

HEALTH

## Want to Live Longer? This Common Supplement Might Be An Anti-Aging Key

Worms and lab mice fed taurine lived longer and middle-aged monkeys had stronger bones and less age-related inflammation.

BY MIRIAM FAUZIA

15 HOURS AGO

Tanja Ivanova/Moment/Getty Images

As the number of adults over age 65 is expected to boom by 2050, there's nothing more important to **Vijay Yadav**, who heads Columbia University's Systems Biology of Aging Laboratory, than to uncover the secrets to healthy aging.

In 2012, a bizarre lab result stumped Yadav. He noticed that in a set of blood samples, levels of the amino acid taurine were much lower than any other reading. This curious finding set him, and many other scientists across the globe, on a decade-long scientific journey to parse apart this biochemical mystery. Now, they think they have an answer, and it has to do with longevity.

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In a study published Thursday in the journal *Science*, Yadav, and his colleagues found that taurine appears to decline as an organism – whether mouse, monkey, or human – ages and that supplementing taurine back into a worm, mouse, or monkey's diet appears to extend the lifespan of these animals along with reversing age-related damage in tissues like the muscle, bone, and brain. It's still too early to say whether supplementing taurine will work the same for humans in adding more healthful, golden years, but the research is promising.

## WHAT IS TAURINE?

Taurine is an amino acid that's essential to human functioning. We've got taurine in abundance, although in varying amounts, throughout the brain, spinal cord, eyes, heart, and muscles, to name a few.

The functions of taurine in the body are diverse. It acts as a key component of bile acids, aiding in the digestion and absorption of fats. Taurine is also involved in the regulation of calcium levels within cells, the modulation of neurotransmitters in the brain, and ensuring cell membrane stability. It has antioxidant properties and may help protect cells from damage caused by free radicals.

Our bodies are capable of cooking up taurine from the chemical spare parts of other amino acids and vitamins, but a major source of the amino acid is dietary, particularly from protein-rich sources like meat, seafood, and dairy. Plants, unfortunately, don't contain enough taurine, so if you're following a vegetarian or vegan diet, you might have lower taurine levels than folks who regularly eat animal products.

This brings us to the matter of taurine deficiency. Being on a plant-based diet may put you at risk, but there's also the thought that, more so than diet, our bodies become either less efficient or completely lose the ability to self-manufacture taurine as we age. And this could have detrimental effects. In animal studies involving mice and cats, the taurine deficiency was found to cause a variety of age-associated ailments like **visual and hearing loss** and **kidney issues**; in other animal studies where the mom had a taurine deficiency, the offspring **developed neurological abnormalities that extended throughout life.**

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## STRONGER MUSCLE, LESS ANXIOUS BRAIN

When you're low on vitamins or minerals, taking a supplement can usually resolve it. But would that work for a taurine deficiency, and would it combat aging long-term?

For Yadav and his colleagues, it was important to test this out, especially to drill down whether declining taurine levels caused aging or whether it was aging curtailing the amino acid.

The first part of the experiment involved looking at how taurine levels, as seen in the blood, fared across mice, rhesus monkeys, and humans with age. The results were pretty unanimous: lab mice a little over a year old had far less taurine in their blood compared to four-week-old pups, 15-year-old rhesus monkeys (equivalent to a 45-year-old in human years) had levels 85 percent lower than five-year-old monkeys. For humans, Yadav and his colleagues looked at taurine levels obtained from Finland's Kuopio Ischemic Heart Disease Risk Factor Study, Kocaeli University in Turkey, and the **EPIC-Norfolk Study**, charted how the levels changed with age and found that there was an 80 percent decrease between younger individuals and the elderly.

With that established, the researchers set about testing to see if supplementing with taurine helped not only with longevity but reversing or at least alleviating health issues associated with aging. This part of the study mostly involved giving lab mice taurine daily, either lifelong (for the younger mice) or for several months for middle-aged mice. (A group of animals that didn't get taurine served as a control).

Lab mice that got taurine mixed into their chow starting at four weeks old lived longer – by 10 to 12 percent, with life expectancy at 28 months increased by 18 to 25 percent. Mice genetically engineered without the protein needed to deliver taurine into cells also exhibited shorter lifespans. Not only that, when 14-month-old female mice (basically mousy middle-aged) were put on either 500 (dubbed T500) or 1000 milligrams per kilogram body weight per day (or T1000), they had stronger muscles, better bones, exhibited less depression and anxiety-like behaviors, lost weight in their fat pads, and less inflammation compared to their brethren not fed taurine. These seemingly stellar age-reversal benefits appeared to be dose-dependent, so better outcomes at the higher 1,000-milligram dose.

