

MEDICAL RESEARCH VOL 6



Using innovative MRI technology, scientists are discovering that overlooked fat tissue might hold crucial clues about heart disease. (© appledesign – stock.adobe.com)

CHARLOTTESVILLE, Va. — Your heart harbors a secret: a layer of fat that can either protect it or potentially contribute to its demise. Now, University of Virginia researchers have invented a revolutionary MRI technique that allows them to study this enigmatic tissue in unprecedented detail, potentially opening new frontiers in cardiac medicine.

This innovative technique examines epicardial adipose tissue (EAT), a specialized fat layer that wraps around our hearts. While EAT naturally serves protective functions in healthy individuals, providing both energy reserves and thermal insulation for the heart, it can undergo concerning changes under certain conditions.

The research team, led by Dr. Frederick H. Epstein, of UVA's Department of Biomedical Engineering, developed this specialized MRI technique to examine the fatty acid composition of EAT, measuring different types of fats: [saturated](#), monounsaturated, and polyunsaturated fatty acids.

“Using this new MRI technique, we now for the very first time have the ability to know the composition of the fat that accumulates around the heart. This is important because depending on its makeup, the fat which surrounds the heart has the potential to release damaging substances directly into the heart muscle, leading to serious [heart problems](#),” explains researcher Amit R. Patel, MD, a cardiologist and imaging expert at UVA Health.

To test their new imaging method, the researchers studied 21 patients who had experienced ST-segment elevation myocardial infarction (STEMI), a severe type of [heart attack](#). All patients were examined within 96 hours after blood flow was restored to their hearts. The study group included 14 men and seven women, with an average age of 62.6 years.

The technique provides detailed insights into EAT composition that weren’t previously possible with conventional imaging. Understanding the proportions of different fat types is crucial because each affects heart health differently. For instance, saturated fats [have been linked](#) to inflammatory responses in adipose tissue, while certain unsaturated fats may help counter inflammation.

One of the major technical achievements was developing a method that could capture clear images despite the constant motion of the heart and lungs. “The ability to make these measurements in epicardial adipose tissue required the use of advanced computational methods that can extract the unique signature of [saturated fatty acids](#) from an overall noisy signal,” explains Epstein, who also serves as associate vice president for research at UVA.

The study found distinct differences in EAT composition compared to other fat deposits in the body. Notably, the researchers discovered significant correlations between EAT composition and measures of heart function and structure in STEMI patients. The findings suggest that analyzing EAT composition might provide valuable insights into cardiac health and disease progression.



As this new technology moves from research labs to clinical practice, it may transform how we view, diagnose, and treat heart disease. (ID 328527023 © Dmitry Buksha | Dreamstime.com)

Looking ahead, Dr. Patel envisions potential therapeutic applications. “With our ongoing research, we hope to show that we can convert the unhealthy fat which surrounds the heart to a more healthy type of fat with either diet and exercise or through the use of medications. We believe that by doing so, we will be able to reduce some of the complications associated with heart disease.”

From protective cushion to potential indicator of [heart health](#), the fat surrounding our hearts may hold crucial clues about cardiac disease. This new imaging technique brings us closer to understanding its complex role.

Paper Summary

Methodology

The researchers developed a specialized MRI sequence that captures multiple images of the heart area during a single breath-hold. The technique uses a complex mathematical model to analyze how different types of fat molecules respond to magnetic fields, allowing them to distinguish between various fatty

acids. The images are then processed using advanced computer algorithms to reduce noise and improve clarity, resulting in detailed maps of fat composition.

Results

The study found that EAT had significantly lower levels of polyunsaturated fats compared to other body fat deposits. Importantly, patients with higher levels of saturated fats in their EAT showed larger heart chambers and reduced heart function. The technique proved highly accurate when tested on oil phantoms (test objects), showing strong correlations with known fat compositions.

Limitations

The study focused specifically on STEMI patients examined within a narrow time window after their heart attacks, so findings may not generalize to other populations or cardiac conditions. The sample size was relatively small at 21 patients. The technique requires sophisticated MRI equipment and complex data processing, which might limit its widespread adoption. Additionally, the imaging method works best on larger deposits of fat tissue and may be less accurate for very thin EAT layers.

Discussion and Takeaways

The research suggests that the composition of fat around the heart, not just its quantity, may play a crucial role in heart disease. The ability to analyze this fat non-invasively could lead to better understanding of heart disease progression and potentially new treatment strategies. The technique might also help identify patients at higher risk of heart problems before they develop severe symptoms.

Funding and Disclosures

The study received substantial support from multiple prestigious organizations, including the National Heart, Lung, and Blood Institute (grant R01 HL162872), the National Institute on Aging (grant R01 AG076360), the American Heart Association (grant 23PRE1011202), and the National Institutes of Health (grant T32 HL007284). The researchers disclosed all their funding sources and declared

no conflicts of interest. This extensive funding underscores the perceived importance and potential impact of this research in the field of cardiac medicine.

As the world shifts away from fossil fuels, clean hydrogen has emerged as a leading candidate for next-generation energy due to its zero carbon emissions. However, existing hydrogen production technologies face significant barriers. Conventional thermochemical methods, which rely on the oxidation-reduction of metal oxides, require extremely high temperatures of up to 1,500°C. These methods are not only energy-intensive and costly but also challenging to scale, limiting their practical application.

To address these challenges, the POSTECH team turned to a familiar yet underutilized energy source: "microwaves" energy, the same source used in household microwave ovens. While microwaves are commonly associated with heating food, they can also drive chemical reactions efficiently.

The researchers demonstrated that microwave energy could lower the reduction temperature of Gd-doped ceria (CeO_2)—a benchmark material for hydrogen production—to below 600°C, cutting the temperature requirement by over 60%. Remarkably, microwave energy was found to replace 75% of the thermal energy needed for the reaction, a breakthrough for sustainable hydrogen production.

Is Your Drinking Water Safe? Common Chemicals Linked to Rising Cancer Risk

BY KECK SCHOOL OF MEDICINE OF USC JANUARY 24, 2025



Communities with PFAS-contaminated drinking water face up to a 33% higher risk of certain cancers, contributing to an estimated 6,864 cancer cases annually in the U.S., according to a Keck School of Medicine study. These findings highlight the need for stricter PFAS regulations to better protect public health.

Researchers at the Keck School of Medicine of USC discovered a link between levels of manmade “forever chemicals” in drinking water and an increased risk of certain cancers, including those affecting the digestive system, endocrine system, respiratory system, and mouth and throat.

New research from the [Keck School of Medicine at USC](#) reveals that communities with drinking water contaminated by manufactured chemicals called per- and polyfluoroalkyl substances (PFAS) face up to a 33% higher risk of developing certain cancers.

Published in the *Journal of Exposure Science and Environmental Epidemiology* and funded by the National Institutes of Health, this is the first U.S.-based study to directly examine the link between PFAS contamination in drinking water and cancer.

PFAS are widely used in consumer products like furniture and food packaging and have been detected in approximately [45% of drinking water supplies](#) across the United States. These chemicals are slow to degrade and accumulate in the body over time. Previous studies have connected PFAS exposure to several health issues, including kidney, breast, and testicular cancers.

To paint a more comprehensive picture of PFAS and cancer risk, Keck School of Medicine researchers conducted an ecological study, which uses large population-level datasets to identify patterns of exposure and associated risk. They found that between 2016 and 2021, counties across the U.S. with PFAS-contaminated drinking water had a higher incidence of certain types of cancer, which differed by sex. Overall, PFAS in drinking water are estimated to contribute to more than 6,800 cancer cases each year, based on the most recent data from the U.S. Environmental Protection Agency (EPA).

“These findings allow us to draw an initial conclusion about the link between certain rare cancers and PFAS,” said Shiwen (Sherlock) Li, PhD, a postdoctoral researcher in the Department of Population and Public Health Sciences at the Keck School of Medicine and first author of the study. “This suggests that it’s worth researching each of these links in a more individualized and precise way.”

In addition to providing a roadmap for researchers, the findings underscore the importance of regulating PFAS. Starting in 2029, the EPA will police levels of [six types of PFAS](#) in drinking water, but stricter limits may ultimately be needed to protect public health, Li said.

The toll of PFAS

To understand how PFAS contamination relates to cancer incidence, the researchers compared two exhaustive datasets—one covering all reported cancer cases and the other including all data on PFAS in drinking water data across the country. Data on cancer cases between 2016 and 2021 were obtained from the National Cancer Institute’s [Surveillance, Epidemiology, and End Results Program](#), while data on PFAS levels in public drinking water (2013-2024) came from the EPA’s [Unregulated Contaminant Monitoring Rule programs](#).

Li and his colleagues controlled for a number of factors that could influence cancer risk. At the individual level, these included age and sex; at the county level, they ruled out changes in cancer incidence due to socioeconomic status, smoking rates, obesity prevalence, urbanicity (how urban or rural an area is), and the presence of other pollutants.

The researchers then compared cancer incidence in each county to PFAS contamination in the drinking water, using the EPA’s recommended cutoffs for each type of PFAS. Counties where drinking water surpassed the recommended maximum levels of PFAS had a higher incidence of digestive, endocrine, respiratory, and mouth and throat cancers. Increases in incidence ranged from slightly elevated at 2% to substantially elevated at 33% (the

increased incidence of mouth and throat cancers linked to perfluorobutanesulfonic acid, or PFBS).

Males in counties with contaminated drinking water had a higher incidence of leukemia, as well as cancers of the urinary system, brain, and soft tissues, compared to males living in areas with uncontaminated water. Females had a higher incidence of cancers in the thyroid, mouth, and throat, and soft tissues. Based on the latest available EPA data, the researchers estimate that PFAS contamination of drinking water contributes to 6,864 cancer cases per year.

“When people hear that PFAS is associated with cancer, it’s hard to know how it’s relevant. By calculating the number of attributable cancer cases, we’re able to estimate how many people may be affected,” Li said, including inferring the personal and financial toll of these cases year after year.

Protecting public health

These population-level findings reveal associations between PFAS and rare cancers that might otherwise go unnoticed. Next, individual-level studies are needed to determine whether the link is causal and to explore what biological mechanisms are involved.

On the regulation side, the results add to the mounting evidence that PFAS levels should be limited, and suggest that proposed changes may not go far enough.

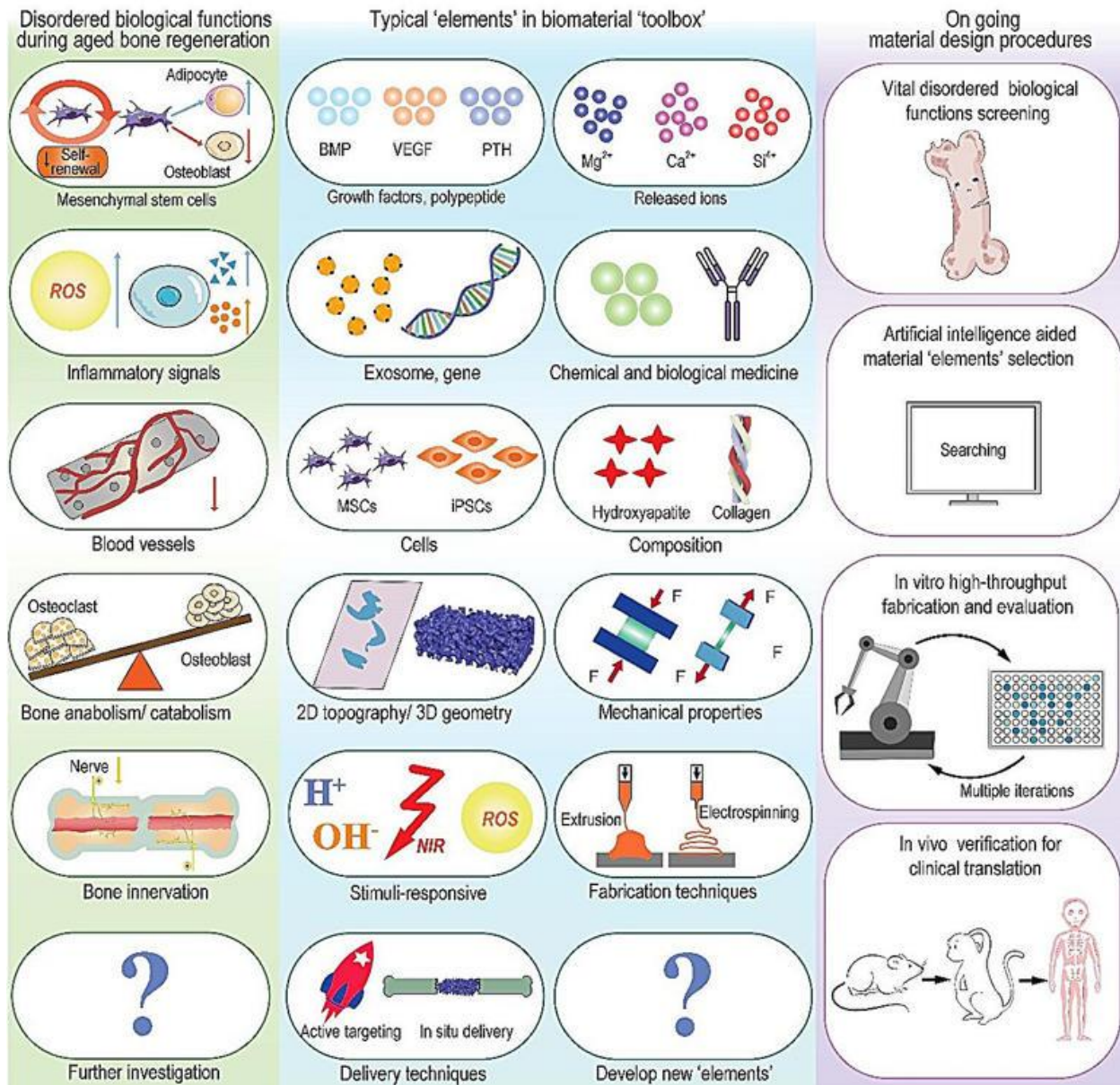
“Certain PFAS that were less studied need to be monitored more, and regulators need to think about other PFAS that may not be strictly regulated yet,” Li said.

Reference: “Associations between per- and polyfluoroalkyl substances (PFAS) and county-level cancer incidence between 2016 and 2021 and incident cancer burden attributable to PFAS in drinking water in the United States” by Shiwen Li, Paulina Oliva, Lu Zhang, Jesse A. Goodrich, Rob McConnell, David V. Conti, Lida Chatzi and Max Aung, 9 January 2025, *Journal of Exposure Science & Environmental Epidemiology*.
[DOI: 10.1038/s41370-024-00742-2](https://doi.org/10.1038/s41370-024-00742-2)

The work is part of a collaboration between the Southern California Environmental Health Sciences Center, which is funded by the National Institute of Environmental Health Sciences, and the USC Norris Comprehensive Cancer Center at the Keck School of Medicine.

This work was supported by a pilot grant from the Southern California Environmental Health Sciences Center [P30ES007048] and the National Cancer Institute [5P30CA014089-47].

Materiobiology: Advances in aging bone regeneration material development



The new development process for aging bone regeneration materials focuses on in-depth research of dysfunctional mechanisms, the development of a biomaterial 'toolbox', AI-assisted material design, and high-throughput in vitro manufacturing and evaluation of materials. Credit: Science China Press© Provided by Medical Xpress

In the elderly, a multitude of factors contribute to diminished bone regeneration capabilities, including a reduction in the self-renewal and differentiation abilities of mesenchymal stem cells, an excessive accumulation of inflammatory signals,

compromised blood vessel regeneration capacity, an imbalance between bone anabolism and catabolism, and inadequate bone innervation.

While biomaterials have enhanced the therapeutic outcomes for bone regeneration, their efficacy is notably reduced in the context of aged bone regeneration. Consequently, it is imperative to devise new biomaterial design strategies specifically aimed at rejuvenating aged bone.

In the realm of aged bone repair, materiobiology emphasizes the meticulous modulation and restoration of biological functions at various levels—cellular, tissue, organ, and organism—through the use of functionalized biomaterials.

This approach leverages a systematic amalgamation of "elements" from the biomaterial "toolbox," which encompasses biochemical factors (such as growth factors, polypeptides, chemical and biological drugs, and genes) and tailored biophysical effects (including composition, mechanical properties, two-dimensional topography, three-dimensional geometry, as well as advanced delivery and fabrication technologies).

Researchers comprehensively discuss the current characteristics of aged bone regeneration, typical elements within the biomaterial toolbox, and the ongoing procedures for material design. To enhance the design of biomaterials for correcting disordered biological functions in aged bone, a toolbox comprising various essential elements has been established. The research is [published](#) in the journal *National Science Review*.

Guided by this material design strategy, standard material design procedures can be summarized as follows: identifying critical disordered biological functions as therapeutic targets for bone repair in the elderly; based on the characteristics of the selected biological functions, synergistically combining elements from the biomaterial toolbox with artificial intelligence (AI) support; optimizing the elements of modular biomaterials for aged bone regeneration through iterative refinements of composition and structure using in vitro high-throughput fabrication and evaluation technologies; conducting in vivo validation of the optimized biomaterials in small animals and non-human primates to facilitate clinical translation.

Further refinement of this material design strategy focuses on uncovering new aspects of biological functions that impede aged bone regeneration and

developing novel elements targeting specific biological functions. The establishment of a specialized database to match specific biological functions with modular biomaterial 'elements' through artificial intelligence presents a promising avenue for accelerating aged bone regeneration.

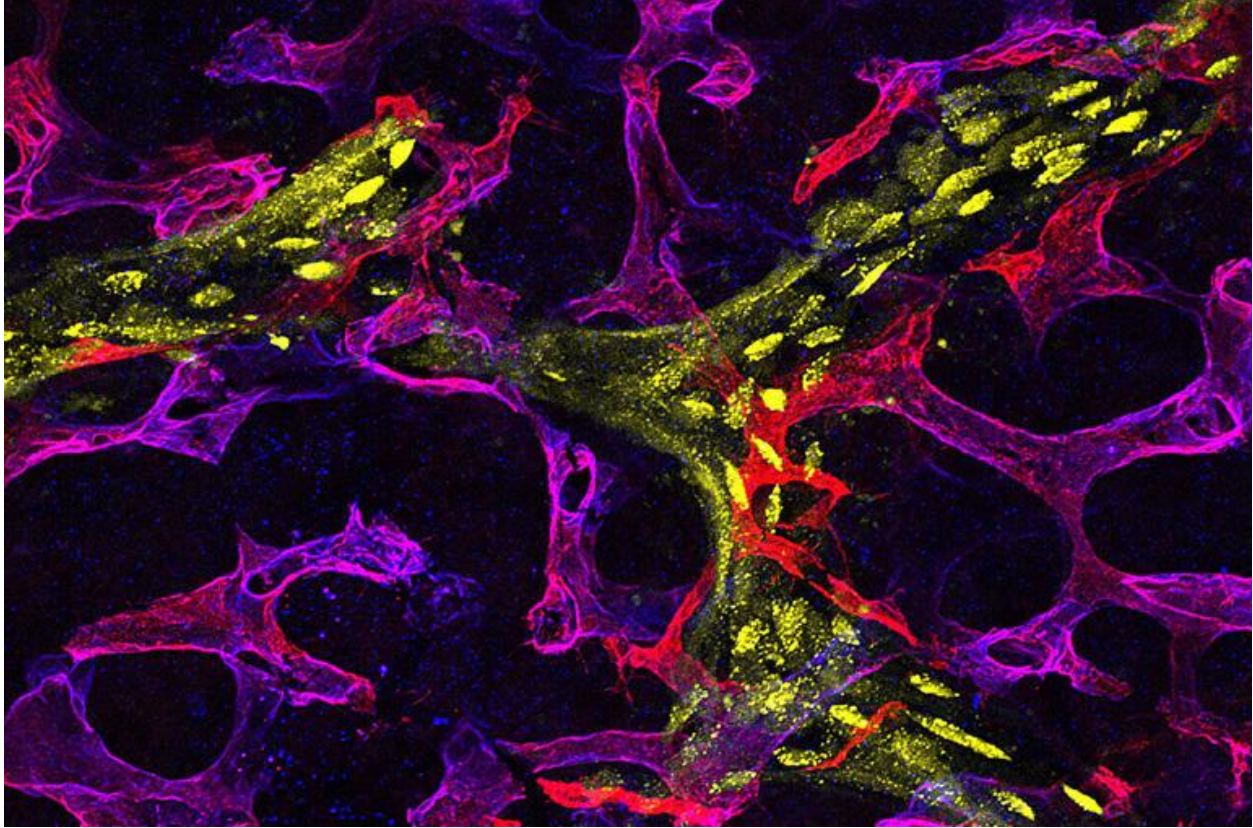
As a nascent interdisciplinary field, materiobiology requires the involvement of researchers from diverse domains to expand its scope and depth continually. This involves elucidating the intrinsic connections between the fundamental physicochemical properties of materials and their biological functions and establishing reliable predictive models to foster a genuine convergence of materials with biology, thereby expediting the development process of biomaterials.

Kay Dai, an associate professor at East China University of Science and Technology; Zhen Geng, an associate professor at Shanghai University; and Wenchao Zhang, a doctoral student at East China University of Science and Technology, are the review's first authors. The corresponding authors are Changsheng Liu, an academican of Chinese academy, at East China University of Science and Technology; Jing Wang, a professor at the same institution, and Guangjun Nie, a distinguished professor at the National Center for Nanoscience and Technology.

More information: Kai Dai et al, Biomaterial design for regenerating aged bone: materiobiological advances and paradigmatic shifts, *National Science Review* (2024). DOI: [10.1093/nsr/nwae076](https://doi.org/10.1093/nsr/nwae076)

Provided by Science China Press

Newly identified Type R capillaries crucial for bone remodeling and aging



Coupling of type R capillaries and remodeling bone: Distribution of EMCN+ VEGFR3- Type R capillaries (red) around trabecular bone marked by Sp7-mCherry+ osteoblasts (yellow). Credit: MPI for Molecular Biomedicine / Vishal Mohanakrishnan

Throughout our lives, our bones are continuously remodeled to maintain strength, repair injuries and adapt to new stresses. Bone dynamics depend on two associated cell types: osteoblasts, which are responsible for bone formation, and osteoclasts, which are responsible for bone resorption. Until now, it has not been understood how these cells function in the low-oxygen microenvironment of bone.

Researchers at the Max Planck Institute for Molecular Biomedicine have achieved a breakthrough by discovering a new type of capillary that is involved in bone remodeling: Type R capillaries. These are a special, physiologically important group of blood vessels that are essential for maintaining healthy bones throughout adulthood and especially during the aging process.

The paper is [published](#) in the journal *Nature Cell Biology*.

Earlier, Ralf Adams and colleagues at the Max Planck Institute for Molecular Biomedicine had discovered so-called Type H and Type L capillaries in long bones. Type H capillaries are exclusively found in the growth plate of the bone, whereas capillaries of the L-type are found in the inner bone.

Now, researchers in the team of Ralf Adams reveal another fundamental player in the skeletal system of the mouse: Type R capillaries, which are essential in the remodeling of bone—not only in adulthood, but also in aging.

Vishal Mohanakrishnan, Ph.D. student and first author of the current study, explains the special features of the newly discovered capillary type, "Type R capillaries are unique vascular structures that emerge in adulthood and are located in trabecular bone, the spongy bone in long bones that makes up most of the bone matrix."

Type R capillaries cannot be thought of as passive conduits for the blood to flow through: "Type R capillaries communicate with the two major cell types of bone, the osteoblasts, which synthesize bone, and the osteoclasts, which are responsible for bone resorption to initiate normal bone remodeling," Mohanakrishnan continues.

The researchers showed that these Type R capillaries contribute to the oxygenation of hypoxic regions necessary for the survival and function of osteoblasts and osteoclasts. "Thus, Type R capillaries are critical in moderating the balance between bone formation and resorption," says Mohanakrishnan.

The researchers thus found these capillaries to be the third unique and essential player in bone remodeling, along with osteoblasts and osteoclasts, all identified by immunostaining on specially prepared bone sections.

Gabriele Bixel, co-author and expert in bone imaging with multiphoton microscopy in Ralf Adams' research team, adds, "We implemented SHG imaging, which produces high-resolution images of fibrillar collagen in various tissues. The strength of SHG imaging is that it does not require any additional labeling.

"By combining the SHG signal intrinsic to the bone collagen fibers with the immunostaining for the different cell types, we could identify the close spatial relationship of Type R vessels with the remodeling trabecular bone."

In the current study, the researchers also showed that Type R capillaries continue to support the bone remodeling throughout life and decrease in number near the trabecular bone.

"These reductions may correlate with the loss of bone mass that occurs in aged bone," says Mohanakrishnan. Surprisingly, compact bone, which forms the outer shaft of the skeletal bones, shows striking changes in thinning and development of cortical porosity, affecting the overall integrity of the bone and increasing the susceptibility to fracture.

"We showed that in the aging mouse cortical bone, new Type R capillaries are created that actually support the remodeling process," says Mohanakrishnan. He also sees these findings as important for the future. "Therapeutic strategies may target bone vascular health and provide a holistic approach to tackle the deterioration of bone health with aging and osteoporosis."

Ralf Adams, Director at the Max Planck Institute for Molecular Biomedicine and corresponding author of the study, explains, "We are very much interested in understanding the specialized functions of the different types of vascular endothelial cells in bone. Our recent discovery underscores the importance of specialized blood vessels in the bone to support the bone remodeling process in the adult and the aging body."

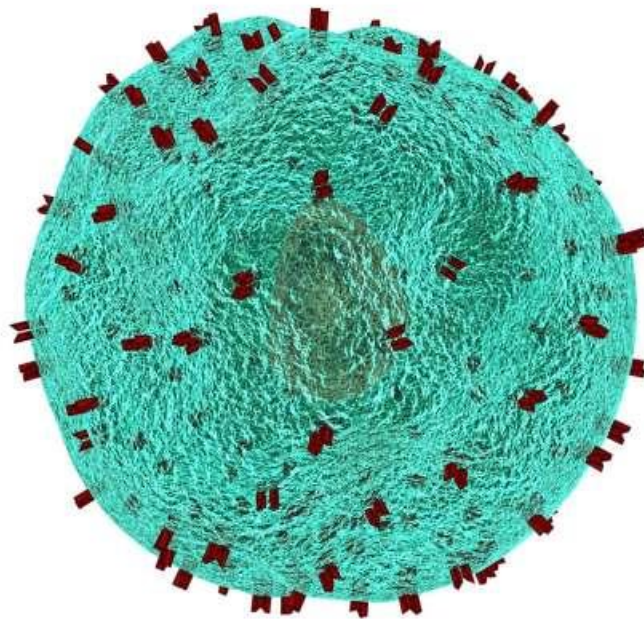
Understanding the formation and maintenance of Type R vessels in the developing and aging bone is critical to maintaining healthy and stable bone. It will be important to understand the role of these specialized vessels during bone healing after fracture injury or in osteoporosis in order to develop improved strategies for bone regeneration or in bone preservation.

More information: Vishal Mohanakrishnan et al, Specialized post-arterial capillaries facilitate adult bone remodelling, *Nature Cell Biology* (2024). DOI: [10.1038/s41556-024-01545-1](https://doi.org/10.1038/s41556-024-01545-1)

Provided by Max Planck Society

Viral protein Nef enables a step toward off-the-shelf CAR T cell therapy for cancer

by Jim Stallard, [Memorial Sloan Kettering Cancer Center](#)



Credit: Pixabay/CC0 Public Domain

CAR T cell therapy is one of the most promising new cancer treatments to emerge in recent years. It involves removing a patient's own immune T cells and engineering them to recognize specific targets on the surface of the cancer cell.

A major limitation of this type of CAR T cell therapy, called autologous therapy, is that the cells are taken from the patient and must be custom-made into a treatment. This requires patients to wait until their cells are modified for infusion—precious time they may not have.

Now research done at Memorial Sloan Kettering Cancer Center (MSK) has demonstrated a new advance that could make it possible to use off-the-shelf CAR T cells provided by healthy donors and stored, so they are ready as soon as the patient needs them. The research identifies a way to modify the donor CAR T cells, called allogeneic CAR T cells, so that they won't be rejected by the patient receiving them and will persist in fighting the cancer.

The new approach involves equipping the CAR T cells with a protein called Nef. The researchers showed that inserting Nef into donor CAR T cells enabled the cells to survive and remain potent in a [mouse model](#) for cancer.

"This could be an important step toward creating safe and effective allogeneic CAR T cells, which would greatly increase the number of patients who could benefit from this immunotherapy," says physician-scientist Karlo Perica, MD, Ph.D., the study's first author.

The research, [published](#) in *Nature*, was conducted in the laboratory of Michel Sadelain, MD, Ph.D., who is a pioneer of CAR T cell therapy. Dr. Sadelain left MSK in fall 2024.

Using viruses to study how cells can evade immune attack

The research builds upon important technical advances made in the Sadelain laboratory in recent years. The scientists knew that viruses had an array of tools to evade or withstand [immune attack](#) after entering the body and infecting cells. (When a virus invades a cell, it must keep the cell alive long enough for the virus to make copies of itself using the cell's machinery.)

"We wanted to learn which components of the immune system might cause rejection of donor CAR T cells, and how different viral proteins could figure out a way around that," Dr. Perica says. "We thought that these viruses, which have been invading cells for millennia, would have something to teach us about avoiding immune detection and keeping the cells that they invade alive."

To identify the viral protein providing the most protection, the researchers employed advanced tools developed in the Sadelain lab. By using a gene-editing tool called CRISPR, they could insert different viral proteins at a precise region in the genome of the CAR T cell called the TRAC locus.

CAR T cells made in this fashion have some remarkable properties. They maintain their cancer-fighting ability for a long time. In addition, inserting a protein at the TRAC locus replaces a receptor that can cause a donor T cell to attack the recipient's tissue—what is known as graft vs. host disease.

The researchers tested the different CAR T cells in a mouse model that contained human immune cells, making it possible to see which [viral protein](#) equipped the cells to best survive in this setting.

Nef helps CAR T cell survival

The clear winner was a protein called Nef, which is used by the HIV virus to evade detection by the immune system. It worked in two ways: First, it reduced a protein called HLA-I on the surface of the CAR T cells. HLA-I normally serves as a red flag to the immune system,

signaling that something is wrong and inviting attack—reducing HLA-I helped the cell stay undetected. In addition, Nef helped prevent a form of cell suicide called apoptosis in the CAR T cell.

"Those two mechanisms combined showed that Nef is uniquely suited to creating a powerful allogeneic CAR T cell," Dr. Perica says.

The hope is to begin testing these CAR T cells in clinical trials at some point. Off-the-shelf CAR T cells are already being tested at MSK to treat multiple myeloma, although that treatment requires immune-suppressing drugs as part of the therapy. This new advance could potentially create off-the-shelf CAR T cells that do not need deep immune suppression, which comes with an increased risk of side effects such as infection.

The benefits of donor CAR T cells

Allogeneic CAR T cells could offer additional advantages for fighting cancer. Cancer patients tend to be older and have often received treatments such as chemotherapy that can weaken their immune cells. By contrast, allogeneic T cells could come from donors who are younger and healthier, making the modified cells more likely to survive after infusion.

"The multiple discoveries coming out of Dr. Sadelain's lab have helped bring us closer to the day when we have CAR T cells right at hand to give to patients without delay," Dr. Perica says. "Removing the need for manufacturing personalized CAR T cells would make the treatment much more widely available and more affordable."

More information: Karlo Perica et al, HIV immune evasin Nef enhances allogeneic CAR T cell potency, *Nature* (2025). DOI: [10.1038/s41586-025-08657-0](https://doi.org/10.1038/s41586-025-08657-0)

Journal information: [Nature](#)

Provided by [Memorial Sloan Kettering Cancer Center](#)

AI-based pregnancy analysis discovers previously unknown warning signs for stillbirth and newborn complications

by [University of Utah Health Sciences](#)



Ultrasound data is one of a large number of factors that care providers must take into account to estimate the risk of negative outcomes during pregnancy. Credit: University of Utah Health

A new AI-based analysis of almost 10,000 pregnancies has discovered previously unidentified combinations of risk factors linked to serious negative pregnancy outcomes, including stillbirth.

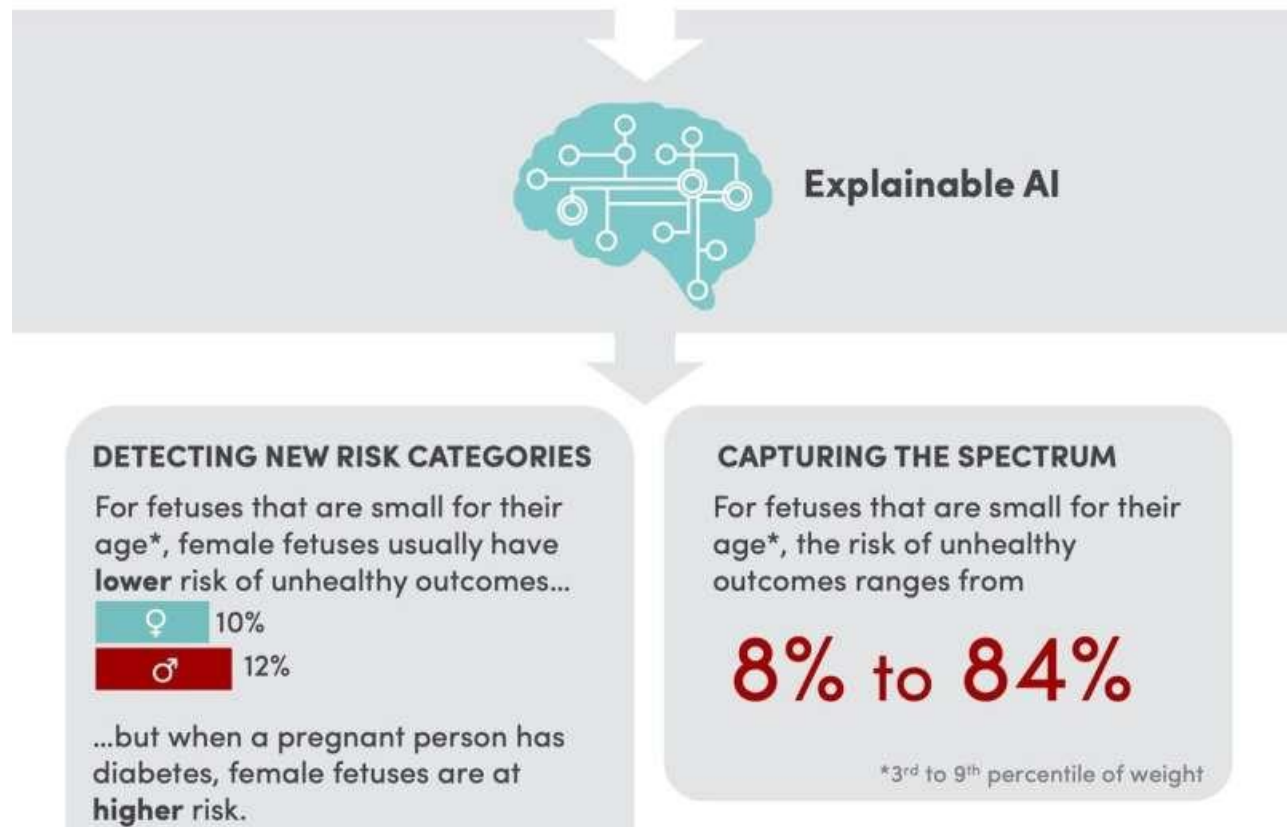
The study also found that there may be up to a tenfold difference in risk for infants who are currently treated identically under clinical guidelines.

Nathan Blue, MD, the senior author on the study, says that the AI model the researchers generated helped identify a "really unexpected" combination of factors associated with higher risk, and that the model is an important step toward more personalized risk assessment and [pregnancy](#) care.

The new results are [published](#) in *BMC Pregnancy and Childbirth*.

Unexpected risks

The researchers started with an existing dataset of 9,558 pregnancies nationwide, which included information on social and physical characteristics ranging from pregnant people's level of [social support](#) to their blood pressure, medical history, and fetal weight, as well as the outcome of each pregnancy. By using AI to look for patterns in the data, they identified new combinations of maternal and fetal characteristics that were linked to unhealthy pregnancy outcomes such as stillbirth.



By analyzing nearly 10,000 pregnancies with explainable AI, researchers identified new combinations of risk factors and found that there may be up to a tenfold difference in risk for infants who are currently treated identically under clinical guidelines. Credit: Sophia Friesen / University of Utah Health

Usually, female fetuses are at slightly lower risk for complications than male fetuses—a small but well-established effect. But the research team found that if a pregnant person has pre-existing diabetes, female fetuses are at higher risk than males.

This previously undetected pattern shows that the AI model can help researchers learn new things about pregnancy health, says Blue, an assistant professor of obstetrics and gynecology in the Spencer Fox Eccles School of Medicine at the University of Utah.

"It detected something that could be used to inform risk that not even the really flexible, experienced clinician brain was recognizing," Blue says.

The researchers were especially interested in developing better risk estimates for fetuses in the bottom 10% for weight, but not the bottom 3%. These babies are small enough to be concerning, but large enough that they are usually perfectly healthy. Figuring out the best course of action in these cases is challenging: Will a pregnancy need intensive monitoring and potentially early delivery, or can the pregnancy proceed largely as normal? Current clinical guidelines advise intensive medical monitoring for all such pregnancies, which can represent a significant emotional and financial burden.

But the researchers found that within this fetal weight class, the risk of an unhealthy pregnancy outcome varied widely, from no riskier than an average pregnancy to nearly ten times the average risk. The risk was based on a combination of factors such as fetal sex, presence or absence of pre-existing diabetes, and presence or absence of a fetal anomaly such as a heart defect.

Blue emphasizes that the study only detected correlations between variables and doesn't provide information on what actually causes negative outcomes.

The wide range of risk is backed up by physician intuition, Blue says; experienced doctors are aware that many low-weight fetuses are healthy and will use many additional factors to make individualized judgment calls about risk and treatment. But an AI risk-assessment tool could provide important advantages over such "gut checks," helping doctors make recommendations that are informed, reproducible, and fair.

Why AI?

For humans or AI models, estimating pregnancy risks involves taking a very large number of variables into account, from [maternal health](#) to ultrasound data. Experienced clinicians can weigh all these variables to make individualized care decisions, but even the best doctors probably wouldn't be able to quantify exactly how they arrived at their final decision. Human factors like bias, mood, or sleep deprivation almost inevitably creep into the mix and can subtly skew judgment calls away from ideal care.

To help address this problem, the researchers used a type of model called "explainable AI," which provides the user with the estimated risk for a given set of pregnancy factors and also includes information on which variables contributed to that risk estimation, and how much. Unlike the more familiar "closed box" AI, which is largely impenetrable even to experts, the explainable model "shows its work," revealing sources of bias so they can be addressed.

Essentially, explainable AI approximates the flexibility of expert clinical judgment while avoiding its pitfalls. The researchers' model is also especially well-suited to judging risk for rare pregnancy scenarios, accurately estimating outcomes for people with unique

combinations of risk factors. This kind of tool could ultimately help personalize care by guiding informed decisions for people whose situations are one-of-a-kind.

The researchers still need to test and validate their model in new populations to make sure it can predict risk in real-world situations. But Blue is hopeful that an explainable AI-based model could ultimately help personalize risk assessment and treatment during pregnancy.

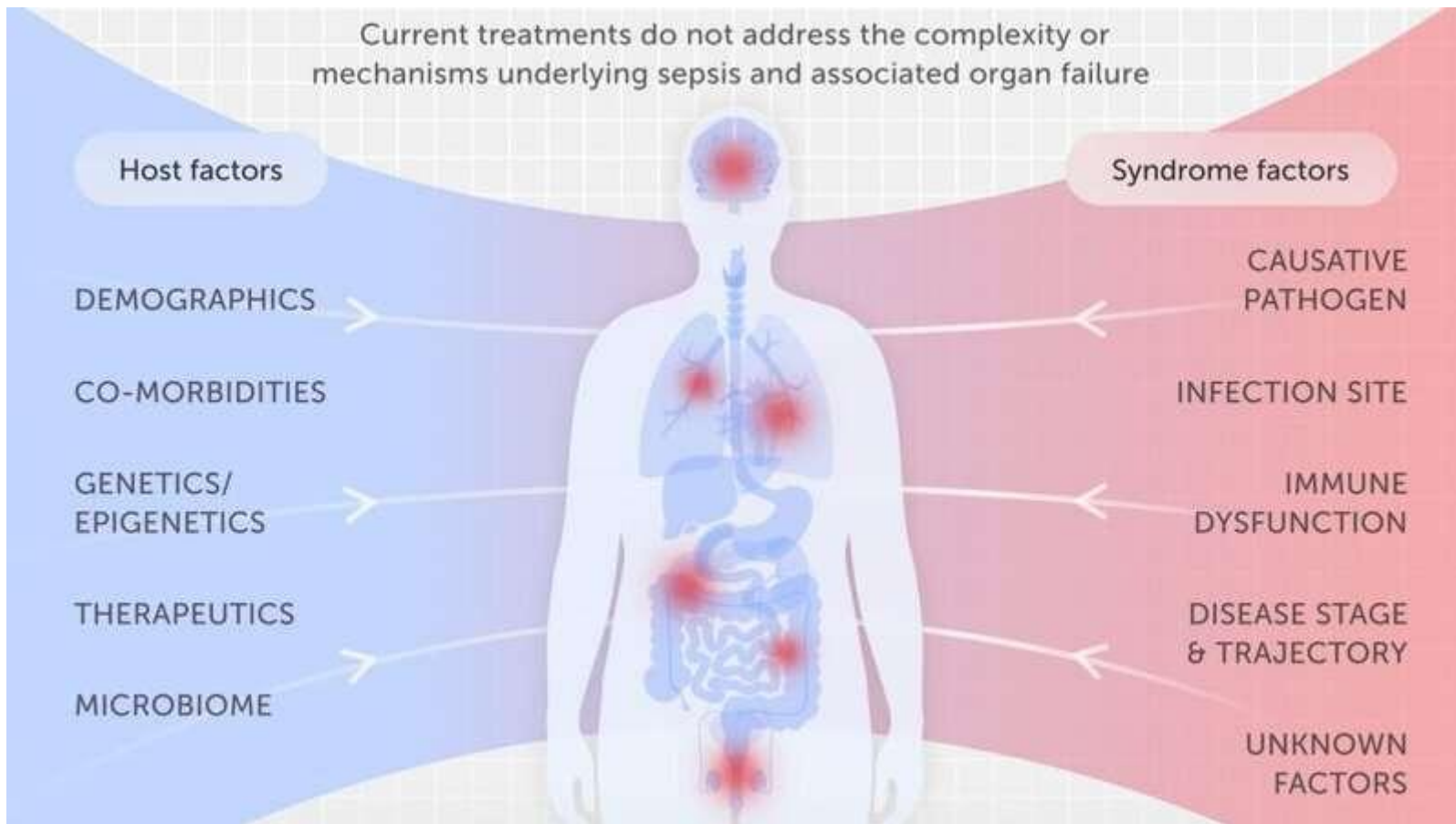
"AI models can essentially estimate a risk that is specific to a given person's context," he says, "and they can do it transparently and reproducibly, which is what our brains can't do. This kind of ability would be transformational across our field."

More information: AI-based analysis of fetal growth restriction in a prospective obstetric cohort quantifies compound risks for perinatal morbidity and mortality and identifies previously unrecognized high risk clinical scenarios, *BMC Pregnancy and Childbirth* (2025). DOI: [10.1186/s12884-024-07095-6](https://doi.org/10.1186/s12884-024-07095-6)

Journal information: [BMC Pregnancy and Childbirth](#)
Provided by [University of Utah Health Sciences](#)

How tackling sepsis can save millions of lives—and prevent future pandemic deaths

by [Frontiers](#)



Sepsis causes approximately 20% of deaths, and likely caused almost all pandemic deaths. *Frontiers in Science* (2025). DOI: 10.3389/fsci.2024.1469417

Sepsis is an underestimated killer. Nearly a quarter of patients treated for sepsis in hospital will die, but because so many different illnesses can predispose patients to experiencing it, it's overlooked as a direct cause of death. Yet approximately 20% of deaths worldwide are caused by sepsis, and currently we have no treatments that tackle it directly.

Now researchers writing in *Frontiers in Science* [explain](#) how systems immunology can help us understand and treat sepsis—and how this could cut the death toll of future pandemics, no matter what disease causes them.

"We need to adopt a concerted approach to tackle sepsis," said Prof. Robert Hancock of the University of British Columbia, lead author of the article. "Only a very small amount of funding is currently invested in sepsis research and product development—and yet sepsis is

as prominent a cause of death as heart disease and cancer, and the major cause of death in pandemics."

Precision medicine for sepsis

One of the reasons it's so hard to understand and treat sepsis is that it is multifaceted. Sepsis arises when the [immune system](#) fails to control an infection and malfunctions, causing multi-organ failure. Many different infections can cause sepsis, and its symptoms and progression vary between patients and over time in the same patient. Its early symptoms are similar to those of many other illnesses, which makes it difficult to diagnose quickly and initiate timely treatment, contributing to high mortality.

Systems immunology offers a potential solution to this diagnosis problem by using mathematical and computational modeling to study the immune system in the context of all the body's other systems. It does this by using different types of clustering analysis to identify patterns in large volumes of omics data, ranging from transcriptomic data (what genes show altered expression) to proteomic and metabolomic data—data that tell us about the body's reaction to its physical circumstances, in this case sepsis, in incredibly fine-grained detail.

These patterns help us work out the patterns and basis for the [immune dysregulation](#) that drives sepsis, come up with new hypotheses that we can research and use to develop new treatments, and identify diagnostic markers that we can use to catch sepsis early.

For instance, using these clustering analyses, scientists have identified changes to [gene expression](#) that act as early warnings for sepsis. They've also been able to identify five different subtypes of sepsis which are caused by different kinds of immune dysregulation and have different prognoses. In the future, we could build on these advances to diagnose different subtypes of sepsis earlier and treat them with the right drugs when we do.

However, systems immunology analysis is not yet in widespread use, because it is expensive and demands significant volumes of data—so we don't yet know how these diagnostics could translate into clinical results. The researchers call urgently for targeted funding and greater data availability.

"In sepsis we lack the depth of information required to enable more effective systems immunology and machine learning approaches," urged Hancock. "We hope to encourage the development of large, in-depth omics-oriented patient studies that will trigger a new generation of insights."

The key to past and future pandemics

Successfully treating sepsis would be a multipurpose life-saver, preventing mortality regardless of the illness that triggered it. Viral sepsis is a major cause of deaths triggered

by severe COVID-19, while many deaths in historical pandemics like the 1919 influenza pandemic and the bubonic plague are thought to have resulted from sepsis.

If we can tackle sepsis, we might be able to protect ourselves against the worst consequences and the highest death tolls in future pandemics, no matter what kind of infection causes them. Since immune dysregulation linked to sepsis can linger, causing symptoms similar to post-viral syndromes like long COVID-19, learning to treat this could also benefit some chronic illness patients.

But to make this happen, the researchers caution, more funding and larger studies will be needed.

"The omics methods that underlie systems immunology are relatively expensive on a per patient basis," said Hancock. "It will require a concerted drive from stakeholders to generate the data needed for further insights. We need to invest in larger omics studies of patients, develop new animal and organoid models that reflect sepsis heterogeneity, and invest in early diagnostics for sepsis and treatments that correct or supplement defective immunity in [sepsis](#) patients."

More information: Deciphering sepsis: transforming diagnosis and treatment through systems immunology, *Frontiers in Science* (2025). DOI: [10.3389/fsci.2024.1469417](https://doi.org/10.3389/fsci.2024.1469417)

Journal information: [Frontiers in Science](#)

Provided by [Frontiers](#)

JANUARY 29, 2025

Large-scale data analysis links rare diseases to higher COVID-19 mortality risk

by Health Data Research UK

Credit: Unsplash/CC0 Public Domain

An England-wide study of over 58 million people has identified eight rare diseases that carry significantly increased risks for COVID-19-related mortality in fully vaccinated individuals. This important research calls for better inclusion of rare diseases in public health strategies, including future pandemic planning, vaccination policies, and NHS service provision.

The [research](#) was published in *The Lancet Digital Health*.

Historically, [rare diseases](#) have been difficult to study and neglected in research, in part due to a lack of large-scale data. This means that people living with rare conditions often

struggle to get the treatment and support they need. Additionally, rare disease patients were overlooked in public health planning—for example, during the COVID-19 lockdown periods, the UK's shielding list excluded most rare diseases, failing to protect highly vulnerable individuals.

Researchers at UCL (University College London) and the University of Glasgow set out to harness the power of large-scale linked data, to uncover new insights into rare diseases.

Using linked [electronic health records](#) (EHRs), they investigated the prevalence of rare diseases across the population, and the risks that COVID-19 may pose to people with these conditions.

They uncovered eight rare diseases linked with an increased risk of dying from COVID-19, and found that people with rare diseases were nearly five times more likely to die from COVID-19 than the general population. The conditions carrying the highest risk were infertility disorders and kidney diseases.

The rarity of some diseases can contribute to a lack of comprehensive data due to lengthy waits for diagnosis. And as the study period spans two 'waves' of the pandemic, it's difficult to untangle the effects of different COVID-19 variants, as well as overlapping symptoms in multiple illnesses.

However, this study takes advantage of one of our health system's unique strengths, having population-wide granular data coverage in EHRs and diversity in representation, highlighting significant health inequalities faced by specific ethnic groups in which some rare diseases were disproportionately common.

It's also the first time an analysis has been performed on so many rare diseases, and the impact of COVID-19 on the people with such conditions, a landmark moment for rare disease research.

Living with a rare disease can be extremely challenging, from a difficult diagnosis to relentless appointments to manage health and well-being. But these findings fill a critical knowledge gap, emphasizing the power of electronic health record data to bring to light the prevalence and outcomes of rare diseases.

Co-author Professor Honghan Wu, University of Glasgow and formerly UCL, said, "Early detection means earlier intervention and better treatment and support. The ability to link data gives us deeper understanding, and allows us to spot individuals who would otherwise have slipped through the net.

