifaceted diseases.

The approach introduced a new protein-coding gene, rather than attempting to correct a mutation in an existing gene and could be the key to lifelong effective weight management.

Genome editing is a cutting-edge treatment approach that works by correcting genetic mutations that cause disease. However, it is less effective for conditions that aren't caused by a single mutation, like heart disease, diabetes, and obesity. As these are some of the leading causes of mortality, the research aimed to discover how gene therapy can provide therapeutic gain in these diseases.

"An alternative to genome editing for many complex and non-genetic diseases is biologic medications, which are essentially injectable proteins," says senior author of the study Keiichiro Suzuki.

"These medications do not stay in the body long, meaning they typically have to be injected weekly, or even daily, to maintain consistent therapeutic levels of the drug."

In vivo genome editing–based therapy in obese and prediabetic mice treatment. Credit: Keiichiro Suzuki

To reduce the need for constant injections, the researchers developed an approach combining genome editing with biologics. They introduced a gene that encodes Exenatide, a weight-loss medication that acts as a glucagon-like peptide-1 receptor agonist, into mice with obesity and pre-diabetes. They then monitored Exenatide levels in the blood, as well as weight and food intake, over the next few months.

"The results were very exciting," explains Suzuki. "We found that these genome-edited mice produced high levels of Exenatide that could be detected in blood for several months after introduction of the gene."

Introducing the gene into the mice encouraged the liver cells to continue producing Exenatide, creating a 'reservoir' of the medication in the liver. This reservoir ensured there was a steady flow of Exenatide in the bloodstream, as shown in the research findings.

In addition, the treated mice ate less food and gained less weight than normal mice whose genomes were not edited. Equally, the genome-edited mice being able to produce their own Exenatide improved their glucose metabolism and insulin sensitivity, key factors in controlling diabetes symptoms, without any noticeable side effects.

Illustration of sustained therapy enabled by one-time genome editing. Credit: Keiichiro Suzuki

"We hope that our design of a one-time genetic treatment can be applied to many conditions that do not have exact genetic causes," says Suzuki.

This innovative approach could be an alternative to standard genome editing, which is unable to treat diseases like type 2 diabetes and chronic inflammatory conditions. Enabling sustained in-body drug production could shorten treatment time, improve treatment adherence, and raise the quality of life for many patients.

More information: Targeted In Vivo Gene Integration of a Secretion-Enabled GLP-1 receptor agonist Reverses Diet-induced Non-genetic Obesity and Pre-diabetes, *Communications Medicine* (2025). DOI: 10.1038/s43856-025-00959-8
Journal information: Communications Medicine
Provided by University of Osaka

Artificial intelligence identifies anti-aging drug candidates targeting 'zombie' cells

Researchers from MIT and Integrated Biosciences discovered three potent senolytic compounds with high oral bioavailability.

From Ten Bridge Communications 06/07/25 (first released 05/05/23)

Senolytics are an emerging class of investigational drug compounds that selectively kill aging-associated senescent cells (left, with red stain) without affecting other cells (right). Using artificial intelligence, researchers from Integrated Biosciences have, for the first time, identified three senolytics with comparable efficacy and superior drug-like properties relative to leading investigational compounds. Credit: Integrated Biosciences

SAN CARLOS, California – A new publication in the May issue of *Nature Aging* by researchers from Integrated Biosciences, a biotechnology company combining synthetic biology and machine learning to target aging, demonstrates the power of artificial intelligence (AI) to discover novel senolytic compounds, a class of small molecules under intense study for their ability to suppress age-related processes such as fibrosis, inflammation and cancer.

The paper, "Discovering small-molecule senolytics with deep neural networks," authored in collaboration with researchers from the Massachusetts Institute of Technology (MIT) and the Broad Institute of MIT and Harvard, describes the AI-guided screening of more than 800,000 compounds to reveal three drug candidates with comparable efficacy and superior medicinal chemistry properties than those of senolytics currently under investigation.