The same was observed for rhesus monkeys who were between 45 to 50 years old in human years. For six months, one group got the T1000 mouse group equivalent at 250 milligrams per kilogram body weight per day; the other group got nothing. Yadav and his colleagues saw the older monkeys doped up on taurine had increased bone density in their spines and legs, lower fasting blood sugar levels, lower levels of enzymes associated with liver damage, less inflammation, and reduced levels of biochemical markers associated with mitochondrial dysfunction.

The scientists had also tested taurine supplementation in yeast and worms, finding the amino acid didn't do much for single-celled yeast (probably due to evolutionary differences in how taurine is used by the microorganism). But it did wonders for the worms' lifespan, extending it by 10 to 23 percent, especially at higher taurine concentrations. This finding was independently corroborated by studies done at the University of Washington in Seattle and the National Institute of Immunology in New Delhi, India.

## SHOULD YOU START SUPPLEMENTING?

So you might be eager to get your hands on some taurine supplement, maybe even throw back your favorite energy drink (many of which contain about a gram of the amino acid) in the hopes of beating Death at its own game. At a press conference, Yadav and his co-author [Henning Wackerhage](#), a molecular exercise physiologist at Germany's Technical University of Munich, say that more research and clinical trials in humans are needed before you jump on the taurine bandwagon.

"It's good if it works in mice, worms, [and] monkeys and some correlational studies in humans, but what really matters now is that we need a human intervention study," Wackerhage told reporters. "We really need funding in order to give people either taurine or a placebo, and then we need to check whether these humans who got taurine live healthier for longer."

This point is especially important since it's not entirely clear, at least in humans, how taurine is wiping away aging's physiological and biological ravages. From this study, looking at mouse cells, it appears the amino acid may be helping out components of mitochondrial DNA, clearing up free radicals, calming down the immune system, and finetuning metabolism.

INVERSE



**Inese Baur**, a professor of physiology at the University of Pennsylvania Perelman School of Medicine, wrote in an accompanying perspective to the study that further investigations into taurine's biochemical mechanisms and its interaction with microbial communities living within us – the microbiome – are warranted since we don't have a lot of data on the long-term safety of taurine supplementation.

"Taurine is notably a source of energy for gut microbes and may influence, or be influenced by microbiota composition. A singular focus on increasing dietary taurine risks driving poor nutritional choices because plant-rich diets are associated with human health and longevity," Baur wrote. "Thus, like any intervention, taurine supplementation with the aim of improving human health and longevity should be approached with caution."

One thing you could do to up your body's taurine stores is exercise. For the study, Wackerhage's lab had 35 healthy young men, all at varying levels of physical activity ranging from sedentary to competitive athletes, riding a stationary bicycle for a bout of cardiovascular exercise. All groups saw a spike in chemicals associated with taurine, like hypotaurine, an antioxidant, and N-acetyltaurine, which helps with metabolism.

It's also hard to say where taurine fits in with other touted anti-aging drugs like rapamycin and metformin. Wackerhage says alongside human intervention studies, we would need investigations ranking the longevity and health potency of taurine against these drugs and whether combination therapy, for instance, taking taurine alongside metformin, bears any significant benefits.

Says Yadav: "At the end of the day, these findings should be relevant to humans." For our longevity-

HEALTH

## Ground-Breaking Genetics Library Finally Represents the Whole of Humanity

This collection of human genomes will ensure that no genetic variation is left out.

BY ELANA SPIVACK

MAY 10, 2023



Photo: Leah, NHGRI

## INVERSE

Twenty years ago last month, scientists sequenced the **first human genome** in the landmark Human Genome Project. Among the many things they discovered was that while any two humans have **99.6 percent** of their genome in common, the remaining 0.4 percent leaves plenty of room for variation. That tiny fraction is also likely responsible for many diseases and conditions. Two decades later, scientists are still trying to unpack how that 0.4 percent influences us.



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Now, swaths of researchers around the world have been working to dive into that remaining, highly variable part of human DNA. **Published today** in the journal *Nature*, with authors from Canada, Denmark, Germany, Italy, Japan, Spain, the UAE, the UK, and the US, researchers created what they are calling the human pangenome reference consortium, a collection of sequenced human genomes that aims to eventually represent as many possible DNA sequences found across our species. Their work offers a starting point for comparing genetic variation so that we may better understand how genes vary and mutate across our species.