"So research harnessing NHS data for impact through linking EHRs has enormous potential to inform care and public health decision-making, beyond the COVID-19 pandemic, especially for patient populations that are far too often neglected."

More information: Prevalence and demographics of 331 rare diseases and associated COVID-19-related mortality among 58 million individuals: a nationwide retrospective observational study, *The Lancet Digital Health* (2025). [www.thelancet.com/journals/lan ...](https://www.thelancet.com/journals/lan...) (24)00253-X/fulltext

Provided by Health Data Research UK

JANUARY 29, 2025 **FEATURE**

Can a heart failure drug effectively treat a lethal form of ovarian cancer? Scientists hope the answer is 'yes'



Credit: CC0 Public Domain

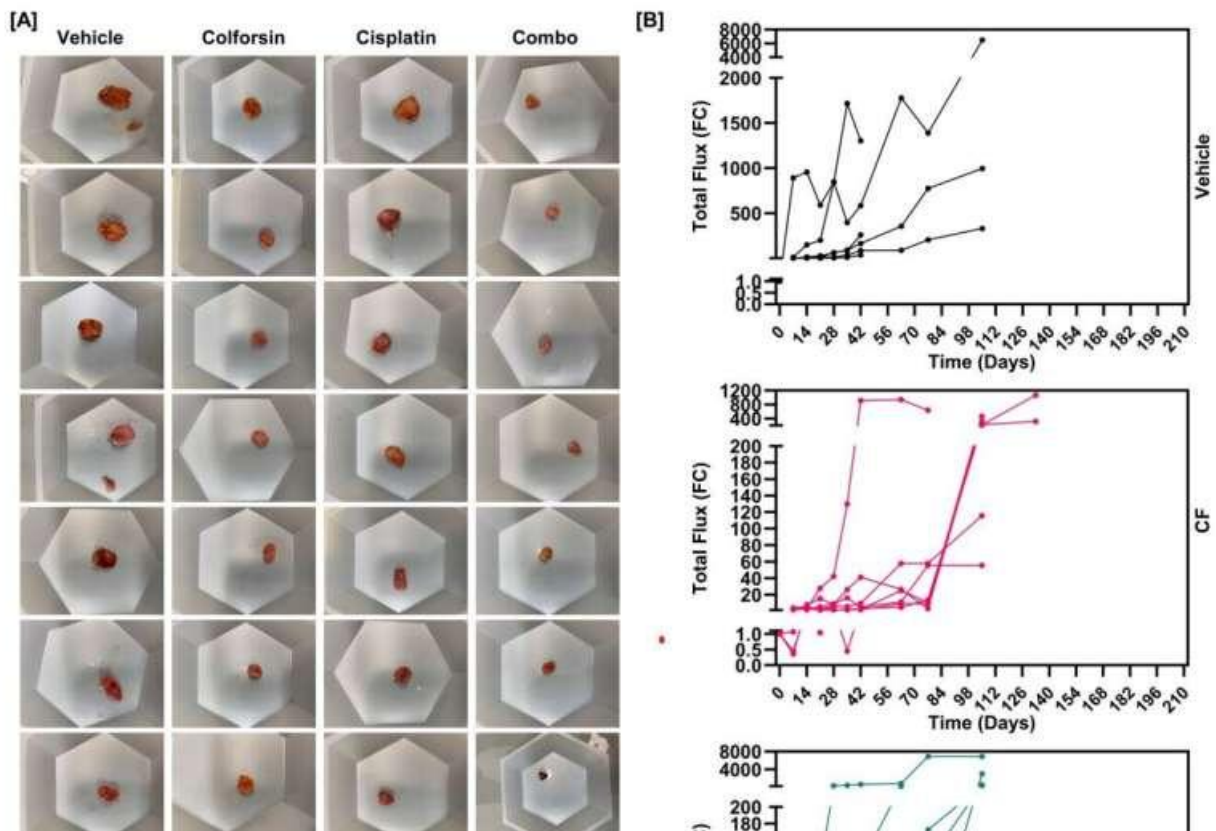
Ovarian cancer is the deadliest gynecologic malignancy globally and is increasing in incidence and mortality with currently more than 300,000 new cases and 200,000 deaths annually, according to data from the World Health Organization.

Among those cancers is a high-grade tumor type that is stealthy, frequently drug resistant—and inevitably complex. Worse, there are no durable treatments that can force high-grade ovarian malignancies into long-term remission. But an experimental medication is being analyzed for this form of cancer in studies led by the Penn Ovarian Cancer Research Center at the University of Pennsylvania.

That drug—colforsin daropate—is still in early laboratory research and has yet to be tested in women with ovarian cancer. And despite its newness to [gynecologic oncology](#), it is a familiar pharmaceutical that has been in use as an approved drug since the mid-1990s for [acute heart failure](#). Cancer biologists hope to eventually repurpose the medication for treatment of an exceptionally lethal tumor subtype.

The type of ovarian cancer that is drawing researchers' attention is formally known as high-grade serous ovarian cancer, or HGSOC. Doctors also refer to it as epithelial high-grade serous ovarian cancer.

Among subtypes of ovarian cancer, HGSOC affects a large swath of women and bears an extraordinarily unfortunate reputation for high rates of recurrence and low survival. In addition, HGSOC has no early detection biomarkers and is difficult to treat.



Images of HEYA8 subcutaneous tumors and graphs of individual intraperitoneal tumor kinetics. Credit: *Science Signaling* (2024). DOI: 10.1126/scisignal.ado8303

"Epithelial high-grade serous ovarian carcinoma is the most common and deadliest subtype of ovarian cancer, accounting for approximately 70% of cases diagnosed, and 75% of ovarian cancer deaths," writes cancer researcher Dr. Matthew J. Knarr of the Penn Ovarian Cancer Research Center, and lead author of the new analysis.

"Its high mortality rate is due to the absence of early symptoms, resulting in 80% of patients being diagnosed at later stages often after metastatic progression throughout the peritoneal cavity," Knarr added, noting that 80% of these cancers recur within five years.

Reporting the [results of the study](#) in the journal *Science Signaling*, Knarr and a team of cancer biologists emphasized that new therapeutics are desperately needed for this difficult-to-treat cancer. And that's why it is important to leave no stone unturned, according to advocates for ovarian cancer patients, who praise efforts like those of the Penn team, which searched the existing pharmacopeia for something new.

Knarr and colleagues examined the effects of colforsin daropate on cell lines and in animal models. Their research demonstrated that the heart drug can kill ovarian cancer cells and shrink tumors when combined with the standard chemotherapy agent, cisplatin. The

medication also has the added benefit of acting only on cancer cells while leaving healthy tissues unscathed.

"Given that ovarian cancer cells tend to metastasize as drug-resistant spheroids, we also wanted to determine whether colforsin daropate could cause cell cycle arrest and/or cell death in HGSOC spheroids," Knarr continued.

Ovarian cancer spheroids are solid, spherical clusters of cancer cells that emerge as the disease progresses. Spheroids can spread throughout the peritoneal cavity and attach to tissues.

Relapses are common even if an HGSOC patient has an initial positive response to standard platinum/taxane therapy. Recurrent chemo-resistant tumors have limited [treatment options](#), Knarr added, noting that the experimental therapy has piqued scientific interest not only because it might offer a new option, but because it offers a unique mechanism of action.

Colforsin daropate works by suppressing a cancer-linked protein known as MYC, which tends to be hyperactive in HGSOC. The heart drug apparently diminishes MYC's activity.

More research is needed to tease apart how colforsin daropate, an experimental compound in ovarian cancer, decreases MYC levels in women with the disease. Data so far suggests that colforsin daropate inhibits MYC signaling.

In their search for a drug that could attack HGSOC cells, the team of scientists first examined the drug forskolin, which has potent anti-cancer properties. The trouble with forskolin is that it didn't translate in the laboratory into a clinically useful medication for ovarian cancer.

The team then turned to a forskolin derivative, colforsin daropate, which possessed far more favorable drug properties that zeroed in on the molecular mechanisms driving the cancer.

"Forskolin has been used in the clinic for the treatment of glaucoma and is being investigated for the treatment of asthma, heart failure, and obesity," Knarr asserted, adding that forskolin isn't water soluble, and therefore not ideal for the kind of medication needed to treat HGSOC.

Water-soluble colforsin daropate, has potent anti-cancer activity and was deemed a strong candidate to address the unique properties of the malignancy.

Additionally, because colforsin daropate was already approved for the treatment of acute heart failure, it became a strong candidate. If it continues to perform in the laboratory the way it has to date, the medication may find its way into clinical testing in the not-too-distant future, scientists say.

In the journal report, colforsin daropate defeated ovarian tumors by arresting the cell cycle and inducing cell death in cultured HGSOC cells and spheroids. When given to mice, the compound slowed the growth of tumors and extended the animals' survival.

Along with Knarr and scientists at Penn Ovarian Cancer Research Center, other team members hailed from the University of Michigan and the Department of Translational Molecular Medicine at Saint John's Cancer Institute in Santa Monica, California.

"We observed here that the colforsin daropate-treated spheroids showed a reduction in adhesion signaling and tended to be less compact," Knarr and colleagues conclude. "It is likely that colforsin daropate decreases important intrinsic pro-survival signals in the spheroids that depend on cell-to-cell adhesion."

"This also allows the drug greater access to more tumor cells than would otherwise be possible. Future studies will need to investigate in detail the mechanisms by which colforsin daropate disrupts [ovarian cancer](#) sphere adhesion."

More information: Matthew J. Knarr et al, Repurposing colforsin daropate to treat MYC-driven high-grade serous ovarian carcinomas, *Science Signaling* (2024). DOI: [10.1126/scisignal.ad08303](https://doi.org/10.1126/scisignal.ad08303)

Journal information: [Science Signaling](#)

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JANUARY 28, 2025

Novel lab-on-chip platform promises to expedite cancer diagnoses

by [American Institute of Physics](#)

Cancer accounted for nearly 10 million deaths in 2020—almost one in every six deaths globally—according to the World Health Organization. Because the detection of abnormal diseased cellular growth often occurs too late, timely cancer diagnosis remains one of humanity's most pressing and elusive medical objectives.

Recent research has focused on the detection in peripheral blood of rare circulating tumor cells (CTCs), which serve as noninvasive markers that can help inform diagnoses.

It is inherently difficult to separate controllable target cells to examine. Traditional methods typically require elaborate sample preparation, substantial equipment, and large sample volumes—and even then, it is not easy to efficiently separate the cells in question.

In *Physics of Fluids*, a pair of researchers at the K. N. Toosi University of Technology in Tehran, Iran, propose a novel system that uses standing surface [acoustic waves](#) to separate CTCs from [red blood cells](#) with unprecedented precision and efficiency. The platform that Afshin Kouhkord and Naser Naserifar developed integrates advanced computational modeling, experimental analysis, and artificial intelligence algorithms to analyze complex acoustofluidic phenomena.

"We combined machine learning algorithms with data-driven modeling and computational data to fine-tune a system for optimal recovery rates and cell separation rates," said Naserifar. "Our system achieves 100% recovery at optimal conditions, with significant reductions in [energy consumption](#) through precise control of acoustic pressures and flow rates."

As various ways of enriching particles through microfluidics have emerged, those that employ acoustofluidics are especially promising because they are biocompatible, generate high-force magnitudes at MPa pressure ranges, and produce cell-scale wavelengths.

With their particular method, the researchers included an innovative use of dualized pressure acoustic fields, which doubles the impact on target cells, and strategically located them at critical channel geometry positions on a lithium niobate substrate.

By means of acoustic pressure applied within the microchannel, the system design provides for the generation of reliable datasets that illustrate cell interaction times and trajectory patterns, which will help predict tumor cell migration.

"We have produced an advanced, lab-on-chip platform that enables [real-time](#), energy-efficient, and highly accurate cell separation," said Kouhkord.

"The technology promises to improve CTC separation efficiency and open new possibilities for earlier and more effective cancer diagnosis. It also paves the way for microengineering and applied AI in personalized medicine and cancer diagnostics."

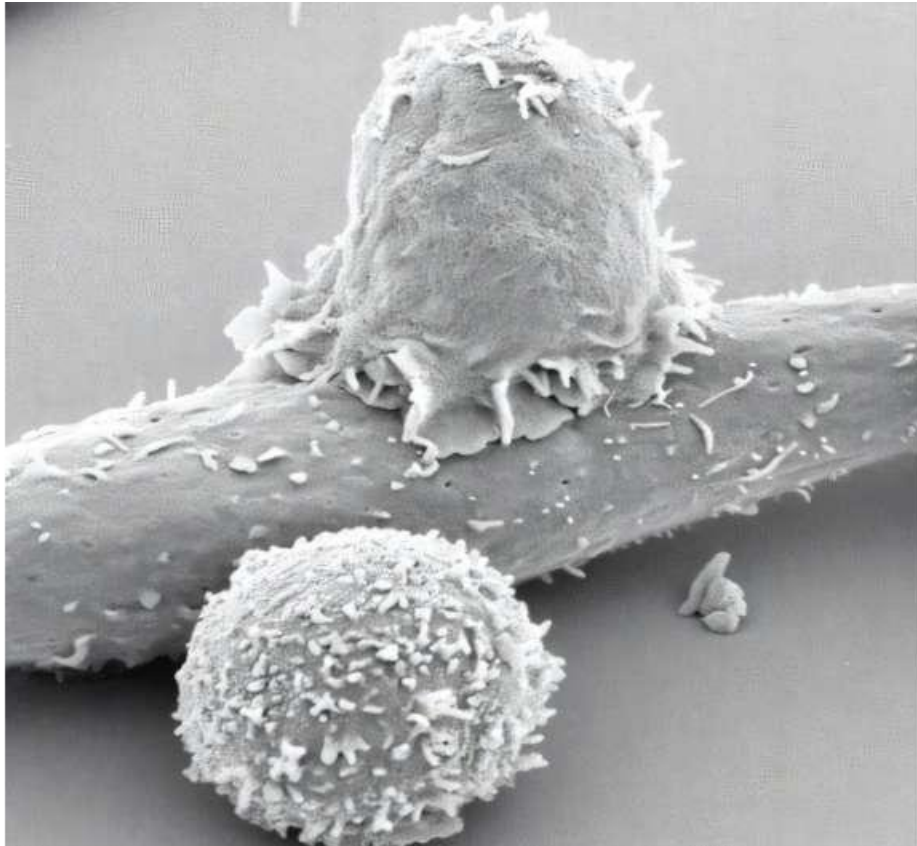
More information: Ultrasound-assisted microfluidic cell separation - A study on microparticles for enhanced cancer diagnosis, *Physics of Fluids* (2025). DOI: [10.1063/5.0243667](https://doi.org/10.1063/5.0243667)

Journal information: [Physics of Fluids](#)
Provided by [American Institute of Physics](#)

JANUARY 28, 2025

Lab-grown T cells with altered metabolism offer lasting cancer defense

by [University of Pittsburgh](#)



A T cell killing a cancer cell. Credit: Andrew Frisch and Donna Stolz, University of Pittsburgh Center for Biologic Imaging

Researchers from the University of Pittsburgh have developed a new way to grow T cells in the lab that enables them to live longer and better destroy cancer cells in a mouse model of melanoma compared to those grown in traditional growth media.

The findings, published in [Cell Metabolism](#), have the potential to greatly improve the effectiveness of cancer immunotherapies that involve taking T cells from a patient and growing them to enormous numbers in the lab before reinfusing them back into the body.

"The way we traditionally grow T cells in the lab is horribly inefficient," said senior author Dr. Greg Delgoffe, professor in the Department of Immunology at Pitt's School of Medicine and director of the Tumor Microenvironment Center at UPMC Hillman Cancer Center.

"We make millions of T cells and we infuse them back into a patient, but most of the cells die. Our research is uncovering new ways to manufacture T cells that live for a long time with the goal of making cell therapies more effective."

Cell therapy is a type of treatment that involves removing [immune cells](#) from the patient, expanding them in a dish and transferring these living cells back into the patient.

Common forms of cell therapy that use T cells—the immune system's soldiers that fight infections and cancers—include chimeric antigen receptor T cells (CAR-T), which are T cells modified to better target cancer, and tumor infiltrating lymphocyte (TIL) therapy, which uses naturally occurring T cells that can fight the tumor.

"Cell therapy is a living drug that responds to the environment in the body," said lead author Andrew Frisch, graduate student in the Department of Immunology at Pitt's School of Medicine. "But there is a major gap between where we are with these therapies and where we could be because the way we feed these cells in the lab does not prepare them well for surviving in the body."

According to Delgoffe, traditional growth media is very high in glucose, so T cells grown in the lab become addicted to this sugar. When reinfused into a patient, they struggle to consume other energy sources and most of the transferred cells quickly die.

With the goal of growing longer lasting T cells, Delgoffe, Frisch and their team supplemented a compound called dichloroacetate (DCA) to the typical growth medium used to expand T cells. DCA alters the metabolism of T cells so they are less reliant on glucose and better able to use other energy sources more common in the bloodstream.

When infused into mice, T cells grown with DCA lived much longer compared to those grown in traditional culture media. Almost one year later, over 5% of circulating killer T cells were those that had been transferred.

In comparison, in mice that received T cells grown in media lacking DCA, the researchers could barely detect these cells even a few weeks later.

In animals with melanoma, treatment with the DCA-grown T cells led to better tumor control and survival than with traditionally grown cells. They also provided long-lasting protection: animals that received the DCA-grown T cells fought off a second challenge with melanoma cells.

"By limiting the access to certain foods, we endowed immune cells with the ability to metabolize things that they would normally metabolize in the body, rather than getting them addicted to the sugar that we were feeding them in the lab," said Delgoffe.

"If we can properly nourish our T cell soldiers in the lab by convincing them to eat the right kind of food, they are better prepared to respond to signals in the body and live much longer. We might be able to have a soldier on guard forever. Just as after getting

the [chicken pox](#) vaccine, you are protected for life—you'll never get chicken pox again. That's the ultimate goal of [cell therapies](#) for cancer."

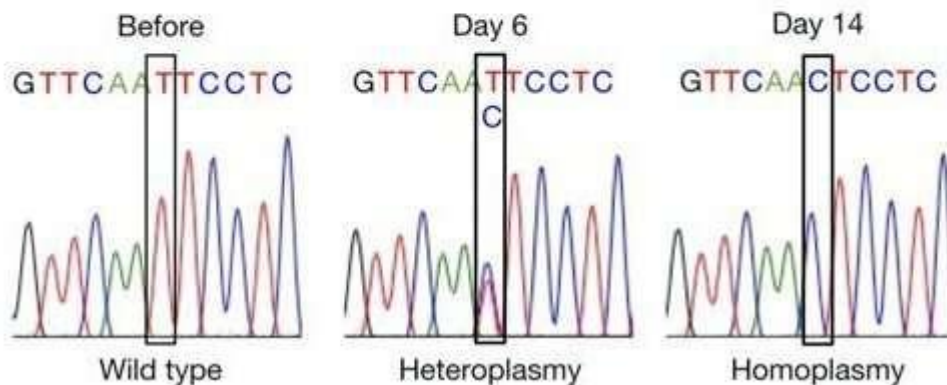
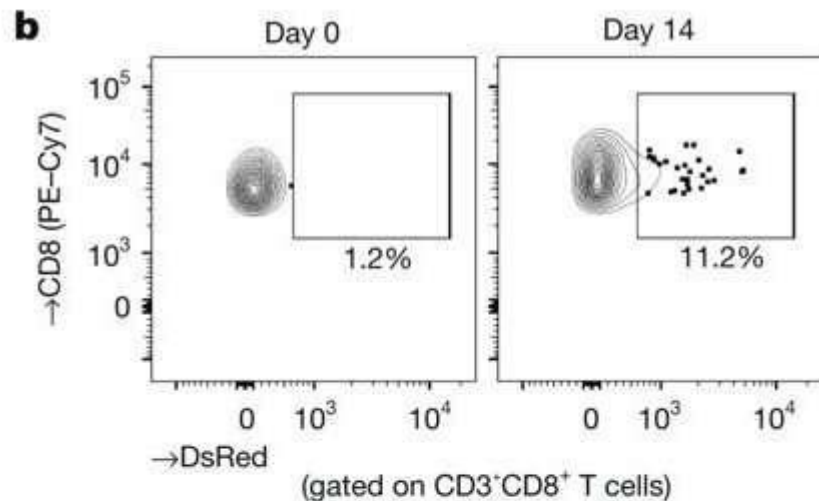
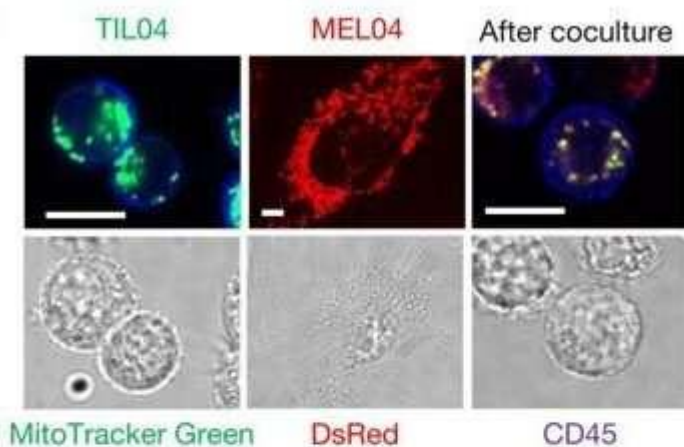
More information: Redirecting glucose flux during in vitro expansion generates epigenetically and metabolically superior T cells for cancer immunotherapy, *Cell Metabolism* (2025). DOI: [10.1016/j.cmet.2024.12.007](https://doi.org/10.1016/j.cmet.2024.12.007). [www.cell.com/cell-metabolism/f ... 1550-4131\(24\)00489-3](https://www.cell.com/cell-metabolism/fulltext/S1550-4131(24)00489-3)

Journal information: [Cell Metabolism](#)
Provided by [University of Pittsburgh](#)

JANUARY 24, 2025

Scientists uncover how cancer cells hijack T-cells, making it harder for the body to fight back

by Justin Jackson , Medical Xpress



mtDNA-mutated mitochondria from cancer cells transfer to TILs and are progressively replaced to homoplasmy in TILs. Credit: *Nature* (2025). DOI: 10.1038/s41586-024-08439-0
Research led by the Chiba Cancer Center Research Institute in Japan has discovered a surprising way cancer evades the immune system. It essentially hacks the immune cells, transferring its own faulty mitochondrial DNA (mtDNA) into the T-cells meant to attack it.

This sneaky move weakens the immune cells, making them less effective at stopping the tumor. The findings could help explain why some cancer treatments, like immunotherapy, are effective for some patients but not others.

In the study, "Immune evasion through mitochondrial transfer in the [tumor microenvironment](#)," [published](#) in *Nature*, the multi-group collaboration looked at how cancer cells interact with tumor-infiltrating lymphocytes, a type of T-cell that typically fights tumors. The research is also featured in a [News and Views](#) piece.

Clinical specimens from melanoma and non-small-cell lung cancer patients were analyzed for mtDNA mutations. Mitochondrial transfer was studied using mitochondrial-specific fluorescent reporters and multiple in vitro and in vivo models. Tumor-infiltrating lymphocyte functions, metabolic profiles, and responses to [immune checkpoint inhibitors](#) were evaluated.

Melanoma and lung sample analysis showed that [mitochondria](#), the energy-making engines of cells, could jump from cancer cells into T-cells. These transferred mitochondria carried functional errors in their DNA that interfered with the T-cells' [energy production](#) and function processes.

Mitochondria are essential for powering cells, including T-cells, which depend heavily on energy production to fight cancer. But when cancer cells pass on their defective mitochondria, they lose their ability to function properly, throttling the energy of the T-cells and causing them to become exhausted.

Transfer was observed in two main ways: tunneling nanotubes and [extracellular vesicles](#). The nanotubes extend out and tunnel into the T-cell, creating tiny passages between cells that deliver mitochondria directly. Extracellular vesicles form as bubbles released by the cancer cells, encapsulating mtDNA and other molecules.

Once inside the T-cells, the damaged mitochondria replace the healthy ones through a mechanism that would normally operate in reverse, where healthy mitochondria would migrate to replace damaged ones. The study found that cancer cells protect their transferred mitochondria by attaching molecules that prevent the T-cells from breaking them down.

Immune checkpoint inhibitors have revolutionized cancer treatment. But not everyone responds well to these drugs. This study found that patients whose tumors had more mitochondrial mutations were less likely to benefit from checkpoint inhibitors, likely because the mitochondrial hack already compromised their T-cells.

Researchers blocked extracellular vesicle release from cancer cells using a compound called GW4869, which inhibits the production of small extracellular vesicle-like exosomes. Applying this inhibitor in their models showed a significant reduction in mitochondrial transfer from cancer cells to T-cells. This intervention helped prevent the T-cells from taking up damaged mitochondria, reducing their dysfunction.

As a result, T-cells showed improved energy production, reduced markers of exhaustion, and a better ability to perform their immune functions. The blocking strategy restored the effectiveness of immune checkpoint inhibitors, particularly in tumors with high levels of mitochondrial transfer. These findings suggest that targeting extracellular vesicles could be a promising strategy to counteract cancer's immune-evasion tactic.

Typically, science works in small, iterative steps toward discovery, with each new element of knowledge putting a piece of the larger puzzle into place. This discovery helps explain why some treatments are ineffective and discovers the mechanism behind their ineffectiveness. Remarkably, it also found a potential solution, representing a significant leap for future research to build from.

More information: Hideki Ikeda et al, Immune evasion through mitochondrial transfer in the tumour microenvironment, *Nature* (2025). DOI: [10.1038/s41586-024-08439-0](https://doi.org/10.1038/s41586-024-08439-0)

Jonathan R. Brestoff, Mitochondrial swap from cancer to immune cells thwarts anti-tumour defences, *Nature* (2025). DOI: [10.1038/d41586-025-00077-4](https://doi.org/10.1038/d41586-025-00077-4)

Journal information: [Nature](#)

New Drug Eliminates Breast Cancer in Mouse Study

This approach appears to be far more effective than current treatments.

Jan 24, 2025

Researchers have discovered a small molecule that **effectively kills cancer cells in the most prevalent type of breast cancer**. The new drug could help against cancer recurrence and decrease the need for surgery [1].

The ongoing fight against breast cancer

Medicine has made great strides in treating breast cancer, but the fight is far from over. About 70% of all cases are estrogen receptor alpha positive (ER α +), meaning that cancer cells express ER α , and tumor growth is driven by the hormone estrogen.

Current therapies already ensure a high five-year survival rate for ER α + cancer patients. However, it hinges on early detection, surgical resection, and consequent long-term hormone therapy that in itself can cause serious side effects, including increased risk of endometrial cancer and osteoporosis [2]. Moreover, there is a high chance of recurrence: 10%-50% over 20 years, depending on the initial tumor size. When this happens, the resurrected cancer often does not respond to endocrine therapy due to mutations in ER α or other mechanisms.

In this case, there is an unmet need for treatments that would eliminate the cancer completely, preferably in a single swoop. A new study coming from the University of Illinois at Urbana-Champaign features a worthy candidate.

The researchers have been working on small molecules for treating ER α + breast cancer for several years. Resistance in this type of cancer "occurs partly because endocrine therapies typically are cytostatic: tumor cell proliferation is inhibited, but cell death is modest," the paper says. Hence, the researchers were looking for a drug that would kill breast cancer cells instead of just preventing their division.

The group's previous candidate, ErSO, was effective, but it harmed ER α -negative cells as well [3]. This time, the researchers described an improved formulation: ErSO-TFPy. In previous studies, it showed high potency at low concentrations and tolerability at high concentrations. ErSO-TFPy targets the protein TRPM4, which is involved in cation transport and is upregulated in some cancers, including breast cancer.

First, the researchers tested ErSO-TFPy versus a string of current state-of-the-art treatments in several ER α + breast cancer lines. The current drugs were less effective and, as expected, mostly cytostatic, causing the cells to stop dividing, while ErSO-TFPy effectively induced cell death.

Similar results were demonstrated in vivo: while fulvestrant, a currently used drug that served as a positive control, was only able to halt tumor growth, ErSO-TFPy achieved full tumor regression in concentrations well within the therapeutic window.

One of the models used was a xenograft derived from a patient who had developed drug-resistant cancer due to a mutation in *ESR1*, the gene coding for ER α +. In this setting, fulvestrant proved mostly ineffective, while ErSO-TFPy again eliminated the tumor completely.

In these experiments, the drug was given weekly as an intravenous injection. "This quantitative tumor regression is highly unusual for single-agent breast cancer therapeutics and may be the result of the unique, necrotic mechanism of action for this class of small molecules," the paper says.

A single dose – even for large tumors

Given the surprising efficacy of the weekly regimen, the researchers wanted to see whether a single dose of their drug would do the trick – and it did. "If recapitulated in humans, such a minimal dosing regimen would revolutionize ER α + breast cancer therapeutic management through improved treatment compliance, quality-of-life, and long-term outcomes for breast cancer patients," the authors note.

"It is very rare for a compound to shrink tumors in mouse models of breast cancer, let alone completely eradicate those tumors with a single dose, so we are eager for ErSO-TFPy to advance for treatment of breast cancer," said Paul Hergenrother, Kenneth L.

Rinehart Jr. Endowed Chair in Natural Products Chemistry and the leading author of the study.

The efficacy of the current treatments for ER α +, as well as the chance of recurrence, is highly dependent on the stage at which the disease was diagnosed, so the researchers tested their drug in the extreme conditions of well-developed, extra-large tumors. Even in this challenging setting, a single IV dose of ErSO-TFPy (albeit at a higher concentration) was enough to shrink the tumors by more than 80%. This indicates the exciting possibility of a drug that can tackle late-stage breast cancer.

Interestingly, ErSO-TFPy gets washed out of circulation quickly. The researchers were pleasantly surprised and somewhat baffled by the prolonged effect of their drug and are looking for possible explanations.

"The ability of ErSO-TFPy to induce complete regressions after a single dose is surprising given ErSO-TFPy serum levels peak within 10 min of administration in mice and are undetectable after 16 h when dosed at 15 mg/kg IV," the paper says. "The xenograft experiments show that tumor regression occurs over a period of weeks, long after the compound is eliminated."

JANUARY 21, 2025

What's behind preterm birth? Scientists discover a molecular timer

[University of California, San Francisco](#)



Credit: Pixabay/CC0 Public Domain

A typical human pregnancy lasts 40 weeks, but most parents know this number is only a rough estimate. Babies are born on a seemingly unpredictable timeline, with a normal pregnancy ranging from 38 to 42 weeks. And 10% of all births are preterm, meaning they occur before 37 weeks of gestation, which puts babies at risk of a host of complications.

Now, UC San Francisco researchers have discovered a molecular timer in mice that plays a role in controlling when they give birth. Surprisingly, the timer is activated in the very first days of pregnancy and operates within the uterus.

If the same set of molecules is found to be important in human pregnancies, it could lead to new tests to identify women who are at risk of preterm labor, as well as interventions to delay it.

"Preterm birth is a huge problem around the world, and for a long time nobody has really understood it. We hope our work can start to shed light on the underlying mechanism," said Adrian Erlebacher, MD, Ph.D., a professor of laboratory medicine at UCSF, and the senior author of the [paper](#), which appears Jan. 21 in *Cell*.

"The new findings raise the possibility that preterm birth is triggered by things that happen much earlier in pregnancy than we expected."

DNA packaging during pregnancy

Throughout pregnancy, the female body undergoes massive biological shifts, with the activity of hundreds of [genes](#) going up or down within the uterus.

Erlebacher and his lab group were studying a protein called KDM6B which regulates gene activity. They suspected that during pregnancy, KDM6B could help regulate the genes involved in the transition to labor.

KDM6B works by removing methyl chemical groups from histones—structures that help organize and package DNA within cells. In response to KDM6B, DNA becomes more accessible to other factors that regulate gene expression, turning on the activity of nearby genes.

The team noticed that when they blocked KDM6B, pregnancies in the mice became longer, and their babies were born later than usual.

At first, the scientists suspected that, late in pregnancy, KDM6B must be activating genes in the uterus's epithelial cells, which produce hormones known to trigger labor.

But when they carried out detailed analyses on different cell types, they found that KDM6B's effects on pregnancy length were tied to a different cell type called fibroblasts. These structural cells are not typically considered to play a role in the regulation of labor. Moreover, KDM6B regulated these fibroblasts during the first days of pregnancy.

"Our findings highlight a surprising role for uterine fibroblasts in regulating birth timing," said Tara McIntyre, Ph.D., who led the work as a graduate student at UCSF. "This wasn't something we anticipated, and it completely reshaped our understanding of the cell types and processes driving labor onset."

A molecular timer?

Further experiments on mice revealed that shortly after conception, more [methyl groups](#) appear on histones near certain genes in uterine fibroblasts. In response, these genes remain inactive, which enables the uterus to support pregnancy.

Over the course of pregnancy, levels of methylation on these histones fade in a slow and steady way, eventually reaching low enough levels that the nearby genes—related to pregnancy events like labor—are activated. This erosion, which does not require KDM6B, functions as a timer.

"Essentially, what appears to happen is this timer gets wound up right at the beginning of pregnancy, and then progressively winds down," Erlebacher explained. "When histone methylation erodes enough, nearby genes flip on."

When the researchers blocked KDM6B, histones near certain genes accumulated too much methylation early in pregnancy. This increased "setpoint" meant that, despite erosion, these genes were not activated on time, delaying labor.

Signals could be linked to preterm birth

While the new study did not directly study preterm births, the newly discovered molecular timer could help control pregnancy length in humans.

"The big question from here is whether these same processes are relevant in humans," Erlebacher said. "If they are, then can we use them to predict or control pregnancy length?"

If the newly studied molecular signals are disrupted in humans, they could be linked to preterm birth risk, his team hypothesizes. For instance, some women could begin pregnancy with lower than usual levels of histone methylation; and this could lead to the erosion of the methylation to turn on labor-related genes too quickly.

He adds that most [preterm birth](#) research has focused on the time immediately before a woman goes into labor. The new results point toward much earlier stages of [pregnancy](#) as being critical, and it could lead to new research efforts.

More information: KDM6B-dependent epigenetic programming of uterine fibroblasts in early pregnancy regulates parturition timing in mice, *Cell* (2025). DOI:

[10.1016/j.cell.2024.12.019](https://doi.org/10.1016/j.cell.2024.12.019). [www.cell.com/cell/fulltext/S0092-8674\(24\)01432-6](https://www.cell.com/cell/fulltext/S0092-8674(24)01432-6)

Journal information: [Cell](#)

Provided by [University of California, San Francisco](#)

JANUARY 20, 2025

Gardenia plants may hold chemical key to regenerating diseased human nerves



Gardenia flower from the gardens at Monticello. Credit: Wikimedia Commons, Queerbubbles [CC BY-SA 3.0](#)

Gardenias are known for their rich, earthy fragrance, waxy petals and brilliant white color that contrasts with the deep emerald green of their leaves. The plant has long been prized by herbalists, seekers of food and fabric dyes, and even pharmaceutical companies.

Now, a collaborative team of scientists at several research centers in the United States has found that a compound known as genipin, derived from the gardenia plant called Cape jasmine, can prompt nerve regeneration. Neurons damaged and stunted by disease find new life in the lab when exposed to the plant-derived compound.

The chemical comes from the fruit of this extraordinarily versatile plant. Gardenia shrubs, in general, are native to tropical and subtropical regions of Asia. But the plants are propagated

globally by horticulturists and amateur gardeners who are most familiar with the flower's beauty and the intoxicating scent of their perfume.

Genipin is being studied as a potential treatment for a rare degenerative nervous system disorder that is caused by a gene mutation. The condition is known as familial dysautonomia, which becomes evident during infancy. The hypothesis of this relatively large cadre of regenerative medicine researchers is that genipin from the humble gardenia plant—known scientifically as *Gardenia jasminoides*—possesses the secret to effective treatment.

"Familial dysautonomia is a devastating disorder caused by a homozygous point mutation in the gene ELP1," writes Dr. Kenyi Saito-Diaz in a study [published](#) in *Science Translational Medicine*. "Familial dysautonomia specifically affects development and causes degeneration of the peripheral nervous system."

While the central nervous system is comprised of the brain and [spinal cord](#), the peripheral nervous system is made up of all nerves branching off the spinal cord, extending to every part of the body.

Familial dysautonomia impacts the development and survival of the nervous system, including autonomic and [sensory neurons](#). These critical nerve cells in affected patients don't develop properly and degenerate over time, leading to serious neurological and cardiac symptoms.

To date, genipin has been tested only in lab dishes and animal models, but the compound appears capable of combating key hallmarks of the inherited condition. Saito-Diaz, a regenerative medicine researcher in the Center for Molecular Medicine at the University of Georgia in Athens, reports that findings so far suggest the team may be on the trail of a potential therapeutic. Currently, doctors have nothing curative to offer familial dysautonomia patients.

Finding a therapeutic that impacts nerve growth is a worldwide research priority, not only for familial dysautonomia, but because a "high percentage of the world's population suffers from nerve degeneration or peripheral nerve damage," Saito-Diaz added.

"Despite this, there are major gaps in the knowledge of human peripheral nervous system development and degeneration. Therefore, there are no available treatments," Saito-Diaz declared.

Familial dysautonomia initially impacts breathing, the regulation of body temperature, blood pressure, and the ability to form tears. As the disease advances, patients can develop [abnormal heart rhythms](#), spinal curvature, an inability to feel pain, vision loss, poor control of breathing, especially during sleep, and a heightened susceptibility to lung infections. A range of other severe symptoms are also associated with the condition, doctors say.

Geneticists at the Cleveland Clinic in Ohio report that, while rare, the condition is most prevalent among people of Ashkenazi Jewish heritage. In the United States, familial dysautonomia is estimated to affect 1 in 10,000 Ashkenazi Jews. In Israel, 1 in 3,700 people are diagnosed with the condition at birth, according to Cleveland Clinic data.

Gardenia-derived compounds, meanwhile, have played a long and storied role in folk and conventional medicine. For centuries, traditional healers in China have turned to gardenia plants as a source of medicinal compounds capable of treating depression, inflammation and insomnia. Gardenia plants were also long prized among the Chinese for the yellow dye from their seeds.

In the 1980s, Japanese scientists discovered a blue dye derived from a fruit, also produced by *Gardenia jasminoides* plants. The family of flowering shrubs includes the common gardenia, Cape jasmine and *Gardenia Augusta*, among others.

Isolation of the blue dye paved the way for a series of exciting discoveries, including genipin, which chemically is an iridoid glycoside. The compound is used to improve the texture and shelf life of certain foods. Additionally, it is being studied as a cancer medication because of its ability to prompt apoptosis, also known as programmed cell death.

Saito-Diaz and colleagues discovered genipin serendipitously while screening a library of 640 compounds for candidates that can protect sensory neurons from degeneration. They happened upon genipin, produced by the fruit of *Gardenia jasminoides*.

In the laboratory, the team found that it wasn't apoptosis that genipin caused when neurons were exposed to it. In lab dishes, the compound not only restored proper development of sensory neurons from patients with familial dysautonomia, but it also prevented the cells' early degeneration. Genipin also improved peripheral nerve formation in two mouse models of familial dysautonomia. The team surmised that genipin's therapeutic effects are tied to the compound's ability to promote cross-linking in the extracellular matrix.

Most important among its powerful activities, the team of U.S. researchers found that when added to cultures of nerve cells, genipin boosted the regeneration of severed axons into healthy sensory and cortical neurons.

Saito-Diaz and a large team of colleagues from the University of Georgia worked with collaborators at the University of Tennessee; Icahn School of Medicine's Institute for Regenerative Medicine at The Mount Sinai Hospital; Weill Cornell Medical College, and the Center for Stem Cell Biology at Sloan Kettering Institute, all three in New York City.

These results "make [genipin] an interesting compound for future applications in nerve regeneration in the [\[peripheral nervous system\]](#) and possibly prevention of peripheral neuropathies," Saito-Diaz concluded.

More information: Kenyi Saito-Diaz et al, Genipin rescues developmental and degenerative defects in familial dysautonomia models and accelerates axon regeneration, *Science Translational Medicine* (2024). DOI: [10.1126/scitranslmed.adq2418](https://doi.org/10.1126/scitranslmed.adq2418)

Journal information: [Science Translational Medicine](#)

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JANUARY 17, 2025

Genetic reanalysis results in more than 500 patients receiving diagnosis

[Radboud University](#)



Researchers Alexander Hoischen and Lisenka Vissers of Radboud university medical center. Credit: @radboudumc

The European consortium for Solving the Unsolved Rare Diseases has demonstrated the significance of international collaboration to address the unmet medical needs for rare diseases' diagnosis. More than 500 European patients with unknown conditions have received a diagnosis through new genetic research. This includes patients with rare neurological disorders, severe intellectual disabilities, muscle diseases, and hereditary gastrointestinal cancer.

These diagnoses were achieved through extensive European collaboration, led by researchers from the University of Tübingen, Radboud university medical center, and the National Center for Genomic Analysis in Barcelona.

A disease is considered rare in the European Union, if fewer than five out of 10,000 people have the condition. Of the 7,000 [rare diseases](#), at least 70% have a genetic cause. Because these diseases are so rare, it's difficult to pinpoint the exact cause in the DNA, even when multiple members of one family have the condition.

Researchers have now been able to diagnose a number of European patients and families with their rare genetic disease. These include rare neurological disorders, malformation syndromes and intellectual disabilities, rare neuromuscular diseases, and suspected hereditary cancer risk syndromes.

In total, the researchers reanalyzed the existing genome data of 6,447 patients and 3,197 unaffected family members. Thanks to this research, 506 patients and their families received a diagnosis. For 15% of the patients, there are leads for actionability, in some including treatment; in other cases, the diagnosis provides clarity for the patients and their families.

These results have been published in *Nature Medicine*.

These diagnoses were made possible by Solve-RD, a large European collaboration involving 300 experts from 12 European countries and Canada. Led by researchers from the University of Tübingen, Radboud university medical center, and the National Center for Genomic Analysis (CNAG) in Barcelona, these experts conducted a thorough reanalysis of patients' [genetic data](#). They work within European Reference Networks (ERNs) that focus on specific rare diseases.

Thanks to this framework, it no longer matters whether a patient with a rare condition is seen in the Netherlands, Germany, or France. The method for reaching a diagnosis is now the same everywhere. This did not happen easily.

The experts had to agree on the analysis method for each condition, for example, which genes and variant types needed to be examined. Logistical challenges and national legislation and regulations were also of major impact.

Blueprint

This initiative, based on the Solve-RD project's two-level expert review framework, provides a structured approach to diagnosing and potentially treating rare diseases. The framework allows analyses to be reviewed by experts from diverse fields, such as clinical genetics and [data science](#), which increases diagnostic accuracy.

The approach is being expanded through the European Rare Disease Research Alliance (ERDERA), a new rare diseases partnership coordinated by INSERM, France, with over 180 organizations including key scientists from Solve-RD.

Further acceleration of diagnosis of rare disease patients being one of its goals. By collecting data from a broader pool of patients and collaborating with additional European medical centers, ERDERA aims to offer diagnoses to those who remain undiagnosed, thus scaling the impact of rare disease research.

Within ERDERA, the University of Tübingen leads the Clinical Research Network diagnostic stream, working again alongside teams from Radboudumc, Barcelona and others across Europe. This includes scaling up patient data reanalysis from 10,000 to over 100,000 rare disease datasets, and covering a wider range of rare genetic conditions.

The work also emphasizes the use of advanced techniques such as long-read genome sequencing, optical genome mapping, and RNA sequencing to accelerate diagnoses for unresolved rare conditions.

Holm Graessner, Solve-RD coordinator said, "The Solve-RD approach to reanalyze data from unsolved rare disease patients was successful and led to a diagnosis for more than 500 patients. This is a major step forward and a milestone for the rare disease research in Europe. We will continue and scale up this approach in ERDERA to provide a diagnosis to even more patients and families across Europe."

Lisenka Vissers, Professor of Translational Genomics and lead researcher from Radboudumc, said, "We conducted a large reanalysis of an enormous amount of patient data. This allowed us to find similarities and draw conclusions. We have now even been able to provide a diagnosis for a patient who has been ill for 20 years and has participated in many studies."

Alexander Hoischen, Professor of Genomic technologies for immune-mediated and infectious diseases and lead researcher from Radboudumc said, "The fact that we have achieved this is a unique example of the power of collaboration. It's a huge step forward in European cooperation, and this is just the beginning.

"Although we haven't made any new discoveries yet and these diagnoses come from existing data and analyses, we hope to be able to help many more patients in the coming years. Initially by making a [diagnosis](#), but hopefully also with possible treatments."

More information: Genomic reanalysis of a pan-European rare-disease resource yields new diagnoses, *Nature Medicine* (2025). DOI: [10.1038/s41591-024-03420-w](https://doi.org/10.1038/s41591-024-03420-w)

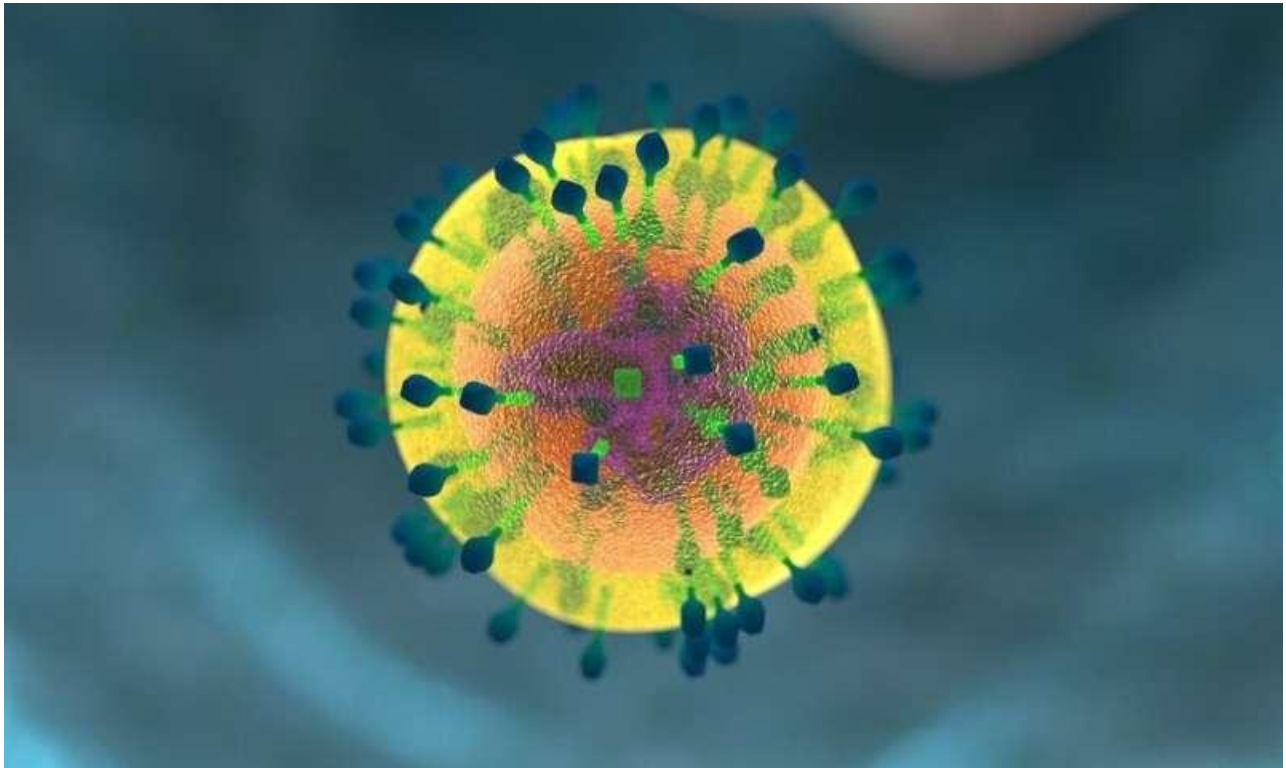
Journal information: [Nature Medicine](#)

Provided by [Radboud University](#)

JANUARY 16, 2025

Protein CD74 can predict immunotherapy response in bowel cancer, independent of subtype

by [The Francis Crick Institute](#)



Credit: Pixabay/CC0 Public Domain

Bowel cancer is the fourth most common cancer in the UK, and the second most common cause of cancer death. The disease falls into two types: one where proteins that repair errors in DNA are missing or deficient (the deficient subtype), and one where this machinery is intact (the proficient subtype).

Cancer [immunotherapy](#) drugs, which boost the immune system to fight the tumor, have revolutionized the treatment of the deficient subtype of colorectal cancer.

However, these drugs only work in about half of these individuals, and people with the proficient subtype, who represent ~90% of all cases, currently aren't eligible for immunotherapy treatment.

In a study [published](#) in *Cancer Cell*, researchers investigated why immunotherapy only works for certain people with [bowel cancer](#), and how we might increase the number of patients who can benefit from this treatment. They found that the levels of expression of a protein called CD74 can predict response to immunotherapy, independent of subtype.

The importance of the immune environment

The team first studied the [immune cells](#) surrounding different tumors, as the presence or absence of these cells can play a major role in a person's response to immunotherapy. They examined samples from both subtypes, and from people who responded to immunotherapy drugs versus people who didn't.

They found that three types of immune cells needed to be present for the tumor to respond to treatment: fighter cells called T and NK cells, and cells called macrophages, which present flags on their surfaces to highlight a threat to the body.

When all three immune cell populations were present and near to cancer cells, the T cells produced molecules called interferons, which triggered a signal in macrophages and tumor cells.

This signal was much higher in tumors of the deficient subtype that responded to immunotherapy, but, surprisingly, some patients in the proficient subtype also produced a comparable signal, suggesting that their immune system may be in the right state to benefit from immunotherapy.

CD74: A marker for immunotherapy response

The team next looked for a simple way to check whether the immune system was in the right state for immunotherapy to be successful.

Using a cutting-edge technique called spatial transcriptomics, they observed that T cells stimulated nearby macrophages and tumor cells to produce a protein called CD74 and that tumors that were responding to immunotherapy drugs produced higher levels of CD74.