"This research result is a significant milestone for both longevity research and the application of artificial intelligence to drug discovery," said Felix Wong, Ph.D., co-founder of Integrated Biosciences and first author of the publication.

“These data demonstrate that we can explore chemical space *in silico* and emerge with multiple candidate anti-aging compounds that are more likely to succeed in the clinic, compared to even the most promising examples of their kind being studied today.”

Senolytics are compounds that selectively induce apoptosis, or programmed cell death, in senescent cells that are no longer dividing.

A hallmark of aging, senescent cells have been implicated in a broad spectrum of age-related diseases and conditions, including cancer, diabetes, cardiovascular disease, and Alzheimer’s disease.

Despite promising clinical results, most senolytic compounds identified to date have been hampered by poor bioavailability and adverse side effects.

Integrated Biosciences was founded in 2022 to overcome these obstacles, target other neglected hallmarks of aging, and advance anti-aging drug development more generally using artificial intelligence, synthetic biology, and other next-generation tools.

“One of the most promising routes to treat age-related diseases is to identify therapeutic interventions that selectively remove these cells from the body, similarly to how antibiotics kill bacteria without harming host cells.

The compounds we discovered display high selectivity, as well as the favorable medicinal chemistry properties needed to yield a successful drug,” said Satotaka Omori, Ph.D., Head of Aging Biology at Integrated Biosciences and joint first author of the publication.

“We believe that the compounds discovered using our platform will have improved prospects in clinical trials and will eventually help restore health to aging individuals.”

In their new study, Integrated Biosciences researchers trained deep neural networks on experimentally generated data to predict the senolytic activity of any molecule.

Using this AI model, they discovered three highly selective and potent senolytic compounds from a chemical space of over 800,000 molecules.

All three displayed chemical properties suggestive of high oral bioavailability and were found to have favorable toxicity profiles in hemolysis and genotoxicity tests.

Structural and biochemical analyses indicate that all three compounds bind Bcl-2, a protein that regulates apoptosis and is also a chemotherapy target.

Experiments testing one of the compounds in 80-week-old mice, roughly corresponding to 80-year-old humans, found that it cleared senescent cells and reduced expression of senescence-associated genes in the kidneys.

“This work illustrates how AI can be used to bring medicine a step closer to therapies that address aging, one of the fundamental challenges in biology,” said James J. Collins, Ph.D., Termeer Professor of Medical Engineering and Science at MIT and founding chair of the Integrated Biosciences Scientific Advisory Board.

“Integrated Biosciences is building on the basic research that my academic lab has done for the last decade or so, showing that we can target cellular stress responses using systems and synthetic biology.

This experimental tour de force and the stellar platform that produced it make this work stand out in the field of drug discovery and will drive substantial progress in longevity research.”

Dr. Collins, who is the senior author on the *Nature Aging* paper, led the team that discovered the first antibiotic identified by machine learning in 2020.

JULY 22, 2025

The A to K of vitamins: What you need and where to get it

by Dan Baumgardt, The Conversation edited by Gaby Clark, reviewed by Andrew Zinin

Credit: Unsplash/CC0 Public Domain

The late, great comedian Barry Humphries (of Dame Edna fame) once spoke whimsically about the health benefits of kale. Just one fistful, he joked, contained enough essential vitamins, minerals, and trace elements to keep you in a sedentary position in the bathroom for two whole days. Apparently, it wasn't tasty enough to justify a second helping.

In a world where "superfoods" are relentlessly marketed for their supposed ability to deliver all the nutrients we need, it's worth asking: which vitamins really are essential? And aside from kale (which I actually rather like), what foods help us meet our daily needs?

Vitamin A

Let's start at the top. Vitamin A—also known as retinol—is found in foods like eggs, oily fish , and dairy products. It plays a crucial role in keeping your skin and immune system healthy.

But it's probably most famous for supporting vision. Vitamin A binds with light-sensitive pigments in the rod and cone cells of your retina, helping you to see, particularly in low light.