The new pangenome reference is a collection of different genomes from which to compare an individual genome sequence. [DARRYL L.F.JA. NHGRI](#)

## WHAT IS THE PANGENOME?

This burgeoning genetic library will represent genomes across *Homo sapiens* so that we may better understand genetic variation among ourselves. By comparing the myriad changes, we can fill in gaps to help treat those of different ancestry who are prone to certain conditions. The pangenome is a composite of genome sequences from 47 people compiled into one data structure.



Albeit extremely simplified, the pangenome might function as a collection of names that includes all the many ways to spell Eric. As an example, at this particular press conference for this research, there were three speakers who were all affiliated with this research: **Eric Green**, director of the National Human Genome Research Institute; **Erich Jarvis**, a genetics professor at Rockefeller University's Howard Hughes Medical Institute; and **Erik Garrison**, a genetics professor at University of Tennessee's College of Medicine.

These three first names share a good deal of overlap – between 75 and 80 percent identical – but with crucial variations. A reference consortium that looks at names, for instance, could include all the many ways to spell this name, highlighting what's shared and what diverges.

Instead of looking at the letters in a name, the pangenome looks at the base pairs in DNA. This library compares among the 47 genomes what's identical and what differs. The more genomes it contains, the more variation it can account for, just like with these three homophonous names. If there's only one genome on record – Eric – then all variations on that genome (or name) are left out. If the only sequenced genomes on record come from healthy white people of Western ancestry, then it doesn't account for the myriad variations among the rest of the world's population.

While the Human Genome Project only looked at the genomic equivalent of the name Eric, the pangenome accounts for different ways to spell the name.

## WHY IS IT IMPORTANT?

The Human Genome Project sourced genetic material from about 20 people, though the majority of its information came from just one person. If that one person were to serve as the singular genetic blueprint, think of all the types of people whose genes would go unaccounted for. The pangenome creates a composite of different genomes to highlight where variations occur.

"This pangenome reference represents an incredible scientific achievement," said Green in a press conference, "providing an expanding view of humanity's DNA blueprint with a significantly greater human diversity than previous reference sequences."

The genome is a map for genetic researchers. The 3.2 billion base pairs (all some combination of guanine, adenine, cytosine, and thymine) provide instructions for how every cell encodes and builds the proteins that we need to function every day. Among those base pairs also lie the changes and mutations that cause genes to code differently, resulting in different diseases or conditions.

The pangenome is a game changer for all genetic researchers. **Wendy Chung**, a molecular geneticist at Columbia University Irving Medical Center, who was not involved in the research, recognizes that the genome can vary in slight but potent ways depending on one's origins. As this research helps us move forward in treating diseases, she tells *Inverse* it's important to her that "we're not leaving anyone behind."

While Chung recognizes that this first draft isn't perfect, she calls it "an important step forward" in incorporating genes from those around the world.

**INVERSE**



## HOW WILL THE PANGENOME HELP RESEARCHERS?

This wealth of data will be a boon for genetics and diagnostics research. The authors acknowledged that risk conditions from coronary heart disease to schizophrenia are linked to genetic mutations that still aren't fully understood. Co-author **Evan Eichler**, professor of genome sciences at the University of Washington School of Medicine, said that these complete sequences account for complete genetic variation that may increase the risk for these conditions. This means that it will be easier for diagnostics researchers to pinpoint the genetic mutation responsible for a disease.

"The mechanics in terms of how we're building this reference are essentially going to transform the discovery of rare diseases or genetic causes," he said.

Some populations are more prone to genetic mutations than others. For example, those of Ashkenazi descent are at higher risk for Tay-Sachs Disease, and African Americans are at higher risk for heart disease. A comparative genomic collection creates a more complete portrait of the human genome, accounting for how genomes may diverge depending on a person's origins.

"We now understand that having one map with a single human genome cannot adequately represent all of humanity," said co-author **Karen Miga**, a biomolecular engineering professor at the University of California, Santa Cruz, during the press conference. "It really is understanding and cataloging these differences between genomes that allow us to understand how cells operate."

## WHAT'S NEXT?

By 2024, the pangenome is expected to grow from 47 individuals to 350. Miga said that important next steps involve bringing in more partnerships and stakeholders, eventually establishing an international consortium called the Human Pangenome Project. Researchers currently work alongside **Global Alliance for Genomics and Health**, an international nonprofit that supports and shares genomic research.

If the pangenome reference consortium grows, it will account for more genetic variations. The goal, researchers say, is for no variation to be left out.

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