To test whether CD74 might hold promise as a clinical marker to predict which patients would benefit from immunotherapy, the researchers studied samples from several international clinical trials testing immunotherapy in groups of people with the proficient subtype.

They found that people who responded to immunotherapy had significantly higher levels of CD74 than those who did not respond.

The results suggest that measuring CD74 levels could predict whether someone with bowel cancer will respond to immunotherapy, independent of which type they have.

Crucially, this means that some people with the proficient subtype, who are currently ineligible for immunotherapy, might benefit from this treatment.

Francesca Ciccarelli, Principal Group Leader of the Cancer Systems Biology Laboratory at the Crick, and Professor of Cancer Genomics at Queen Mary University of London's Barts Cancer Institute, said, "Immunotherapy drugs can be hugely successful for people with bowel cancer, but currently the majority of patients can't be prescribed these drugs and, even when patients are eligible, we don't know upfront who will respond.

"Our work suggests that testing for CD74 levels—which signal that the immune system is 'just right' to fight the tumor—could widen access to immunotherapy. This could revolutionize treatment for a sizable fraction of people with the proficient bowel cancer subtype, which is a large number of patients across the UK in real terms.

"It could also be used to identify people with the deficient subtype who won't respond, saving them from experiencing side effects unnecessarily."

Kalum Clayton, former postdoc at the Crick and joint first author with Pietro Andrei and Amelia Acha, said, "Our work shows how state-of-the-art technologies coupled with computational analysis can address important clinical questions. As an early career research scientist, seeing the potential of our work to provide benefit to patients and their families is greatly rewarding."

The research team are now working with Cancer Research Horizons to develop the findings into a test that can work in the clinic. They will also research why macrophages and [tumor cells](#) overexpress CD74, and whether this marker is present in other types of cancer.

Anna Kinsella, Science Engagement Manager at Cancer Research UK, said, "Immunotherapy treatments, such as immune checkpoint inhibitors, use the power of the immune system to fight cancer. While these treatments benefit some people with bowel cancer, they aren't effective for everyone.

"Although further research is needed, studies like this—diving deep into the biology of tumors—help researchers find ways to predict when immunotherapy is likely to work. In the future, this could help clinicians tailor treatment and allow more people with bowel cancer to benefit from immunotherapy.

"Understanding the biology of cancer is vital to unlocking better ways to prevent, detect and treat it, so that people can live longer, better lives free from the fear of cancer. That's why at Cancer Research UK, discovery research is at the heart of everything we do."

The team also worked with UCL, the University of Pisa, King's College London, the Sarah Cannon Research Institute and the Veneto Institute of Oncology.

More information: A constitutive interferon-high immunophenotype defines response to immunotherapy in colorectal cancer., *Cancer Cell* (2025). DOI:

[10.1016/j.ccell.2024.12.008](https://doi.org/10.1016/j.ccell.2024.12.008). [www.cell.com/cancer-cell/fulltext/S1535-6108\(24\)00483-5](https://www.cell.com/cancer-cell/fulltext/S1535-6108(24)00483-5)

Journal information: *Cancer Cell*

Provided by [The Francis Crick Institute](#)

JANUARY 13, 2025

Vascular 'fingerprint' at the back of the eye can accurately predict stroke risk

by [British Medical Journal](#)



Credit: CC0 Public Domain

A vascular 'fingerprint' on the light sensitive tissue layer at the back of the eye—the retina—can predict a person's risk of stroke as accurately as traditional risk factors alone, but without the need for multiple invasive lab tests, finds research [published](#) online in the journal *Heart*.

The fingerprint, comprising 29 indicators of vascular health, is a practical and readily implementable approach that is particularly well suited for primary health care and [low-resource settings](#), conclude the researchers.

Stroke affects around 100 million people around the globe and kills 6.7 million of them every year, point out the researchers. Most cases are caused by [modifiable risk factors](#), such as [high blood pressure](#), high cholesterol, poor diet, and smoking.

The retina's intricate vascular network is known to share common anatomical and physiological features with the vasculature of the brain, making it an ideal candidate for assessing damage from systemic ill health, such as diabetes, explain the researchers.

Its potential for [stroke](#) risk prediction hasn't been fully explored, due to variable study findings and inconsistent use of the specialized imaging technique for the back of the eye—fundus photography—they add.

But machine learning (AI), such as the Retina-based Microvascular Health Assessment System (RMHAS), has opened up the possibilities for the identification of biological markers that can accurately predict stroke risk without the need for invasive lab tests, say the researchers.

To explore this further, they measured 30 indicators across five categories of retinal vascular architecture in fundus images from 68,753 [UK Biobank study](#) participants.

The five categories included caliber (length, diameter, ratio) density, twistedness, branching angle and complexity of the veins and arteries.

And they accounted for potentially influential risk factors: background demographic and socioeconomic factors; lifestyle; and health parameters, including blood pressure, cholesterol, HbA1c (blood glucose [indicator](#)), and weight (BMI).

The final analysis included 45,161 participants (average age 55). During an average monitoring period of 12.5 years, 749 participants had a stroke.

These people tended to be significantly older, male, current smokers, and to have diabetes. They also weighed more, had higher blood pressure, and lower levels of 'good' cholesterol, all of which are known risk factors for stroke.

In all, 118 retinal vascular measurable indicators were included, of which 29 were significantly associated with first time stroke risk after adjusting for traditional risk factors. Over half (17) were density indicators; eight fell into the complexity category; three were caliber indicators; and one came under the twistedness category.

Each change in density indicators was associated with an increased stroke risk of 10–19%, while similar changes in caliber indicators were associated with an increased risk of 10–14%.

Each decrease in the complexity and twistedness indicators was associated with an increased risk of 10.5-19.5%.

This retinal 'vascular fingerprint,' even when combined with just age and sex, was as good as the use of traditional risk factors alone for predicting future stroke risk, the findings showed.

This is an observational study, and therefore no firm conclusions can be drawn about cause and effect. And the researchers acknowledge that the findings may not apply to diverse ethnicities as most of the UK Biobank's participants are white. Nor were they able to assess the risk associated with different types of stroke.

Nevertheless, they conclude, "Given that age and sex are readily available, and retinal parameters can be obtained through routine fundus photography, this model presents a practical and easily implementable approach for incident stroke risk assessment, particularly for [primary health care](#) and low-resource settings."

More information: Retinal vascular fingerprints predict incident stroke: findings from the UK Biobank cohort study, *Heart* (2025). DOI: [10.1136/heartjnl-2024-324705](https://doi.org/10.1136/heartjnl-2024-324705)

Journal information: [Heart](#)

Provided by [British Medical Journal](#)

Stretchy, self-healing 'jelly batteries' could revolutionize medical implants

In a nutshell

- Cambridge scientists have created stretchy, self-healing "jelly batteries" that can extend to 15 times their length while maintaining electrical conductivity – a combination never achieved before in a single material
- The materials repair themselves within hours of damage and could revolutionize medical implants, as they match human tissue properties and are less likely to be rejected by the body
- Inspired by electric eels, these hydrogels can generate power like a battery (about 1/10th of a AA battery's voltage) and maintain stable performance even when stretched 50% – five times better than previous versions

CAMBRIDGE, England — The next generation of medical devices won't just interact with the human body, they'll move and flex with it. University of

Cambridge researchers have created remarkable “jelly batteries” that stretch, conduct electricity, and even heal themselves, potentially revolutionizing everything from brain implants to wearable health monitors.

Unlike traditional electronics, which rely on rigid metal components and wires, these new materials are primarily water-based and can stretch to more than 15 times their original length without losing their ability to conduct electricity. The breakthrough, published in [Science Advances](#), overcomes a fundamental challenge in materials science.

“It’s difficult to design a material that is both highly stretchable and highly conductive since those two properties are normally at odds with one another,” explains lead author Stephen O’Neill from Cambridge’s Yusuf Hamied Department of Chemistry, in a statement. “Typically, conductivity decreases when a material is stretched.”

A research team from the University of Cambridge solved this challenge by creating special *hydrogels*, which are materials composed of [3D networks](#) of *polymers* containing over 60% water. These hydrogels use the same principle as our own bodies to conduct electricity, carrying charges through ions rather than electrons like traditional electronics.

“Normally, [hydrogels](#) are made of polymers that have a neutral charge, but if we charge them, they can become conductive,” says co-author Dr. Jade McCune. “And by changing the salt component of each gel, we can make them sticky and squish them together in multiple layers, so we can build up a larger energy potential.”

The secret to these materials’ remarkable properties lies in their [molecular structure](#). The researchers developed a system using special barrel-shaped molecules called *cucurbiturils*, which act like molecular handcuffs to bind different layers of the material together. These bonds can repeatedly break and reform, allowing the material to stretch, compress, and even heal itself when damaged.

This [self-healing capability](#) is particularly impressive. When the material is cut, it can repair itself within minutes. Tests showed that after just two hours of healing time, the material recovers 90% of its original stretchability. The team demonstrated this by cutting samples in half and watching them fuse back

together, tracking the healing process using fluorescent dyes under a microscope.

Taking inspiration from [electric eels](#), which stun their prey using special cells called *electrocytes*, the researchers created a working prototype of a soft, stretchable power source. By stacking different types of their conductive gels together in layers, they built a device that generates electricity through ion concentration gradients, similar to how electric eels produce their shock.

The device produces about 115-125 *millivolts* (roughly a tenth of an AA battery's voltage), and by connecting two cells in series, they could double this to around 248 millivolts. Most importantly, it maintains stable performance even when stretched up to 50%, which is about the same amount [human skin](#) can stretch. Previous attempts at similar devices would fail at just a 10% stretch.

"We can customize the mechanical properties of the hydrogels so they match [human tissue](#)," explains Professor Scherman. "Since they contain no rigid components such as metal, a hydrogel implant would be much less likely to be rejected by the body or cause the build-up of scar tissue."

Beyond medical applications, these materials could revolutionize soft [robotics](#), machines designed to interact safely with humans or handle delicate objects. The combination of flexibility, conductivity, and durability could enable robots that move more naturally and adapt better to their environment.

The materials are remarkably resilient in other ways, too. They can be compressed by more than 90% without permanently losing their shape, and they bounce back within 30 seconds, though some variations show minor delays in full recovery. This level of durability, combined with their self-healing properties, suggests they could last longer than traditional [electronic components](#) in many applications.

This invention is a significant step forward in creating electronics that adapt to humans rather than forcing humans to adapt to electronics. As testing continues, they could fundamentally change our approach to everything from [medical implants](#) to wearable devices.

Paper Summary

Methodology

The researchers created these hydrogels by combining water-based polymers with specially designed molecular structures that can form reversible bonds. The key innovation was using barrel-shaped molecules called cucurbiturils as tiny molecular containers that can hold and release other molecules, creating dynamic links between polymer chains. They tested several types of charged molecules to create different versions of the hydrogel, each with unique properties. The team used multiple testing methods including mechanical stretching tests, electrical conductivity measurements, and microscopic imaging with fluorescent dyes to analyze how the materials performed.

Results

The hydrogels achieved several breakthrough properties: they could stretch to more than 15 times their original length, compress by over 90%, and conduct electricity at levels up to 0.1 Siemens per centimeter. They demonstrated rapid self-healing abilities, recovering most of their strength within hours of being damaged. When used as a power source, the materials maintained consistent voltage even when stretched to 50% – five times more than previous versions. The team also proved these materials could stick strongly to each other without separating under strain.

Limitations

While the research shows promise, several challenges remain. The materials show some trade-off between stretchability and immediate elastic recovery – meaning they don't snap back to their original shape as quickly as some applications might require. The power output, while stable, remains relatively low compared to conventional batteries. Additionally, more testing is needed to fully understand how these materials would perform in long-term use, particularly in medical applications.

Discussion and Takeaways

This research represents a significant advance in creating electronics that can better integrate with biological systems. The combination of stretchability, conductivity, and self-healing properties could enable new applications in medicine and robotics that weren't previously possible. The approach of using reversible molecular bonds provides a framework for developing other advanced materials with similar properties. The biocompatibility of these materials makes them particularly promising for medical implants and devices that need to interface directly with human tissue.

Funding and Disclosures

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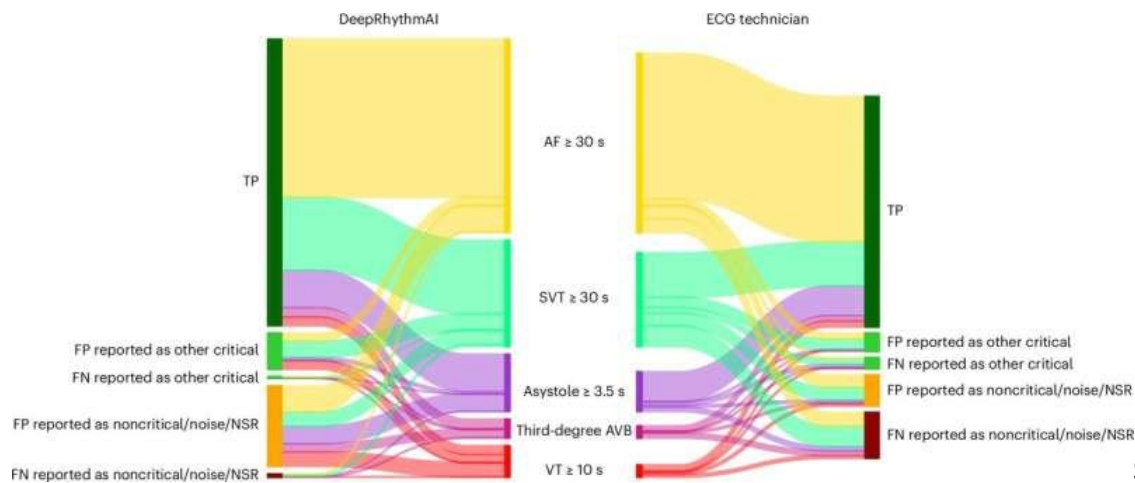
Publication Information

This research paper, "Highly stretchable dynamic hydrogels for soft multilayer electronics," was published in [Science Advances](#) on July 17, 2024. The study was conducted by researchers at the University of Cambridge's Melville Laboratory for Polymer Synthesis and the Electrical Engineering Division, in collaboration between the Yusuf Hamied Department of Chemistry and the Department of Engineering.

FEBRUARY 10, 2025

AI proves better than humans at analyzing long-term ECG recordings in large international study

by [Lund University](#)



Sankey diagram showing arrhythmic event durations for critical arrhythmias as detected by each of the two methods. Cardiologist panel annotations are used to classify DeepRhythmAI and ECG technician annotations into TP, FP or FN. For FP and FN detections, we also report whether these were annotated by the cardiologist panels as another critical arrhythmia class or as a noncritical arrhythmia/noise or NSR. TP, true positives; FP, false positives; FN, false negatives; NSR, normal sinus rhythm. Credit: *Nature Medicine* (2025). DOI: 10.1038/s41591-025-03516-x

In patients with symptoms such as irregular heartbeats, dizziness, or fainting, or in individuals that physicians suspect may have atrial fibrillation, many days of ECGs may be required for diagnosis—"long-term ECG recordings." These recordings must then undergo a time-consuming and human resource-intensive review to identify heart rhythm abnormalities.

In a large international study, researchers tested whether an AI model can replace humans in analyzing long-term ECG recordings. The results: 14 times fewer missed diagnoses by the AI.

Linda Johnson, Associate Professor of Cardiovascular Epidemiology at Lund University in Sweden, led the study alongside Jeff Healey, senior scientist at the Population Health Research Institute, a joint institute of McMaster University and Hamilton Health Sciences in Canada. The findings are [published](#) in *Nature Medicine*.

The human heart beats 80,000–20,000 times a day. Long-term ECGs record every heartbeat, and the recording is then scrutinized for abnormalities—arrhythmias—which is a time-consuming process.

The current study included 14,606 individual patients who had recorded an average of 14 days of ECG; in total of over 200,000 days of ECG data. These data were reviewed by ECG technicians using standard clinical methodology. The same data were then re-analyzed using an AI algorithm—"DeepRhythmAI"—specifically developed for the task by MEDICALgorithmics, Poland.

"We then randomly selected over 5,000 episodes of arrhythmias for intensive, beat-by-beat analysis by 17 panels of expert physicians (mainly cardiologists and electrophysiologists) from all over the world, which provided an extremely high-quality gold standard diagnoses against which we then compared the ECG and AI algorithm interpretation," says Johnson.

The researchers found that analysis by the AI led to 14 times fewer missed diagnoses of severe arrhythmias (including complete heart block, ventricular tachycardia, and [atrial fibrillation](#)). Severe arrhythmias were missed in 0.3% of patients by the AI, compared with 4.4% for the technicians.

The researchers' intention was not to prove that AI is as good as or better than cardiologists for the diagnosis of specific arrhythmias. Rather, the study sought to determine what would happen if the technicians were replaced, and physicians received reports directly from the AI. If successful, such an approach would be a major innovation that could address the worldwide shortage of trained staff capable of interpreting long-term ECG monitoring.

"There is a shortage of around 15 million health workers worldwide. Ambulatory ECGs need to be analyzed by specially trained staff, often called ECG technicians. Lack of staff leads to a huge bottleneck in health care worldwide, and at the same time, patients would benefit if we did more and longer ambulatory ECG recordings, not shorter.

"We believed that AI could solve this problem. That's why we wanted to study what happens if you skip the ECG technicians altogether and let an AI algorithm do the job of detecting the arrhythmias, that cardiologists then review," says Johnson.

This is the first study to test not only how good the AI algorithm is at assessing individual selected ECG strips, but also what we could expect to happen if human technicians were replaced by AI.

"Today, most long-term ECG devices use some type of AI to support interpretation, but with varying quality. And there are still long waiting times for long-term ECG monitoring, in some cases many months. If we have a qualified AI model that can review all ECGs, then we would have both much cheaper and faster diagnostics," says Healey.

When designing this study, there were a few key characteristics that the researchers felt that the AI must have.

"It must have near-perfect sensitivity, which means that anything that is a potentially serious arrhythmia must be flagged for assessment by a doctor. This is the most important aspect; patients and physicians would not tolerate any failure to diagnose serious arrhythmias (i.e. [false negatives](#)). At the same time, the AI model must not identify too many rhythms that are not serious (i.e. false positives), that then require physician review," states Healey.

The AI model was able to rule out severe arrhythmia with 99.9% confidence in a 14-day ECG recording. The number of [false positives](#) (in this context, findings misinterpreted as a serious [arrhythmia](#)) was 12 per 1,000 recording days for AI compared with 5 per 1,000 recording days for human analysis.

"We have shown what this AI model can do, and how sensitive and accurate it is. I also think it's an impressive effort by everyone who contributed to the study. In total, there were 50 expert reviewers and cardiologists who all went through the selected ECGs beat by beat. We are very grateful to all those who have supported the idea and invested so much time and commitment," says Johnson.

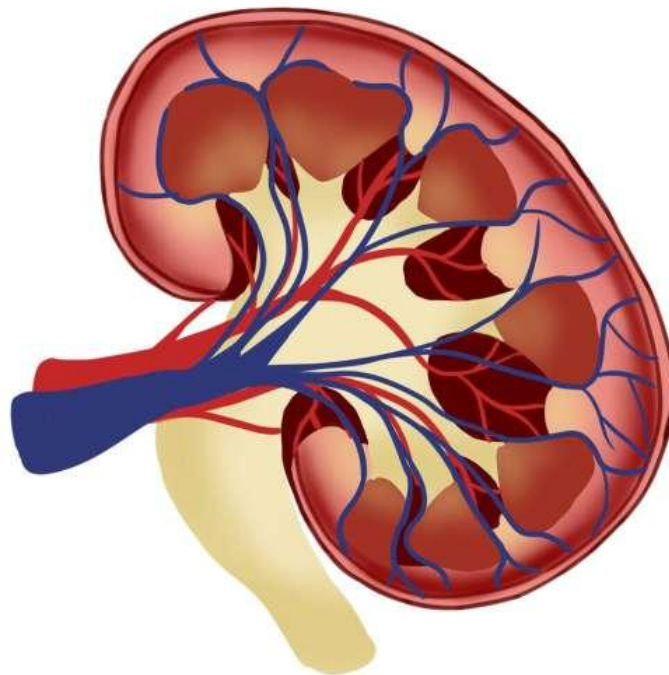
More information: L. S. Johnson et al, Artificial intelligence for direct-to-physician reporting of ambulatory electrocardiography, *Nature Medicine* (2025). DOI: [10.1038/s41591-025-03516-x](https://doi.org/10.1038/s41591-025-03516-x)

Journal information: [Nature Medicine](#)
Provided by [Lund University](#)

FEBRUARY 10, 2025

Popular weight-loss drugs show promise in reducing kidney disease complications and mortality

by [UT Southwestern Medical Center](#)



Credit:

Pixabay/CC0 Public Domain

A well-known class of drugs used to manage type 2 diabetes and control weight could offer hope for patients who also struggle with related chronic kidney disease (CKD), researchers at UT Southwestern Medical Center found.

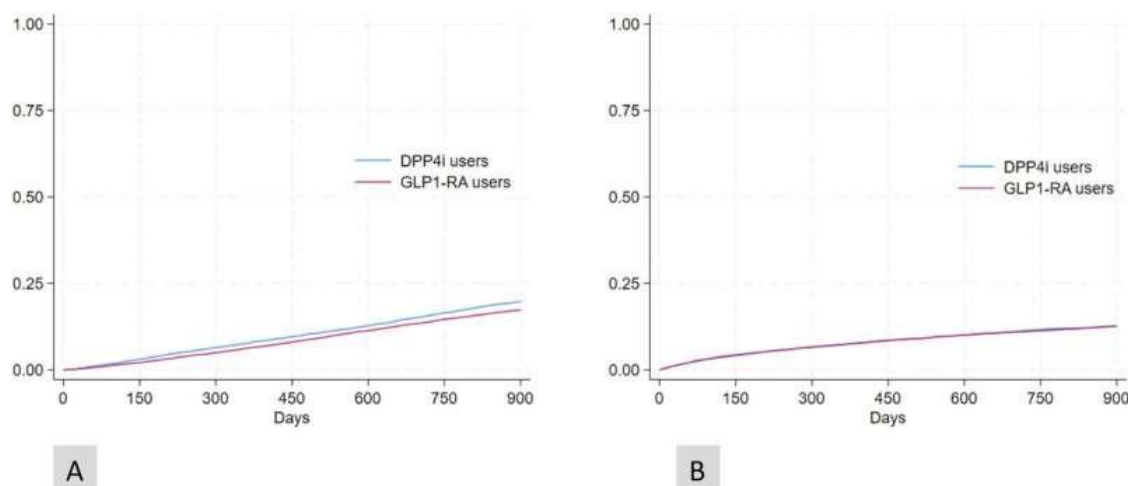
The medications, known as glucagon-like peptide-1 receptor agonists (GLP1-RAs), include semaglutides, liraglutides, dulaglutides, and more, available under a variety of brand names. UTSW researchers and their colleagues found that these drugs provide three significant benefits for patients with diabetes-related kidney disease compared with another common class of medications known as dipeptidyl peptidase-4 inhibitors (DPP4is): reducing hospitalization, all-cause mortality, and kidney disease progression.

"The benefits of GLP1-RA therapy for blood glucose management are well known, but our research provides much-needed evidence in support of the renal-protective effect of GLP1-RAs in [high-risk patients](#) with moderate to [advanced chronic kidney disease](#)," said first

author Shuyao Zhang, M.D., Assistant Professor of Internal Medicine in the Division of Endocrinology at UT Southwestern. Dr. Zhang worked under the mentorship of co-senior authors Ildiko Lingvay, M.D., M.P.H., M.S.C.S., Professor of Internal Medicine in the Division of Endocrinology and in the Peter O'Donnell Jr. School of Public Health, and Ishak A. Mansi, M.D., Professor of Internal Medicine at the University of Central Florida College of Medicine.

The study, [published](#) in *Nature Communications*, was designed to emulate a clinical trial, using data from a nationwide cohort of patients at Veterans Health Administration hospitals and clinics. Researchers analyzed the [medical records](#) of 64,705 veterans with diabetes and CKD—divided into propensity-matched pairs of people who initiated GLP1-RA or DPP4i, to ensure there was no significant difference in baseline characteristics between the two groups. Propensity-matched pairs include one individual from a treatment group and one from a control group who have a high probability of receiving the same treatment based on their symptoms.

Over the study period of almost two years, the data showed significant reductions in acute health care utilization (10% lower); death from any cause (16% lower); and kidney disease progression (36% lower) among patients initiated on a GLP1-RA vs. DPP4i.



Kaplan-Meier curves for all-cause mortality and first composite cardiovascular event. Credit: *Nature Communications* (2024). DOI: 10.1038/s41467-024-54009-3

Patients with CKD and end-stage renal disease due to type 2 diabetes are also prone to complications such as hypoglycemia ([low blood sugar](#)), infections, or cardiovascular events. Managing these risks—and reducing the need for expensive, acute-care hospitalization—has long been a challenge.

"People with diabetes and chronic kidney disease have a very high risk of complications and experience frequent hospitalizations," Dr. Lingvay said.

"Yet this population is much less likely to be included in clinical trials or be treated with medications that have proven benefits. Our findings demonstrate that GLP1-RAs can lead to fewer cardiovascular events, less progression of kidney disease, and lower health care

costs. These are very impactful outcomes that support the widespread benefits of this class of medications in this high-risk population."

Drs. Zhang and Lingvay believe that their study could help lead to changes in the clinical management of CKD.

"Historically, diabetic kidney disease has been difficult to address," Dr. Zhang said. "With further research, we could eventually see new guidelines that include GLP1-RAs as part of a comprehensive treatment approach for diabetes-related kidney disease, potentially improving long-term outcomes and enhancing patient quality of life."

Dr. Lingvay and her colleagues have extensive experience studying the benefits of semaglutide, including its value in reducing the risk of cardiovascular events and its ability to help patients with diabetes or obesity lose weight.

More information: Shuyao Zhang et al, Healthcare utilization, mortality, and cardiovascular events following GLP1-RA initiation in chronic kidney disease, *Nature Communications* (2024). DOI: [10.1038/s41467-024-54009-3](https://doi.org/10.1038/s41467-024-54009-3)

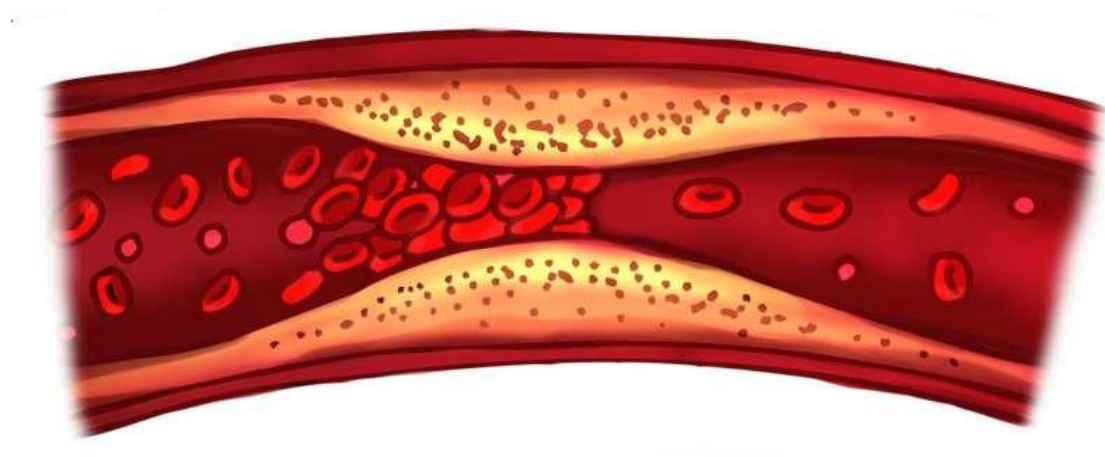
Journal information: [Nature Communications](#)

Provided by [UT Southwestern Medical Center](#)

FEBRUARY 8, 2025

Removing large brain artery clot, chased with clot-buster shot may improve stroke outcomes

by [American Heart Association](#)



Credit: Pixabay/CC0 Public Domain

Removing a blood clot from a large brain artery, then injecting the clot-dissolving drug tenecteplase into the artery resulted in stroke survivors being more likely to have better function 90 days after their stroke than those receiving standard clot removal, according to preliminary late-breaking science presented today at the [American Stroke Association's International Stroke Conference 2025](#). The conference, in Los Angeles, Feb. 5-7, 2025, is a world premier meeting for researchers and clinicians dedicated to the science of stroke and brain health.

About 1 in 5 clot-caused (ischemic) strokes result from a clot obstructing a large artery (large vessel occlusions) in the brain. The standard of care in the U.S. per the American Heart Association/American Stroke Association 2019 Guidelines for the Early Management of Patients with Acute Ischemic Stroke and in China for this type of stroke is prompt removal of the clot to restore blood flow using minimally invasive endovascular [treatment](#)—a procedure that inserts a slim catheter (small tube) and/or a stent into an artery to retrieve the clot and restore blood flow, preventing further brain damage.

Without treatment, more than 80% of people with strokes caused by large vessel occlusions are disabled, and 20% die, based on prior studies. Even when clots are successfully removed, up to half of the people may die or be disabled three months later.

"Endovascular treatment can help restore blood flow in a blocked large blood vessel. However, it might not improve blood flow in the smaller vessels and microcirculation in the area. This clinical trial tests whether delivering tenecteplase directly into the affected artery after endovascular treatment can break up [blood clots](#) in the small vessels and improve blood flow, reducing the amount of brain tissue that lacks blood supply," said Xiaochuan Huo, M.D., Ph.D., lead author of the study and director of the neurological disease center at Beijing Anzhen Hospital in China.

The current study, conducted at 19 centers in China, evaluated the safety and effectiveness of injecting tenecteplase directly into a large brain artery (intra-arterial injection) near where a clot was removed and restoring blood flow. All participants had large vessel occlusions and were treated between 4.5 hours and 24 hours after the last time they were observed to be well. According to the study protocols, 127 patients received tenecteplase and successfully underwent endovascular therapy, and 129 received standard medical care (in the full analysis population for the final results) after successful endovascular therapy. Disability was measured by a score of 0-1 on the modified Rankin Scale with ratings from 0 (no disability) to 6 (death).

The analysis found:

- Stroke survivors were 44% more likely to have an excellent outcome (modified Rankin score 0-1) after 90 days if they received the tenecteplase injection and standard care after clot removal compared to those who received only standard care (40.5% vs. 26.4%).
- Rates of brain bleeds in the two days after treatment were similar in those receiving tenecteplase (5.6%) and those receiving standard medical treatment (6.2%).

- Rates of death from any cause within 90 days were similar in those receiving tenecteplase (21.4%) and those receiving standard medical treatment (21.7%).

"Intra-arterial tenecteplase after successful thrombectomy could improve the percentage of people with an excellent outcome. It could also improve the rate of large vessel occlusion stroke survivors who can return to society and live independently," Huo said.

The researchers are following the participants to assess their one-year outcomes. Huo said their results may someday be used to change treatment guidelines for [stroke survivors](#) who have undergone successful clot removal. "We still need to directly analyze the individual data of participants in this and other trials—an individual meta-analysis—in order to release a high evidence-based recommendation," Huo said.

The study did not include patients treated with intravenous clot-busting drugs or medications that reduce blood clotting, like heparin and anti-platelet drugs, during their endovascular procedures. This means that the benefits of intra-arterial tenecteplase shown in this study may not apply to people who received those treatments.

Study background, details and design:

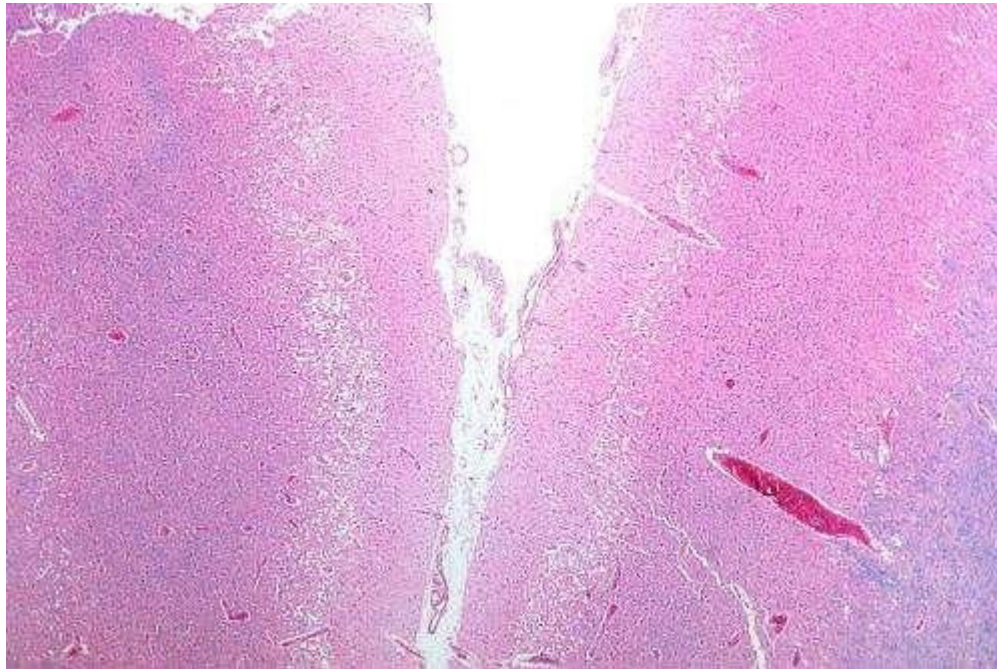
- ANGEL-TNK enrolled 255 participants (mean age of 70; 44.7% female) between February 2023 and March 2024 at 19 centers in 13 provinces of China.
- All participants were adults who experienced a clot-caused (ischemic) stroke obstructing a large artery in the brain's anterior circulation. All had blood flow successfully restored by having the clot removed via catheter or aspiration (breaks up and draws the clot through the tube) between 4.5 and 24 hours from the time they were last known to be well. No participants were disabled before their stroke. The main exclusion criterion was treatment with intravenous clot-busting medications (which, by Chinese guidelines, must be used within 4.5 hours after a person was last known to be well).
- After successful restoration of blood flow, participants were randomized to receive either standard medical care or to have the clot-dissolving drug tenecteplase infused into the artery near the clot.
- The primary assessment for the effectiveness of the additional treatment was the percentage of participants who had no symptoms or some symptoms but no disability 90 days later, as measured by a score of 0-1 on the modified Rankin Scale administered and scored by someone without knowledge of the treatment group.
- The primary assessments for safety were brain bleeding within 48 hours of treatment or death from any cause within 90 days.

Provided by [American Heart Association](#)

FEBRUARY 8, 2025

Clot-busting meds may be effective up to 24 hours after initial stroke symptoms

by [American Heart Association](#)



Micrograph

showing cortical pseudolaminar necrosis, a finding seen in strokes on medical imaging and at autopsy. H&E-LFB stain. Credit: Nephron/Wikipedia

The clot-dissolving medication, alteplase, improved stroke patients' recovery by more than 50% when given up to 24 hours after the beginning of an ischemic stroke, according to preliminary late-breaking science presented today at the [American Stroke Association's International Stroke Conference 2025](#). The conference, in Los Angeles, Feb. 5-7, 2025, is a world premier meeting for researchers and clinicians dedicated to the science of stroke and brain health.

These results give hope to stroke patients worldwide who may not be able to access clot-dissolving medications within the approved time window, which in China is within 4.5 hours, said the trial's principal investigator Min Lou, M.D., Ph.D., a professor at the Second Affiliated Hospital of Zhejiang University's School of Medicine in China.

In the U.S., alteplase is approved to treat stroke within three hours of symptom onset and is recommended for use up to 4.5 hours for select patients. Other research has indicated it may also work well in some patients 4.5 to 9 hours after stroke onset.

The American Heart Association/American Stroke Association 2019 Guidelines for the Early Management of Patients with Acute Ischemic Stroke note that IV alteplase within 4.5 hours of stroke onset is the standard of care for most [ischemic stroke](#) patients in the United States.

Researchers enrolled 372 stroke patients whose symptoms began 4.5 hours to 24 hours earlier. They used widely available CT perfusion imaging (advanced brain scanning) to confirm that these patients still had [brain tissue](#) that could recover with treatment. Participants were randomly split into two groups—one group received the clot-busting medication alteplase, while the other received standard stroke care of antiplatelet therapy at the discretion of the investigator, based on the Chinese Guidelines for Diagnosis and Treatment of Acute Ischemic Stroke 2018. Functional recovery was assessed at 90 days.

"We believe these findings mean more people may return to normal or near-normal lives after a stroke, even if they receive treatment later than originally thought beneficial," Lou said. "This method of treatment could become the new standard, especially in hospitals that use CT perfusion imaging. This technology helps health care professionals see how blood flows in different parts of the brain after an ischemic stroke. This could extend treatment eligibility to millions more patients across the globe."

The study found:

- 40% of participants treated with alteplase had little to no disability after 90 days, compared to 26% of those who received standard care—a 54% higher chance of functional recovery.
- Less than 3% of participants in either group received rescue mechanical clot removal as an additional treatment.
- Rates of death were the same (10.8%) for both groups.
- The risk of brain bleeding was higher among those who received alteplase than among participants who did not (3.8% vs. 0.5%), but researchers believe this is a manageable risk.

"We also need to look more closely at how safe and effective other clot-dissolving medications, like tenecteplase, are when given after a stroke, especially beyond the usual time frames. It's also important to learn if our findings apply to other groups of people, especially in areas with different stroke risks and health care resources," Lou explained.

Study limitations include the that both participants and researcher knew which treatment was being given, which could have introduced bias, and results may not be generalizable to patients outside of China.

Study design, background and details:

- The study enrolled 372 [stroke patients](#) in a multicenter, prospective, randomized trial at 26 stroke centers in China.
- The patient's average age was 72 years, and 43% were women.

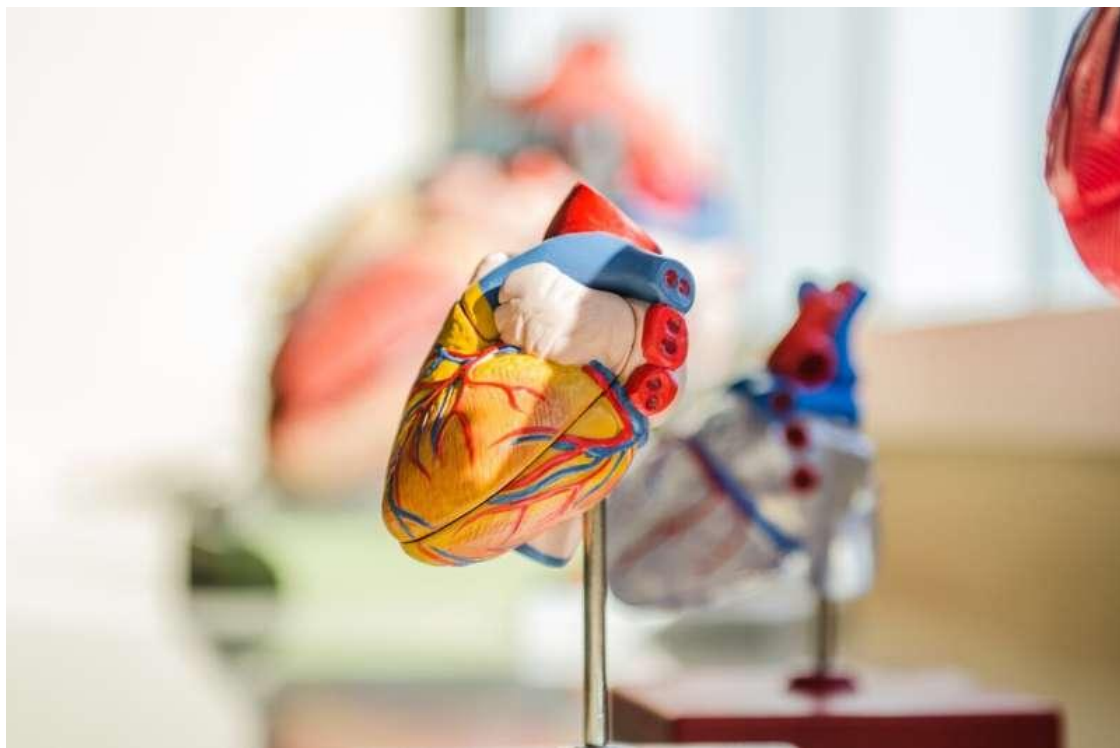
- The trial used widely available CT perfusion imaging software to gauge salvageable brain tissue, making the findings more applicable to real-world clinical settings.
- Enrolled patients were assigned to the alteplase group or a standard medical treatment group.
- The primary outcome was a score of 0 or 1 on the modified Rankin scale, which scores disability from 0 (no symptoms) to 6 (death) at 90 days.

Provided by [American Heart Association](#)

FEBRUARY 10, 2025

What you need to know about the new implants to patch up failing hearts. Are they really a 'breakthrough'?

by John Martin, [The Conversation](#)



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There are many difficulties in converting any biological research into a medicine that will treat patients. Because of the complexity involved, these difficulties apply especially to translating cell research in the laboratory to a successful treatment for heart failure, where the heart is unable to pump blood around the body properly.

The definitive treatment for [heart failure](#) is a heart transplant—a difficult and costly procedure. Pills are prescribed for the condition, but they only delay death and are not effective in changing the cause of the disease.

Fifteen to 20 years ago, scientists started enthusiastically exploring the use of heart muscle precursor cells grown in the laboratory to transplant to the failing heart in the hope that they might make new heart muscle. Although results in animal tests were positive, they all failed in humans. Included in the failures was the one that [my colleagues and I conducted](#).

We'd had success with animal studies and even some positive results in small groups of patients. Buoyed by these results, we organized a randomized controlled trial—the gold standard for medical studies in humans.

Our study was funded by the European Commission and entailed a massive effort by a large group of researchers across Europe. The result was that the therapy, which entailed injecting bone marrow cells into the heart muscle of patients who had had a heart attack, did not work.

I was therefore surprised to read recently that an [article in *Nature*](#) on this subject had an enthusiastic reception in the press. It was variously described as "[groundbreaking](#)," "[remarkable](#)" and a "[major breakthrough](#)."

The authors of the article report growing patches of heart muscle in the lab from precursor cells and then applying those patches to the hearts of monkeys that had had an induced heart attack, producing heart failure.

A woman who'd had a [heart attack](#) in 2016 also had the procedure. Three months later, she had a [heart transplant](#), allowing the researchers to analyze her heart.

As this was the only case of a human receiving this treatment, and the procedure had failed, as the heart was removed from the patient, the title of the *Nature* article is perhaps too wide in its scope: Engineering heart muscle allografts for heart repair in primates and humans.

It is noted that a senior author of the article declares that he has shares in the company that will commercialize any success. This conflict may have been declared, but it is still a potential conflict.

Heart arrhythmia

The article does not discuss previous attempts to use heart muscle precursor cells for treating heart failure in humans. In particular, the pioneering work in Paris of the surgeon Philippe Menasché who in 2003 reported in [The Lancet](#) that he had injected heart muscle precursor cells into the myocardium (heart muscle) of a patient with apparent success.

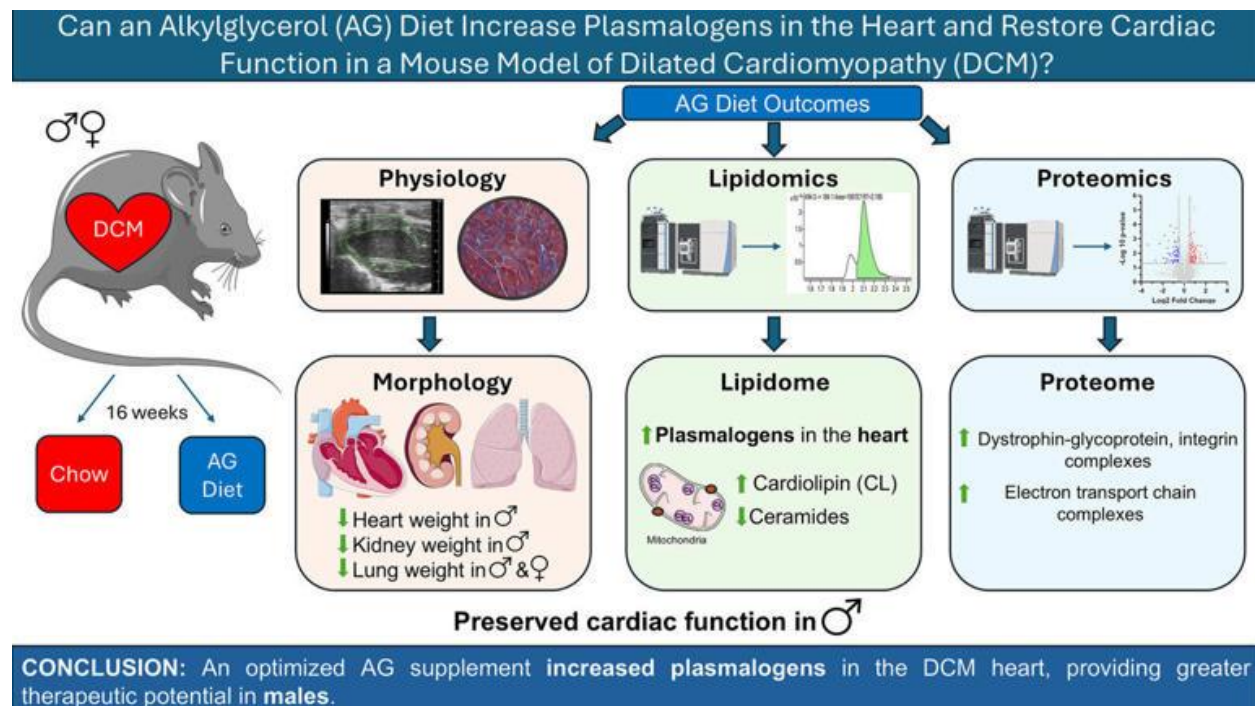
He then published the results of [a study](#) where he repeated the same procedure in a larger group. The study was not successful. Menasché noted that some of the patients suffered from cardiac rhythm abnormalities following the procedure.

There was much discussion in the field that the junctions between the transplanted cells and the patient's own heart muscle cells might give rise to abnormal electrical activity that would unpredictably produce potentially fatal heart rhythm change.

Because of the history of failure of cell therapy in [human trials](#) after positive tests in lab animals, the objective reader should regard results from [animal experiments](#) with skepticism.

Journal information: [The Lancet](#) , [Nature](#)
Provided by [The Conversation](#)

Dietary supplement shown to restore cardiac function



Credit: Journal of Molecular and Cellular Cardiology Plus (2024). DOI: 10.1016/j.jmccpl.2024.100273

A dietary supplement developed at the Baker Heart and Diabetes Institute has been found to stop the progression of heart failure in animal models, providing further evidence of the supplement's efficacy for potential use in humans.

The new paper, [published](#) in the *Journal of Molecular and Cellular Cardiology Plus*, has shown that feeding mice a diet that included this supplement, elevated energy-boosting, anti-oxidant fats that circulate in our blood, called plasmalogen lipids, which restores the integrity of damaged cells in a failing heart.

Plasmalogens make up about 15% of cell membranes—the outer layer of cells—and are predominantly found in the brain and heart. They are important for immune function, energy metabolism and for their antioxidant properties, co-senior author Dr. Yow Keat Tham said.

"The cell membrane is the barrier between what happens outside and inside of the cell," Dr. Tham said. "What we're doing is adding something to the diet that would increase the levels of these plasmalogens, which help to smooth out the surface of the cells that have been damaged by disease, and restore functionality," he said.

Disruptions to the cell membrane can change the composition of the lipids within cells and that can contribute to and exacerbate the seriousness of diseases including obesity, neurological and cardiovascular diseases, paper first author Teleah Belkin said.

"A heart with cardiomyopathy—or heart failure—has reduced levels of plasmalogens, so we were looking at whether including this plasmalogen-enriching dietary supplement was able to replenish the plasmalogens in a diseased heart," Belkin said. "What we found was that the dietary supplement was able to restore cardiac function and lessen other pathological features associated with heart failure."

Earlier Baker Institute trials using variations of this dietary supplement have already shown the therapeutic potential of enhancing plasmalogen levels in preclinical models of atherosclerosis, fatty liver disease and even in obese human study participants, but this is the first study that shows this plasmalogen-modulating dietary supplement has therapeutic potential for the heart, lungs and kidneys in a preclinical model of dilated cardiomyopathy.

"We showed that when we elevated circulating and cardiac plasmalogens with this dietary supplement in mice with heart failure, remodeling of the lipid composition in the heart occurred, reducing the negative effects associated with

cardiomyopathy, including tissue scarring and impaired mitochondrial properties, which are crucial for producing energy for the heart," Dr. Tham said.

"Interestingly, this approach provided greater protection in males than females and highlights the importance of including both sexes in preclinical and clinical research."

Plasmalogens can be found naturally in foods, including mussels, scallops and octopus, and even strawberries, but you would have to consume large quantities of these food items to potentially receive the health benefits. The Baker Institute supplement, licensed to Juvenescence Ltd, contains natural components that support the production of plasmalogens in our body.

Human clinical trials to test the efficacy of the patented supplement on a range of health outcomes, including arterial function, lipid metabolism and inflammation, will start in late 2025, and there are hopes that the supplement will be available sometime within the next two years.

"We'd also like to test the diet in other models of heart failure, or even different heart settings, including in people who have had a heart attack," Dr. Tham said. "We'd test whether we're able to reverse some of that heart damage that occurred from the heart attack with this supplement."

More information: Teleah G. Belkin et al, An optimized plasmalogen modulating dietary supplement provides greater protection in a male than female mouse model of dilated cardiomyopathy, *Journal of Molecular and Cellular Cardiology Plus* (2024). DOI: [10.1016/j.jmccpl.2024.100273](https://doi.org/10.1016/j.jmccpl.2024.100273)

Provided by Baker Heart & Diabetes Institute

Your smartwatch will soon be able to detect signs of heart failure

Congestive heart failure (CHF) is a condition that affects over five million Americans. For people over the age of 65, it is the most common diagnosis when they are hospitalized. One in nine deaths has heart failure as a contributing cause, as [per](#) Johns Hopkins Medicine.