A deficiency in vitamin A, though uncommon in wealthy countries, can lead to serious vision problems and even blindness. Another source of vitamin A is beta-carotene, found in

colorful fruits and vegetables like carrots, peppers, spinach, and pumpkin. Your body converts beta-carotene into vitamin A, which is why we associate carrots with seeing in the dark.

Vitamin B

The B vitamins are a family of eight different nutrients, each with its own number and role.

B1 (thiamin) helps the nervous system and aids digestion. People with chronic alcoholism are especially at risk of deficiency, which can lead to Wernicke-Korsakoff syndrome, a serious neurological disorder that affects memory and movement.

B2 (riboflavin) and B3 (niacin) support similar functions, while B9 (folate) and B12 (cobalamin) are essential for red blood cell production. A lack of either can lead to anemia.

Folate is especially important in early pregnancy, helping to prevent neural tube defects like spina bifida. That's why it's recommended for people who are pregnant or trying to conceive.

You'll find B vitamins in everything from beans and legumes to meat, fish, and dairy; a wide-ranging family of nutrients in a wide-ranging variety of foods.

Vitamin C

The go-to vitamin when we're under the weather, whether from a virus or a hangover, vitamin C (ascorbic acid) is known as the "healing" vitamin for good reason. It promotes wound healing, supports tissue repair and helps maintain blood vessels and bones.

A deficiency in vitamin C causes scurvy—a condition once common among sailors—with symptoms like fatigue, bruising, depression, and gum disease.

Fortunately, vitamin C is found in many different fruits and vegetables, especially citrus fruits. That's why 19th-century British sailors were given limes to prevent scurvy, earning them the nickname "limeys."

Vitamin D

Vitamin D is essential for bones, teeth, and muscles. It can be absorbed through diet, especially from oily fish, eggs, and meat, but your body also makes it in the skin, thanks to sunlight.

In the summer, most people get enough vitamin D from being outside. But in the winter months, diet and, if needed, supplementation become more important.

Deficiency is more common, especially in areas with limited sun exposure. It can lead to soft, weakened bones and symptoms like bone pain, fractures and deformities—including the classic bow-legged appearance. In children, this condition is known as rickets; in adults, it's called osteomalacia.

Vitamin E

Often overlooked, vitamin E helps protect cells, supports vision, and bolsters the immune system. You'll find it in nuts, seeds, and plant oils, and it's usually easy to get enough through a varied diet.

Vitamin F (Sort of)

Not actually a vitamin, "vitamin F" is just a nickname for two omega fatty acids: alpha-linolenic acid (ALA) and linoleic acid (LA). These essential fats support brain function, reduce inflammation, and help maintain healthy skin and cell membranes. Since they're technically not vitamins, we'll let them quietly bow out.

Vitamin K

No, you didn't miss vitamins G through J: they were renamed over the years. But vitamin K is real, and crucial for blood clotting.

Deficiencies are more common in children and can lead to bruising and bleeding that's hard to stop. Supplements are effective and given after birth.

Most adults get enough through foods like leafy greens and grains.

And the winner is…

All these vitamins are important—and all are found in a wide range of everyday foods. But which single food provides the widest variety?

Kale, oily fish, and eggs come in strong at second, third, and fourth. But number one is: liver.

Yes, liver. The stuff of childhood dread and overcooked school dinners. But it's also rich in vitamins A, B, D, and K. So rich in vitamin A, in fact, that it's advised to eat it only once a week to avoid vitamin A toxicity, and not at all if you're pregnant. Sometimes, you just can't win.

What Is The One Meal a Day (OMAD) Diet?

By Laura Dorwart
Published on February 07, 2025
Medically reviewed by Sohaib Imtiaz, MD

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The one-meal-a-day (OMAD) diet is extreme intermittent fasting. Intermittent fasting involves restricting your eating periods to certain times, usually to burn more fat and lose weight. People who follow the OMAD diet fast for 23 hours and then consume all of their daily calories and nutrients in a single meal during the remaining hour [1]

While many people do lose weight while on the OMAD diet, it can have negative impacts on your mind and body.