Smartwatches might soon come to the rescue.

Experts at Tampere University have developed a new smartwatch-based method for detecting congestive heart rate failure. As part of a multi-disciplinary research that involved heart health and machine learning experts, the team created a real-time analysis method that works with smartwatches and heart rate monitors.

Heart diseases usually follow a signature pattern of cardiac activity, and their careful analysis by an expert can help detect signs of serious problems. [Take for example AFib detection](#), which looks for signs of irregular heartbeat rhythm using electrocardiogram (ECG) data.



The team is applying a similar tactic for diagnosing CHF in patients, relying on the insights gleaned from inter-beat or RR intervals. The RR interval is representative of the length of a ventricular cardiac cycle.

In the context of an electrocardiogram, it represents the time gap between two successive R-waves on an ECG graph. The team measured the accuracy of their method against a control set of healthy folks and people living with atrial fibrillation (AFib) problems.

As per the research paper that was published in the Heart Rhythm O2 journal, smartwatches can detect signs of congestive heart failure with impressive accuracy. The system is not only convenient and cost-effective, but can also help detect the onset of a serious cardiac problem and save lives.

"This approach highlights the potential of non-invasive, cost-efficient RRI analysis for early detection of CHF (congestive heart failure) and AF (atrial fibrillation)," concludes the research paper. As far as measurement accuracy goes, the method achieved 90% sensitivity and 92% specificity in detecting heart failure and AFib markers.



Joe Maring / Digital Trends© Provided by Digital Trends

Last year, the same team developed a smartwatch-based computation method that can [predict](#) the risk of death from sudden cardiac arrest using a minute's worth of heart rate measurement on a smartwatch.

"Our findings pave the way for the early detection of congestive heart failure using readily available equipment, eliminating the need for complex diagnostic procedures," says Professor Jussi Hernesniemi, a cardiologist at Tays Heart Hospital.

The latest breakthrough is just the latest in a series of promising smartwatch-based research. In just a decade, smartwatches have transformed from digital companion devices to serious health-sensing powerhouses.

We already have smartwatches out there that [measure blood pressure](#) and look for [signs of sleep apnea](#), while capabilities such as [blood glucose monitoring](#) are also on the horizon. Earlier this year, another research highlighted how smartwatch data can help accurately [detect psychiatric illnesses](#) and also trace their roots to a person's unique genes.

New gut microbiome atlas builds most accurate profile of global gut health to date



Credit: Pixabay/CC0 Public Domain© Provided by Medical Xpress

A new and freely available [Human Gut Microbiome Atlas](#) could help researchers and health care professionals around the world better understand how microorganisms in the gut impact disease, leading to more effective treatment.

The study, [published](#) in *Genome Research*, is an international collaboration led by King's College London that identifies gut bacteria appearing in individuals with 23 separate diseases across 19 countries. Carried out in collaboration with MetaGenoPolis and the Science for Life Laboratory, the global study is the largest to date.

By tagging clusters of microbiome features to specific diseases, the authors believe this data could help diagnose and provide individual pathways for treatment for illnesses such as colorectal cancer and Crohn's Disease.

The human gut microbiome is the individual profile of bacteria and other microorganisms that live in the gut that helps perform key bodily functions, such

as digestion. Recently, it has been shown to have a strong relationship with the development of a wide variety of diseases, including type two diabetes, depression and Alzheimer's disease.

Until now the information that exists on microbiomes has been fragmented. While data exists on the genetic makeup of individual microbes in the gut, these are siloed dependent on specific diseases. This prevents large-scale comparative studies and doctors from tailoring treatments to work with the microbiome of their patients.

Dr. Saeed Shoaie, Senior Lecturer in Systems & Synthetic Biology at King's College London and corresponding author said, "The human microbiome has been an increasingly promising field of study, but the lack of access to high-quality harmonized data has been a stumbling block for future impactful research. That's why we created the Human Gut Microbiome Atlas.

"The discovery of microbiome patterns common across disease will allow researchers to answer what constitutes a healthy or unhealthy gut microbiome. This will allow health care professionals to identify and diagnose diseases with greater clarity and implement effective treatments that target areas of the microbiome, like dietary modifications or even microbiome transplants."

The team carried out a systematic survey of genetic data from more than 6,000 human gut microbiome samples across North America, Europe and South and East Asia. Using machine learning models, they then classified which gut bacteria appeared most frequently in healthy individuals and those with specific diseases, tagging specific functions to specific bacteria.

By presenting a freely available data set to health professionals working in affected communities, the resource will empower better health care decision making at a community level.

In the future, the team hope to expand their work to produce oral and skin microbiome atlases to treat illnesses like eczema and psoriasis, as well as tracing antimicrobial resistance (AMR) in the gut.

AMR is projected to kill more than 10 million people a year by 2050. By tracing which gut bacteria are becoming resistant to antibiotics within global populations and environments, the group hope to improve and assess the efficacy of efforts to treat disease and combat AMR.

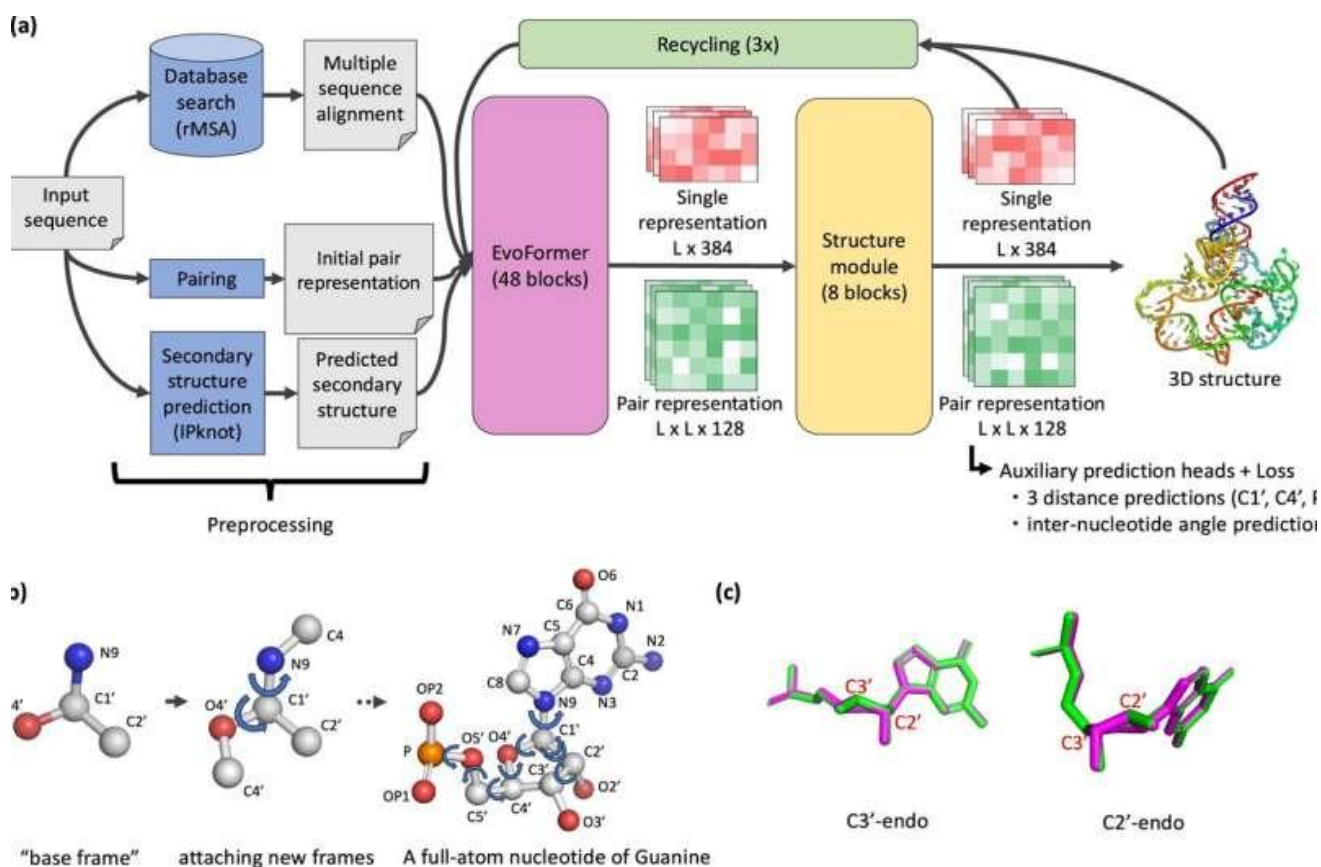
Dr. Frederick Clasen, Research Associate at King's College London and co-author of the study, said "The threat of AMR requires novel and innovative solutions, and using the microbiome holds great potential for improved diagnosis, surveillance, and treatments. We believe that the human microbiome atlas is an important step to unlocking the power of microbiome for this purpose."

More information: Sunjae Lee et al, Global compositional and functional states of the human gut microbiome in health and disease, *Genome Research* (2024). DOI: [10.1101/gr.278637.123](https://doi.org/10.1101/gr.278637.123)

Provided by King's College London

Computational solution to model 3D RNA structures could speed medical discoveries by decades

by [Purdue University](#)



Ribonucleic acid, commonly known as RNA, is involved in many biological functions, and some, including gene silencing, are utilized to cure diseases. RNA has recently gained attention as a promising drug target. Unfortunately, only a small fraction of RNA structures have been determined experimentally, and the process of uncovering these structures requires significant time and effort. Using this time scale, the structures of many lifesaving RNA structures may not be discovered for years. As a result, there is a significant gap between the types of known RNA and the available structural data.

Researchers at Purdue University have developed a computational solution to this problem named NuFold, which will model 3D RNA structures that could expedite medical discovery decades ahead of schedule. The research team, led by Daisuke Kihara, professor of biological sciences and computer science in the Purdue College of Science, [has published their findings](#) in *Nature Communications*.

This result has wide-ranging potential applications, such as in understanding RNA mechanisms and in drug development for diseases involving RNA. NuFold's code and Google Colab notebook are publicly available, making it accessible not only to researchers but also to anyone interested in RNA structural models. NuFold is a groundbreaking tool for more accurate and efficient RNA structure prediction, with the potential to significantly advance RNA research.

In order to sustain life, varieties of molecules must work together. Proteins in these molecules have typically been the primary focus of research, but recently RNA has been found to play unique and broad roles in essential life functions. To understand how RNA functions, it is essential for scientists to know its 3D structure.

Kihara studies protein tertiary structure prediction/comparison, protein-protein docking, protein-ligand docking, protein function prediction, protein sequence analysis, and metabolic/regulatory pathway analysis in the Structural Biology Group within the Department of Biological Sciences. His team is affiliated with the Purdue Institute for Cancer Research and also works closely with the Rosen Center for Advanced Computing (RCAC).

"NuFold is the RNA equivalent of AlphaFold. AlphaFold is the computational protein structure prediction method that got the Nobel Prize in chemistry in 2024," said Kihara. "AlphaFold is now routinely used in many biology labs. NuFold would be an RNA version of AlphaFold. So, in a way, we're extending the breakthrough of AlphaFold into the world of RNA, which has been much more challenging to tackle. By modeling RNA's 3D structure, we can help bridge the gap created by the lack of experimentally determined structures, advancing research on RNA and its crucial roles in life and health."

"It took over three years to develop NuFold," said Yuki Kagaya, main developer of NuFold and postdoctoral research assistant at Purdue. "A key feature of NuFold is how it represents RNA internally, considering the base pairs that are pivotal to the structure while accurately capturing RNA's inherent flexibility. In benchmark tests, NuFold has outperformed traditional energy-based methods and shown better accuracy in local structure prediction compared to recent deep learning-based approaches."

NuFold will help researchers "visualize" how RNA structure would look and boost research progress and drug development with RNA.

"To solve problems that cannot be immediately addressed through experiments, we developed NuFold as a computational solution," said Kihara. "NuFold can help bridge the gap by predicting the 3D structures of RNA from its sequence. By leveraging state-of-the-art machine learning techniques, NuFold can predict the full atomic structure of RNA given its sequence."

The research authors are all affiliated with Purdue. Kihara is the lead author who conceived of and directed the study. Other authors include Kagaya, Zicong Zhang (graduate student, computer science), Nabil Ibtehaz (graduate student, computer science), Xiao Wang (former graduate student, computer science), Tsukasa Nakamura (postdoc, biological sciences) and Pranav Deep Punuru (undergraduate student, biological sciences). Kagaya is the main

developer, and the rest of the team participated in coding and benchmarking and developing the Google Colab web server.

More information: Yuki Kagaya et al, NuFold: end-to-end approach for RNA tertiary structure prediction with flexible nucleobase center representation, *Nature Communications* (2025). DOI: [10.1038/s41467-025-56261-7](https://doi.org/10.1038/s41467-025-56261-7)

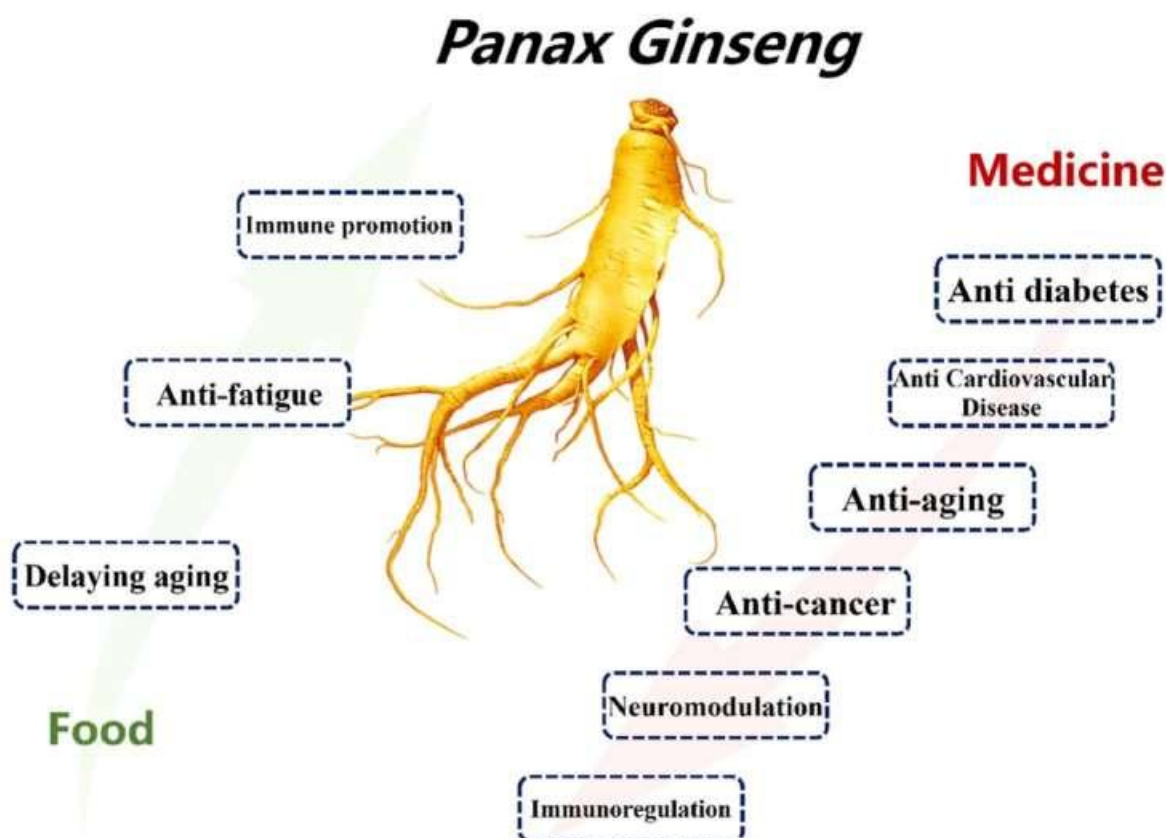
Journal information: [Nature Communications](#)

Provided by [Purdue University](#)

FEBRUARY 25, 2025

Ginseng: The dual-purpose herb for health and healing

by Tsinghua University Press



Schematic illustrating the application of *P. ginseng* in medicine and food. Credit: *Food & Medicine Homology* (2024). DOI: [10.26599/FMH.2025.9420059](https://doi.org/10.26599/FMH.2025.9420059)

For more than 2,000 years, *Panax ginseng* has been a cornerstone of traditional Chinese medicine, renowned for its nourishing and healing properties. In today's world, challenges

such as subfertility and an aging population have intensified the need for natural, holistic remedies.

Despite extensive research, the full potential of [ginseng](#) as both a food and medicinal substance remains largely unexplored. This growing demand for natural solutions calls for deeper investigations into ginseng's nutritional and therapeutic benefits.

In a new [review article](#) published in *Food & Medicine Homology*, researchers from China Pharmaceutical University and collaborating institutions offer a comprehensive look at the historical and contemporary uses of *Panax ginseng*. The article delves into the herb's medicinal and edible properties, showcasing its potential in both health maintenance and disease prevention.

The review provides a thorough analysis of ginseng's chemical composition and therapeutic benefits. The herb is rich in [bioactive compounds](#), such as ginsenosides, polysaccharides, peptides, and [essential nutrients](#), which contribute to its remarkable medicinal and nutritional properties.

Modern research has identified over 200 different ginsenosides, the primary active compounds in ginseng, with demonstrated anti-cancer, anti-inflammatory, neuroprotective, and metabolic-regulatory effects.

The study also examines how various processing techniques, such as steaming and fermentation, can enhance the bioactivity of ginseng. Steaming, for instance, transforms certain ginsenosides into more potent forms, while fermentation can produce rare ginsenosides with distinct health benefits.

The review underscores the need for further exploration of these processing methods to unlock ginseng's full potential in both its medicinal and edible forms.

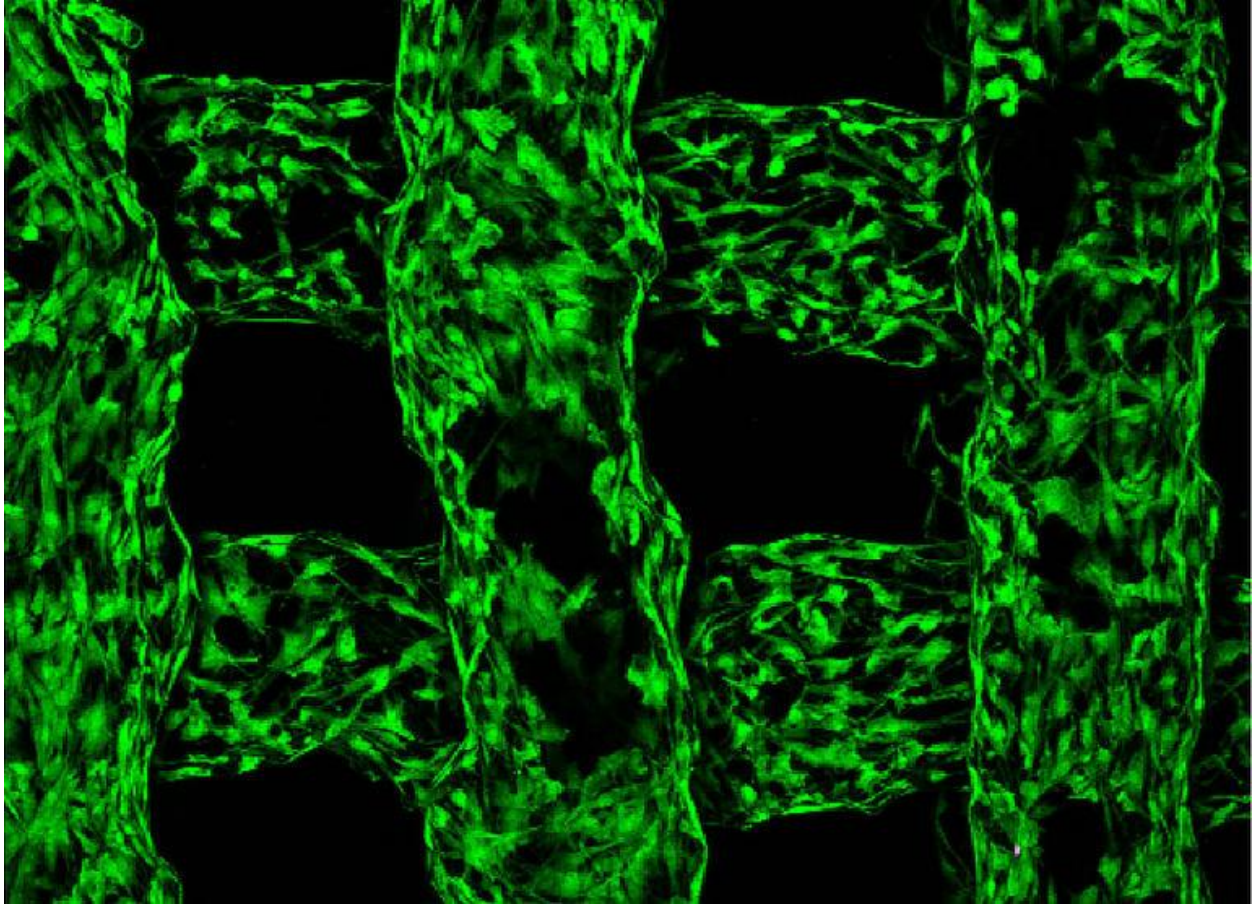
Dr. Bing Yang, a leading researcher on the project, stresses the importance of recognizing ginseng's dual role. "Ginseng is not only a medicinal herb but also a valuable food with substantial health benefits. Our study aims to bridge the gap between traditional wisdom and modern science to fully tap into its potential," says Dr. Yang.

This study highlights the vast potential of *Panax ginseng* for applications in functional foods and pharmaceuticals. Its ability to regulate metabolism, reduce inflammation, boost cognitive function, and promote overall well-being positions it as a powerful resource for addressing modern health challenges. The research advocates for optimizing processing methods to maximize ginseng's therapeutic benefits.

Looking ahead, the development of innovative products that integrate both medicinal and edible applications of ginseng could lead to new health supplements, functional foods, and pharmaceuticals, advancing health outcomes and enhancing disease prevention strategies.

More information: Zhu-Bin Zhang et al, The history, beneficial ingredients, mechanism, processing, and products of Panax ginseng for medicinal and edible value, *Food & Medicine Homology* (2024). DOI: [10.26599/FMH.2025.9420059](https://doi.org/10.26599/FMH.2025.9420059)
Provided by Tsinghua University Press

For success in bioelectronics, build with nature-inspired design



Alexandra Rutz and Somtochukwu Okafor have developed a technique to 3D print bioelectronic scaffolds that could help grow new tissue, which could be used for drug development, environmental toxicity and other purposes. Credit: Somtochukwu Okafor

In addition to making gadgets and game pieces, 3D printing is being used in health care to print prosthetics, dental implants and surgical models. Now, a team at Washington University in St. Louis is using 3D printing to create bioelectronic scaffolds that would allow researchers to create new tissue with a host of potential applications.

Alexandra Rutz, an assistant professor of biomedical engineering at the McKelvey School of Engineering, and Somtochukwu Okafor, a doctoral student in Rutz's lab, have 3D printed bioelectronic scaffolds that have the properties cells need to form new tissue. They [published](#) the result of their work this month in the journal *Advanced Materials Technologies*.

"Most traditional scaffolds have been on materials that have been inspired by nature, but here, we are taking that concept and applying it to what we call functional materials," Rutz said. "These are materials that are designed to perform a certain function, such as being electronically conducting."

The bioelectronic scaffolds that Rutz and Okafor print appear as dark-colored dots about 6 millimeters in diameter—about the size of a pencil eraser—and are floating in water. Okafor has carefully created these tiny scaffolds with a polymer known as PEDOT:PSS, which she has processed into a water-based gel used as an ink.

"When you think of electronics, you aren't thinking of them being in water," Okafor said. "But that's an advantage of using PEDOT:PSS as the conducting material. We are creating hydrated electronics that maintain their electronic properties in an environment that can also sustain living systems."

Okafor, a fifth-year doctoral student in biomedical engineering, said that while their team isn't the only one using this process, their work is unique.

"Bioelectronics as a field isn't new—think cochlear implants, pacemakers and smartwatches—but we are trying to interface with biology to make the technology more like systems that would occur in nature," Okafor said. "We have borrowed approaches in 3D printing and tissue engineering and combined it with bioelectronics. All these processes have individual advantages that they bring to the table, and we are combining them into one."

Most traditional materials that conduct electricity are stiff, which may negatively impact formation of tissue. Rutz's lab created their scaffolds from a soft, conducting hydrogel and with pores that are about 150–300 microns in size that can influence how cells behave within the scaffold, such as how they attach to others, how they move through the scaffold and how they multiply.

The pores help to form a lattice-like structure that grows upward to support the cells. The researchers can also adjust the angle of the pores so that the grid lines are diagonal instead of vertical and horizontal.

"The pores have to be big enough to allow the cells to move around, but small enough that the cells have structure to hold on to and don't fall through," Okafor said.

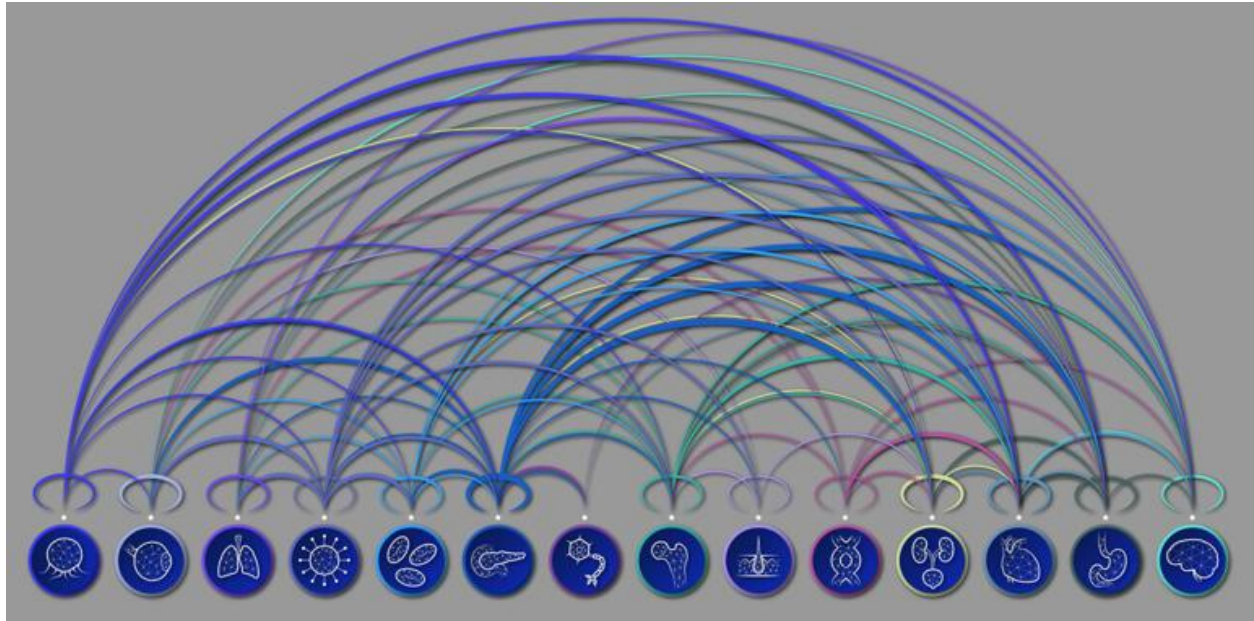
The tissue the team seeks to create could be used as human tissue or plant tissue, making it versatile for several uses.

"We have many projects in the lab that are envisioned for tissues-on-chips technology, where this could be used for drug development purposes, toxicology, environmental toxicity and other projects where human tissues are in a dish," Rutz said.

More information: Somtochukwu S. Okafor et al, 3D Printed Bioelectronic Scaffolds with Soft Tissue-Like Stiffness, *Advanced Materials Technologies* (2025). DOI: [10.1002/admt.202401528](https://doi.org/10.1002/admt.202401528)

Provided by Washington University in St. Louis

AI tool maps hidden links between diseases



By uncovering hidden links between diseases, the AI-powered tool created by KAUST researchers reveals how treating one illness could help prevent another. Credit: 2025 KAUST

An AI-powered tool from KAUST researchers is helping scientists trace hidden connections between diseases, revealing insights into how one illness might lead to another and, by extension, how treating one illness could help prevent another.

The work is [published](#) in the journal *Bioinformatics*.

By systematically combing through medical literature and real-world patient data, this tool maps cause-and-effect relationships, creating a framework that could guide targeted therapeutic strategies and uncover the potential for drug repurposing.

Think of it as the ultimate disease relationship detective. Using natural language processing, the tool scans vast quantities of biomedical research to pinpoint causal connections—like how high blood pressure can set the stage for heart failure.

"Instead of treating diseases as unrelated outcomes, our approach facilitates the identification of shared risk factors among causally linked diseases," says Sumyyah Toonsi, a graduate student in the Bio-Ontology Research Group.

"This deepens our understanding of human diseases and enhances the performance of risk-prediction tools for personalized medicine."

The tool's power lies in its ability to go beyond mere association. Traditional methods might highlight which diseases commonly co-occur, but the KAUST tool—developed by Toonsi and her team under the guidance of computer scientist Robert Hoehndorf—identifies which diseases can trigger others.

For example, type 2 diabetes leads to high blood sugar, causing small blood vessel disease, ultimately resulting in a diabetic eye condition. Mapping these relationships suggests that treating one "upstream" condition may help prevent or lessen downstream complications.

To achieve these insights, the tool integrates scientific literature with data from the UK Biobank, a large-scale health database of about half a million Britons. This dual approach validates disease connections by checking that diseases follow a logical sequence, with causes preceding outcomes. This process strengthens the evidence of causation while highlighting new connections that might otherwise be overlooked.

Among its discoveries, the tool unearthed surprising links. As Toonsi explains, "We found endocrine, metabolic and nutritional diseases to be leading drivers of diseases in other categories," including cardiovascular, nervous system and inflammatory diseases of the gut and eye.

"This is interesting because many metabolic diseases can be managed with lifestyle changes, opening opportunities for broad disease prevention," she says.

A standout feature is the tool's ability to improve polygenic risk scores (PRS)—calculations that assess a person's genetic susceptibility to disease. Standard PRS models don't account for how one genetic variant might affect multiple diseases, but by adding causal disease relationships, the KAUST tool produces an enhanced PRS that improves prediction accuracy, especially for complex diseases.

This helps disentangle pleiotropic effects, where a single gene variant can impact multiple conditions. By factoring in these causal links, the tool offers a more holistic view of genetic risk.

Now freely available to the research community, this tool represents a major advancement for scientists exploring disease connections. Its potential applications range from refining prevention strategies to suggesting new uses for existing drugs. As researchers further investigate disease pathways, this tool could serve as a key resource in the quest to decode the interconnected landscape of human health.

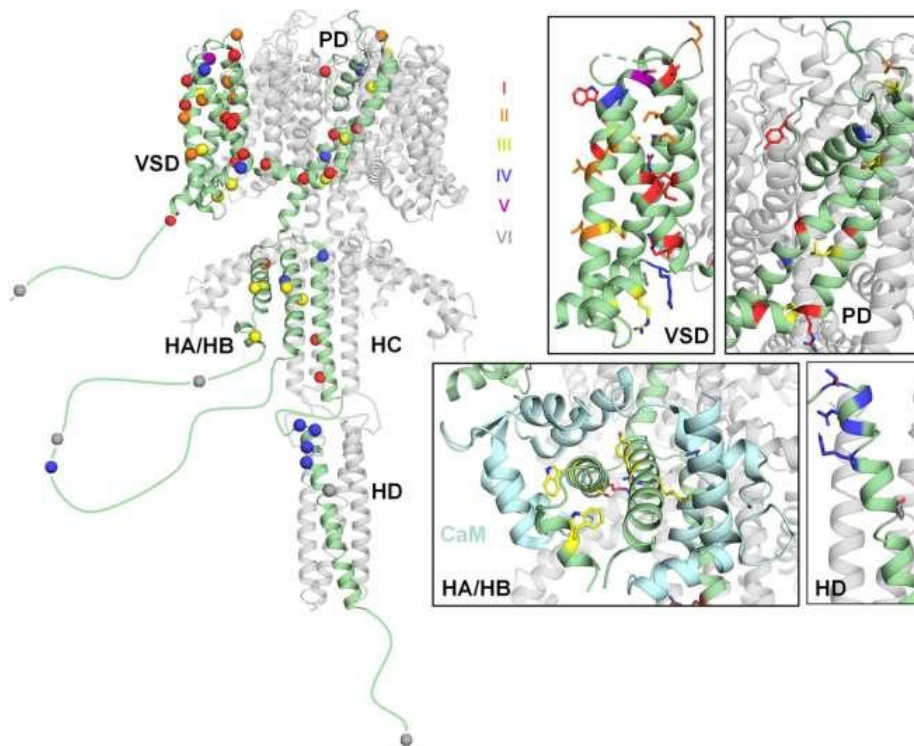
More information: Summyah Toonsi et al, Causal relationships between diseases mined from the literature improve the use of polygenic risk scores, *Bioinformatics* (2024). DOI: [10.1093/bioinformatics/btae639](https://doi.org/10.1093/bioinformatics/btae639)

Provided by King Abdullah University of Science and Technology

FEBRUARY 26, 2025

Labs discover new mechanisms that cause irregular heartbeat

by Sarah Ward, [Vanderbilt University](#)



Structural mapping of the analyzed KCNQ1 variants. Credit: *Proceedings of the National Academy of Sciences* (2025). DOI: 10.1073/pnas.2412971122

Medicine often takes a one-size-fits-all approach, but a disorder's root cause can vary. Vanderbilt researchers have found that for people with long QT syndrome, a heart condition that causes an irregular heartbeat, a more tailored approach could be beneficial.

The research is [published](#) in *PNAS*. It was led by Vanderbilt University Professor of Biochemistry and Vice Dean of Basic Sciences Charles Sanders, and Northwestern University Professor and Chair of Pharmacology Dr. Al George.

Congenital LQTS is caused by [genetic mutations](#) that affect KCNQ1 [potassium channels](#) in the heart's muscle cells. These channels act as pathways for electrical currents that help reset the heart's electrical activity after each contraction. For patients with LQTS, this process is prolonged, leading to an irregular heartbeat. An inadequate understanding of what causes these potassium channels to malfunction makes it difficult to create effective treatments for LQTS patients, especially considering that over 2,500 mutations in KCNQ1 have been documented in people, most of them with unclear pathogenicity.

To address this knowledge gap, the Sanders lab, in collaboration with the George lab at Northwestern University, characterized 61 KCNQ1 gene variants to determine whether and how they might lead to LQTS. The chosen variants represented amino acid changes located across the full span of the protein sequence.

The researchers characterized channel variants using a variety of methods. Using flow cytometry, they recorded whether the potassium channel coded for by each variant made it to the cell's surface—a critical step in heart contraction. They also tested how resilient the channels were by heating them. Some remained as heat-resistant as the wild type channel, while others proved much less stable; unstable channels are more likely to misfold and less likely to successfully be transported to the cell surface. Third, the researchers used electrophysiology experiments to measure electrical currents in the potassium channels, thereby measuring how well each variant functioned.

Although LQTS is traditionally thought to be caused by loss-of-function mutations in KCNQ1, the exhaustive testing conducted by first author and Sanders lab Ph.D. student Kathryn Butcher (Brewer) indicated that the tested KCNQ1 variants can be sorted into five classes that all display loss of function, but through different mechanisms.

Some variants were stable and trafficked correctly but exhibited reduced channel activity; some were normal except they were regulated differently by a change in transmembrane voltage; others were seen to be unstable and mistrafficked; and others were stable but still mistrafficked.

Of note, one group of tested variants demonstrated wild-type-like properties, which would suggest that those mutations are "benign" and don't lead to disease.

"Our results indicate that if you suffer from LQTS and find that you are carrying a KCNQ1 variant, you can't assume that a particular molecular mechanism underlies your condition," Sanders said. "If they haven't been done yet, someone needs to do the necessary experiments to establish the exact disease mechanism of a particular patient, which in the future might help determine their treatment."

Several disease-prediction algorithms exist that purport to predict whether a particular protein variant is pathogenic or benign. To see if these algorithms could potentially help clinicians determine into which class a particular patient's KCNQ1 mutation falls—and through that knowledge, how to treat that patient—the researchers tested eight such algorithms against their [experimental data](#).

Generally, the algorithms successfully predicted disease in which the variants improperly folded, but they often could not predict disease in variants with a modified response to electrical signals. Stanford University's REVEL predicted disease incidence best, with a prediction accuracy of 85%. AlphaMissense, a Google DeepMind tool related to AlphaFold2, was not among the best-performing algorithms. The researchers hope that future work will focus on improving these prediction algorithms.

According to Sanders, this paper was the result of a hugely collaborative "roll up your sleeves and do the experiments" effort in which each lab was responsible for a different set of experiments. Notably, Professor of Cell and Developmental Biology Dylan Burnette and his graduate student James Hayes dropped everything to help Sanders and George when reviewers requested additional experiments, providing data that was pivotal in the final acceptance of the paper.

"Kathryn and Carlos Vanoye from the George lab were exceedingly patient and methodical in their work, though they were supported by other lab members and the crucial work by James Hayes and Dylan Burnette," Sanders said. "It takes a lot of fortitude to complete a project like this. I am so proud of all of them."

The study is a step toward treatments tailored to a patient's genetic makeup.

"This work is part of the growing field of personalized medicine, often also referred to as precision medicine," Sanders said. "Our results could be used by physicians treating patients who carry the mutations we have looked at."

One LQTS patient with a particular [variant](#), for example, might require a drug that enhances potassium channel functioning while another LQTS patient might require the exact opposite: a drug that calms down their overactive potassium channels.

"Our results complement fantastic pioneering work on the personalized medicine of ion channel-based heart disease being carried out by a number of labs in the medical center, including those of Dan Roden, Andrew Glazer, Jerod Denton, Brett Kroncke, and Bjorn Knollmann, among others," Sanders said.

"Some of these labs are now using deep mutational scanning to analyze huge numbers of channel variants. Our work may provide a benchmark data set for testing and may further illuminate results from their high-throughput testing on KCNQ1."

More information: Kathryn R. Brewer et al, Integrative analysis of KCNQ1 variants reveals molecular mechanisms of type 1 long QT syndrome pathogenesis, *Proceedings of the National Academy of Sciences* (2025). DOI: [10.1073/pnas.2412971122](https://doi.org/10.1073/pnas.2412971122)

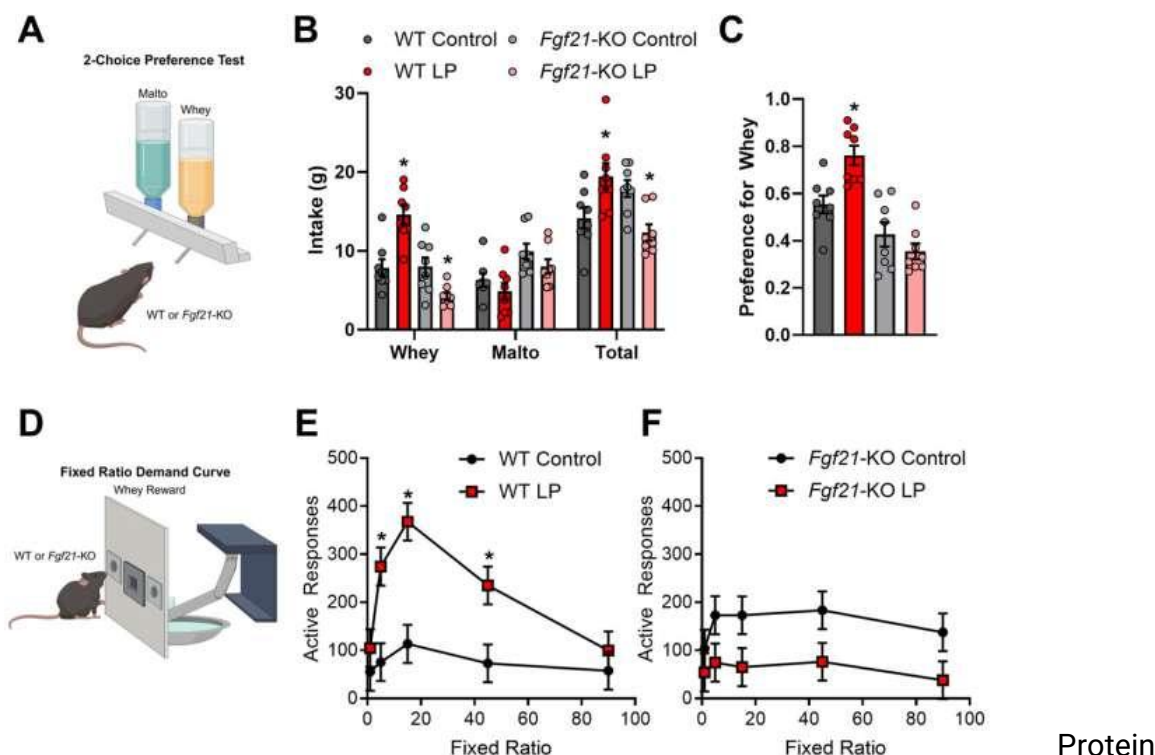
Journal information: [Proceedings of the National Academy of Sciences](#)

Provided by [Vanderbilt University](#)

FEBRUARY 26, 2025

Hormone FGF21 found to influence brain's food reward system in response to protein restriction

by [Pennington Biomedical Research Center](#)



restriction increases preference and motivation for whey protein in WT but not Fgf21-KO mice. Credit: *Molecular Metabolism* (2024). DOI: [10.1016/j.molmet.2024.102068](https://doi.org/10.1016/j.molmet.2024.102068)

When faced with multiple food options and ultimately choosing one, the factors of that decision-making process may be more physiological than previously assumed. A group of scientists led by Pennington Biomedical Research Center's Dr. Christopher Morrison has

discovered that the hormone fibroblast growth factor 21 (FGF21) plays an influential role in brain reward mechanisms like those involved in dietary choices.

ADVERTISING

The discovery was announced in the research team's recent [paper](#) titled "FGF21 acts in the brain to drive macronutrient-specific changes in behavioral motivation and brain reward signaling," which was published in *Molecular Metabolism*. The study data indicates that the FGF21 hormone acts on the brain to induce a protein-specific appetite by enhancing the reward value of foods that contain protein.

"What's fascinating is that this isn't just general hunger—it's a very specific appetite for protein," said Dr. Morrison, Associate Executive Director of Basic Science at Pennington Biomedical.

"When protein is restricted, FGF21 acts in the brain to flip a molecular switch that makes protein-rich foods more rewarding and motivates animals to seek them out. Many people struggle to maintain a balanced diet. Understanding how the body naturally regulates protein appetite could lead to better strategies for promoting healthy eating."

In the study, animals on a low-protein diet worked especially hard for liquid protein rewards, but not carbohydrate, fatty, or sweet rewards, compared to those on a normal diet. However, if FGF21's ability to act in the brain was disrupted, this protein-specific motivation was lost.

The researchers then used a sophisticated neuroscience technique called fiber photometry to assess how nutrients activate dopamine neurons within the [ventral tegmental area](#), or VTA, a brain region associated with reward. They discovered that protein restriction shifts the dopamine response, with carbohydrate more strongly activating dopamine neurons in control animals and protein more strongly activating [dopamine neurons](#) in [protein](#)-restricted animals. Importantly, this shift in reward signaling was lost in animals lacking FGF21.

ADVERTISING

"It's a remarkable example of how hormone signals can tune the brain's reward system to drive specific nutritional appetites," explains Dr. Morrison.

"This recent discovery demonstrates the continual journey to uncover the functions of certain genes, proteins and nutrients in our bodies while also highlighting the principal value that Pennington Biomedical delivers to the broader scientific community," said Dr. John Kirwan, Executive Director of Pennington Biomedical.

"Understanding how the [brain](#) drives specific nutritional preferences has been a long-standing challenge in metabolism research. This work exemplifies how Pennington Biomedical's integrative approach—combining [molecular biology](#), neuroscience, and behavioral studies—can unlock complex biological mysteries. I commend Dr. Morrison and his team for this extensive study, and I look forward to the additional discoveries that will emerge because of this one."

The FGF21 hormone is produced in the liver and has been previously recognized as a regulator of energy balance and for its role in glucose metabolism. This newly published research emphasizes its significant impact on the central nervous system.

More information: Md Shahjalal H. Khan et al, FGF21 acts in the brain to drive macronutrient-specific changes in behavioral motivation and brain reward signaling, *Molecular Metabolism* (2024). DOI: [10.1016/j.molmet.2024.102068](https://doi.org/10.1016/j.molmet.2024.102068)

Journal information: [Molecular Metabolism](#)

FEBRUARY 26, 2025

Physician explains: Sleep and heart health

by Mayo Clinic News Network

Does how much you sleep affect your heart? According to health officials, adults who sleep fewer than seven hours each night are more likely to experience health problems.

ADVERTISING

Dr. Juan Cardenas Rosales, an internal medicine physician at Mayo Clinic, stresses that [adequate sleep](#) is crucial for your overall well-being, including your heart health.

Getting a good night's sleep can give you the energy to jump-start your day and your health.

"Sleeping is very important to try to prevent other [chronic conditions](#) in the future, such as diabetes, heart attacks and strokes," says Dr. Cardenas Rosales.

When it comes to how many hours a night adults should sleep, keep the number seven in mind.

Adults should aim for at least seven hours of sleep each night

"It's usually recommended for you to sleep at least seven hours per night in order to allow your body to recover to be ready for the following day," he says.

"Try to sleep at the same time. Try to get a schedule in which you're going to sleep at the same time and you're waking up also at the same time, that's very important," Dr. Cardenas Rosales says.

Create good sleep habits

Keep the time you go to bed and the time you wake up the same every day, including weekends.

- Stay active. Regular activity can lead to a good night's sleep.
- Limit naps or do not nap at all.
- Limit or do not use [caffeine](#), [alcohol](#) and nicotine.
- Do not eat large meals or drink a lot of fluids before bed.
- Make your bedroom comfortable.
- Create a relaxing bedtime ritual, such as taking a warm bath, reading or listening to soft music.

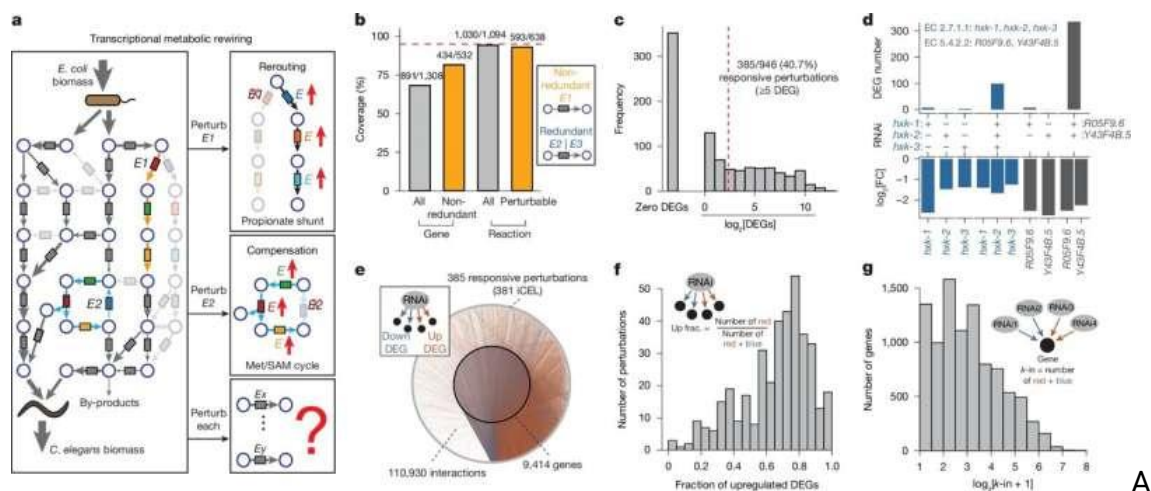
"You want to set up the environment to make it easier for your body to fall asleep," he says.

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FEBRUARY 27, 2025

A genomics approach to metabolism reveals how reactions flow

by UMass Chan Medical School



genome-scale, whole-animal mGRN for *C. elegans*. Credit: *Nature* (2025). DOI: 10.1038/s41586-025-08636-5. <https://www.nature.com/articles/s41586-025-08636-5>

Two papers published today in the journal *Nature* describe a significant advance in understanding the complex functions of the metabolic network. The research is from the lab of Marian Walhout, Ph.D., the Maroun Semaan Chair in Biomedical Research and chair and professor of systems biology, who has been engaged with fundamental questions of metabolism for more than a decade.

According to Dr. Walhout, organisms constantly monitor their nutrient intake and adjust their metabolism to generate biomass and energy; their metabolism takes place through a series of chemical reactions that together make up the [metabolic network](#).

The Walhout lab has sought to understand how these reactions work together and what happens when the normal flow of information within the network is disrupted. Do cells have the capacity to find alternate routes through the network? And how do they do this? The answers to these questions have broad implications as many diseases and health-related issues such as cancer, diabetes and obesity have root causes that stem from altered metabolism.

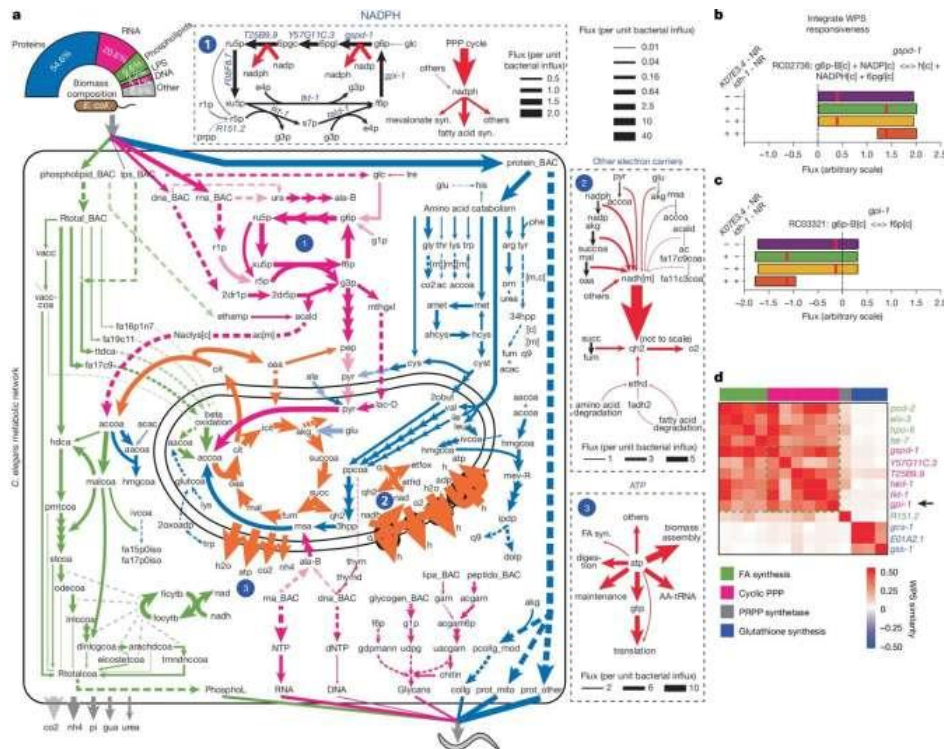
While single reactions and [metabolic pathways](#) have been studied in detail, it has been painstaking to determine which are active or "carry flux" in a given cell at a given moment. The [first paper](#) published today, titled "Systems-level design principles of metabolic rewiring in an animal," employs a systems approach to understanding the principles whereby the animal changes the flow of metabolism when metabolic reactions are disrupted.

The [second paper](#), titled "A systems-level, semi-quantitative landscape of metabolic flux in *C. elegans*," uses data obtained from the first paper to infer the 'natural' wiring of the metabolic circuit in an animal, describing which reactions are active and which are turned off in a normal state.

Both studies were enabled by "Worm Perturb-Seq" (WPS), a novel high-throughput method used to deplete the expression of around 900 metabolic genes individually in *C. elegans*. WPS uses RNA sequencing to unveil how changes in different parts of the metabolic network (flux) affect gene expression and shows that gene expression can be used to learn how an organism deals with alterations in its metabolism.

The data accrued from this systematic study revealed a high-level model where core metabolic functions, when depleted, are compensated for by genes with the same core metabolic function while other core metabolic functions are repressed.

What Walhout and colleagues have called a "compensation-repression," or CR model, represents a strategy used by—in this case—the worm, to monitor the state of its metabolism and adjust it at the gene regulatory level. Fascinatingly, preliminary analysis of human data indicates that the CR model may also explain perturbations in human metabolism.



A systems-level flux wiring landscape of adult *C. elegans*. Credit: *Nature* (2025). DOI: 10.1038/s41586-025-08635-6. <https://www.nature.com/articles/s41586-025-08635-6>

"When we analyzed the WPS data, it became clear that it was not only instrumental to understand how the animal rewires its metabolism through the compensation-repression model, but also that we could use the data to infer, by computational modeling, how the metabolic flux runs through the network, or is 'wired,' in the worm in its normal state," said Walhout.

"By transforming questions about metabolism into a genomics challenge, we were able to draw a 'wiring map' of adult worm metabolism that revealed numerous novel insights."

"The most exciting part of the study for me was seeing that the majority of our predictions were validated through isotope-tracing experiments," said Hefei Zhang, Ph.D., a postdoctoral fellow and co-first author on both papers. "Those results indicate that our concept of using molecular phenotypes to predict metabolic network wiring at systems level is really reliable."

Among these insights are the use of RNA as a **carbon source** by the organism; the use of amino acids as an energy source to fuel the tricarboxylic acid cycle; and surprisingly, that carbohydrates such as glucose, which had previously been assumed to be the major source for energy production, have a relatively minor contribution in the worm.

"WPS and the results presented in the two studies should provide a powerful framework for similar studies in other organisms, including humans, to provide insights into healthy metabolism, as well as different diseases where metabolism runs awry," said Walhout.

Xuhang Li, a recently graduated student and co-first author on both papers, added, "Together, these studies establish a new paradigm for studying metabolism through the lens of genomics, enabling a systems-level understanding of metabolic dynamics."

More information: Albertha Walhout, Systems-level design principles of metabolic rewiring in an animal, *Nature* (2025). DOI: [10.1038/s41586-025-08636-5](https://doi.org/10.1038/s41586-025-08636-5). [5. www.nature.com/articles/s41586-025-08636-5](https://www.nature.com/articles/s41586-025-08636-5)

Albertha Walhout, Article A systems-level, semi-quantitative landscape of metabolic flux in *C. elegans*, *Nature* (2025). DOI: [10.1038/s41586-025-08635-6](https://doi.org/10.1038/s41586-025-08635-6). [6. www.nature.com/articles/s41586-025-08635-6](https://www.nature.com/articles/s41586-025-08635-6)

Journal information: [Nature](#)

Provided by UMass Chan Medical School

FEBRUARY 27, 2025

What's the difference between burnout and depression?

by Gordon Parker, [The Conversation](#)

If your summer holiday already feels like a distant memory, you're not alone. Burnout—a state of emotional, physical and mental exhaustion following prolonged stress—has been described in workplaces since a [5th century monastery in Egypt](#).

Burnout and depression can look similar and are relatively common conditions. It's estimated that [30% of the Australian workforce is feeling some level of burnout](#), while [almost 20%](#) of Australians are diagnosed with depression at some point in their lives.

So what's the difference between [burnout](#) and depression?

Depression is marked by helplessness and burnout by hopelessness. They can have different causes and should also be managed differently.

What is burnout?

The World Health Organization defines burnout as an "[occupational phenomenon](#)" resulting from excessively demanding workload pressures. While it is typically associated with the workplace, caregivers of children or elderly parents with demanding needs are also at risk.

[Our research](#) created a set of burnout symptoms we captured in the Sydney Burnout Measure to assist self-diagnosis and clinicians undertaking assessments. They include:

- exhaustion as the primary symptom
- brain fog (poor concentration and memory)
- difficulty finding pleasure in anything
- social withdrawal
- an unsettled mood (feeling anxious and irritable)
- impaired [work performance](#) (this may be result of other symptoms such as fatigue).

People can develop a "burning out" phase after intense work demands over only a week or two. A "burnout" stage usually follows years of unrelenting work pressure.

What is depression?

A depressive episode involves a drop in self-worth, increase in self-criticism and feelings of wanting to give up. Not everyone with these symptoms will have clinical depression, which requires a diagnosis and has an additional set of symptoms.

Clinically diagnosed depression can vary by mood, how long it lasts and whether it comes back. There are [two types](#) of [clinical depression](#):

1. melancholic depression has genetic causes, with episodes largely coming "out of the blue"
2. non-melancholic depression is caused by environmental factors, often triggered by significant life events which cause a drop in self-worth.

When we created our burnout measure, we compared burnout symptoms with [these two types of depression](#).

Burnout shares some features with melancholic depression, but they tend to be general symptoms, such as feeling a loss of pleasure, energy and concentration skills.

We found there were more similarities between burnout and non-melancholic (environmental) depression. This included a lack of motivation and difficulties sleeping or being cheered up, perhaps reflecting the fact both have environmental causes.

Looking for the root cause

The differences between burnout and depression become clearer when we look at why they happen.

Personality comes into play. [Our work](#) suggests a trait like perfectionism puts people at a much higher risk of burnout. But they may be less likely to become depressed as they tend to avoid stressful events and keep things under control.

Those with burnout generally feel overwhelmed by demands or deadlines they can't meet, creating a sense of helplessness.

On the other hand, those with depression report lowered self-esteem. So, rather than helpless, they feel that they and their future are hopeless.

However, it is not uncommon for someone to experience both burnout and depression at once. For example, a boss may place excessive work demands on an employee, putting them at risk of burnout. At the same time, the employer may also humiliate that employee and contribute to an episode of non-melancholic depression.

What can you do?

A principal strategy in managing burnout is identifying the contributing stressors. For many people, this is the workplace. Taking a break, even a short one, or scheduling some time off can help.

Australians now have the right to disconnect, meaning they don't have to answer work phone calls or emails after hours. Setting boundaries can help separate home and work life.

Burnout can also be caused by compromised work roles, work insecurity or inequity. More broadly, a dictatorial organizational structure can make employees feel devalued. In the workplace, environmental factors, such as excessive noise, can be a contributor. Addressing these factors [can help prevent burnout](#).

As for managing symptoms, the monks had the right idea. [Strenuous exercise, meditation and mindfulness](#) are effective ways to deal with everyday stress.

Deeper contributing factors, including traits such as perfectionism, should be managed by a skilled clinical psychologist.

For melancholic depression, clinicians will [often recommend antidepressant medication](#).

For non-melancholic depression, clinicians will help address and manage triggers that are the root cause. Others will benefit from antidepressants or formal psychotherapy.

While misdiagnosis between depression and burnout can occur, burnout can mimic other medical conditions such as [anemia](#) or [hypothyroidism](#).

For the right diagnosis, it's best to speak to your doctor or clinician, who should seek to obtain a sense of "the whole picture." Only then, once a burnout diagnosis has been affirmed and other possible causes ruled out, should effective support strategies be put in place.

Provided by [The Conversation](#)

FEBRUARY 27, 2025

Know the warning signs of hypertrophic cardiomyopathy

by Mayo Clinic News Network

It's often silent but can be a deadly killer. Hypertrophic cardiomyopathy is a genetic condition that occurs in one in 500 people.

Dr. Said Alsidawi, a Mayo Clinic cardiologist, says the problem is that many people don't even know they have it because they have no symptoms. And in many cases, the first presentation is [sudden cardiac death](#).

Hypertrophic cardiomyopathy is a genetic condition that causes the heart muscle to thicken, making it harder to pump blood and sometimes causing an irregular heart rhythm.

"So right now, what we think in the United States, we've only diagnosed one-seventh of the people who have hypertrophic cardiomyopathy. So we're trying to increase the [awareness](#) in the community about this disease," says Dr. Alsidawi.

He says patients are born with a genetic mutation. The disease can start at a young age or later in life — many times with no symptoms.

"We know the patients that we lose to this condition, the majority of them are young, active and athletes. So high-level athletic exercise can put you at higher risk of sudden cardiac death," says Dr. Alsidawi.

He says it's important to seek medical attention if you have any symptoms, especially with exertion, "including shortness of breath, [chest pain](#), lightheaded, dizzy or passing out."

If diagnosed, the good news is that [hypertrophic cardiomyopathy](#) can be treated with medications, surgery, implanting a defibrillator that monitors the heart or, in severe cases, heart transplantation.

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FEBRUARY 27, 2025

PFAS 'forever chemicals' are worthy of public concern, expert says

by Dennis Thompson

Average people are right to be worried about PFAS "forever chemicals" being found in the food and water supply, an internationally renowned leader in children's environmental health says.

"We're not overreacting, and we need to take it even more seriously in the form of government action, ultimately," Dr. Leonardo Trasande, a professor of pediatrics and [population health](#) at NYU Grossman School of Medicine in New York City, told HealthDay TV in an exclusive interview.

PFAS (perfluoroalkyl and polyfluoroalkyl substances) are a category of thousands of manufactured chemicals that have become an emerging concern for environmental and human health.

PFAS are called "forever chemicals" because they combine carbon and fluorine molecules, one of the strongest chemical bonds possible. This makes PFAS removal and breakdown very difficult.

PFAS compounds have been used in [consumer products](#) since the 1940s, including fire extinguishing foam, nonstick cookware and food wrappers, researchers said.

"The nonstick cooking materials that we've used for many years are lined with these PFAS, because we like our eggs to not stick to the proverbial pan," Trasande said. "And the same is true with oil-and-water-resistant clothing. PFAS has been used to make the coats we wear, particularly for sporting engagements, free of the nuisance of having things get stuck on them."

Unfortunately, PFAS chemicals have leached their way into humans through their food and water. Nearly every American has some level of PFAS in their blood, and the forever chemicals have been found in public water supplies.

Exposure to PFAS has been linked to a number of serious health concerns, but is particularly dangerous for children.

"Kids are uniquely vulnerable (to PFAS) for many reasons," Trasande said. "Pound for pound, they eat more food, they breathe in more air and drink more water, and so they have higher exposure."

In addition, "they also have developing [organ systems](#) that are susceptible to the consequences of PFAS and other endocrine-disrupting chemicals," he said. "But we're all susceptible because we're all exposed."

Based on the mounting evidence, Trasande hopes the U.S. government will start taking a more active role in regulating PFAS.

The Environmental Protection Agency last year set limits on the levels of six PFAS in public drinking water systems, but more is needed, Trasande said.

"The French have actually gone ahead and proceeded with a full-scale ban on PFAS, and that's based on the same [scientific evidence](#) that isn't prompting the same level of action here in the United States," Trasande said.

"Now, I will say that certain states in the U.S. have taken remarkable steps to get ahead of the federal government and taken steps to limit the use of PFAS in manufacturing," he added. "That's the biggest way that we're going to get PFAS out of our bodies, out of our lives, and ultimately out of our food."

In the meantime, Trasande recommends that people take steps to limit their own exposure, including swapping non-stick cookware for cast iron or stainless steel.

"The best approach is to minimize exposure whenever possible," Trasande said.

"Reducing our plastic footprint is really important not just for PFAS, but also for other endocrine-disrupting chemicals used in plastic, like bisphenol and phthalates," he said. "Particularly, not machine-dishwashing or microwaving plastic materials, and using glass and stainless steel when it's possible."

People can also reduce PFAS exposure by increasing air circulation in their homes, he added.

"We know that PFAS and other related chemicals recirculate in dust," Trasande said. "Opening the window, for example, can accelerate the egress of dust into the outdoor air."

More information: The U.S. Environmental Protection Agency has more on [PFAS and drinking water](#).

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The Brain Plays a Central Role in the Development of Obesity

Short-term intake of high-calorie foods can alter insulin sensitivity in the brain.

Published: March 3, 2025

| [Original story from the German Center for Diabetes Research](#)



Credit: iStock

Download Article The number of obese persons has grown significantly in recent decades, which presents significant difficulties for those who are impacted, healthcare systems, and those who provide treatment. The hormone insulin plays a key role in the development of obesity. Up until

recently, there have been numerous signs indicating insulin causes neurodegenerative and metabolic disorders, especially in the brain. A recent study by the University Hospital of Tübingen, the German Center for Diabetes Research (DZD), and Helmholtz Munich offers intriguing new insights into the origins of type 2 diabetes and obesity as well as the brain's function as a critical control center.

Obesity has only been officially recognized as a disease in Germany since 2020, despite the fact that it has long been known to cause a number of illnesses, including diabetes, heart attacks, and even cancer. The World Health Organization has already declared obesity to be an epidemic, affecting over one billion individuals globally and almost 16 million in Germany alone. A body mass index of 30 or more is considered obese, and a poor diet and insufficient exercise are frequently cited as the causes of this chronic illness. However, the mechanisms in the body that lead to obesity and cause the disease are more complex.

Obesity and the role of insulin in the brain

Unhealthy body fat distribution and chronic weight gain are linked to the brain's sensitivity to insulin. What specific functions does insulin perform in the brain, and how does it affect individuals of normal weight? In their study, Prof. Dr. Stephanie Kullmann and her colleagues at the Tübingen University Hospital for Diabetology, Endocrinology, and Nephrology found the answer to this query. "Our findings demonstrate for the first time that even a brief consumption of highly processed, unhealthy foods (such as chocolate bars and potato chips) causes a significant alteration in the brain of healthy individuals, which may be the initial cause of obesity and type 2 diabetes," says Prof. Kullmann, the study's leader. In a healthy state, insulin has an appetite-suppressing effect in the brain. However, in people with obesity in particular, insulin no longer regulates eating behavior properly, resulting in insulin resistance. "Interestingly, in our healthy study participants, the brain shows a similar decrease in sensitivity to insulin after a short-term high calorie intake as in people with obesity," says Ms. Kullmann.

"This effect can even be observed one week after returning to a balanced diet," she adds. She is also deputy head of the Metabolic Neuroimaging department at the DZD partner Institute for Diabetes Research and Metabolic Diseases (IDM) of Helmholtz Munich at the University of Tübingen.

Focus on the brain

Prof. Dr. Andreas Birkenfeld, Medical Director of Internal Medicine IV, Director of the IDM and DZD Board Member, and the study's final author, concludes, "We assume that the brain's insulin response adapts to short-term changes in diet before any weight gain occurs and thus promotes the development of obesity and other secondary diseases." He urges more research on how the brain contributes to the development of obesity and other metabolic illnesses in light of the current findings.

Short period with far-reaching effects

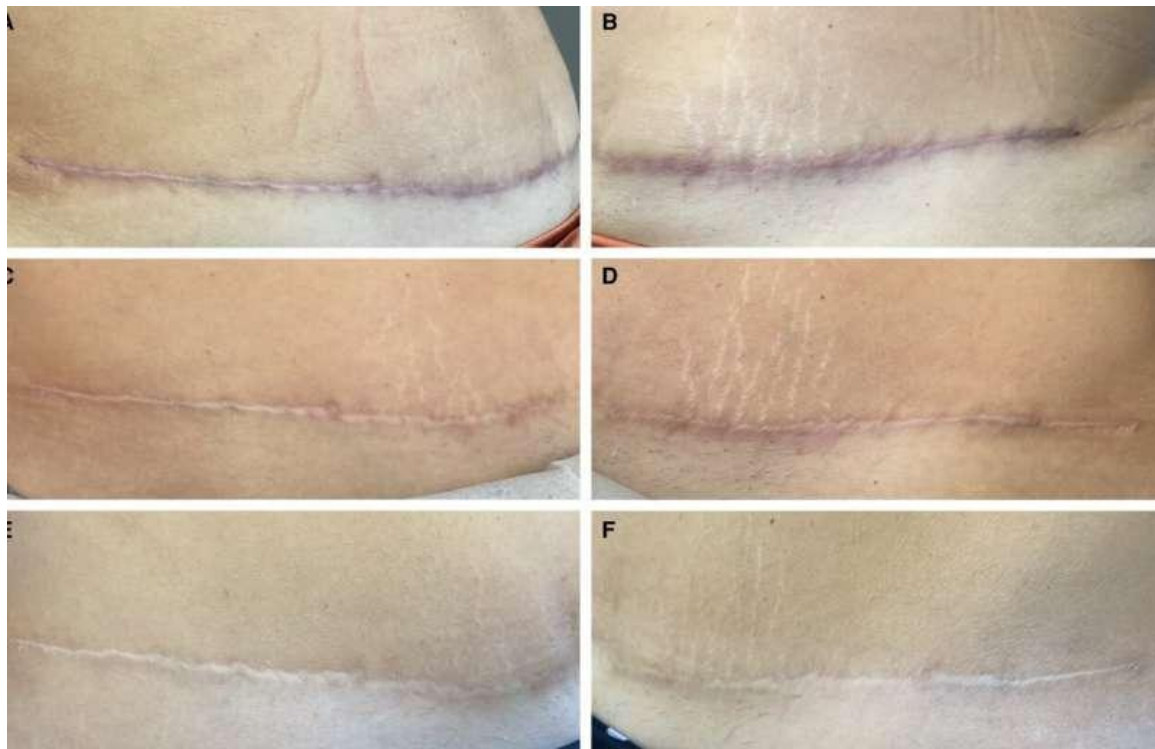
29 male volunteers of average weight participated in the study and were split into two groups. For five days in a row, the first group had to supplement their regular diet with 1500 kcal from highly processed, high-calorie snacks. The extra calories were not consumed by the control group. Both groups underwent two separate examinations following an initial evaluation. One examination was conducted immediately following the five-day period, and another was conducted seven days after the first group had resumed their regular diet. The researchers used magnetic resonance imaging (MRI) to look at the liver's fat content and the brain's insulin sensitivity. Not only did the fat content of the liver of the first group increase significantly after five days of increased calorie intake. Surprisingly, the significantly lower insulin sensitivity in the brain compared to the control group also persisted one week after returning to a normal diet. This effect had previously only been observed in obese people.

Reference: Kullmann S, Wagner L, Hauffe R, et al. A short-term, high-caloric diet has prolonged effects on brain insulin action in men. *Nat Metab.* 2025. doi: [10.1038/s42255-025-01226-9](https://doi.org/10.1038/s42255-025-01226-9)

MARCH 3, 2025

Stem cells from adipose tissue may improve wound healing and scar formation

by [Free University of Brussels](#)



Clinical images of the abdominal scar of a 39-year-old female study patient: (A) the treated side at the 1-month follow-up; (B) the control side at the 1-month follow-up; (C) the treated

side at the 6-month follow-up; (D) the control side at the 6-month follow-up; (E) the treated side at the 1-year follow-up; (F) the control side at the 1-year follow-up. Credit: *Aesthetic Surgery Journal Open Forum* (2024). DOI: 10.1093/asjof/ojae072

Dr. Lisa Ramaut from the Department of Plastic, Reconstructive, and Aesthetic Surgery at the Brussels University Hospital (UZ Brussel) has conducted research on the use of stem cells derived from adipose tissue for wound healing and scar formation. Her study sheds new light on the potential of these cells to improve surgical scars and prevent pathological scar formation.

The paper is [published](#) in the *Aesthetic Surgery Journal Open Forum*.

"Traditionally, stem cells were primarily harvested from [bone marrow](#) or umbilical cord blood, both relatively difficult-to-access sources. In 2001, it was discovered that [adipose tissue](#) not only contains fat cells but also [mesenchymal stem cells](#)—supporting cells that function as stem cells in cases of tissue damage. This provided a much more accessible alternative for stem cell therapies. Since then, these stem cells have been studied and used for various applications, including neurological disorders, osteoarthritis, pain therapy, and wound healing," says Dr. Ramaut.

"For my research, I specifically focused on the impact of these stem cells on wound healing and scar formation. We conducted clinical experiments in which surgical wounds were treated with adipose-derived stem cells, known as nanofat."

The study showed that nanofat had a positive effect on the early phase of scar maturation. In the treated group, inflammation and redness of the scar subsided more quickly than in the control group, which is a promising finding. Long-term benefits on [scar formation](#) have not yet been established, but the faster reduction of inflammation suggests that this therapy may help prevent problematic scars.

"This calls for further research in larger clinical studies," continues Dr. Ramaut. "Although the research focused on surgical scars, it also holds potential for the medical and cosmetic sectors. Adipose-derived stem cell therapies are already being used for [wound healing](#) and skin improvement, but the scientific foundation has so far been limited. My research helps explain why certain positive effects occur and paves the way for more targeted treatments."

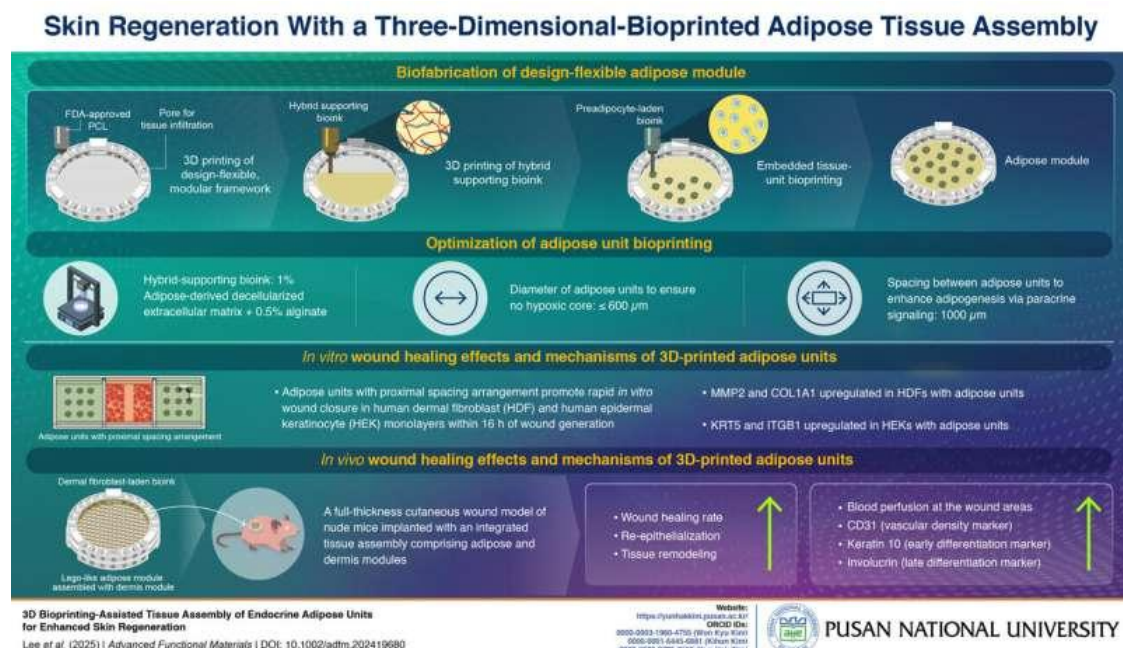
The importance of further studies to fully map the potential of these stem cells must be emphasized. "Many people already undergo stem cell treatments for scars and skin improvement, but solid scientific evidence on the exact mechanisms was lacking. Our research contributes to unraveling these mechanisms," concludes Dr. Ramaut.

More information: Lisa Ramaut et al, Improvement in Early Scar Maturation by Nanofat Infiltration: Histological and Spectrophotometric Preliminary Results From a Split Scar–Controlled, Randomized, Double-Blinded Clinical Trial, *Aesthetic Surgery Journal Open Forum* (2024). DOI: [10.1093/asjof/ojae072](#)
Provided by [Free University of Brussels](#)

MARCH 3, 2025

3D adipose tissue bioprinting method could enhance skin regeneration

by Pusan National University



The conditions for 3D bioprinting of adipose tissues involved the use of adipose-derived decellularized extracellular matrix and alginate as a hybrid ink. The optimal diameter of adipose units and the spacing between them were established. In addition to promoting wound healing *in vitro*, the bioprinted adipose tissue promoted skin regeneration in a mouse skin wound model by regulating cell migration, vasculogenesis, and keratinocyte differentiation. Credit: Byoung Soo Kim from National Pusa University, Korea

The adipose tissue, which serves as an endocrine organ, releases various molecules that regulate the repair of other damaged tissues, including the skin. Hence, adipose tissues can potentially be reengineered to regenerate the damaged organs. Three-dimensional (3D)

bioprinting technology has revolutionized regenerative medicine by enabling the generation of engineered and functional 3D organs or tissues, including adipose tissues. However, the currently used tissue biofabrication methods cannot replicate the native structure and densely packed lipid droplets of adipose tissues, hindering the therapeutic application of 3D-printed adipose tissues.

To overcome this limitation, a research team led by Assistant Professor Byoung Soo Kim from the Pusan National University, Korea, has developed a novel [adipose tissue](#) biofabrication approach. This paper was made available online on February 2, 2025 in [Advanced Functional Materials](#). The highlight of this study was the development of a hybrid bioink, which is a combination of 1% adipose-derived decellularized extracellular matrix and 0.5% alginate. This hybrid bioink limited the migration of preadipocytes, the fat cell precursors, while promoting their differentiation.

Dr. Kim states, "Under standard culture conditions, preadipocytes tend to proliferate and migrate, preventing the formation of lipid droplets that are essential for adipose tissue functions. The hybrid bioink developed in this study maintains the physiological properties of the adipose tissue."

Additionally, a diameter of $\leq 600 \mu\text{m}$ was deemed to ensure sufficient nutrient and oxygen delivery for the fabricated adipose tissue. Furthermore, bioprinted adipose tissues arranged with a spacing of $\leq 1000 \mu\text{m}$ promoted adipogenesis via paracrine signaling. The optimized 3D bioprinted adipose tissues rapidly promoted the migration of skin cells in vitro by modulating the expression levels of cell migration-related proteins (MMP2, COL1A1, KRT5, and ITGB1).

To examine the in vivo effects of bioprinted adipose tissues, the authors prepared a tissue assembly comprising adipose and dermis modules. This tissue assembly was implanted into mice with skin wounds. The findings revealed that the tissue assembly promoted wound healing in mice by inducing re-epithelialization, tissue remodeling, and blood vessel formation and regulated the expression of skin cell differentiation-related proteins.

These results demonstrate bioprinting's potential as a core technology in precision medicine and regenerative health care, driving a new wave of medical innovation. With the commercialization of 3D bioprinting technology expected to fuel significant market growth in customized tissue manufacturing, hospitals and research institutes are likely to increasingly adopt personalized bioprinting systems for patient treatments and medical studies.

The method developed in this study has various implications. According to the lead author, Jae-Seong Lee, "The 3D bioprinted endocrine tissues enhance skin regeneration, indicating their potential applications in [regenerative medicine](#). While current fat grafting procedures suffer from low survival rates and gradual resorption, our hybrid bioinks enhance endocrine function and cell viability, potentially overcoming these limitations. This approach could be particularly valuable for treating chronic wounds such as diabetic foot ulcers, pressure sores, and burns."

More information: Jae-Seong Lee et al, 3D Bioprinting-Assisted Tissue Assembly of Endocrine Adipose Units for Enhanced Skin Regeneration, *Advanced Functional Materials* (2025). DOI: [10.1002/adfm.202419680](https://doi.org/10.1002/adfm.202419680)

Journal information: [Advanced Functional Materials](#)

Provided by [Pusan National University](#)

MARCH 4, 2025

Smoking and antibiotic resistance: How cigarette waste promotes the spread of resistant germs

by Benjamin Griebel, [Dresden University of Technology](#)



Credit: Pixabay/CC0 Public Domain

Antibiotic resistance is a major global health problem: it implies that vital drugs are no longer effective. A study led by researchers at the Institute of Hydrobiology at TUD Dresden University of Technology demonstrates that pollutants from cigarette smoke and cigarette waste can promote the growth and spread of resistant bacteria in the environment. The interdisciplinary and international research group also shows that smoking increases the

spread of resistant bacteria in the human lung. The study is [published](#) in the journal *Environmental Health Perspectives*.

Every year, millions of people die from the direct consequences of smoking. The study by the Dresden scientists, which was carried out in collaboration with the University Hospitals in Dresden and Heidelberg as well as Tsinghua University in China, now shows that smoking also poses indirect health risks when pollutants from cigarette smoke and cigarette butts are released into the lung and the environment.

"Cigarette filters contain many of the [toxic substances](#) found in cigarette smoke," explains Dr. Uli Klümper from the Institute of Hydrobiology at the TUD. "In our study, we found that when these filters end up in waterbodies, they are increasingly colonized by potentially pathogenic bugs and bacteria displaying [antibiotic resistance](#), as these are particularly well adapted to the adverse conditions on the filters."

The cigarette butts colonized with resistant and [pathogenic bacteria](#) can then be transported to rivers, other waterbodies, or beaches, contributing to the spread of dangerous bacteria. "This underlines the need for stricter measures against the careless discarding of [cigarette butts](#) and highlights another hidden health hazard caused by smoking," Klümper emphasizes.

Smoking increases the spread of resistant bacteria in the human lung

The study also confirms the effects for the consumers of tobacco products: Smokers could promote a faster spread of resistant germs in their own lungs, resulting in a lower effectiveness of administered antibiotics in the case of future lung infections.

Different bacterial species can exchange resistance genes via so-called plasmids—small DNA molecules that bacteria pass on to each other. This enables bacteria that were previously treatable with antibiotics to acquire resistance to these antibiotics, making them no longer treatable.

"In our experiments with an artificial lung medium, we were able to show that the toxic substances that accumulate in the lung fluid due to [cigarette smoke](#) trigger a stress reaction in the bacteria, which, among other things, more than doubles the frequency with which [resistance genes](#) are passed on between bacteria via plasmids," explain the researchers.

More information: Peiju Fang et al, Effects of cigarette-derived compounds on the spread of antimicrobial resistance in artificial human lung sputum medium, simulated environmental media and wastewater, *Environmental Health Perspectives* (2025). DOI: [10.1289/EHP14704](https://doi.org/10.1289/EHP14704)

Journal information: [Environmental Health Perspectives](#)
Provided by [Dresden University of Technology](#)

MARCH 3, 2025

How cancer hijacks the immune system by draining T cells' energy

by [Amsterdam University Medical Centers](#)

Credit: CC0 Public Domain

Research into immunotherapy against cancer typically focuses on better recognition of cancer cells by the body's own immune system. Researchers at Amsterdam UMC and Moffitt Cancer Center have taken a different approach.

They investigated how cancer affects the energy management of a patient's T cells and showed for the first time that contact with [chronic lymphocytic leukemia](#) (CLL) cells leads to a serious energy crisis in these cells.

These findings are published in *Cellular & Molecular Immunology*, building on a publication in the [Blood Journal](#).

CLL is the most common type of leukemia in the Western world and mainly affects the elderly. Despite new therapies, the disease remains incurable, and treatments are becoming increasingly expensive.

Some cancers, like acute B-cell leukemia, can now be treated by redirecting a patient's own T cells against cancer cells, known as CAR-T cell therapy. However, in many others, including chronic B-cell leukemia (CLL), [immune cells](#) fail to eliminate tumors effectively. While it can be lifesaving, it works in only 15% of CLL patients and costs more than \$250,000 per patient.

"Our research revealed two things to us: firstly, that healthy T cells greatly increase their absorption of cholesterol and fats after they have identified their targets. Without this fuel, they are unable to proliferate. Secondly, and crucially, that this doesn't happen when T cells come into close contact with leukemia cells," says Arnon Kater, professor of Translational Hematology at Amsterdam UMC.

This second finding is in line with the results of [another study](#), published in *Blood Advances*, by the Amsterdam UMC research team and Moffitt Cancer Center. In that study, researchers found that the 'engine' of T cells—the mitochondria, small structures in the cell that provide energy—does not function properly in CLL patients. In CLL, these mitochondria become damaged, causing T cells to lose their power to attack cancer cells.

"Just like when a battery is overcharged, we tried to rejuvenate T cells. This was very successful. We demonstrated that an existing drug, which affects energy management, greatly improved the effectiveness of CAR T-cell therapy.

"We hope this discovery will lead to improved success of CAR T-cell treatment in the future," says Javier Pinilla-Ibarz, MD, Ph.D, a senior member at Moffitt Cancer Center.

"This discovery brings us one step closer to making CAR T-cell treatment more successful for a greater number of patients. More importantly, it opens the door for exploring similar strategies in other cancers where immune cells struggle to sustain their attack. By addressing the energy crisis in T cells, we hope to enhance immunotherapy across a wider range of cancers," he adds.

New treatment options

The researchers are now working on ways to modify [specific genes](#) so that T cells become more resistant to the disruptive effects of CLL on the uptake, processing and use of fuel and building materials. This should ensure that both the fuel supply and the engine of T cells continue to function properly. If this approach is successful, it may also be possible to apply it to other forms of cancer, as immunotherapy with the body's own immune cells does not yet work optimally in many types of cancer.

In addition, an international clinical trial ([HOVON study](#)) is underway, in which the first results show that combining a drug that weakens and reduces the number of leukemia cells greatly improves the effectiveness of a treatment that attracts T cells to cancer cells.

This opens the door to combination therapies in which the cancer cells are tackled first, so that the [energy management](#) of the immune system is not first weakened by the cancer, and it can therefore function better.

"These findings, combined with our ongoing research, underscore the profound impact of cancer-immune cell crosstalk on metabolism, disrupting the efficient energy supply necessary for immune function. Restoring T cell energy has the potential to significantly enhance the effectiveness of current treatments," concludes Kater.

More information: Cholesterol homeostasis and lipid raft dynamics at the basis of tumor-induced immune dysfunction in Chronic Lymphocytic Leukemia, *Cellular and Molecular Immunology* (2025).

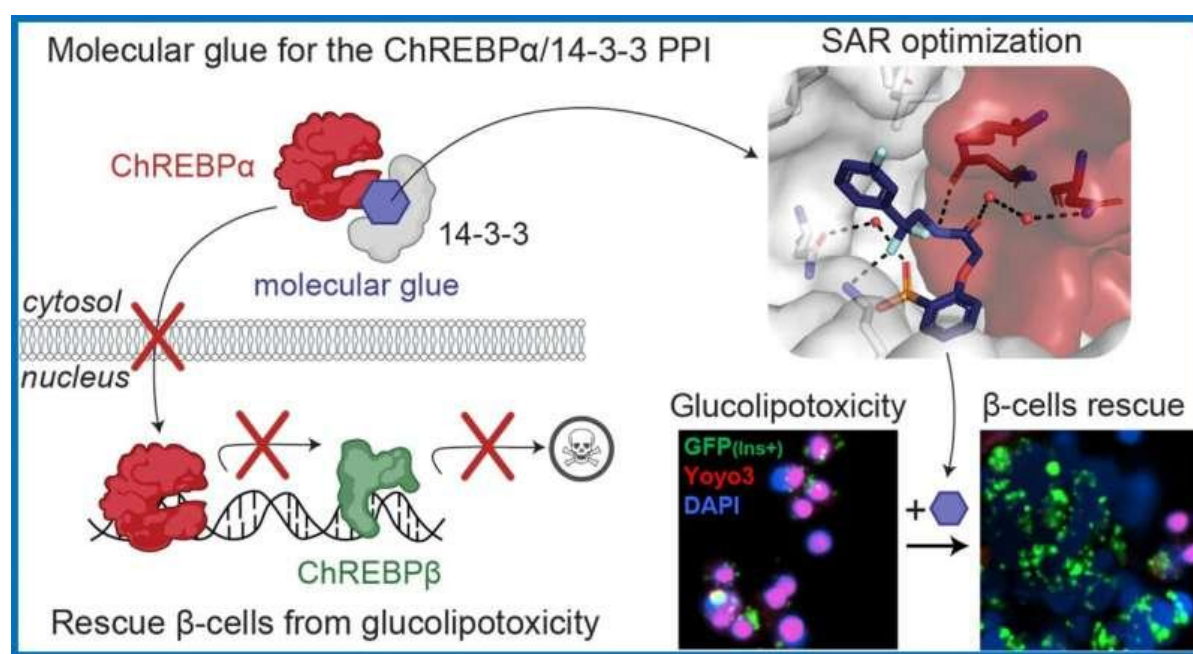
Arnon P. Kater et al, The MURANO study: final analysis and retreatment/crossover substudy results of VenR for patients with relapsed/refractory CLL, *Blood Journal* (2025). DOI: [10.1182/blood.2024025525](https://doi.org/10.1182/blood.2024025525)

Wael Gamal et al, Mitigating T-Cell Mitochondrial Dysfunction in CLL to Augment CAR T-Cell Therapy: Evaluation in an Immunocompetent Model, *Blood Advances* (2025). DOI: [DOI:](#)

MARCH 4, 2025

Molecular glues can shield insulin-producing cells from diabetes-related damage

by The Mount Sinai Hospital



Illustrating the mechanism by which small molecule stabilizers of the ChREBPα/14-3-3 protein-protein interaction (PPI) protect insulin-secreting beta cells from glucolipotoxicity. The optimized "molecular glue" compounds retain ChREBPα in the cytoplasm, preventing its transcriptional activity and subsequent beta cell dedifferentiation and death. This approach highlights a novel therapeutic strategy for maintaining beta cell identity and function in the context of type 2 diabetes. Credit: Mount Sinai Health System

Researchers from the Icahn School of Medicine at Mount Sinai in New York have discovered a novel approach to protecting insulin-producing beta cells from the damaging effects of glucolipotoxicity—a harmful condition linked to the progression of type 2 diabetes (T2D). These findings, [published](#) on March 2, 2025 in *Nature Communications*, could lead to promising treatments targeting beta cell dysfunction.

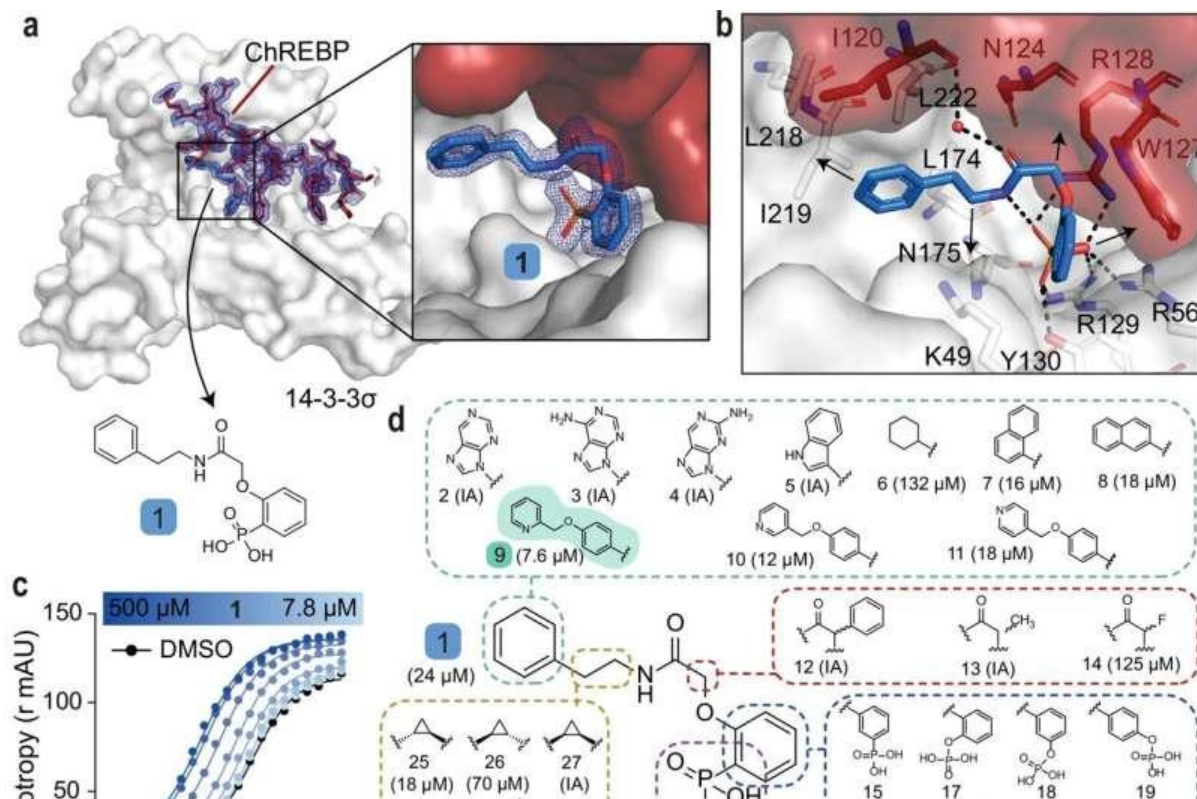
For patients, this research could lead to new treatments that protect the insulin-producing cells in the pancreas, potentially slowing or even preventing the progression of diabetes, thus reducing the need for insulin therapy and improving long-term blood sugar control. Unlike current therapies that primarily manage blood sugar levels, this approach would

allow doctors to directly target beta cell loss, which could improve long-term disease outcomes for their patients.

"This is an exciting step forward in our understanding of beta cell protection and the prevention of diabetes deterioration," said lead author Liora S. Katz, Ph.D.-Associate Professor of Medicine (Endocrinology, Diabetes and Bone Disease) at the Icahn School of Medicine. "For the first time, we've shown that it's possible to use small molecules to fine-tune carbohydrate response element binding protein (ChREBP) activity in a way that could have major therapeutic implications."

More than 500 million people worldwide are living with diabetes, a disease characterized by high blood sugar levels due to insulin resistance and/or beta cell failure. In T2D, long-term exposure to high glucose and fatty acid levels (glucolipotoxicity) can ultimately lead to beta cell dysfunction and death.

ChREBP is a transcription factor that plays a crucial role in regulating glucose metabolism. It exists in two main isoforms: ChREBP α and ChREBP β . This is the first study to identify and develop **small molecules**—termed "molecular glues"—that enhance the interaction between ChREBP α and 14-3-3 proteins in **pancreatic beta cells**.



SAR around analog 1 results in improved stabilizer 30. Credit: *Nature Communications* (2025). DOI: 10.1038/s41467-025-57241-7

The molecular glues in this case increase the binding between 14-3-3 proteins and ChREBP α , which is anchored in the cytoplasm of the beta cell by the 14-3-3 proteins. Under conditions of glucolipotoxicity, ChREBP α goes into the nucleus and starts making too much

of ChREBP β , which acts to disable and even kill the patient's beta cells. By using a molecular glue designed to increase the binding of ChREBP α to 14-3-3 proteins, ChREBP α never leaves the cytoplasm, cannot enter the nucleus, and therefore does not make ChREBP β .

When tested in primary human beta cells, these molecular glues significantly reduced the toxic effects of glucolipotoxicity, thus preserving beta cell function and identity. This discovery represents a major shift in diabetes research, as [transcription factors](#) like ChREBP have long been considered "undruggable" targets. The study also highlights the broader potential of molecular glues for modulating similar interactions in other diseases.

"Our findings suggest a completely new strategy for preserving beta cell function in diabetes," said Donald K. Scott, Ph.D., Professor of Medicine (Endocrinology, Diabetes and Bone Disease) at the Icahn School of Medicine. "This approach could complement existing diabetes treatments and help prevent disease progression."

Researchers are now working to refine these compounds and evaluate their potential for clinical translation. Future studies will focus on optimizing the molecular glues for therapeutic use and testing them in preclinical [diabetes](#) models.

This study was done in collaboration with research teams from Eindhoven University of Technology in the Netherlands and the University of Duisburg-Essen in Germany.

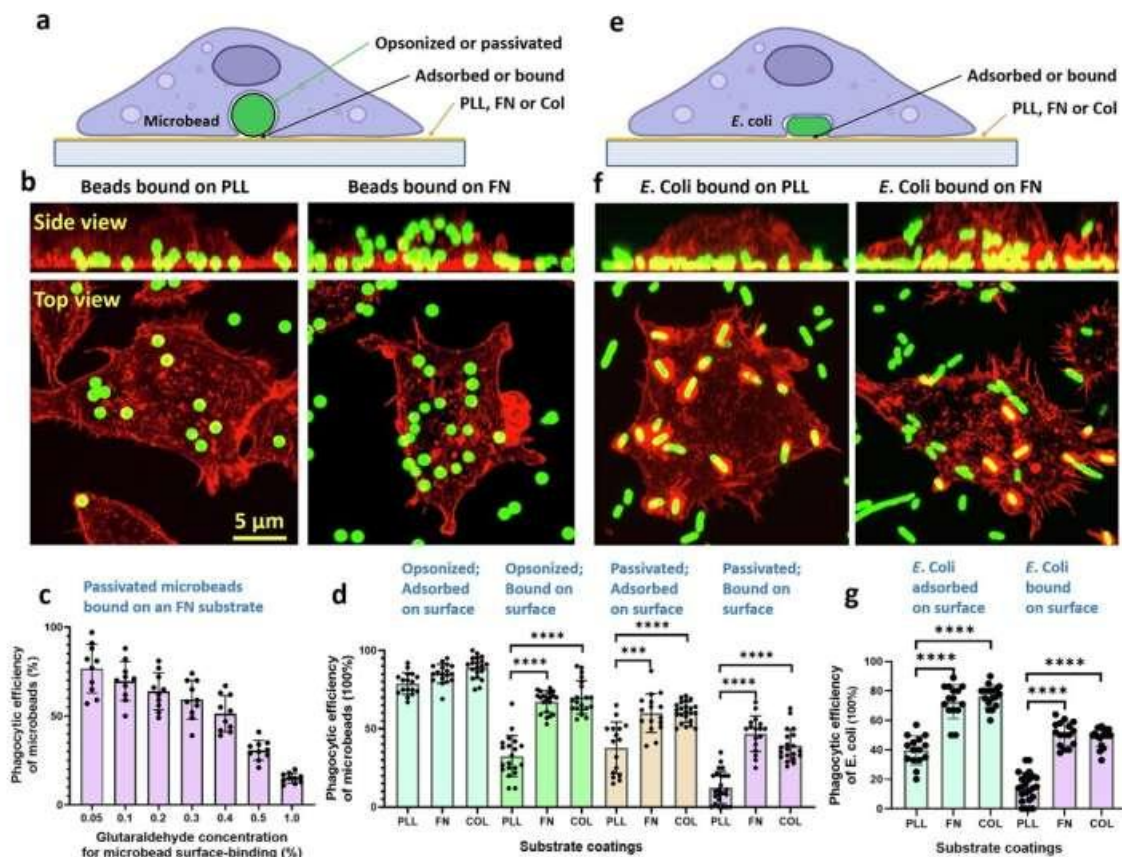
More information: Liora S. Katz et al, Molecular glues of the regulatory ChREBP/14-3-3 complex protect beta cells from glucolipotoxicity, *Nature Communications* (2025). DOI: [10.1038/s41467-025-57241-7](https://doi.org/10.1038/s41467-025-57241-7)

Journal information: [Nature Communications](#)

MARCH 4, 2025

White blood cells use brute force to dislodge bacteria, study shows

by Megan Burgasser, [University of Cincinnati](#)



Fibronectin or collagen on a substrate facilitates the phagocytosis of surface-bound particles by macrophages. Credit: *Nature Communications* (2025). DOI: 10.1038/s41467-025-56404-w

A vivid new image is taking shape in the world of cell biology: Imagine bacteria adhering to the surface of a cell, perhaps at the site of an injury or wound. In response, a white blood cell arrives at the scene. This cell encircles the pathogen with its membrane, forming a tight, constricting ring. With remarkable force, the white blood cell yanks the pathogen off the wound's surface. The white blood cell then engulfs the pathogen in a process called phagocytosis, in which it "eats" the foreign invader to neutralize it.

This dramatic process might sound like something out of a science fiction story.

"But it's precisely what occurs inside our bodies," said Xuefeng Wang, an associate professor at the University of Cincinnati's Hoxworth Blood Center.