ArtMarie / Getty Images

Impact On Your Mind and Body

Long periods of fasting can significantly damage both mind and body, making it challenging to maintain daily routines and overall well-being.

When you go extended hours without eating, you may experience:

- A noticeable decline in your energy levels: This can make it difficult to stay active and exercise regularly.
- Inability to concentrate, making it harder to focus on tasks, retain information, and perform at your best in work, school, or other responsibilities.

- Headaches and dizziness, which can affect your ability to drive or even walk
- Abnormal drop in blood sugar levels, which may cause shakiness

There is some evidence that intermittent fasting, including the OMAD diet, may help you lose weight and burn fat more quickly than restricting calories alone. It's also been shown to improve certain biomarkers in people with health conditions like insulin sensitivity.[2]

If you are considering the OMAD diet, speak with a healthcare provider.[3]

Why Most People Should Avoid the OMAD Diet

Despite its potential benefits, the OMAD diet is extremely difficult to sustain for most people. Most obviously, fasting for 23 hours at a time can sap your energy levels and make it harder to focus on anything but your hunger. It can also lead to side effects such as:[2]

- Fainting
- Fatigue
- Headache
- Hypoglycemia (low blood sugar)
- Insomnia
- Light-headedness
- Nausea
- Weakness

Dramatic intermittent fasting, such as OMAD, can raise health risks in people with underlying conditions, such as heart disease.

One 2024 study found that people who followed a time-restricted eating pattern were 91% more likely to die of cardiovascular disease (conditions of the heart and blood vessels) than those who followed a standard eating schedule. The risk was particularly increased for people with cancer.[4]

People with kidney disease and diabetes may also face potential complications, as intermittent fasting can be taxing on the kidneys.[5]

When Do Experts Say You Should Eat?

There's technically no agreed-upon time when it's "best" to fast on the OMAD diet. Usually, people choose a schedule that works with their daily routine.[1]

However, some experts recommend eating breakfast and fasting later in the day. This is because eating large meals just before bedtime may spike your blood glucose (sugar) overnight, and eating breakfast can help with blood sugar control.[6]

How to Decide If One Meal a Day Is Right for You

The best way to decide if the OMAD diet—or any form of intermittent fasting or other changes in your dietary pattern, for that matter—is to consult a healthcare professional, such as a registered dietitian or a registered dietitian nutritionist.

They can tailor an eating plan and schedule to fit your needs and preferences. They can also perform a physical examination if necessary. Most importantly, they can review your medical and family history, including any medications you're currently taking, to let you know if intermittent fasting is safe and effective for you [5]

Other Methods of Intermittent Fasting

In addition to the OMAD diet, other popular forms of intermittent fasting include

- **16-to-8 method:** Fasting for 16 hours and eating within an eight-hour window
- **18-to-6 method:** Fasting for 18 hours and eating within a six-hour window
- **5-to-2 method:** Eating as usual for five days of the week and fasting for two days
- **Alternate-day fasting:** Fasting every other day and eating as usual on the other days
- **Fasting-mimicking diet:** Eating a small portion of food during fasting times

Summary

The OMAD diet is a form of intermittent fasting that involves fasting for 23 hours and eating within the remaining hour of the day. Some research indicates that it may help with short-term weight loss, improve lipid profiles, lower inflammation, and reduce insulin resistance in people with conditions like prediabetes and metabolic syndrome.

However, intermittent fasting comes with major potential health risks for people with conditions such as kidney disease, diabetes, and cancer. The OMAD diet, in particular, is difficult to sustain and may lower your energy levels, leading to fatigue and problems with cognitive functioning. It’s also not necessarily more effective for weight loss than simply restricting your calorie intake.

To be sure it's safe for you, consult a healthcare provider, a registered dietitian, or another healthcare professional before trying intermittent fasting.