One key player in this process is integrin, a protein found on the surface of cells that facilitates adhesion, helping them stick to other surfaces. In this scenario, integrin is what the white blood cell actively works against when it pulls the pathogen away from the wound.

Wang's biomedical research lab at Hoxworth focuses on understanding integrin and its role in [cell biology](#). Notably, Hoxworth is the only blood center in the United States that houses an academic research arm, and Wang is one of two research professors on Hoxworth's team.

Wang is the corresponding author of a study [published](#) recently in *Nature Communications*. The study highlights the newly discovered mechanism by which [white blood cells](#) use brute force to dislodge bacteria that stick to [human tissues](#). Once detached, the white blood cells engulf and consume the pathogens. Reconstructed 3D images of macrophages ingesting *E. coli* bound on PLL or fibronectin surfaces, respectively. Phagocytic efficiency can be evaluated by observing and quantifying the percentage of *E. coli* detached from the substrate. F-actin is displayed in red and *E. coli* are displayed in green. Credit: *Nature Communications* (2025). DOI: [10.1038/s41467-025-56404-w](https://doi.org/10.1038/s41467-025-56404-w)

This study was led by Wang, with Subhankar Kundu, a postdoctoral research fellow in his lab, serving as the first author. The research team also included Kaushik Pal and Arghajit Pyne, two other postdoctoral fellows in Wang's lab. Their collective work has far-reaching implications.

For example, consider the impact of environmental pollutants such as dust or smoke when they enter the lungs. These particles can adhere to [lung tissue](#), and macrophages—the white blood cells responsible for cleaning up such intruders—are tasked with removing them. Macrophages dislodge the pollutants from the lung tissue and then ingest them, preventing harm to the respiratory system.

Looking ahead, Wang is hopeful that his research will contribute to the development of pharmaceuticals designed to enhance the ability of white blood cells to effectively target and neutralize pathogens.

"This research could open up novel treatments that not only combat infections but also accelerate the healing process of wounds," said Wang, underscoring the real-world impact of his work.

More information: Subhankar Kundu et al, Force-bearing phagocytic adhesion rings mediate the phagocytosis of surface-bound particles, *Nature Communications* (2025). DOI: [10.1038/s41467-025-56404-w](https://doi.org/10.1038/s41467-025-56404-w)

Journal information: [Nature Communications](#)

Provided by [University of Cincinnati](#)

MARCH 4, 2025

Advanced brain imaging technique could better tailor stroke rehabilitation

by [Georgetown University Medical Center](#)

Credit: Pixabay/CC0 Public Domain

A new Georgetown University Medical Center study exploring a new brain imaging technique is bringing stroke experts a step closer to better tailoring rehabilitation.

The research was conducted in collaboration with MedStar Health and the National Institutes of Health. The work [appears](#) in *Neurology*.

Neurologists often use MRI images of the brain's white matter to glean information about a person's ability to recover, but a new imaging technique added to MRI allows clinicians to better see the condition of white-matter tracts leading to the limbs, an observation usually only seen after death during an autopsy.

"A white matter tract called the [corticospinal tract](#) provides the main wiring that goes from your brain down to your [spinal cord](#) to help power your arms and legs," explains study leader, Matthew A. Edwardson, MD, an associate professor of neurology at Georgetown University School of Medicine and a vascular neurologist and a member of the stroke team at MedStar Georgetown University Hospital. "If those cables are severed or atrophied, the person is not going to be able to regain meaningful use of their arms and legs—they wouldn't have much motor strength."

The imaging technique used by Edwardson and his colleagues is called diffusion tensor-based morphometry (DTBM). It combines directional information about the structures in the brain with the shape and size of the structures being imaged. Previously, it was difficult to separate the white-matter cables from the gray matter using morphometry approaches because they did not include the directional information. This two-part technique allows researchers to map and quantify changes over time in the white matter tracts.

ADVERTISING

"To our knowledge, this is the first study to allow us to measure atrophy of these tracts in stroke survivors," says Edwardson, a member of the Center for Brain Plasticity and Recovery, a joint collaboration between Georgetown University and MedStar National Rehabilitation Network.

"Now, we can see if the cables have shrunk in size, which would indicate that a stroke has caused enough damage to the brain to lead to the wiring becoming atrophied," says Edwardson. "That observation is strongly correlated with how well somebody will recover. If

there's a lot of atrophy in the brain in those cables, they're not going to have much ability to recover their arm function after a stroke."

Edwardson says further studies would be needed before the observations could be used to tailor [stroke](#) rehabilitation.

"It would be helpful for the therapist to know at the time of admission to inpatient rehabilitation whether there's some likelihood of their patient regaining function," he says. "If it is determined that the patient isn't likely to recover meaningful motor use, then the therapist could change their strategy to perhaps focus on the unimpaired side with strategies to compensate for the disability."

More information: Matthew A. Edwardson et al, Association between changes in white matter volume detected with diffusion tensor-based morphometry and motor recovery after stroke, *Neurology* (2025). DOI: [10.1212/WNL.0000000000213408](https://doi.org/10.1212/WNL.0000000000213408)

Journal information: [Neurology](#)

Provided by [Georgetown University Medical Center](#)

MARCH 4, 2025

Analysis predicts a third of children worldwide will be obese or overweight by 2050

by [Murdoch Children's Research Institute](#)

Obesity rates are set to skyrocket, with one in six children and adolescents worldwide forecast to be obese by 2050, according to a new study. But with significant increases predicted within the next five years, the researchers stress urgent action now could turn the tide on the public health crisis.

The research, led by Murdoch Children's Research Institute (MCRI) and [published](#) in *The Lancet*, found a third of children and adolescents will be overweight (385 million) or obese (360 million) within the next 25 years. The forecast equates to 356 million children aged 5–14 years and 390 million aged 15–24 years, with one in six facing obesity.

The global obesity rate for those between 5–24 years old tripled from 1990 to 2021, rising by 244% to 174 million, suggesting that current approaches to curbing increases in obesity have failed a generation of young people. As of 2021, 493 million children and adolescents were overweight or obese.

MCRI Dr. Jessica Kerr said if immediate five-year action plans were not developed, the future would be bleak for our youth.

"Children and adolescents remain a vulnerable population within the obesity epidemic," she said. Prevention is key as obesity rarely resolves after adolescence.

"This giant burden will not only cost the health system and the economy billions, but complications associated with a high Body Mass Index (BMI), including diabetes, cancer, [heart problems](#), breathing issues, fertility problems and mental health challenges, will negatively impact our children and adolescents now and into the future, even holding the potential to impact our grandchildren's risk of obesity and quality of life for decades to come.

"Despite these findings indicating monumental societal failures and a lack of coordinated global action across the entire developmental window to reduce obesity, our results provide optimism that this trajectory can be avoided if action comes before 2030."

The analysis, released on World Obesity Day, used the [2021 Global Burden of Diseases, Injuries, and Risk Factors Study](#) led by the Institute for Health Metrics and Evaluation to estimate the latest overweight and obesity levels and forecasts in 204 countries and territories.

The United Arab Emirates, Cook Islands, Nauru and Tonga are forecast to have the highest prevalence while China, Egypt, India and the US will have the greatest number of children and adolescents with obesity by 2050.

In Australia, children and adolescents have experienced some of the fastest transitions to obesity in the world. Girls are already more likely to be obese than overweight. Overall, by 2050, for those aged 5–24 years, 2.2 million are forecasted to be obese and 1.6 million overweight.

Globally, there will be more boys aged 5–14 years with obesity than being overweight by 2050.

"Without urgent policy reform, the transition to obesity will be particularly rapid in North Africa, the Middle East, Latin America and in the Caribbean, where the rise is concurrent with high population numbers and limited resources," Dr. Kerr said.

"Many regions have historically had to focus on preventing undernutrition and stunting in children. To prevent a public health emergency from this newer threat, an immediate imperative should be creating national surveillance surveys of obesity in children and adolescents in every country."

Dr. Kerr said older [adolescent](#) girls, aged 15–24 years entering their reproductive years, were a priority population for intervention.

"Adolescent girls who are obese are a main focus if we are to avoid intergenerational transmission of obesity, [chronic conditions](#) and the dire financial and societal costs across future generations," she said.

"With this age group increasingly being out of school and cared for by adult services, we need to focus on interventions at the community and commercial level."

MCRI Professor Susan Sawyer said governments needed to invest in multicomponent strategies that reduce obesity drivers, across food and drink, activity, lifestyle and the built environment.

"While people and families can work to balance their physical activity, diet and sleep, everything in our environments works to counteract these efforts," she said.

"Given this huge global shift in children's and adolescents' weight, we can no longer keep blaming people for their choices. We require governments to step up by addressing regulatory interventions, including taxing [sugar-sweetened beverages](#), banning junk food advertising aimed at [children](#) and young people and funding healthy meals in primary and secondary schools.

"We also need to consider the benefits of wider policies such as overhauling urban planning to encourage active lifestyles."

More information: Global, regional, and national prevalence of child and adolescent overweight and obesity, 1990-2021, with forecasts to 2050: a forecasting study for the Global Burden of Disease Study 2021, *The Lancet* (2025). DOI: [10.1016/S0140-6736\(25\)00397-6](https://doi.org/10.1016/S0140-6736(25)00397-6)

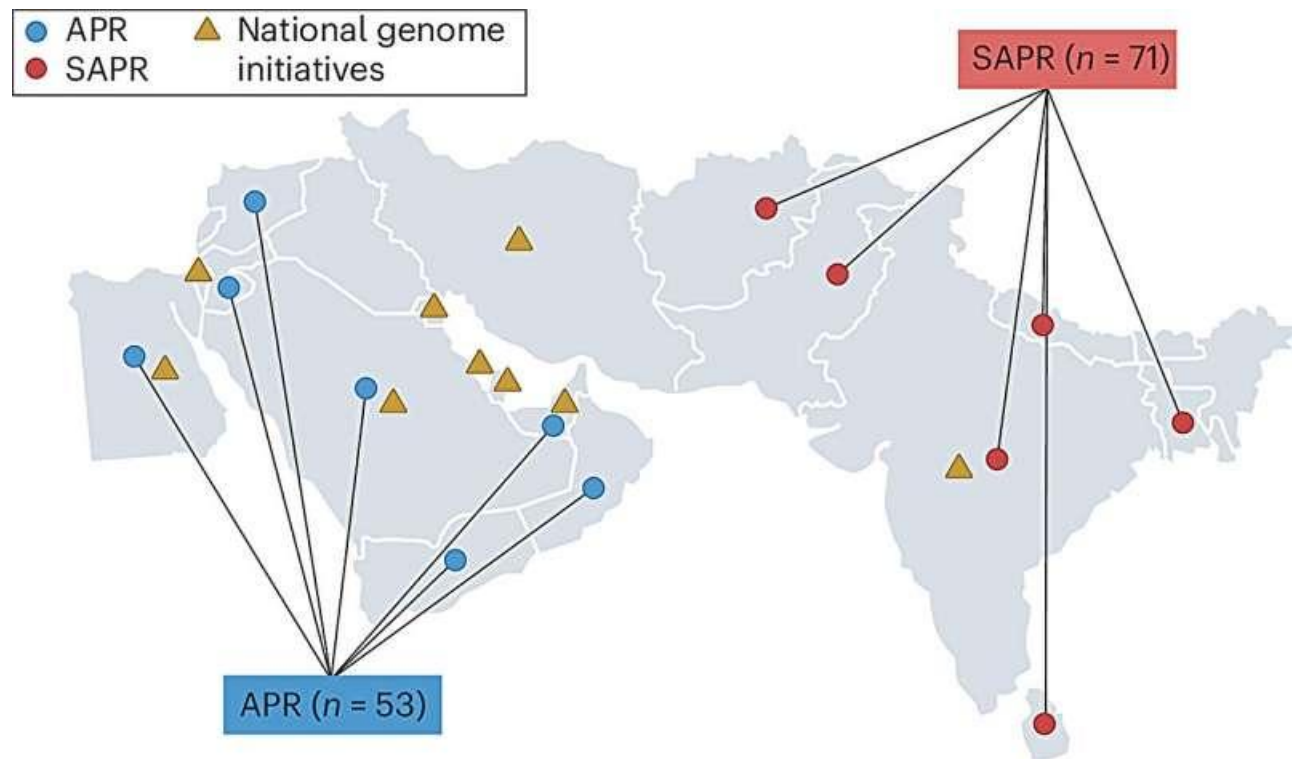
Journal information: [The Lancet](#)

Provided by [Murdoch Children's Research Institute](#)

MARCH 4, 2025

Advanced genetic blueprint aims to enhance precision medicine in diverse populations

by University of Birmingham



Geographic distribution of pangenome initiatives across the Middle East and South Asia.

Credit: *Nature Medicine* (2025). <https://doi.org/10.1038/s41591-025-03544-7>

Creation of a comprehensive genetic representation for more than 2.5 billion people across the Middle East and South Asia could make a major contribution towards advancing precision medicine, a [publication](#) in *Nature Medicine* reveals.

Traditional genetic research has mainly relied on linear reference genomes, which is like having a single, standard version of human DNA that scientists compare everyone's [genetic information](#) against. This works well for studying individual genetics but does not capture all the complexities and differences found in diverse populations.

The Arab Pangenome Reference (APR) takes a different approach. Instead of relying on just one "standard" genome, it includes a collection of many different genetic versions specific to the Arab population. This helps scientists see the full picture of genetic diversity, including variations and unique traits that might be missed using the old method.

The international group of researchers was led by Dubai Health's Center for Applied and Translational Genomics (CATG), Mohammed Bin Rashid University of Medicine and Health Sciences, in partnership with the University of Birmingham Dubai.

Authors included Nasna Nassir, Mohamed A. Almarri, Hosneara Akter, Hamda Hassan Khansaheb, K. M. Furkan Uddin, Ahmad Abou Tayoun, Stefan Du Plessis, Marc Haber, Alawi Alsheikh-Ali and Mohammed Uddin.

Professor Alawi Alsheikh-Ali, Deputy CEO and Chief Academic Officer of Dubai Health and Provost of Mohammed Bin Rashid University of Medicine and Health Sciences, commented, "This publication provides a comprehensive and inclusive perspective on human genetic diversity, ensuring that the unique genetic landscapes of the Middle East and South Asia are represented. Integration of these pangenomes into global genomic databases will unlock new discoveries and represents a vital step in advancing health for humanity."

Professor Yusra Mouzughi, Provost University of Birmingham Dubai, commented, "At the University of Birmingham, we pride ourselves on 'research that changes lives.'"

"This latest research demonstrates the impact of our strong partnership between the University of Birmingham Dubai and Dubai Health to deliver research that fundamentally advances science and discovery, creating a new understanding of genetic diversity among Arabs and enabling a deeper understanding of the genetic origins of disease."

Dr. Mohammed Uddin, Director of the Center for Applied and Translational Genomics (CATG) at the Mohammed Bin Rashid University of Medicine and Health Sciences, commented, "The APR is the first reference genome constructed to capture the genetic diversity among Arabs."

"This landmark resource aims to enhance early diagnosis and personalized treatments for genetic diseases that are prevalent in the region. This research uncovered millions of base pairs of novel human DNA sequences, which will contribute to a deeper understanding of the genetic origins of diseases and traits."

"Our goal is to construct graph pangenomes encompassing the entire Middle East and South Asia, aiming to accelerate the adoption of precision medicine in these regions."

Co-author Marc Haber, from the University of Birmingham Dubai, commented, "The precision offered by pangenomic approaches is particularly beneficial for studying rare and previously undetected disease-causing variants, which paves the way for better understanding and treatment of these conditions, leading to new discoveries in population genetics, disease susceptibility and drug response."

Professor Stefan Du Plessis, Dean of Research and Graduate Studies at MBRU commented, "At Dubai Health, our Discovery Mission embodies our commitment to innovation, research, and the advancement of health care."

"This publication emphasizes the importance of collaborative research in making advanced genomic references a routine part of diagnostics and health care. As we move forward, this comprehensive genetic approach promises to reshape our understanding of health and disease, ultimately improving health care for millions."

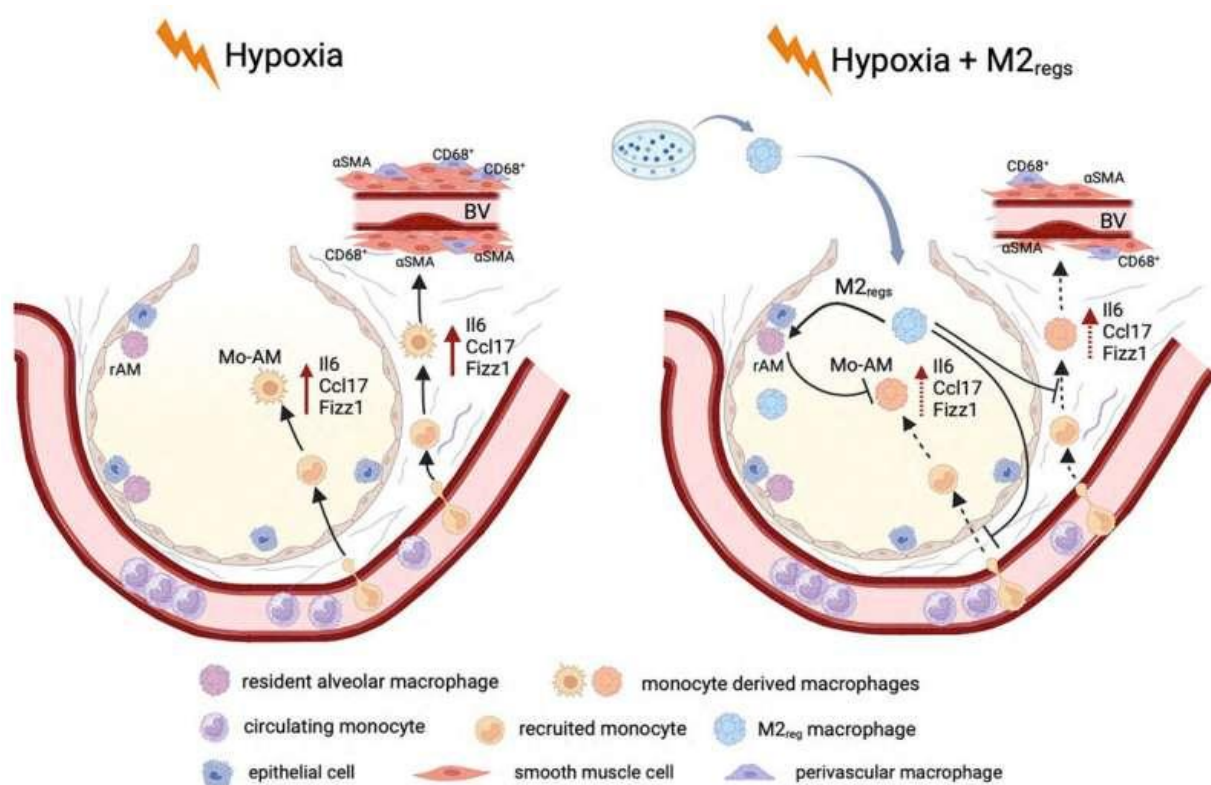
More information: Nassir, N., et al. Advancing clinical genomics with Middle Eastern and South Asian pangenomes. *Nature Medicine* (2025). doi.org/10.1038/s41591-025-03544-7

Journal information: [Nature Medicine](#)
Provided by [University of Birmingham](#)

MARCH 4, 2025

Modifying macrophages in the lung could head off pulmonary hypertension

by Nancy Fliesler, [Children's Hospital Boston](#)



Graphical Abstract. Credit: *Arteriosclerosis, Thrombosis, and Vascular Biology* (2024). DOI: 10.1161/ATVBAHA.124.321264

In the 1980s, when Stella Kourembanas, MD, began her career in neonatology, she cared for newborns with pulmonary hypertension, a disease that results in abnormally high blood

pressure in the lung arteries and can lead to heart failure. Since then, treatments like inhaled nitric oxide, new vasodilators, new modalities of mechanical ventilation, and extracorporeal membrane oxygenation (ECMO) have reduced mortality from about 85% to 10%. But pulmonary hypertension still persists.

ADVERTISING

"There's amelioration, improved survival, but no cure," says Kourembanas, chief of the Division of Newborn Medicine at Boston Children's Hospital.

As more infants survive premature births and develop [bronchopulmonary dysplasia](#) (BPD), a [chronic lung disease](#), more are developing pulmonary hypertension. It's believed that BPD arrests the development of blood vessels in the lungs and prevents normal lung growth.

Inflammatory vs. anti-inflammatory macrophages

About 25 years ago, Kourembanas and her colleagues started testing new therapeutic approaches in animal models of BPD and hypoxia-induced pulmonary hypertension. In the process, they uncovered critical pathological mechanisms and new cellular targets. They showed that lung vascular disease is preceded by [inflammation](#). Later, they found that specific subtypes of macrophages (a class of white blood cells), recruited to the lung during hypoxia, release inflammatory factors that cause vascular disease to progress.

They further showed that other macrophage subtypes could resolve inflammation and inhibit the development of pulmonary hypertension. Finally, in their model of hypoxia, they showed that interfering with early inflammation prevents pulmonary hypertension from developing.

In work recently [published](#) in *Arteriosclerosis, Thrombosis, and Vascular Biology*, Kourembanas's team, led by Angeles Fernandez-Gonzalez, Ph.D., modified macrophages to have an anti-inflammatory profile by incubating them with specific cytokines. When they administered the modified macrophages into the lungs of mice via the trachea, they saw reduced inflammation caused by hypoxia, and monocyte recruitment was halted.

Four weeks after treatment, the team saw decreased cardiac pathology. Right [ventricular hypertrophy](#), right ventricular systolic pressure, and vascular remodeling—all complications of pulmonary hypertension—were reduced as compared with controls that did not receive modified macrophages.

"The key is to halt inflammation at an early time point and eliminate triggers that switch on in the beginning," says Fernandez-Gonzalez. "After activation of inflammatory factors, crosstalk leads to production of more inflammatory factors, thickening of the vessel walls, and vascular remodeling that makes vessels resistant to blood flow. This forces the heart to work harder."

Possible directions for therapy

Kourembanas believes focusing on manipulating macrophages could prevent pulmonary hypertension in clinically deteriorating infants with BPD, without harming normal lung development.

"Today we give steroids, which halt inflammation but also halt normal lung development," she says. She believes that focusing on macrophages and early inflammation could also curb exacerbations of [pulmonary hypertension](#) in older children and adults.

In her mind, a macrophage-focused therapy could take different forms—cell therapy delivering the anti-inflammatory macrophages themselves, delivery of products derived from macrophages, or delivery of factors that modify macrophages or the lung environment. It's a question that academic and industry labs are actively investigating.

Fernandez-Gonzalez notes that "good" macrophages can be altered by signals in their environment after being put in the lung, losing their anti-inflammatory properties.

To prevent this from happening, "It may turn out not to be cells, but something derived from them that could have long-lasting effects, but we don't know yet," Kourembanas says. "Active research and future clinical trials will give us the answer."

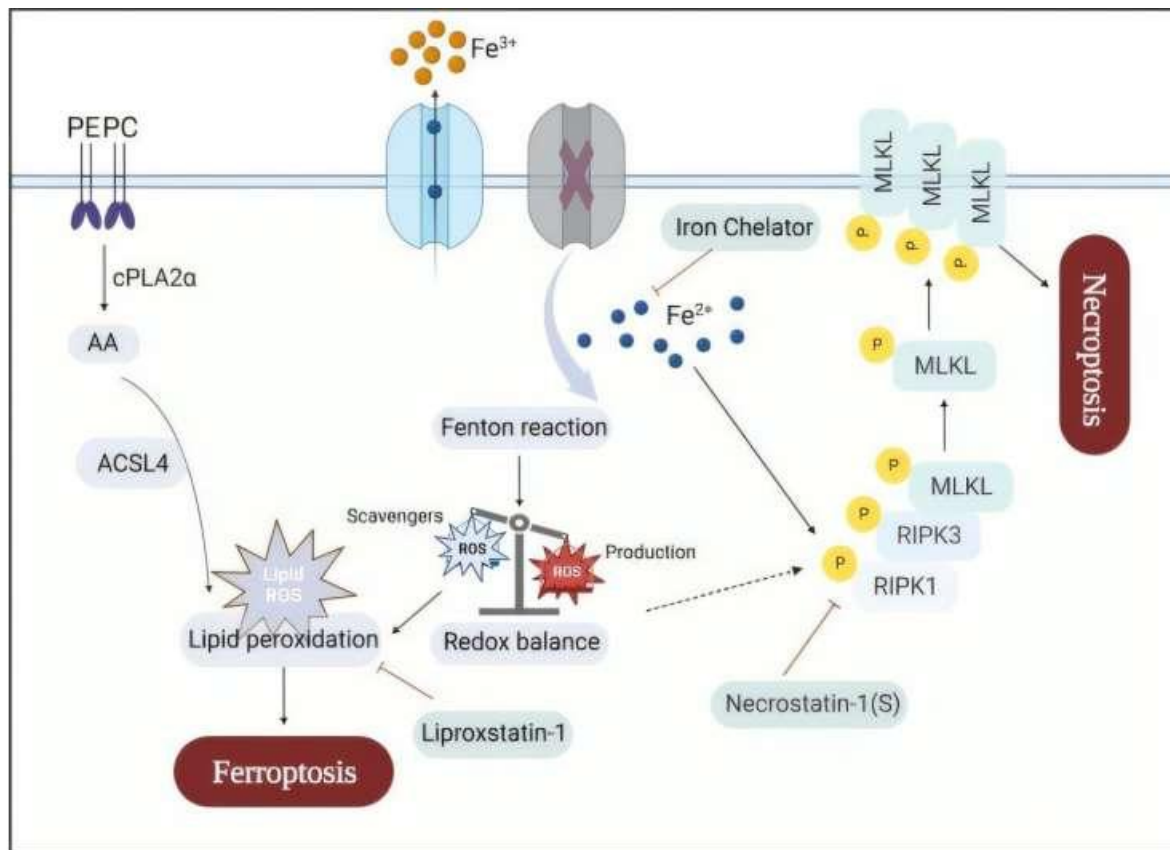
More information: Angeles Fernandez-Gonzalez et al, Immunoregulatory Macrophages Modify Local Pulmonary Immunity and Ameliorate Hypoxic Pulmonary Hypertension, *Arteriosclerosis, Thrombosis, and Vascular Biology* (2024). DOI: [10.1161/ATVBAHA.124.321264](https://doi.org/10.1161/ATVBAHA.124.321264)

Journal information: [Arteriosclerosis, Thrombosis and Vascular Biology](#)
Provided by [Children's Hospital Boston](#)

MARCH 4, 2025

Iron overload: An accelerator of deadly cell responses in stroke

by Chongqing Medical University



Schematic hypothesis. Ischemic stroke causes iron accumulation, disrupting the redox balance, which in turn leads to two outcomes. One of the outcomes is the increased cell susceptibility to ferroptosis, accompanied by the accumulation of lipid reactive oxygen species (ROS). Additionally, the disrupted redox balance induces the phosphorylation of RIPK1, amplifying susceptibility to necroptosis. Credit: *Genes & Diseases*

A study has uncovered that iron orchestrates the activation of two damaging cell death pathways—ferroptosis and necroptosis—early in ischemic stroke recovery, exacerbating brain injury. This discovery sheds light on how iron disruption fuels neurological damage, positioning iron regulation as a promising therapeutic target to protect the brain during the critical reperfusion phase.

The work is [published](#) in the journal *Genes & Diseases*.

Ischemic stroke continues to rank among the top causes of death and long-term disability globally. While advances in acute treatments like clot retrieval and thrombolysis have

improved outcomes, the challenge of managing reperfusion injury—a phase when restored blood flow can ironically harm brain tissue—persists. Key contributors to this damage are programmed cell death pathways, including ferroptosis and necroptosis. Yet, the intricate timing and interaction between these mechanisms remain poorly understood, leaving gaps in therapeutic strategies that urgently need addressing.

A team from Sichuan University has tackled this complex issue. Using RNA sequencing and protein analysis in ischemic mouse models, the researchers demonstrated that ferroptosis and necroptosis are triggered within hours of reperfusion, while apoptosis occurs later. They found that iron plays a central role in amplifying both early pathways by destabilizing redox balance, which accelerates [oxidative damage](#) and worsens neurological outcomes.

This research highlights the dynamic interplay between ferroptosis and necroptosis, revealing iron as a linchpin in their activation. The study also found that ferroptosis inhibitors like liproxstatin-1 not only halt ferroptosis but also reduce necroptosis, and necroptosis inhibitors such as necrostatin-1 show reciprocal effects. Iron chelation therapy with deferoxamine emerged as a particularly effective approach, mitigating both pathways by addressing the root cause—iron overload. These findings emphasize the need for [early intervention](#) and a multi-target therapeutic approach to minimize stroke-related damage.

Dr. Peng Lei, the study's senior author, remarked, "Our findings unravel the intricate relationship between ferroptosis and necroptosis in stroke recovery. Iron stands out as a crucial driver of these processes, offering a highly actionable target for novel therapies. This dual-pathway approach could significantly improve outcomes for [ischemic stroke](#) patients."

Looking ahead, this research paves the way for the development of combination therapies targeting multiple cell death pathways to alleviate [reperfusion injury](#). Iron chelation strategies, in particular, could redefine stroke management and recovery, while also providing a foundation for precision medicine in treating stroke and other neurodegenerative disorders.

More information: Bin Du et al, Iron promotes both ferroptosis and necroptosis in the early stage of reperfusion in ischemic stroke, *Genes & Diseases* (2024). DOI:

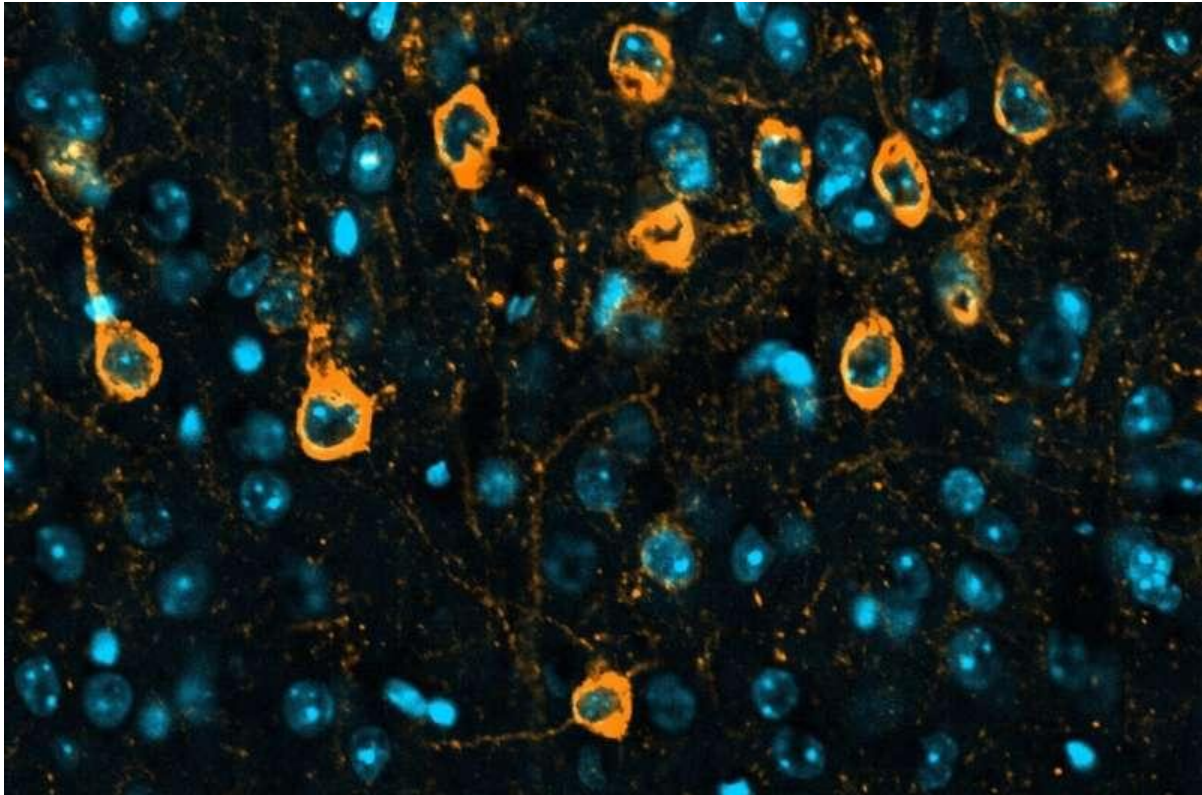
[10.1016/j.gendis.2024.101262](https://doi.org/10.1016/j.gendis.2024.101262)

Provided by Chongqing Medical University

MARCH 5, 2025

How to clear the toxic tau protein that can lead to Alzheimer's and related diseases

by [Keck School of Medicine of USC](#)



Tau protein in the brain of a mouse with a mutation that causes a common form of dementia. Credit: Joshua Berlind/Ichida Lab/USC Stem Cell

The neurotransmitter glutamate is essential for regulating everything from mood to memory, but it can also encourage a toxic buildup of the notorious tau protein, which can contribute to Alzheimer's and related diseases.

In a USC Stem Cell-led study [published](#) in *Neuron*, scientists describe a new approach for counteracting these devastating and often fatal neurodegenerative effects.

In the study, first authors Joshua Berlind and Jesse Lai made their discovery by studying lab mice as well as human brain "organoids," which are rudimentary brain-like structures grown in the lab.

The scientists produced these organoids from [stem cells](#) derived from healthy people as well as from patients with [neurodegenerative diseases](#) related to tau toxicity.

When exposed to glutamate, the organoids—particularly the ones derived from patients with neurodegenerative diseases—exhibited a toxic buildup of tau protein as well as neurodegeneration and nerve cell death. Mice with a mutation in tau, which causes a common form of dementia, displayed similar pathologies.

"Many potential drugs have been developed to mitigate the neurodegenerative effects of glutamate toxicity, but they've had mixed results in [clinical trials](#)," said corresponding author Justin Ichida, who is the John Douglas French Alzheimer's Foundation Associate Professor of Stem Cell Biology and Regenerative Medicine at the Keck School of Medicine of USC, a New York Stem Cell Foundation-Robertson Investigator, and a USC Merkin Scholar.

"One challenge is that directly limiting the activity of glutamate, a key neurotransmitter, can have negative consequences, such as motor or memory deficits or even reduced consciousness."

Taking a different approach, the scientists screened for genes that respond to glutamate and identified a gene called KCTD20. When the scientists suppressed the activity of this gene in the organoids and in the mice, glutamate did not produce the same ill effects in terms of either tau buildup or neurodegeneration.

Through additional experiments, the team discovered that suppressing this gene activated cellular compartments called lysosomes, which enveloped the toxic tau proteins and expelled them from the organoids' cells.

"Our study points towards enhancing tau protein clearance as an important therapeutic strategy, rather than aiming to limit glutamate activity," said Lai, who completed his postdoctoral training in the Ichida Lab and Amgen and now works at Dewpoint Therapeutics.

Berlind, a postdoc in the Ichida Lab, added, "This is a promising new direction for developing targeted treatments for patients with tau-related neurodegenerative diseases, including Alzheimer's disease."

Additional co-authors include Cecilia Lie, Jokabeth Vicente, Kelsey Lam, Sheron Guo, and Jonathan Chang from USC; and Violeta Yu from Dewpoint Therapeutics.

More information: KCTD20 suppression mitigates excitotoxicity in tauopathy patient organoids, *Neuron* (2025). DOI:

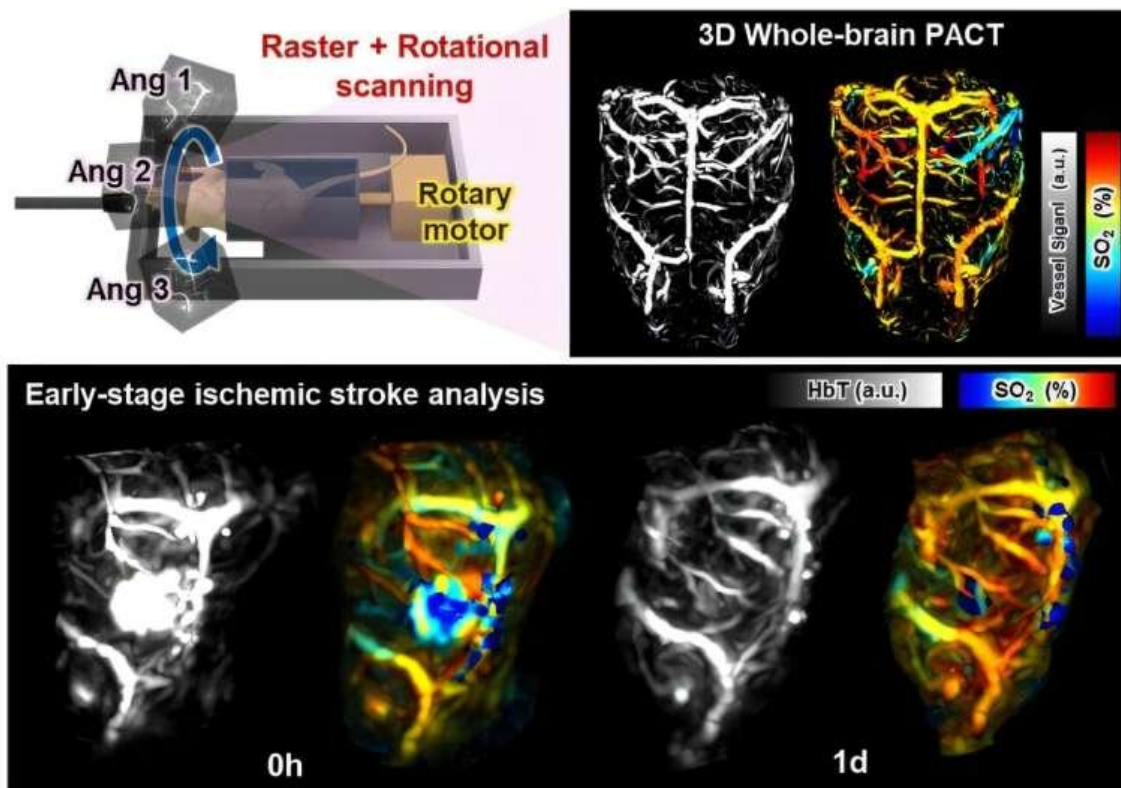
[10.1016/j.neuron.2025.02.001](https://doi.org/10.1016/j.neuron.2025.02.001). [www.cell.com/neuron/fulltext/S0896-6273\(25\)00114-X](https://www.cell.com/neuron/fulltext/S0896-6273(25)00114-X)

Journal information: *Neuron*

Provided by [Keck School of Medicine of USC](#)

Technique using light and sound allows for real-time stroke monitoring

by Pohang University of Science and Technology



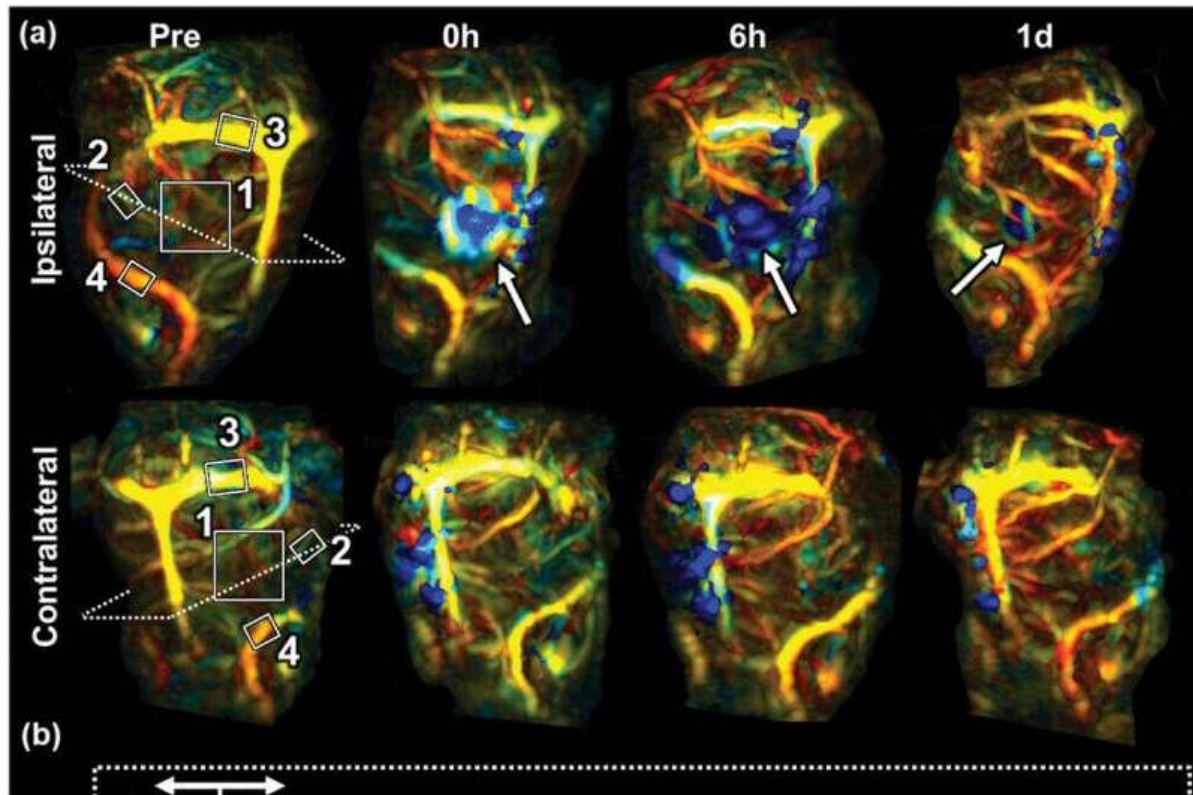
Visualization of the entire cerebrovascular structure and observation of acute ischemic stroke lesions using PACT on the entire brain. Credit: POSTECH

Every year, millions of people die from stroke. In order to win against the disease, which occurs the moment when a blood vessel is blocked in the brain, a POSTECH research team made a breakthrough with a cutting-edge technology combining light and sound. The research is [published](#) in the journal *Advanced Science*.

Stroke is the second most common cause of death worldwide. In particular, ischemic stroke occurs when a blood vessel supplying blood to your brain is blocked. If [treatment](#) is delayed, a patient will have accelerated [brain tissue damage](#), making it virtually impossible to recover. The existing technologies such as CT and MRI have limitations on capturing any early vascular changes in [real-time](#). Furthermore, animal model research has limitations with scope and efficiency.

To solve this, the POSTECH research team developed a photoacoustic computed tomography (PACT) that combines light and ultrasound. The research team applied a complex scanning method that combines linear and rotational scanning to synthesize images from multiple angles into one. It is the same method used to take images from different directions and reconstitute them into a 3D image.

Using this technology, the research team was able to non-invasively monitor cerebrovascular changes within **small animals** in the early stages of an **ischemic stroke** in real time, and successfully analyzed vascular changes in a wide region with precision.



Oxygen saturation of early-stage ischemia in a region with a photothrombotically induced stroke. (a) Maximum amplitude projection oxygen saturation distribution images at pre-, 0-, 6 h, and 1-day after photothrombotic stroke induction (b) B-mode slice images of the rat brain at corresponding time points (c) Vessel-specific oxygen saturation changes in the ipsilateral and contralateral sides of the brain after photothrombosis. ROI 3 ($p = 0.2$) and ROI 4 ($p = 0.4$) did not show statistically significant differences between the ipsilateral and contralateral sides. $*p < 0.05$; $**p < 0.01$. Credit: *Advanced Science* (2024). DOI: 10.1002/adv.202409361

In addition, the team developed an algorithm that non-invasively observes hemoglobin and measures **oxygen saturation** in each blood vessel in real time by utilizing multi-wavelength photoacoustic imaging within a near-infrared region. This allowed the team to precisely monitor not only ischemic lesions but also collateral blood flow and neovascular changes. These results were proven reliable compared to the existing pathological tissue tests, and showed that the new PACT system can effectively track the vascular recovery process after stroke.

The POSTECH research team said, "The most significant result from this research is that we can now have precise observation of blood flow changes without using contrast. This will provide new experimental approaches not only for stroke treatment research but also for research on various neurological and vascular diseases."

More information: Jiwoong Kim et al, Non-Invasive Photoacoustic Cerebrovascular Monitoring of Early-Stage Ischemic Strokes In Vivo, *Advanced Science* (2024). DOI: [10.1002/adv.202409361](https://doi.org/10.1002/adv.202409361)

Journal information: [Advanced Science](#)

Provided by [Pohang University of Science and Technology](#)

MARCH 5, 2025

Engineered cartilage from nasal septum cells helps treat complex knee injuries

by [University of Basel](#)



Human articular cartilage defects can be treated with cells taken from the nasal septum.
Credit: Christian Flierl / University of Basel

Injuries to the articular cartilage in different joints, including the knee, are painful and limit mobility. In response, researchers at the University of Basel and University Hospital Basel are developing cartilage implants using cells from the patient's nasal septum. A recent study shows that giving these cartilage implants more time to mature significantly improved clinical efficacy, even in patients with complex cartilage injuries. This suggests that the method could also be suitable for the treatment of degenerated cartilage in osteoarthritis.

The findings are [published](#) in the journal *Science Translational Medicine*.

An unlucky fall while skiing or playing football can spell the end of sports activities. Damage to [articular cartilage](#) does not heal by itself and increases the risk of osteoarthritis. Researchers at the University of Basel and the University Hospital Basel have now shown that even complex cartilage injuries can be repaired with replacement cartilage engineered from cells taken from the nasal septum.

A team led by Professor Ivan Martin, Dr. Marcus Mumme and Professor Andrea Barbero has been developing this method for several years. It involves extracting the cells from a tiny piece of the patient's nasal septum cartilage and then allowing them to multiply in the laboratory on a scaffold made of soft fibers. Finally, the newly grown cartilage is cut into the required shape and implanted into the knee joint.

Earlier studies have already shown promising results. "Nasal septum cartilage cells have particular characteristics that are ideally suited to cartilage regeneration," explains Professor Martin. For example, it has emerged that these cells can counteract inflammation in the joints.



Researchers grow cartilage replacements from cells of the nasal septum to repair cartilage injuries in the knee. Credit: Christian Flierl / University of Basel

More mature cartilage shows better results

In a clinical trial involving 98 participants at clinics in four countries, the researchers compared two experimental approaches. One group received cartilage grafts that had matured in the lab for only two days before implantation—similar to other cartilage replacement products. For the other group, the grafts were allowed to mature for two weeks. During this time, the tissue acquires characteristics similar to native cartilage.

For 24 months after the procedure, the participants self-assessed their well-being and the functionality of the treated knee through questionnaires. The results showed a clear improvement in both groups. However, patients who received more mature engineered cartilage continued to improve even in the second year following the procedure, overtaking the group with less mature cartilage grafts.

Magnetic resonance imaging (MRI) further revealed that the more mature cartilage grafts resulted in better tissue composition at the site of the implant, and even of the neighboring cartilage.

"The longer period of prior maturation is worthwhile," emphasizes Anke Wixmerten, co-lead author of the study. The additional maturation time of the implant, she points out, only requires a slight increase in effort and manufacturing costs, and gives much better results.

Particularly suited to larger and more complex cartilage injuries

"It is noteworthy that patients with larger injuries benefit from cartilage grafts with longer prior maturation periods," says Professor Barbero. This also applies, he says, to cases in which previous cartilage treatments with other techniques have been unsuccessful.

"Our study did not include a direct comparison with current treatments," admits Professor Martin. "However, if we look at the results from standard questionnaires, patients treated with our approach achieved far higher long-term scores in joint functionality and quality of life."

Based on these and earlier findings, the researchers at the Department of Biomedicine now plan to test this method for treating osteoarthritis—an inflammatory disease that causes joint cartilage degeneration, resulting in chronic pain and disability.

Two large-scale [clinical studies](#) are about to begin. These studies will explore the technique's effectiveness in treating a specific form of osteoarthritis affecting the kneecaps (i.e., patellofemoral osteoarthritis). The activities will further develop in Basel the field of cellular therapies, strategically defined as a priority area for research and innovation at the University of Basel and University Hospital Basel.

More information: Marcus Mumme et al, Clinical relevance of engineered cartilage maturation in a randomized multicenter trial for articular cartilage repair, *Science Translational Medicine* (2025). DOI: [10.1126/scitranslmed.ads0848](https://doi.org/10.1126/scitranslmed.ads0848)

Journal information: [Science Translational Medicine](#)
Provided by [University of Basel](#)

MARCH 5, 2025

When you get hurt matters: Circadian rhythms shown to play a role in muscle repair

by Ben Schamisso, [Northwestern University](#)

Credit: Andrea Piacquadio from Pexels

The body's internal clock doesn't just dictate when we sleep—it also determines how quickly our muscles heal. A new Northwestern Medicine study in mice, [published](#) today in *Science Advances*, suggests that muscle injuries heal faster when they occur during the body's natural waking hours.

The findings could have implications for shift workers and may also prove useful in understanding the effects of aging and obesity, said senior author Clara Peek, assistant professor of biochemistry and [molecular genetics](#) at Northwestern University Feinberg School of Medicine.

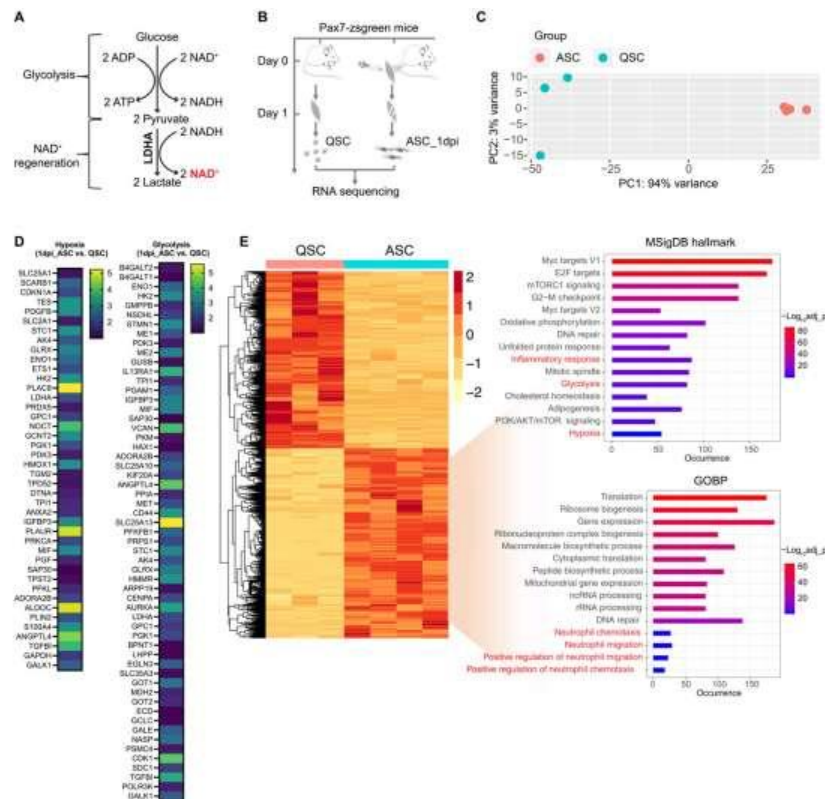
The study also may help explain how disruptions like jetlag and daylight saving time changes impact [circadian rhythms](#) and muscle recovery.

"In each of our cells, we have genes that form the molecular circadian clock," Peek said. "These clock genes encode a set of transcription factors that regulate many processes throughout the body and align them with the appropriate time of day. Things like sleep/wake behavior, metabolism, body temperature and hormones—all these are circadian."

[Previous research](#) from the Peek laboratory had found that mice regenerated muscle tissues faster when the damage occurred during their normal waking hours. When mice experienced muscle damage during their usual sleeping hours, healing was slowed.

In the current study, Peek and her collaborators sought to better understand how circadian clocks within muscle stem cells govern regeneration depending on the time of day.

For the study, Peek and her collaborators performed single-cell sequencing of injured and uninjured muscles in mice at different times of the day. They found that the time of day influenced inflammatory response levels in stem cells, which signal to neutrophils—the "first responder" innate immune cells in muscle regeneration.



Elevated expression of glycolysis and inflammation-related genes in SCs following CTX injury. Credit: *Science Advances* (2025). DOI: 10.1126/sciadv.adq8538

"We discovered that the cells' signaling to each other was much stronger right after injury when mice were injured during their wake period," Peek said. "That was an exciting finding and is further evidence that the circadian regulation of muscle regeneration is dictated by this stem cell-immune cell crosstalk."

The scientists found that the muscle stem cell clock also affected the post-injury production of NAD⁺, a coenzyme found in all cells that is essential to creating energy in the body and is involved in hundreds of [metabolic processes](#).

Next, using a genetically manipulated mouse model, which boosted NAD⁺ production specifically in [muscle stem cells](#), the team of scientists found that NAD⁺ induces [inflammatory responses](#) and neutrophil recruitment, promoting muscle regeneration.

The findings may be especially relevant to understanding the circadian rhythm disruptions that occur in aging and obesity, Peek said.

"Circadian disruptions linked to aging and metabolic syndromes like obesity and diabetes are also associated with diminished muscle regeneration," Peek said. "Now, we are able to ask: Do these circadian disruptions contribute to poorer muscle regeneration capacity in these conditions? How does that interact with the immune system?"

Moving forward, Peek and her collaborators hope to identify exactly how NAD⁺ induces immune responses and how these responses are altered in disease.

"A lot of circadian biology focuses on molecular clocks in individual cell types and in the absence of stress," Peek said. "We haven't had the technology to sufficiently look at cell-cell interactions until recently. Trying to understand how different circadian clocks interact in conditions of stress and [regeneration](#) is really an exciting new frontier."

More information: Pei Zhu et al, Immunomodulatory role of the stem cell circadian clock in muscle repair, *Science Advances* (2025). DOI: [10.1126/sciadv.adq8538](https://doi.org/10.1126/sciadv.adq8538)

Journal information: [Science Advances](#)

Provided by [Northwestern University](#)

MARCH 5, 2025

Some people living with chronic stress have a higher risk of stroke, study finds

by [American Academy of Neurology](#)

Some people living with chronic stress have a higher risk of stroke, according to a study published in *Neurology*. The study looked at younger adults and found an association between stress and stroke, with no known cause, in female participants, but not male participants. This study does not prove that stress causes stroke; it only shows an association.

"Younger people often experience stress due to the demands and pressures associated with work, including long hours and job insecurity, as well as financial burdens," said Nicolas Martinez-Majander, MD, Ph.D., of the Helsinki University Hospital in Finland.

"Previous research has shown that [chronic stress](#) can negatively affect physical and mental health. Our study found it may increase the risk of stroke in [younger women](#)."

For the study, researchers looked at 426 people aged 18 to 49 who had an [ischemic stroke](#) with no known cause. They were matched for age and sex with 426 people who did not have a stroke. Ischemic stroke is when [blood flow](#) is blocked to part of the brain. It can lead to weakness, trouble speaking, vision problems or even death.

Participants completed a questionnaire about stress levels over a one-month period. Those with a stroke were asked after their stroke to record stress levels in the month prior to their stroke.

Participants were asked 10 questions, such as "In the last month, how often have you felt that you were unable to control the important things in your life?" Scores for each question ranged from zero to four, with four meaning "very often."

A total score of 0 to 13 represented low stress; 14 to 26, moderate stress; and 27 to 40, high stress. Those with stroke had an average score of 13 compared to those without stroke who had an average score of 10.

People with stroke were more likely to have at least moderate stress levels. Of those with stroke, 46% had moderate or high stress levels compared to 33% of those who did not have a stroke.

After adjusting for factors that could affect the risk of stroke such as [education level](#), alcohol use and [blood pressure](#), researchers found for [female participants](#), moderate stress was associated with a 78% increased risk of stroke and high stress was associated with a 6% increased risk. Researchers did not find a link between stress and stroke in male participants.

"More research is needed to understand why women who feel stressed, but not men, may have a higher risk of stroke," said Martinez-Majander. "In addition, we need to further explore why the risk of stroke in women was higher for moderate stress than high stress. Knowing more about how stress plays a role could help us to create better ways to prevent these strokes."

A limitation of the study was that people experiencing higher levels of stress may have been less likely to enroll in the study, which could have affected the results.

More information: *Neurology* (2025).

Journal information: [Neurology](#)

Provided by [American Academy of Neurology](#)

MARCH 5, 2025

The 'dark matter' of nutrition: How AI and network science are transforming our understanding of food and health

by Alena Kuzub, [Northeastern University](#)



Credit: Pixabay/CC0 Public Domain

Network science and artificial intelligence can identify food molecules that negatively affect health as well as alleviate disease by proposing dietary changes, a Northeastern expert says.

Since the [human genome](#) was decoded in 2003, Albert-László Barabási—a distinguished professor of physics at Northeastern University and director of the Center for Complex Network Research—has used [network science](#) to map out connections between proteins in [human cells](#). "That's where network medicine comes in," Barabási says.

Eventually, network medicine will be able to provide personalized dietary recommendations and treatments, he says, based on an individual's genetics, diet and disease stage.

Genes define proteins, he says, and disease arises when a gene mutates.

"Mutations change the protein in the network, which then alters the network itself," he says.

However, genetic changes can only explain a fraction of diseases, Barabási says.

"From a few percent of cases to, maybe, 30%, depending on the disease," he says.

The remaining causes stem from lifestyle, including stress, exercise and sleep, and environment, he says, with food being the most significant factor.

Recognizing this, Barabási set out about a decade ago to integrate diet into network medicine—a field he [named in 2007](#) that applies network science to biological systems to understand diseases and develop drugs.

This research has led to a series of scientific papers on topics ranging from defining the "dark matter" of nutrition to discovering universal laws of chemical concentration in food and measuring the degree of food processing.

The culmination of this work is a recent review article, "[Decoding the Foodome: Molecular Networks Connecting Diet and Health](#)," published in the *Annual Review of Nutrition*. It demonstrates how network science and AI can reveal how food molecules affect health and disease.

When food molecules enter the bloodstream and reach cells, some are used for energy, Barabási says, while others can bind to cell proteins or DNA, influencing [biological processes](#). These molecules can either block certain processes from happening or accelerate them.

Initially, Barabási assumed mapping food molecules' interactions with human cells would be straightforward. To his surprise, he and his team discovered that scientists had identified only a limited number of food's chemical components.

The U.S. Department of Agriculture has systematically measured 150 essential micro- and macronutrients related primarily to energy intake and metabolism, including fatty acids, amino acids, sugars, fibers, minerals and vitamins. Since 2003, it has expanded its list to 188 components, including some flavonoids—[plant compounds](#) responsible for color that have antioxidant, anti-inflammatory and immune-boosting properties.

"We realized many molecules in the food that have known [health consequences](#) are not included in this nutritional list," Barabási says.

His team began by examining tens of thousands of food compounds found in the Canadian FooDB, a comprehensive database detailing the chemical composition of foods, but largely overlooked by epidemiological studies. In 2019, they dubbed these unrecognized molecules the "[dark matter](#)" of nutrition.

Since then, Barabási and his collaborators have compiled a library of over 139,000 food molecules, drawing from specialized scientific literature, various databases, mass spectrometry repositories and mass spectrometry experiments.

However, the underlying molecular mechanisms through which the "dark matter" of nutrition affects human health remain largely unexplored. Researchers argue that dietary compounds should not be investigated in isolation, as was common in the 20th century, but rather in the context of their interactions with one another.

Another discovery from Barabási's lab concerns ultra-processed foods. [They found](#) that relative ratios of concentrations of individual chemicals in different natural foods are consistent and predictable. Deviations from those ratios, Barabási says, signal that the food underwent processing.

"No matter what foods you look at, as long as there are natural ingredients there will be relatively minor variations from one food to the other one," he says. "The reason for that is because, in the end, we and what we eat is really the same chemical engine."

Virtually all ingredients of the human diet, Barabási says, were once living organisms, producing and regulating nutrients according to universal biochemical rules.

"These chemical engines cannot produce something [with concentration of a certain chemical] 100 times more than normal, because there are clear constraints of production," Barabási says. "Typically the difference is like two or three times more in one [food item] compared to the other one."

Ultra-processed foods such as margarine, packaged bread, sweetened [breakfast cereals](#) or cookies typically have longer lists of ingredients, including substances not commonly used in home cooking.

Since the Industrial Revolution, food processing technology has advanced dramatically. However, human biology and physiology, Barabási says, have not evolved as much. This misalignment is believed to contribute to modern diseases.

Food processing alters natural nutrient concentration and often involves adding salt, sugar, fats and other additives to enhance taste and mask undesirable qualities. In the past decade, [epidemiological studies](#) have linked ultra-processed foods to higher risks of obesity, type 2 diabetes, cardiovascular conditions, cancer and depression.

The precise underlying mechanisms remain unclear.

"We think that the problem most likely comes from the chemical changes that the processing does to you," Barabási says. "For example, it has chemicals that turn off the feeling of satiation. That's really mostly for making us eat more."

According to one of Barabási's studies, over 73% of the U.S. food supply is ultra-processed.

"It shows on the scale and in the health problems we face," Barabási says.

His best advice for better health is to eat foods our great-grandmothers would recognize as good back when ultra-processing didn't exist.

Barabási advocates for a large-scale project combining AI, mass spectrometry and network medicine to map the chemical makeup of the foods we consume.

He says the project is "doable with the current technologies."

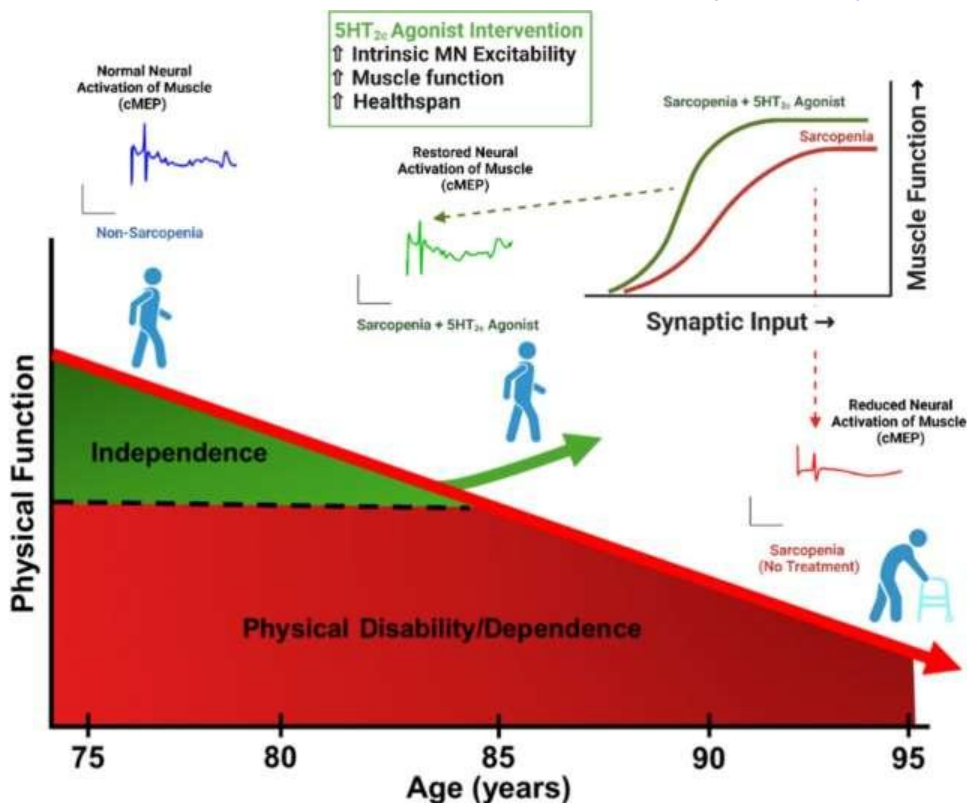
With proper funding, Barabási estimates that scientists could uncover 50% to 60% of the "dark matter" of nutrition within five years, which is sufficient to cover over 99% of the food we consume. Decoding the remaining portion might get harder and take longer.

More information: Giulia Menichetti et al, Decoding the Foodome: Molecular Networks Connecting Diet and Health, *Annual Review of Nutrition* (2024). DOI: [10.1146/annurev-nutr-062322-030557](https://doi.org/10.1146/annurev-nutr-062322-030557)

Provided by [Northeastern University](#)

MARCH 5, 2025

First-ever neurotherapeutic to address muscle weakness identified by [University of Missouri](#)



Proposed clinical application of a 5-HT_{2c} agonist to enhance motor neuron excitability and muscle function. This figure illustrates the potential therapeutic effects of a 5-HT_{2c} agonist in addressing age-related sarcopenia by enhancing intrinsic motor neuron (MN) excitability. Credit: *GeroScience* (2025). DOI: 10.1007/s11357-025-01519-7

While a gradual loss in muscle strength is a natural part of aging, for many older adults it's more than just feeling a little weaker. Sarcopenia—a condition affecting nearly half of adults over 80—involves a sharp decline in muscle size and strength, increasing the risk of falls and fractures, impacting overall health, life expectancy and quality of life.

Now, researchers at the University of Missouri have identified a game-changing solution. [Published](#) in *GeroScience*, their recent study suggests that a small molecule drug that targets a specific serotonin receptor could become the first neurotherapeutic treatment for sarcopenia—offering hope for older adults struggling to stay strong.

"What many people don't realize is that grip strength is actually a better predictor of health outcomes and even lifespan than factors such as [blood pressure](#)," said W. David Arnold, executive director of the University of Missouri System's NextGen Precision Health initiative and a professor in the School of Medicine.

"This was the first time we have ever shown that a drug can successfully help [motor neurons](#), the final cell that communicates between the [nervous system](#) and muscle, to fire more effectively, signal muscle contraction and improve [muscle strength](#). So, this is an exciting breakthrough in our mission to help older adults with sarcopenia."

The small molecule drug used in the study—which can make motor neurons fire more consistently and reliably—could potentially be used in [human clinical trials](#). And with Mizzou's Roy Blunt NextGen Precision Health building, which houses both research and clinical spaces, the path to bringing this treatment to patients could be accelerated.

Arnold added that while all adults lose motor neurons as they age, he and his research team are learning that the [muscle weakness](#) linked with sarcopenia is less about the loss of the number of motor neurons and more about the steep decline in the ability of motor neurons to repetitively fire to activate muscle movement.

"In this study we were able to show that this small molecule drug can activate motor neurons to make them more able to fire repetitively, which was a huge breakthrough," Arnold said.

The discovery can also help the research team at Mizzou generate other molecular candidates to achieve the same effect.

"If we can make neurotherapeutics become widely available, it can improve the quality of life for so many [older adults](#) by improving their strength and balance, helping them stay mobile and independent as they age," Arnold said.

More information: Nathan R. Kerr et al, 5-HT_{2c} agonism as a neurotherapeutic for sarcopenia: preclinical proof of concept, *GeroScience* (2025). DOI: [10.1007/s11357-025-01519-7](https://doi.org/10.1007/s11357-025-01519-7)

Provided by [University of Missouri](#)

MARCH 5, 2025

NHS urged to offer single pill to all over-50s to prevent heart attacks and strokes

by [University College London](#)

The NHS could prevent thousands more heart attacks and strokes every year by offering everyone in the UK aged 50 and over a single "polypill" combining a statin and three blood pressure lowering drugs, according to academics from UCL.

In an [opinion piece](#) for *The BMJ*, the authors argued that a [polypill program](#) could be a "flagship strategy" in Labour's commitment to preventing disease rather than treating sickness. The program would use age alone to assess eligibility, focusing on disease prevention rather than disease prediction.

They said such a strategy should replace the NHS Health Check, a five-yearly assessment for people aged 40 to 74 who are prescribed cholesterol-lowering statins if they are judged to have a higher risk of a [heart attack](#) or stroke, or given blood pressure lowering drugs if their blood pressure is above a certain threshold.

The new program, the authors said, would only require 8% of those aged 50 and over to take up the offer of a polypill to achieve a bigger health benefit than the NHS Health Check*.

The authors pointed to a landmark paper in 2003, which estimated that a polypill for all over 55s could prevent about 80% of heart attacks and strokes. They argued its conclusion was supported by [clinical trials](#) that had taken place in the years since in several countries.

Co-author Professor Aroon Hingorani (UCL Institute of Health Informatics) said, "The NHS Health Check isn't working very well. Uptake is low, with only four in 10 people taking up the offer of an appointment. Lots of people who would benefit from medication are not prescribed it.

"What is more, our complex risk prediction tools are not very effective. They do not predict very well who will get a heart attack or stroke. That is because most heart attacks and strokes occur in people with average levels of risk.

"Now is the time to do much better on prevention. A population-wide approach could prevent many more heart attacks and strokes than the current strategy of targeting a more limited group only."

Professor Hingorani added, "A polypill program would be a simple, effective, and potentially low-cost strategy. The drugs are off patent so inexpensive. Many years of evidence show statins are low risk, with minimal side effects, while combining three [blood pressure](#) lowering drugs at low dose reduces these drugs' side effects and increases their benefits.

"People could receive an offer of a polypill once they turn 50. They would not need a health check or test but only to answer a few questions to assess their risk of side effects. Further assessments via an online questionnaire could be required before the prescription is repeated."

In their piece, the authors pointed to a randomized trial in rural Iran, whose findings were published in 2019, showing that a polypill taken for five years reduced heart attacks and strokes by a third.

In an analysis [published](#) last year, the authors compared optimal take-up of the NHS Health Check and a polypill program (where everyone offered both a check and medication took them up). They found that the polypill approach would have more than twice the benefit in terms of years of life free of heart attacks and strokes that would be gained as a result.

Co-author Professor Sir Nicholas Wald (UCL Institute of Health Informatics) said, "Rather than being a 'medicalization' of a large section of the population, a polypill program is a preventative strategy designed to avoid a person becoming a patient. It can be compared to public health programs such as vaccinations, reducing salt in food and adding folic acid to flour."

In the opinion piece, the authors said the next step would be a [pilot project](#) to see how a national program could best be carried out and to evaluate uptake, adherence and cost.

As local authorities have a statutory obligation to provide an NHS Health Check, they wrote, a directive would be needed to give authorities permission to replace the health check with a polypill program.

"The status quo is not a justifiable option," the authors concluded. "We have the means of preventing most heart attacks and strokes, many more than are currently being prevented. All that is required is to translate what we know into action."

The opinion piece was based on discussions at a consensus-building seminar organized by the authors that involved eminent health experts from a range of fields, including cardiologists, neurologists, epidemiologists, pharmacologists, statisticians, and policymakers.

In the UK, more than seven million people are living with cardiovascular disease. Around 100,000 people have a heart attack and more than 100,000 people have a [stroke](#) every year.

More information: Rachel E. Jordan et al, Primary prevention of heart attacks and strokes: seeking consensus on the polypill approach, *BMJ* (2025). DOI: [10.1136/bmj.r208](https://doi.org/10.1136/bmj.r208)

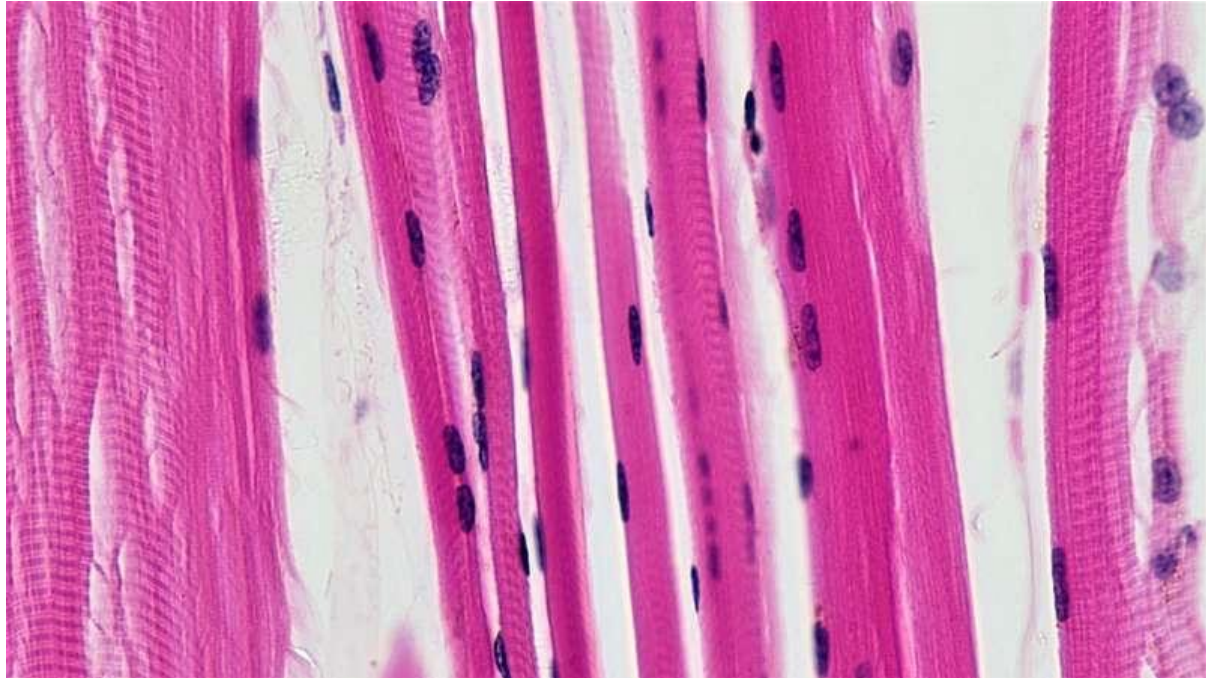
Journal information: [British Medical Journal \(BMJ\)](#)

Provided by [University College London](#)

MARCH 5, 2025

Melatonin shown to improve muscle energy efficiency, offering a potential therapy to combat 'diabetesity'

by [University of Granada](#)



Skeletal muscle fibers. Credit: Berkshire Community College Bioscience Image Library / Public domain

An international study led by the University of Granada (UGR) has revealed that melatonin, known for its ability to regulate the sleep/wake cycle, can restore the composition of muscle fibers and protect skeletal muscle from damage caused by obesity and type 2 diabetes, known as "diabetesity."

The results, published in the journals [Free Radical Biology and Medicine](#) and [Antioxidants](#), show that this hormone improves mitochondrial function, reduces cellular stress and prevents programmed [cell death](#), offering a new therapeutic strategy to combat this metabolic disease.

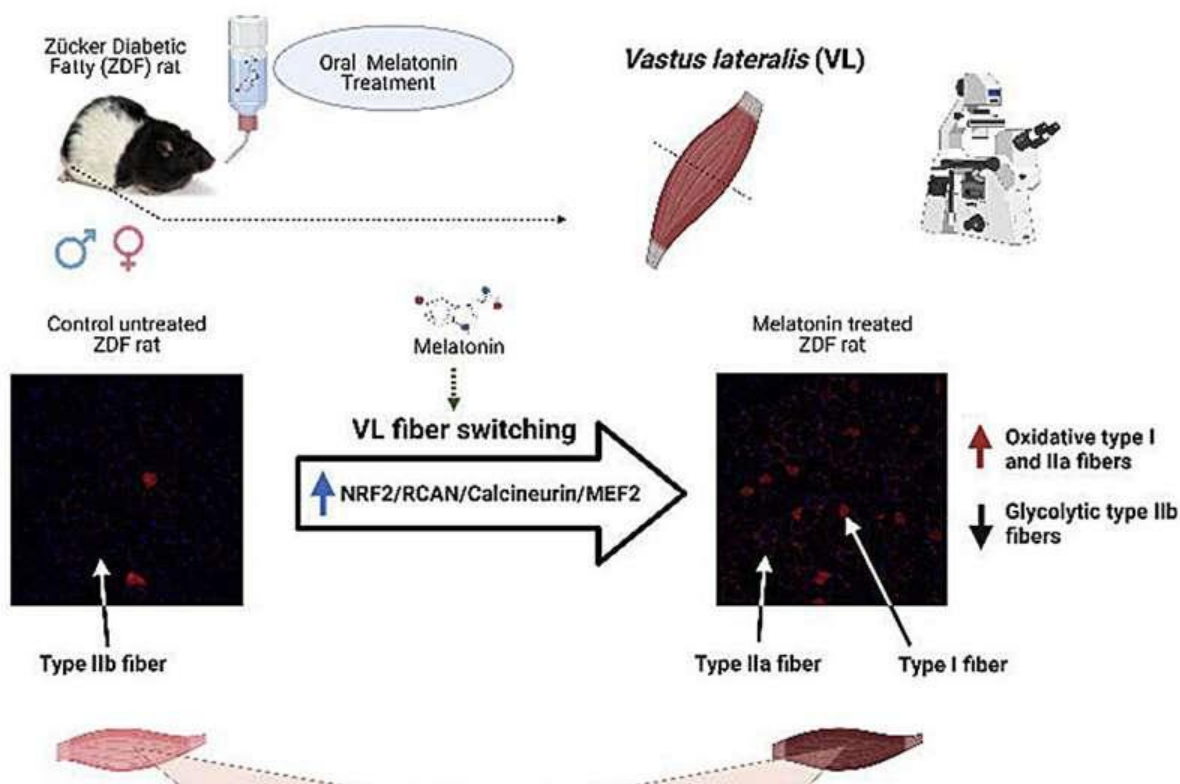
Improvement and protection of the muscles

The study, led by Ahmad Agil, professor of pharmacology at the University of Granada, showed that the administration of melatonin to obese and diabetic rodents for 12 weeks succeeded in promoting the conversion of glycolytic (fast) [muscle fibers](#) to oxidative (slow) fibers, improving the energy efficiency of the muscle. This change not only optimizes

energy production, but also protects the muscle from deterioration caused by "diabetes," a condition that combines obesity and type 2 diabetes.

The work, in which scientists from the Department of Pharmacology of the University of Granada, the Federico Olóriz Institute of Neurosciences and the Granada Biosanitary Institute have participated, as well as other collaborating institutions such as the Department of Nutrition and Food Science and the Department of Histology at the University of Granada, the Center for Endocrinology, Diabetes and Nutrition in Madrid, the University of Qatar and Yarmouk University in Jordan, has focused on **skeletal muscle**, a key organ that accounts for more than 50% of body weight.

Muscle fibers are divided into three types: slow twitch (type I) or red fibers due to the large number of mitochondria they possess, fast twitch (type IIb) or white fibers and intermediate (type IIa). In addition, each muscle in our body has a specific variable and changing proportion of each of these fiber types, depending on the type of movement performed. During short periods of intense muscular activity, white fibers with glycolytic metabolism predominate, and during prolonged periods of low-intensity muscular activity, red fibers with oxidative metabolism predominate.



Graphical abstract. Credit: *Free Radical Biology and Medicine* (2024). DOI: 10.1016/j.freeradbiomed.2024.12.019

Melatonin managed to restore the healthy proportion of these fibers, increasing oxidative fibers and reducing glycolytic fibers, reversing the effects of "diabetes," which improves the muscle's ability to burn fat (reducing fat accumulation, and therefore obesity) and produce energy. In addition, melatonin showed effects similar to those of prolonged aerobic activity,

especially improving [mitochondrial function](#) and regulating [calcium levels](#) in cell compartments, which reduces [cellular stress](#) and prevents programmed cell death.

"We discovered that melatonin restores calcium levels in the mitochondria and the [endoplasmic reticulum](#), which helps to reduce cell damage," says Dr. Agil.

These results are in line with those previously published over the last 15 years by this research group. Their findings could open up new perspectives for the development of therapeutic strategies based on the pharmacological administration of melatonin, aimed at improving muscle health in patients with diabetes. "Our main challenge is the application of melatonin in the field of medicine," say the authors of the paper.

Confirming the results in humans

Obesity and type 2 diabetes are two of the most prevalent metabolic diseases in the world, affecting almost 900 million and 800 million people, respectively. Both conditions are closely related and tend to coexist in what is known as "diabesity." This disorder not only reduces patients' quality of life, but also represents a challenge for health care systems.

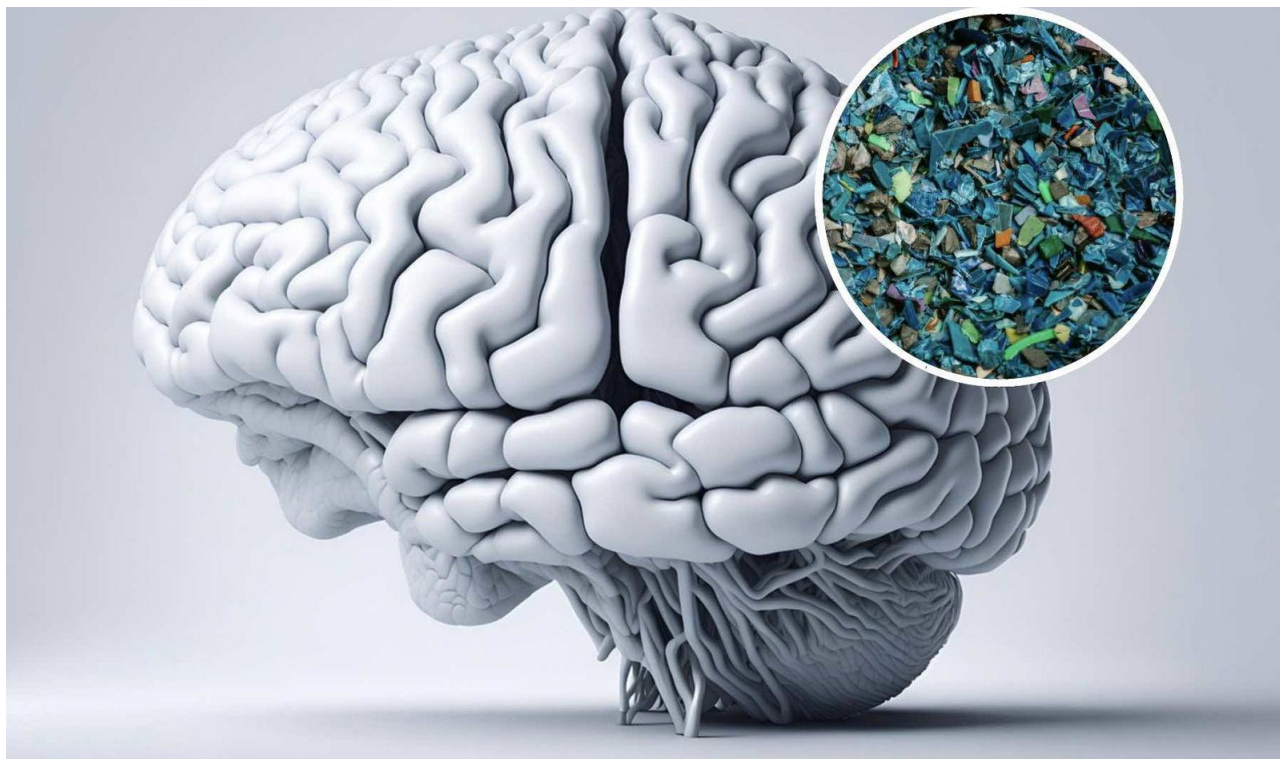
The findings of the UGR open up new perspectives for the therapeutic use of melatonin, a substance with a well-established safety profile. For the head of this research, "our results reinforce the idea that melatonin could have therapeutic applications in metabolic diseases, improving the muscle health of patients." For this reason, he reminds us that maintaining a healthy, active and balanced lifestyle during the day, accompanied by proper nighttime rest, is key to preserving muscle health and preventing the negative effects of obesity.

The study suggests that [melatonin](#) could become an accessible and effective therapy to combat "diabesity" and its complications. However, the researchers stress the need for clinical studies in humans to confirm these results and determine the optimal dose in each case. "If we can demonstrate its effectiveness in humans, we could have an innovative treatment that would improve the lives of millions of people," concludes Dr. Agil.

More information: Diego Salagre et al, Melatonin induces fiber switching by improvement of mitochondrial oxidative capacity and function via NRF2/RCAN/MEF2 in the vastus lateralis muscle from both sex Zucker diabetic fatty rats, *Free Radical Biology and Medicine* (2024). DOI: [10.1016/j.freeradbiomed.2024.12.019](https://doi.org/10.1016/j.freeradbiomed.2024.12.019)

Diego Salagre et al, Melatonin Ameliorates Organellar Calcium Homeostasis, Improving Endoplasmic Reticulum Stress-Mediated Apoptosis in the Vastus Lateralis Muscle of Both Sexes of Obese Diabetic Rats, *Antioxidants* (2024). DOI: [10.3390/antiox14010016](https://doi.org/10.3390/antiox14010016)

Journal information: [Free Radical Biology and Medicine](#) , [Antioxidants](#)
Provided by [University of Granada](#)



THIS IS YOUR BRAIN ON MICROPLASTICS: SCIENTISTS WARN OF ALARMING RISE IN BRAIN MICROPLASTIC LEVELS

CHRISTOPHER PLAIN • MARCH 5, 2025

The average human [brain](#) is so filled with [microplastics](#) and nanoplastics (MNPs) that scientists believe the accumulation could be affecting its operation, including increasing the chances of [dementia](#). The same research found that the levels of microplastics and nanoplastics were significantly higher in the [brain](#) than in other organs, totaling as much as a plastic spoon.

Although the microplastics and nanoplastics found inside the brain can come from several sources, the researchers say the average person could reduce their [exposure to microplastics](#) by as much as 90% by simply eliminating their use of bottled water.

MICROPLASTICS AND NANOPLASTICS ARE ACCUMULATING AT AN ALARMING RATE

In the 1967 classic *The Graduate*, Walter Brook's Mr. McGuire pulls Dustin Hoffman's character aside to give him one word of advice about the future: plastics! Ranked by the American Film Institute as [the 42nd greatest movie quote of all time](#), nearly six decades later, the words have proven to be more of a warning than the glowing opportunity projected by McGuire.

Since that movie's release, society has been catching up to the ramifications of engineered materials that can last thousands of years. Recently, [accumulated plastic waste in the deepest parts of the Earth's oceans](#), including the Mariana Trench, has been discovered, affecting the region's entire ecosystem.

At the same time, science is increasingly concerned about the health and wellness ramifications of the MNPs. For example, University of Queensland scientists are investigating [plastic-eating super worms](#) that can digest Styrofoam and other plastic-based materials and remove them from the environment. University of Waterloo scientists have gone even smaller by [engineering bacteria that can break down microplastics](#).

A team of engineers searching for a non-biological solution created [swarms of micro-robots](#) that can hunt down plastics and bacteria contaminating water. University of California, Berkley scientists have developed [a new plastic bag that can break down into smaller biodegradable pieces within two weeks](#).

This latest study adds even more urgency to the battle against MNPs by suggesting that microplastics and nanoplastics may be tiny enough to cross the blood-brain barrier. The researchers say the evidence is compelling, including the potential association between elevated plastic levels in the brain and dementia.

DRAMATIC INCREASE IN BRAIN MNP CONCENTRATIONS

In a [peer-reviewed Commentary](#) on the increased levels of MNPs found inside the human brain, lead author Dr. Nicholas Fabiano from the University of Ottawa's Department of Psychiatry explains that plastic particles smaller than 200 nanometers, predominantly made of polyethylene, are the primary concern. The author also notes that the increase of MNPs in the brain has risen significantly in the last eight years alone.

"The dramatic increase in brain microplastic concentrations over just eight years, from 2016 to 2024, is particularly alarming," Fabiano writes. "This rise mirrors the exponential increase we're seeing in environmental microplastic levels."

According to [a statement](#) from the commentary authors, previous research evaluating the concentrations of microplastic particles small enough to potentially influence the functions of the human brain found "notable deposition in cerebrovascular walls and immune cells." As noted, [one study](#) found the levels of MNPs in human brains were roughly the total of a plastic spoon. The same study found that these "alarming" levels were 3-5 times higher in people with documented dementia diagnoses. Perhaps more surprisingly, human brain tissues showed 7-30 times higher concentrations of MNPs than organs known for their filtration roles, such as the liver or kidney.

WHAT TO DO? STOP DRINKING BOTTLED WATER

After documenting the studies showing elevated levels of MNPs in the human brain, the commentary authors offered several practical suggestions for individuals looking to reduce their plastic exposure. Perhaps the most significant step highlighted by the authors is eliminating drinking water from plastic bottles. This simple step could mitigate microplastic intake from 90,000 to 4,000 particles per year.

"Bottled water alone can expose people to nearly as many microplastic particles annually as all ingested and inhaled sources combined," says Dr. Brandon Luu, an Internal Medicine Resident at

the University of Toronto quoted in the statement. “Switching to tap water could reduce this exposure by almost 90%, making it one of the simplest ways to cut down on microplastic intake.”

The authors also highlighted several other strategies for reducing MNP intake. For example, tea bags that contain plastics can release millions of particles in one brewing session. Another suggestion involved the best methods for storing and reheating leftovers.

“Heating food in plastic containers—especially in the microwave—can release substantial amounts of microplastics and nanoplastics,” Luu explains. “Avoiding plastic food storage and using glass or stainless-steel alternatives is a small but meaningful step in limiting exposure.”

Still, Luu cautions that the results of these measures have not been tested, and “we still need research to confirm whether lowering intake leads to reduced accumulation in human tissues.”

MORE STUDY NEEDED TO CONFIRM DOSE-RESPONSE RELATIONSHIPS

Moving forward, the authors recommend “urgent research priorities,” including establishing “clear exposure limits” similar to those regulating other toxic substances. They also note that “large-scale human studies” will ultimately be needed to establish “dose-response relationships between microplastic exposure and chronic health outcomes.”

“We need more research to wrap our heads around microplastics—rather than wrapping our brains in them—since this could be one of the biggest environmental storms most people never saw coming,” said Dr. David Puder, host of the Psychiatry & Psychotherapy Podcast.

The peer-reviewed Commentary article, “[Human microplastic removal: what does the evidence tell us?](#)” appears online on 4 March 2025 in *Brain Medicine*.

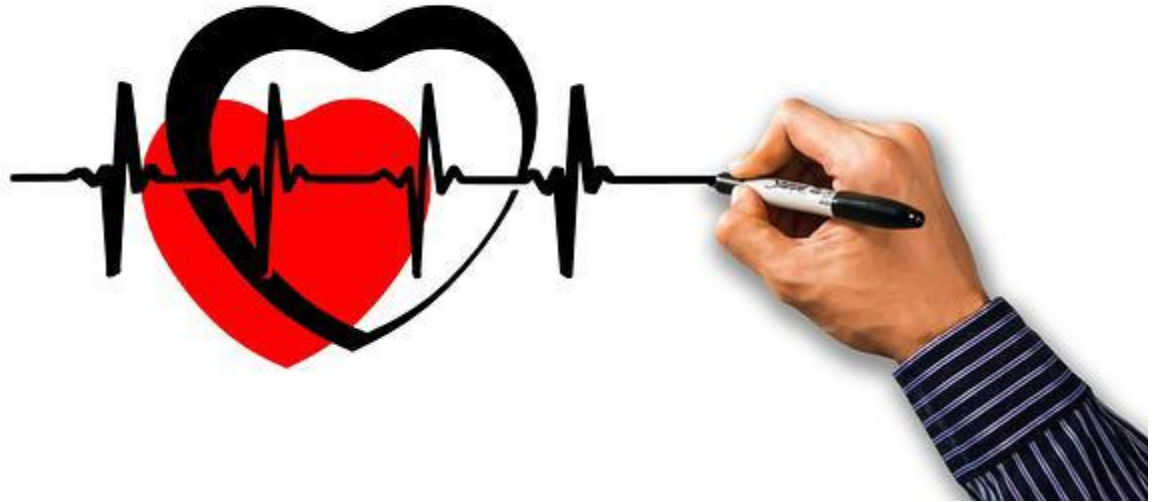
Heart Failure Could Be Reversed as the Human Heart May Have Self-Healing Abilities



Heart Failure Could Be Reversed as the Human Heart May Have Self-Healing Abilities© Bruce Abrahamse

Imagine you could grow a new limb or a new organ. We would be able to live forever if that were the case. However, while we cannot grow new limbs, our bodies still react in pretty miraculous ways when they have experienced injuries. For example, skeletal muscle has the amazing ability to regenerate itself after injury. Typically, when a heart muscle is injured, it doesn't grow back. Yet, a new study has revealed that cardiac muscle may actually regenerate itself after heart failure in a subset of patients with artificial hearts!

The Study



Credit: Pexels

In the study, the tissue of patients with artificial hearts was analyzed to determine their regenerative capabilities. They discovered that a subset of these patients experienced muscle cell regeneration at more than six times the rate than those with healthy hearts. The research team was co-led by a scientist at the University of Arizona College of Medicine, Hesham Sadek.

Why This Finding on Heart Failure Is Important



Credit: Pexels

Heart failure is a serious issue in the United States. In fact, it affects around 7 million American adults and is responsible for around 14% of deaths annually, according to the [Centers for Disease Control and Prevention](#). While there are medications that can certainly slow down the progression, there is, as yet, no cure for heart failure. This means that other than a heart transplant, the only available treatment for advanced heart failure is pump replacement using an artificial heart. This device, known as a left ventricular assist device, helps the heart pump blood.

Strong Evidence for Cardiac Tissue Regeneration



Credit: Pexels

According to [Hesham Sadek](#), *"This is the strongest evidence we have, so far, that human heart muscle cells can actually regenerate, which really is exciting because it solidifies the notion that there is an intrinsic capacity of the human heart to regenerate"*. This also adds support to the hypothesis that the heart loses its ability to regenerate soon after birth because of the heart muscle's inability to "rest". The team feels that it may actually be possible to target the specific molecular pathways responsible for cell division to amplify the ability of the heart to regenerate.

Significance of the Study's Findings



Credit: Pexels

Hesham Sadek further added that this was the very first study to offer direct evidence of human cardiac muscle regeneration. Typically, severe heart attacks, such as the "widow maker", are caused by a blockage of one of the biggest arteries in the heart. *"If you survive it, you can lose up to 40% of your heart muscle cells in one event. When you lose so much heart muscle, the remaining muscle is under a lot more stress, and the heart gets progressively weaker over time"*, stated Sadek.

Building on Older Studies



Credit: Pexels

This is not the first time that Dr, Sadek has tackled this specific issue. In fact, he considers finding more effective ways of treating heart failure to be his top priority. This new study builds upon several prior studies that Dr. Sadek led regarding rest and the regeneration of heart muscle. He had published prior studies in 2011 and 2014. The 2011 study was published in [Science](#) and revealed that heart muscle cells actively divide while in utero. However, after birth, they stopped dividing to focus all their energy on continuously pumping blood through the body. This process leaves no time for the rest required for regeneration. The [2014 study](#) revealed that they had found cell division in those patients who had artificial hearts. This pointed to the possibility that their heart muscle cells were regenerating.

The Power of Rest



Credit: Pexels

These findings inspired them to ask if an artificial heart provides cardiac muscles the same amount of bed rest in an athlete recovering from an injury. "*The pump pushes blood into the aorta, bypassing the heart – the heart is essentially resting*", remarked Dr. Sadek. Their previous studies had hinted that this rest may be beneficial for the cardiac muscle cells. However, he first needed to create an experiment to find out whether those who had artificial hearts were really regeneration muscle cells. Hence, why he designed this particular study.

The Bottom Line on Heart Failure and Cell Regeneration



Credit: Pexels

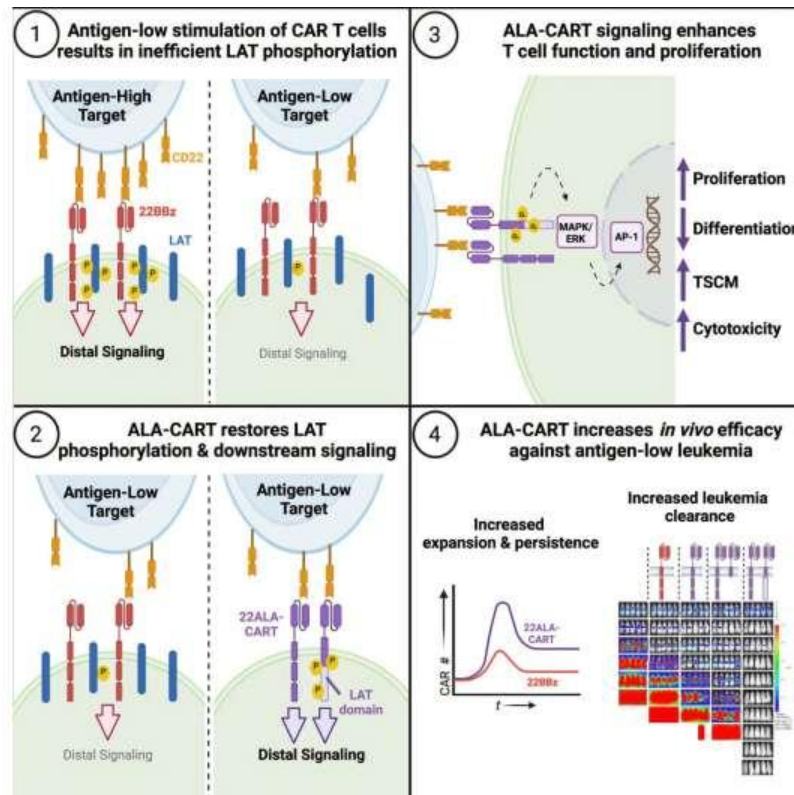
This ground-breaking study provides hope for improving heart failure treatments by demonstrating the heart's inactive regeneration capabilities. These findings indicate that artificial hearts supply the rest required for cardiac muscle cells to recover, a discovery that has the potential to alter approaches to heart health. With heart failure affecting millions of people, the ability to harness and magnify this natural repair process could open the way for new treatments. Building on previous studies, this work not only demonstrates the incredible resilience of the human body, but it also takes us closer to addressing one of the most serious health issues.

The post Heart Failure Could Be Reversed as the Human Heart May Have Self-Healing Abilities appeared first on [The Hearty Soul](#).

MARCH 10, 2025

New CAR-T cell therapy 'ALA-CART' shows promise for hard-to-treat cancers

by [CU Anschutz Medical Campus](#)



Graphical abstract. Credit: *Cancer Cell* (2025). DOI: 10.1016/j.ccell.2025.02.008

Researchers at the University of Colorado Anschutz Medical Campus have successfully developed a supercharged iteration of CAR-T cell therapy that can enhance the effectiveness and longevity of the cells, particularly against cancer cells that are harder for prior CAR-T therapies to detect and fight.

The study was [published](#) today in the journal *Cancer Cell*.

"This next-generation approach, called ALA-CART (adjunctive LAT-activating CAR-T cells), optimizes CAR-T cells to more effectively eliminate cancer cells, including those that have been able to hide from traditional CAR-T cells," said Catherine Danis, Ph.D., lead author and postdoctoral fellow at the University of Colorado School of Medicine.

CAR-T cell therapy involves extracting a patient's T-cells, modifying them to recognize cancer cells, and then reinfusing them into the patient where they target cancer cells

throughout the body. But some cancer cells can evade detection by CAR-T cells, leading to [treatment failure](#) and relapse. Using human T cells and [leukemia cells](#) in specialized mouse models, researchers developed the novel ALA-CART cells which showed promising results in fighting acute lymphocytic leukemias that were resistant to traditional CAR-T cells.

"ALA-CART improves the ability of CAR-T cells to detect and attack resistant cancer cells more effectively. This could lead to longer lasting results, even when other treatments have failed," said M. Eric Kohler, MD, Ph.D., corresponding author and member at the University of Colorado Cancer Center. "It also shows signs it could reduce side effects that often accompany traditional therapies."

Kohler said the same CAR-T cell therapies have been used for more than a decade.

"When you look back, it's easy to see how revolutionary CAR-T cells have been. But, for many patients, this therapy isn't enough. And stepping back you realize that we have been driving these CAR-T cells with the same basic design for the last 15 years," said Kohler.

"When we began this project, we wanted to understand why this design allowed certain leukemia cells to escape therapy. Once we understood that, we knew how to design our ALA-CART cells. What was surprising is that we didn't just fix the problem of leukemia cells escaping, we improved multiple aspects of the ALA-CART cells, and we're hopeful this will translate into improved outcomes for patients in the future."

The next step is advancing ALA-CART into [clinical trials](#) to assess its safety and efficacy in human patients. Danis said they hope to begin that phase within the next two years.

In the meantime, the researchers are also testing the treatment on other types of cancers, including [acute myeloid leukemia](#), multiple myeloma, and solid tumors.

"This marks a major shift in cancer immunotherapy, offering a groundbreaking innovation that could eventually improve survival and quality of life for patients with some of the most difficult-to-treat cancers," Danis said.

More information: Catherine Pham-Danis et al, Restoration of LAT activity improves CAR T cell sensitivity and persistence in response to antigen-low acute lymphoblastic leukemia, *Cancer Cell* (2025). DOI: [10.1016/j.ccell.2025.02.008](https://doi.org/10.1016/j.ccell.2025.02.008)

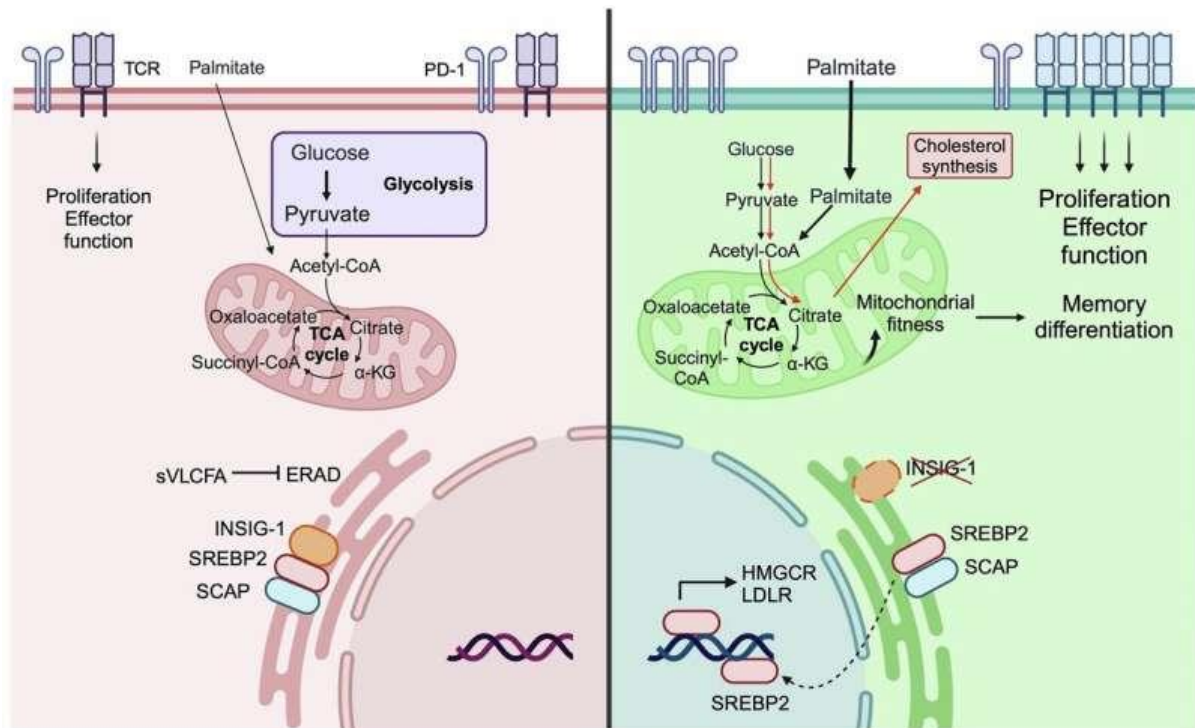
Journal information: [Cancer Cell](#)

Provided by [CU Anschutz Medical Campus](#)

MARCH 10, 2025

Reprogramming the metabolic pathways of immune cells to improve cancer treatment

by VIB (the Flanders Institute for Biotechnology)



Scheme illustrating the role of Elov11 in CD8⁺ T cells.. Credit: *Nature Metabolism* (2025). DOI: 10.1038/s42255-025-01233-w

Solid tumors often provide a challenging environment for the T cells of our immune system. By reprogramming the metabolism of T cells, scientists at the VIB-KU Leuven Center for Cancer Biology and their collaborators demonstrated a remarkable ability to boost the immune system's fight against cancer, showing promise for improving patient outcomes in difficult-to-treat malignancies. Their work is [published](#) in *Nature Metabolism*.

Over the past few decades, [immune therapies](#) such as checkpoint inhibitor therapy have revolutionized cancer treatment by "teaching" the immune system to attack tumors. However, these therapies often fall short in solid tumors, where a hostile tumor microenvironment (TME) hinders the activity of immune cells. For example, in high-mortality cancers like pancreatic cancer, the TME can harm the [immune cells](#) with nutrient deprivation, acidity, and [low oxygen levels](#), leading to T cell exhaustion.

But what if we can reprogram T cells so that they can use a different nutrient?

"We turned to the metabolic pathways that govern T cell functioning to identify mechanisms that can help them thrive in challenging conditions. If we could reprogram T cells to use another food source, they might survive for longer inside tumors and be more effective in fighting cancer," says Dr. Samantha Pretto (VIB-KU Leuven), first author of the study

A metabolic maneuver

Using several research methods, such as single-cell RNA sequencing, single-cell gene perturbation screenings, and gene knockouts, the scientists homed in on the enzyme Elov11 as a target to reprogram T cells. By blocking Elov11, T cells could harness [fatty acid oxidation](#)—an efficient energy source—over glucose metabolism, which is often compromised in tumor-saturated environments.

Prof. Max Mazzone (VIB-KU Leuven) says, "This study offers a genetic analysis of multiple [metabolic pathways](#) at the primary tumor and metastatic site, disclosing which T phenotype is enabled by the perturbation of each of these pathways. Specifically, targeting Elov11 not only enhanced the T cells' energy efficiency but also empowered them to maintain higher rates of proliferation and robust antitumor activity. T cells that underwent this metabolic reprogramming survived for longer and remained active and effective in combating cancer cells."

In a compelling demonstration of the potential of this approach, the researchers showed that blocking Elov11 in conjunction with providing immune checkpoint therapies significantly improves T cell responses in experimental models of melanoma and [pancreatic cancer](#). These stronger anti-tumor responses outsmart the cancer's defenses and increase the likelihood of successful treatment outcomes.

"By shifting the metabolic approach to T cell therapy, we open exciting new avenues for cancer treatment, particularly for patients who have limited options," says Mazzone. "Our findings suggest that modifying T cell metabolism not only helps these cells to combat cancer more effectively but also enhances the overall efficacy of existing immunotherapies."

As the quest for more effective cancer treatments continues, this innovative study marks a significant stride forward in empowering T cells to overcome the obstacles posed by [solid tumors](#).

More information: Samantha Pretto et al, A functional single-cell metabolic survey identifies Elov11 as a target to enhance CD8+ T cell fitness in solid tumours, *Nature Metabolism* (2025). DOI: [10.1038/s42255-025-01233-w](https://doi.org/10.1038/s42255-025-01233-w)

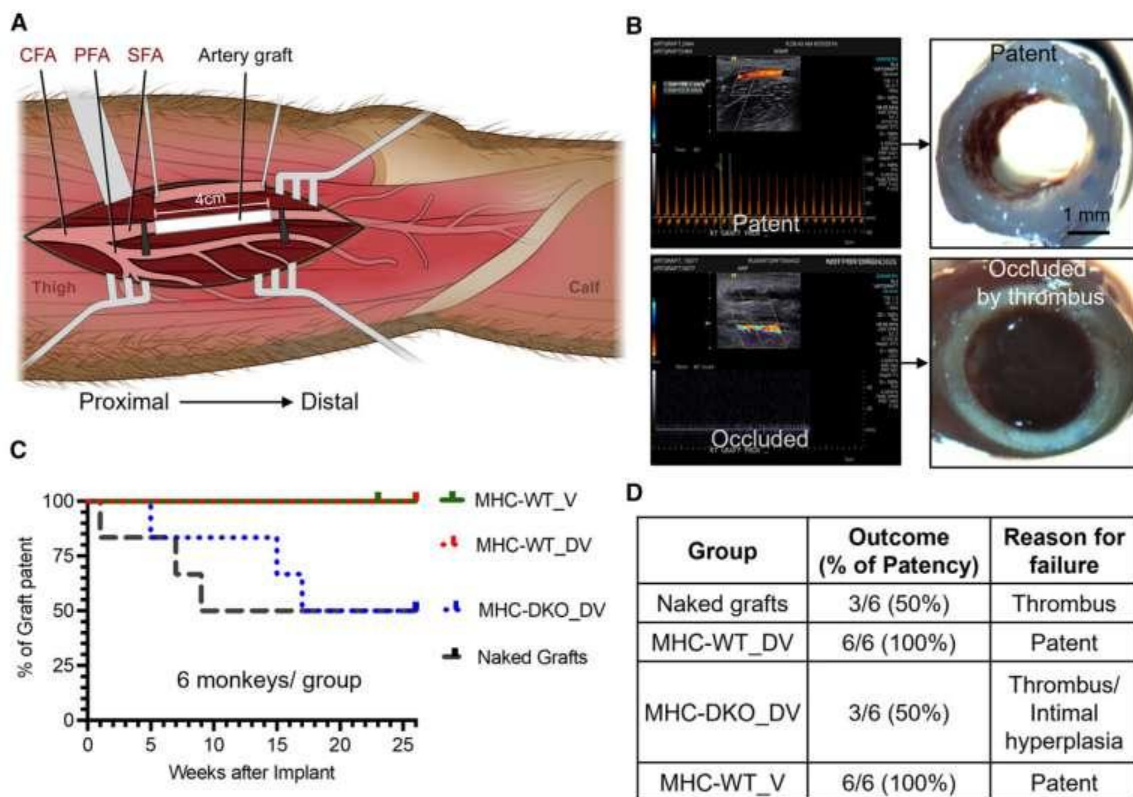
Journal information: [Nature Metabolism](#)

Provided by [VIB \(the Flanders Institute for Biotechnology\)](#)

MARCH 10, 2025

Scientists create universal vascular graft with stem cells to improve surgery for cardiovascular disease

by [Morgridge Institute for Research](#)



Allogenic MHC-wild-type artery grafts maintain 100% patency in a rhesus model. Credit: *Cell Reports Medicine* (2025). DOI: 10.1016/j.xcrm.2025.102002

Scientists at the Wisconsin National Primate Research Center (WNPRC) and the Morgridge Institute for Research at the University of Wisconsin–Madison have been at the forefront of stem cell research and regenerative biology since James Thomson isolated the first human embryonic stem cell in 1998.

The Thomson Lab continued to pioneer new techniques to advance the field, including methods to generate [functional arterial cells](#) derived from [human pluripotent stem cells](#)—opening the door for bioengineered solutions to combat cardiovascular disease.

In a new study published in *Cell Reports Medicine*, they built upon that work to create a universal, small diameter, vascular graft using stem cell-derived arterial endothelial cells (AECs) that could advance the field of vascular bypass surgery.

"Although synthetic [vascular grafts](#) have been successfully used in clinics for large vessel repair, sources for small-diameter vessels, most commonly used for the coronary bypass surgery, are limited," says senior co-author Igor Slukvin, UW–Madison professor of pathology and laboratory medicine at the WNPRC. "This work is an important step in advancing stem cell technologies for bioengineering vascular grafts for cardiac vessel repair and their clinical translation."

Currently, the only clinically approved option for small diameter vascular bypass graft involves taking a blood vessel from another part of the patient's body. However, this method is invasive and limited by which vessels can be used. The graft may also be of poor quality if the patient has comorbidities. Blood vessels taken from another donor are an alternative but are limited by immune responses that lead to graft rejection.

Previous clinical trials engineered venous synthetic vascular grafts for use in peripheral vascular bypass by harvesting patient-specific venous endothelial cells with success.

Scientists at the Wisconsin National Primate Research Center and the Morgridge Institute for Research at the University of Wisconsin–Madison bioengineered arterial grafts derived from pluripotent stem cells. Pictured in the foreground: Marcella Diana Tabima (L) and John Maufort (R). Pictured in background: Matt Brown (L) and Jue Zhang (R). Credit: Morgridge Institute for Research / David Nevala Photography

"Patient-specific cell therapies can be cost-prohibitive and time-consuming. We wanted to develop a 'off-the-shelf' small diameter arterial graft that can be readily used in clinical settings," says senior co-author John Maufort, an associate scientist formerly in the Thomson Lab at the Morgridge Institute.

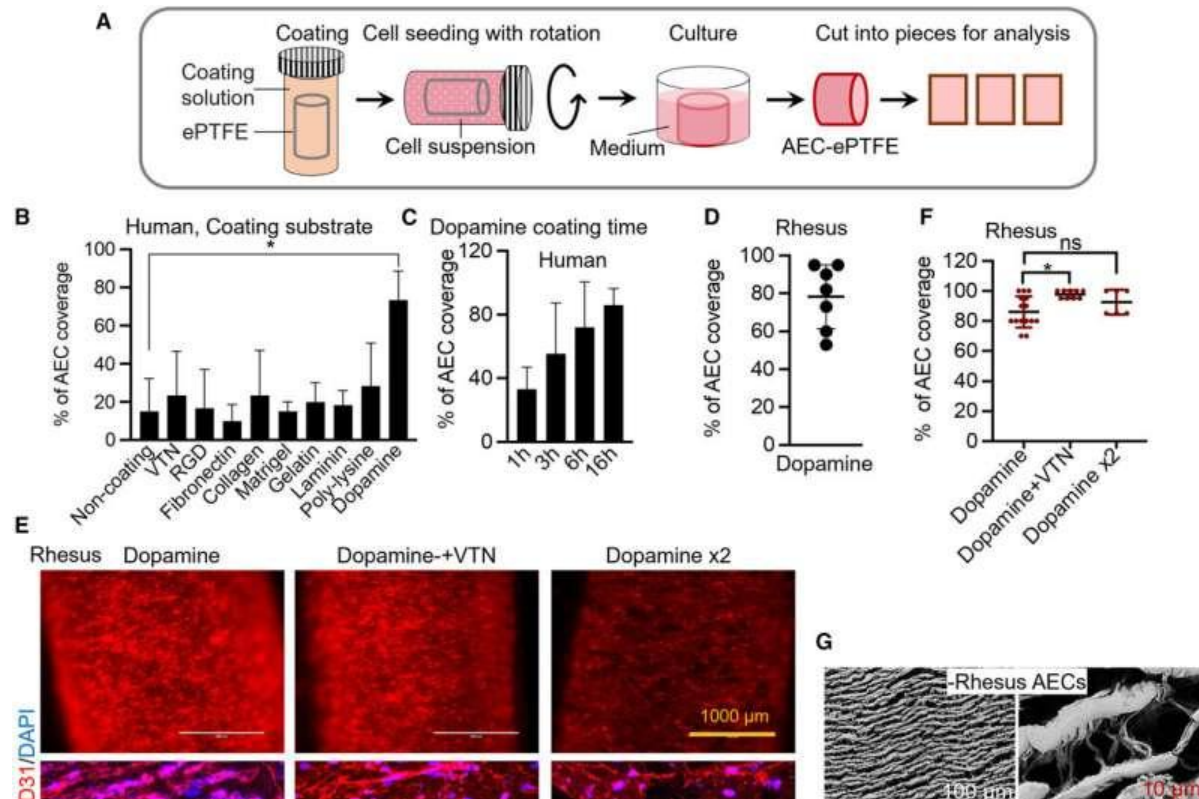
In this study, scientists used a small graft made of ePTFE, a porous material made from the same material as Teflon. Once they generated quality stem cell-derived AECs, they established methods to line them onto the ePTFE grafts.

"The advantages of using pluripotent stem cells are the ability to self-renew, providing an unlimited cell source, and differentiate into any human cell type," says Maufort.

However, the researchers faced a challenge—ePTFE is hydrophobic and repels water, so they needed to find a way to modify the surface of the grafts so the cells could attach.

"We were inspired by [adhesive proteins](#) made in mussels, specifically dopamine, a chemical component of these proteins," says first author Jue Zhang, one of the corresponding authors of the study and former associate scientist in the Thomson Lab who developed this procedure.

They used a dual-layer coating with dopamine and vitronectin, another cell adhesion protein, to attach the AECs to the inner surface of the ePTFE grafts. They tested them against physiological flow generated by a pump and demonstrated the bioengineered cells remained uniform and stable.



Modifying ePTFE by dopamine and vitronectin or vitronectin-vacuum improves AEC adhesion. Credit: *Cell Reports Medicine* (2025). DOI: 10.1016/j.xcrm.2025.102002

Next, they implanted the grafts into the femoral arteries of Rhesus macaques, a common non-human primate model used for their similarities to human biology. The success of any transplant depends on cells expressing the major histocompatibility complex (both MHC class I and class II)—a group of proteins involved with the immune response to reject a foreign body.

Using this model, the authors experimented with different graft compositions—naked ePTFE grafts, grafts lined with AECs expressing MHC (wildtype), or grafts lined with AECs lacking MHC (double knockout)—to assess immune rejection.

The grafts were monitored biweekly by ultrasound imaging to look for signs of failure, specifically stenosis, cell wall thickening, or thrombosis, a blood clot in the graft. To the researchers' surprise, 50% of the MHC double knockout grafts failed.

"Since knockout of the MHC class I and II mitigates T-cell response, we hypothesize that natural killer cells could be playing a role in mediating immune rejection of these grafts," says Zhang.

The MHC wildtype grafts, on the other hand, maintained normal function for 6 months, more successful than the other grafts. The authors also observed the graft endothelium was repopulated with the host cells, contributing to long-term success. Their findings suggest that these bioengineered grafts could advance the field of vascular bypass surgery and open possibilities for human clinical trials.

"This is an exciting, collaborative project with the potential to be a true bench to bedside advancement," says Samuel Poore, chair of the division of plastic surgery at UW–Madison and co-author of the study.

"Stem cell-based, off-the-shelf vascular grafts have the potential to expand surgical indications, limit morbidity of operations, and give options for surgery that currently don't exist, impacting subspecialties such as plastic and reconstructive surgery, vascular and cardiac surgery."

More information: Jue Zhang et al. Small-diameter artery grafts engineered from pluripotent stem cells maintain 100% patency in an allogeneic rhesus macaque model, *Cell Reports Medicine* (2025). DOI: [10.1016/j.xcrm.2025.102002](https://doi.org/10.1016/j.xcrm.2025.102002). [www.cell.com/cell-reports-medi ... 2666-3791\(25\)00075-8](https://www.cell.com/cell-reports-medicine/abstract/S2666-3791(25)00075-8)

Journal information: [Cell Reports Medicine](#)
Provided by [Morgridge Institute for Research](#)

MARCH 8, 2025

60% of adults will be overweight or obese by 2050: Study

Nearly 60 percent of all adults and a third of all children in the world will be overweight or obese by 2050 unless governments take action, a large new study said Tuesday.

The research published in *The Lancet* medical journal used data from 204 countries to paint a grim picture of what it described as one of the great health challenges of the century.

"The unprecedented global epidemic of overweight and obesity is a profound tragedy and a monumental societal failure," lead author Emmanuela Gakidou, from the US-based Institute for Health Metrics and Evaluation (IHME), said in a statement.

The number of overweight or obese people worldwide rose from 929 million in 1990 to 2.6 billion in 2021, the study found.

Without a serious change, the researchers estimate that 3.8 billion adults will be overweight or obese in 15 years—or around 60 percent of the global adult population in 2050.

The world's health systems will come under crippling pressure, the researchers warned, with around a quarter of the world's obese expected to be aged over 65 by that time.

They also predicted a 121-percent increase in obesity among children and adolescents around the world.

A third of all obese young people will be living in two regions—North Africa and the Middle East, and Latin America and the Caribbean—by 2050, the researchers warned.

But it is not too late to act, said study co-author Jessica Kerr from Murdoch Children's Research Institute in Australia.

"Much stronger political commitment is needed to transform diets within sustainable global food systems," she said.

That commitment was also needed for strategies "that improve people's nutrition, [physical activity](#) and living environments, whether it's too much processed food or not enough parks," Kerr said.

More than half the world's overweight or obese adults already live in just eight countries—China, India, the United States, Brazil, Russia, Mexico, Indonesia and Egypt, the study said.

While [poor diet](#) and [sedentary lifestyles](#) are clearly drivers of the obesity epidemic, "there remains doubt" about the underlying causes for this, said Thorkild Sorensen, a researcher at the University of Copenhagen not involved in the study.

For example, socially deprived groups have a "consistent and unexplained tendency" towards obesity, he said in a linked comment in *The Lancet*.

The research is based on figures from the Global Burden of Disease study from the IHME, which brings together thousands of researchers across the world and is funded by the Bill and Melinda Gates Foundation.

More information: Global, regional, and national prevalence of adult overweight and obesity, 1990–2021, with forecasts to 2050: a forecasting study for the Global Burden of Disease Study 2021, *The Lancet* (2025). DOI: [10.1016/S0140-6736\(25\)00355-1](https://doi.org/10.1016/S0140-6736(25)00355-1)

Journal information: [The Lancet](#)

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MARCH 12, 2025

Axolotls help reveal keratinocytes, not fibroblasts, make collagen for healthy skin

by [Okayama University](#)



Axolotl is an animal model widely used in dermatology research due to its transparent 'glass skin.' A study by researchers from Okayama University, Japan, discovered that healthy collagen fibers, which maintain good skin texture and appearance, are produced by the outer skin cells called keratinocytes rather than the support cells called fibroblasts that help in skin repair, as previously thought. Credit: Professor Akira Satoh from Okayama University, Japan

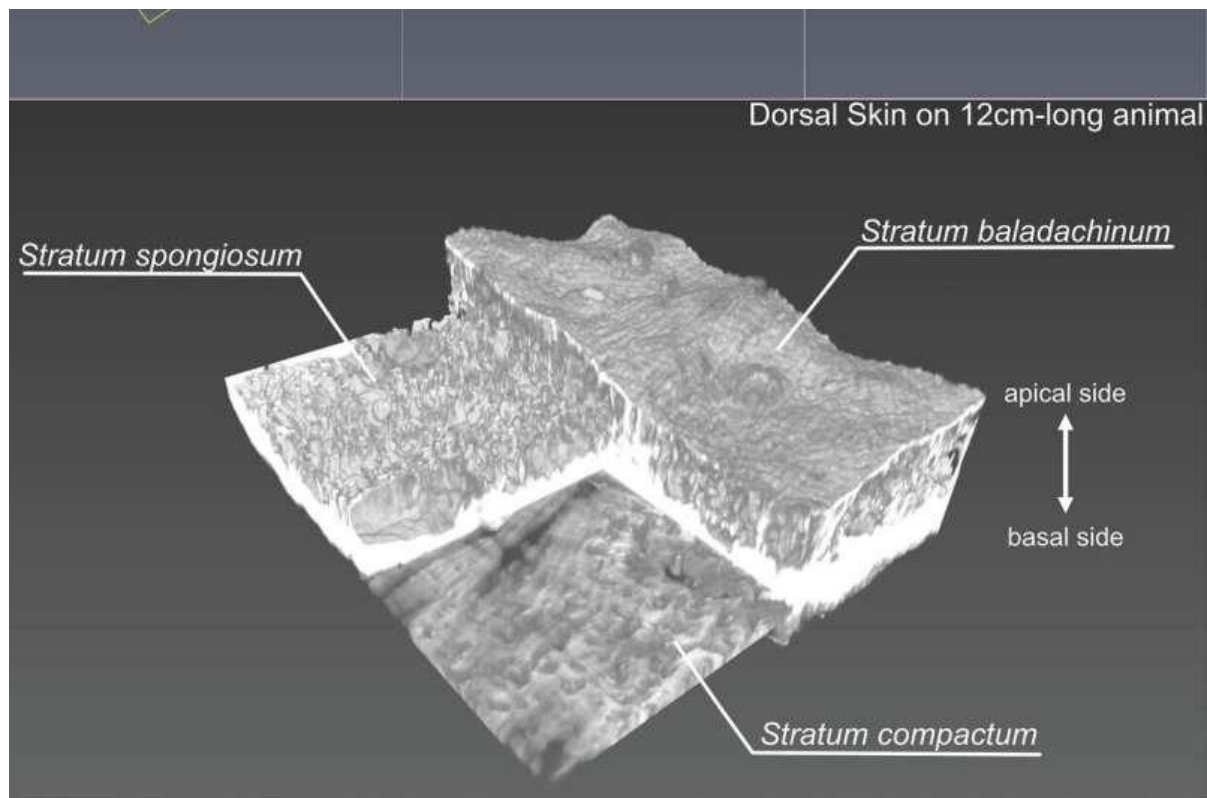
The skin consists of two primary layers. The epidermis, the outermost layer, is predominantly made up of keratinocytes, while the deeper dermis contains blood vessels, nerves, and structural proteins such as collagen, which give the skin its strength and texture. Traditionally, fibroblasts—specialized supporting cells within the dermis—have been believed to play a key role in producing collagen.

In humans, collagen is formed before and after birth. It has been believed that fibroblasts play an exclusive role in collagen production in the skin, and no keratinocytes contribute to collagen production. The statement "Collagen production in the human skin is achieved by fibroblasts" has been an unspoken agreement in the skin research field.

However, in a study published in [Nature Communications](#) on February 24, 2025, scientists from Okayama University, Japan, challenged this long-standing belief. Using the transparent skin of axolotls, an aquatic amphibian widely used in dermatology research, they uncovered a different mechanism for dermal collagen formation.

To track collagen development, the researchers examined axolotl skin at different growth stages—5 cm, 8 cm, 10 cm, and 12 cm in length—using advanced fluorescence-based microscopy techniques. At 5 cm, the axolotl's skin consisted of an epidermis with keratinocytes and a thin, fibroblast-free collagen layer in the dermis, which they named the stratum coniunctum.

As the axolotl grew, the collagen layer thickened, and only later did fibroblasts begin migrating into it, eventually forming three distinct dermal layers beneath the epidermis: the stratum baladachinum, stratum spongiosum, and stratum compactum. Each of these layers had a unique collagen structure, none of which matched the original pattern of the stratum coniunctum.



Structure of type I collagen in the 12-cm-long axolotl dorsal skin. Credit: *Nature Communications* (2025). DOI: 10.1038/s41467-025-57055-7

Since collagen was already present before fibroblasts start contributing the dermal collagen formation, the team searched for the source of collagen production by a novel collagen labeling technique that can clarify newly synthesized collagen fibers. The results were surprising: strong fluorescent signals were detected in [collagen fibers](#) made by keratinocytes, not fibroblasts.

"So far, fibroblasts have been thought to be the major contributors to skin collagen. All efforts in cosmetic science and skin [medical research](#) have focused on fibroblast regulation. But the present study demands a change in mindset. We clarified that keratinocytes are primarily responsible for dermal collagen formation," explains Ayaka Ohashi, a Ph.D. student at the Graduate School of Environmental, Life, Natural Science, and Technology at Okayama University.

Further investigation revealed that keratinocytes produce collagen in a structured, grid-like arrangement on their undersurface. Later, [fibroblasts](#), which have a lattice-like structure and finger-like projections, migrated into this collagen layer, modifying, and reinforcing it.

To confirm that this process is not unique to axolotls, the researchers examined other vertebrate models, including zebrafish, chick embryos, and mammalian (mouse) embryos. Their findings were consistent across all species, suggesting that keratinocyte-driven collagen production is an evolutionarily conserved mechanism.

Understanding how collagen forms before birth is crucial for addressing skin aging and developing new treatments for collagen-related conditions. "Axolotls can maintain good skin texture and appearance for a long time. I mean, they have a sort of eternal youth," says Professor Akira Satoh from Okayama University.

"This might be because they continue producing collagen in keratinocytes for a long time. On the other hand, we humans cannot maintain collagen production in keratinocytes after birth. If we can clarify the mechanism that allows axolotls to keep keratinocytes producing collagen throughout their lifetime, we might be able to achieve eternal youth, just like axolotls."

This discovery reshapes our understanding of skin biology and could lead to breakthroughs in [regenerative medicine](#), wound healing, and cosmetic formulations. Current skincare products primarily target fibroblast activity, but future treatments may need to focus on stimulating [keratinocyte](#)-driven [collagen](#) production instead.

By overturning a decades-old belief, this research paves the way for a new era in skincare science—one that could bring us closer to maintaining youthful, resilient skin for a lifetime.

More information: Ayaka Ohashi et al, Keratinocyte-driven dermal collagen formation in the axolotl skin, *Nature Communications* (2025). DOI: [10.1038/s41467-025-57055-7](https://doi.org/10.1038/s41467-025-57055-7)

Journal information: [Nature Communications](#)

Provided by [Okayama University](#)

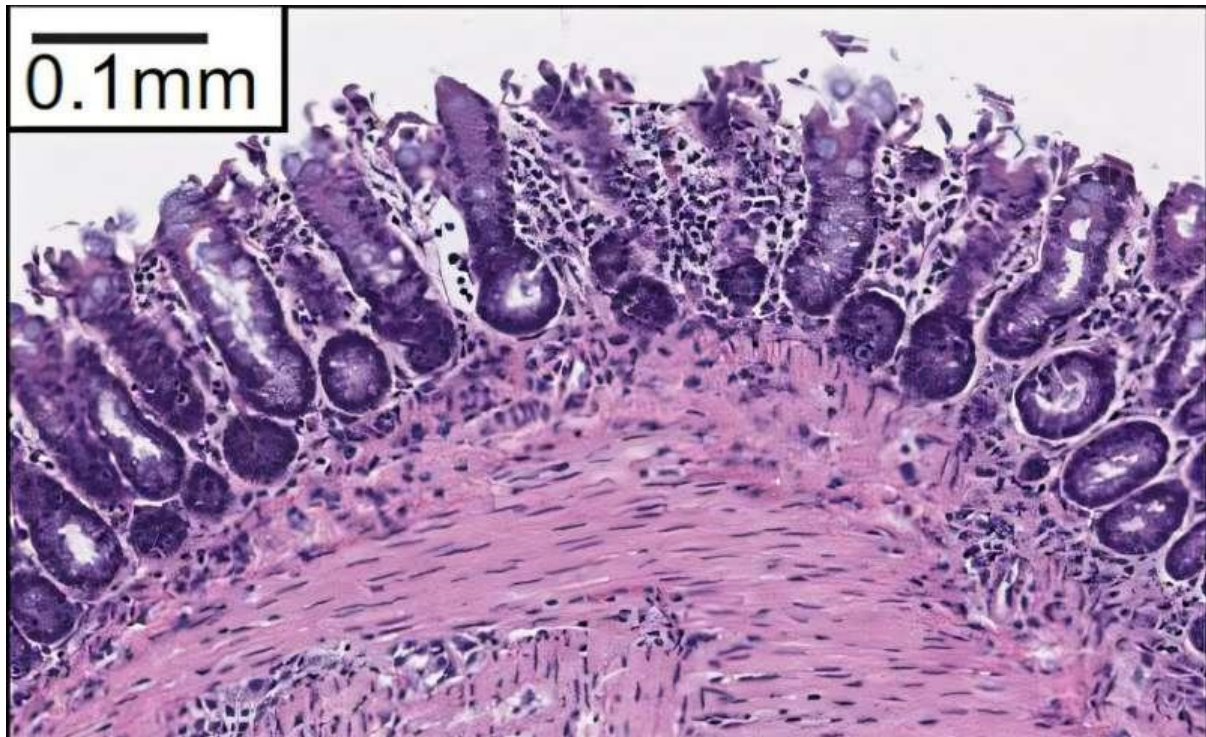
Explore further

[Video: Can collagen supplements help with aging?](#)

MARCH 12, 2025

Discovery of metabolic link to immune protein suppression offers new therapeutic avenues

by Mario Aguilera, [University of California - San Diego](#)



colon histology from virally infected mice that received pDCs. Credit: University of California - San Diego

Not long after a threatening organism enters our bodies, our immune system springs into action and starts producing proteins known as type one interferons (IFN-I), which fight viruses and cancer, while also playing pathogenic roles in autoimmune disorders.

While all cells can produce low amounts of these anti-viral and anti-tumor proteins, one particular cell type, termed [plasmacytoid dendritic cells](#) (pDCs), stands out as a specialized IFN-I producer.

These specialists are capable of generating up to 1,000 times more and a broader range of IFN-I subtypes within hours of encountering a pathogen, compared with any other cell in our body. This powerful IFN-I burst is, however, short-lived. At later stages of infection and within tumors, pDCs exhibit a sharp decline in IFN-I production.

Immunologists have long focused on understanding the early, robust IFN-I response of pDCs, yet a critical gap remains: Why do pDCs stop producing IFN-I after this initial wave?

What mechanisms drive their suppression at later stages of infection? Unraveling this process is key to harnessing pDC function for therapeutic interventions in infections, cancer and potentially suppressing pathogenic IFN-I in autoimmune disorders.

Professor Elina Zúñiga of the UC San Diego School of Biological Sciences and her colleagues have uncovered critical mechanisms underlying pDC suppression after infection. For the first time, the researchers identified that this suppression is linked to metabolic deficiencies, specifically the downregulation of lactate dehydrogenase B (LDHB)—an enzyme essential for metabolism and [energy production](#).

The research paper, "Metabolic deficiencies underlie reduced plasmacytoid dendritic cell IFN-1 production following viral infection," was [published](#) on Feb. 7, 2025, in *Nature Communications*.

Follow-up studies demonstrated that LDHB is crucial for pDC-mediated IFN-I production, and its deficiency limits the host's ability to control viral infections. Remarkably, restoration of LDHB in suppressed pDCs was sufficient to improve their IFN-I production capacity. The extent to which pDCs function depends on—and can be restored by—LDHB expression was a surprising discovery for the research team, highlighting metabolism as a key regulator of this potent interferon-producing cell.

Zúñiga believes that interventions that target LDHB or related metabolic pathways could be explored as a way to counteract the normal cycle of pDC suppression and boost interferons in [viral infections](#) and cancers, or to limit the pathogenic production of these proteins in autoimmune diseases.

"We found that defective metabolism is deeply linked to the suppression of pDCs that naturally occurs during a viral infection. This is significant because these cells have an unparalleled capacity to produce interferons, which are essential in antiviral defense and antitumor immunity, while also playing pathogenic roles in autoimmunity" said Zúñiga.

"Targeting [metabolic pathways](#) such as those related to the enzyme LDHB in these potent interferon-producing cells could empower immune responses against infections and cancer or mitigate pathology in autoimmune diseases."

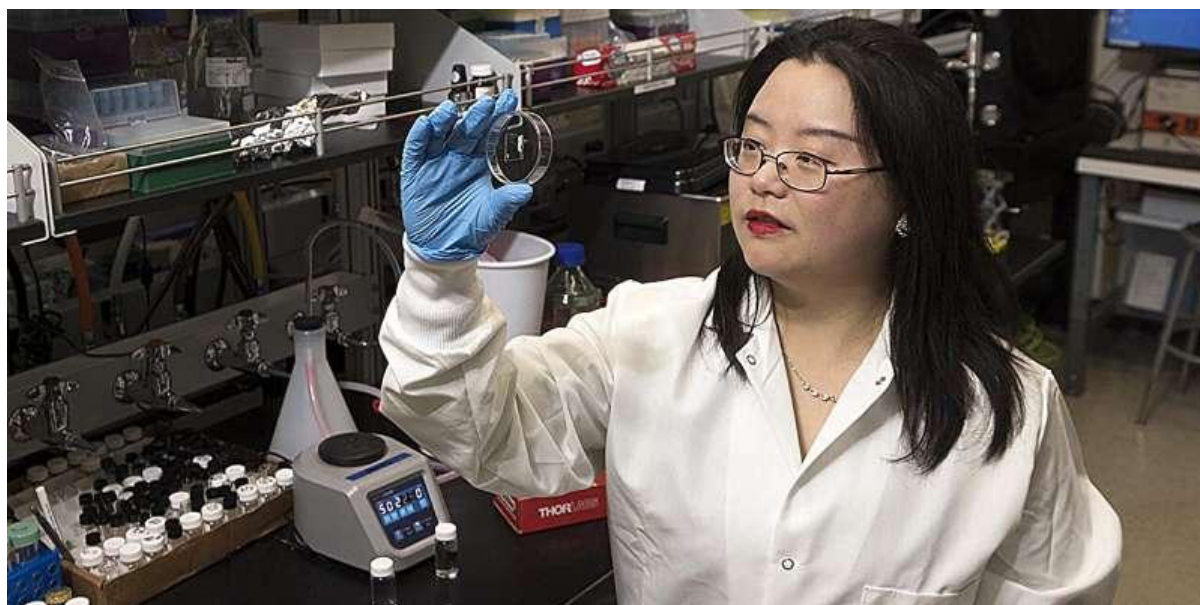
More information: Trever T. Greene et al, Metabolic deficiencies underlie reduced plasmacytoid dendritic cell IFN-I production following viral infection, *Nature Communications* (2025). DOI: [10.1038/s41467-025-56603-5](https://doi.org/10.1038/s41467-025-56603-5)

Journal information: [Nature Communications](#)
Provided by [University of California - San Diego](#)

MARCH 12, 2025

Conductive gel improves study of spinal cord injuries by transmitting clear signals while remaining flexible

by [Binghamton University](#)



Assistant Professor Siyuan Rao from the Thomas J. Watson College of Engineering and Applied Science's Department of Biomedical Engineering studies how bioelectronics interface with the brain and nervous system. Credit: Binghamton University, State University of New York

Studying spinal cord injuries requires a material that can transmit clear signals yet remain flexible for when patients move around. Researchers at Binghamton University think they have hit upon a solution that will offer the best of both requirements.

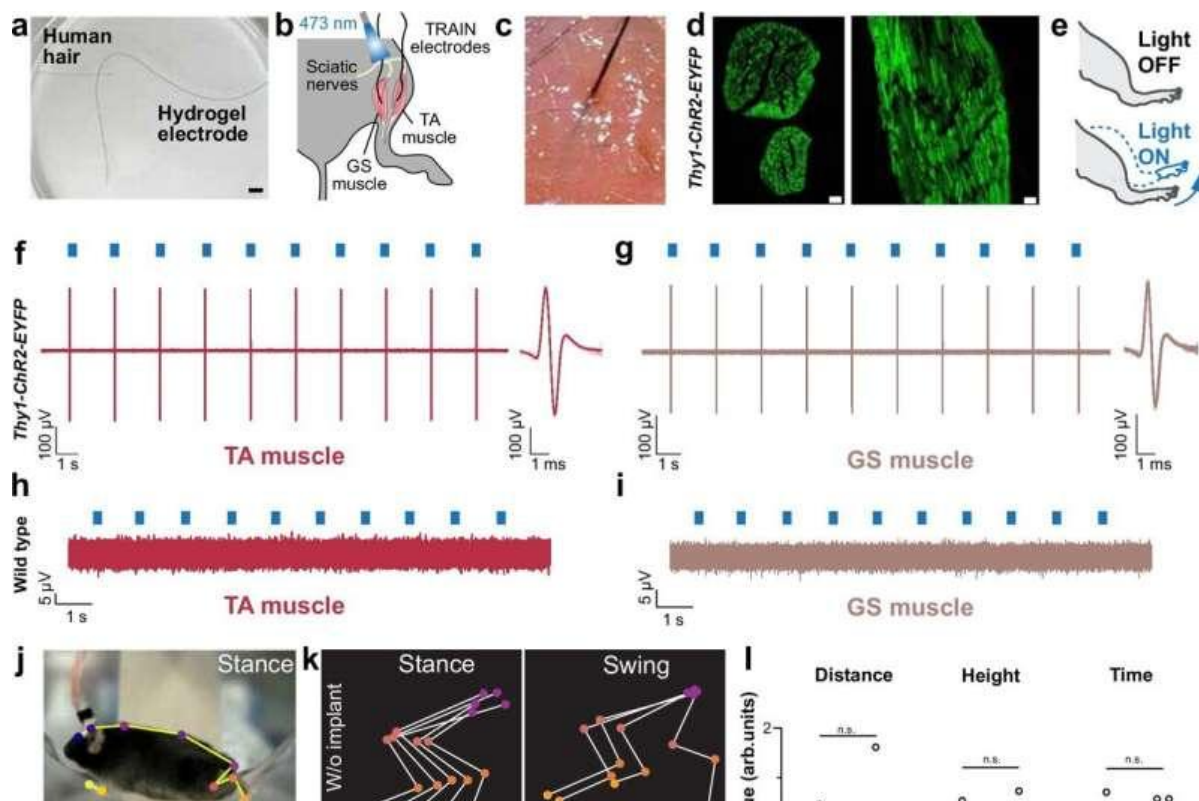
In a recently [published](#) paper in *Nature Communications*, Binghamton University, State University of New York Assistant Professor Siyuan Rao and her team have created a hydrogel electrode that includes conductive carbon nanotubes to monitor nerve activity. When integrated into bioelectronic devices, the hydrogel enables the recording of electrical signals from spinal cord neurons and leg muscles in mice.

"If you have a rigid material in a soft tissue, especially during movement, it's going to cause a lot of damage," said Rao, a faculty member at the Thomas J. Watson College of Engineering and Applied Science's Department of Biomedical Engineering. "Our technology solves that [fundamental problem](#), so we can pick up a single cell's activity from the spinal cord and maintain the device's functionality for a long time."

Also part of the study are lecturer Sizhe Huang, Ph.D. '24; Assistant Professor Qianbin Wang; Associate Professor Fake "Frank" Lu; master students Ruobai Xiao '24 and Chen Lin '24; research technician Geunho Jang; Ph.D. students Eunji Hong, Zuer Wu and Shovit Gupta; and collaborators from the University of Massachusetts, the University of Texas, Michigan State University, the Massachusetts Institute of Technology and the Boston Children's Hospital.

The hydrogels used in the research are made from a synthetic plastic polymer that is nontoxic, shows good biocompatibility and has high absorbing capacity. Rao has previously investigated [similar hydrogels to inhibit pain using light transmissions](#).

"You can imagine it as a sponge that contains a lot of water and the conductive material, which are the nanocarbon tubes invisible to the [naked eye](#) because they're so small," Huang said. "Those conductive nanomaterials are filling the free space in the 3D network."



TRAIN-enabled freely moving Electromyographic (EMG) recordings. Credit: *Nature Communications* (2025). DOI: 10.1038/s41467-025-56450-4

Although her previous work focused on the brain, Rao is hopeful that she and her team can leverage their ideas about soft materials engineering to answer questions about the spinal cord system.

"We are strengthening our capability to cover multiple regions of the nervous system," she said. "Ultimately, we hope to have an effective tool to probe the different parts of the body and the causal link between the central nervous system and peripheral nervous system."

Huang—who spearheaded the paper as part of his Ph.D. research at Rao's Neurobiological Interfaces Lab—believes he grew as a leader by supervising the work of undergraduates and master's students.

"It's like we're in a car," he said. "I'm in the driver's seat, and all of the master's students are my passengers—but they don't just sit in the car. They also contribute, like one of them is keeping an eye on the maps to tell me directions, or I tell them directions. That's how we work."

The next challenge is to research pain inhibition and motor functional recovery in the spinal cord region.

"We specifically want to look at the ventral horn motor neurons that control voluntary movement," Rao said. "We will build on our past research to use light to achieve pain inhibition and then use this new conductive material to pick up electrophysiological signals."

More information: Sizhe Huang et al, Anisotropic hydrogel microelectrodes for intraspinal neural recordings in vivo, *Nature Communications* (2025). DOI: [10.1038/s41467-025-56450-4](https://doi.org/10.1038/s41467-025-56450-4)

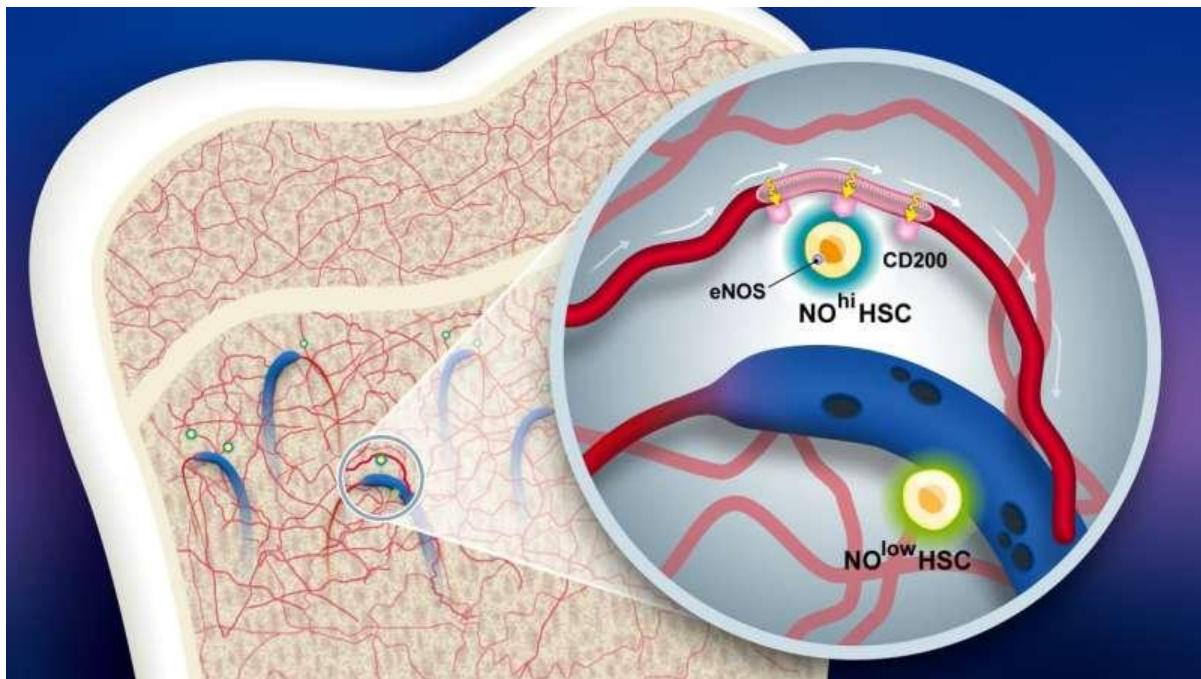
Journal information: [Nature Communications](#)

Provided by [Binghamton University](#)

MARCH 12, 2025

Specialized blood vessels and nitric oxide found to be key to stem cell survival and immune evasion

by [Nagoya University](#)



The bone marrow niche formed by CD200-positive vessels orchestrate stem-cell hierarchy and immune tolerance. Credit: Keiko Itano

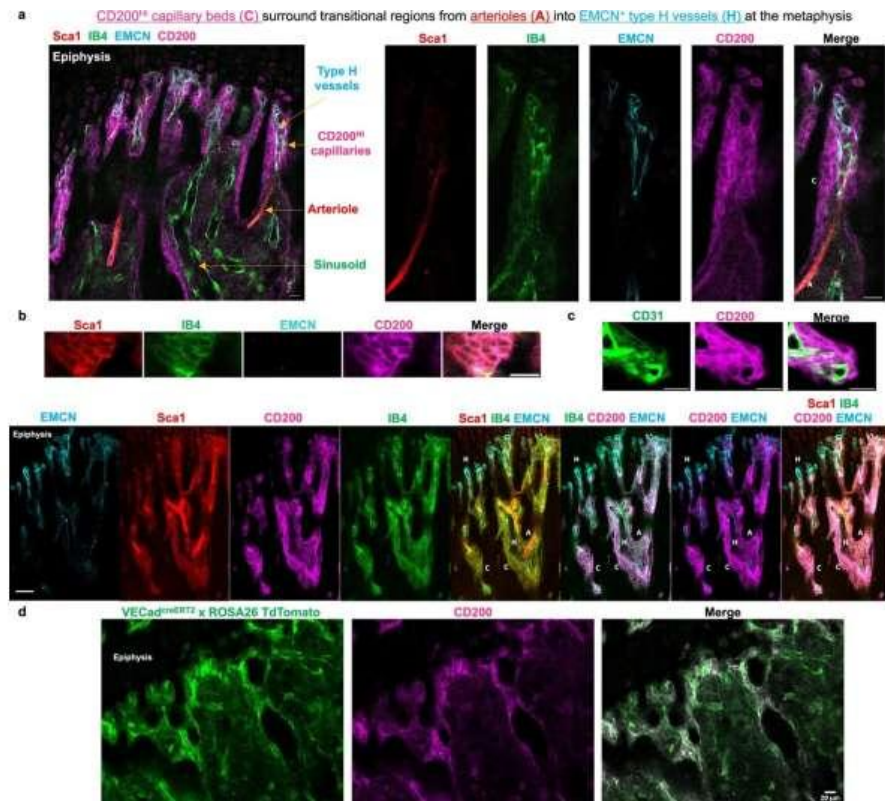
An international group of researchers has identified an important mechanism that enables stem cells to evade immune rejection. Their research, [published](#) in *Nature*, sheds light on how these specialized cells create an "immune-privileged" environment—areas in the body where stem cells survive and function without being attacked by the immune system. The team was led by Kazuhiro Furuhashi (Nagoya University and Columbia University) and Joji Fujisaki (Harvard University and Columbia University).

Stem cells are special cells in the body that can divide and turn into different types of cells. This functionality allows them to play roles in the growth, healing, and development of tissues and organs.

Stem cells in immune-privileged sites in the body use multiple mechanisms to inhibit or prevent immune responses against them. This protection is necessary because if the immune system recognizes them as foreign, it may attack them—a common occurrence in autoimmune diseases.

The researchers focused on [hematopoietic stem cells](#) (HSCs), which generate blood cells and are often used by clinicians to treat leukemia and inherited blood disorders. Being able to transfer these cells without triggering the patient's immune response or requiring large amounts of immune-suppressing medicine would be a valuable way to increase their effectiveness.

Scientists have long proposed a hierarchy in HSCs that is related to their survivability. At the top of the hierarchy are specialized stem cells that produce [nitric oxide](#) (NO), which they use to manipulate the immune response to ensure safe reproduction.



CD200^{hi} capillaries preferentially localize at the metaphyseal endosteum.

Credit: *Nature* (2025). DOI: 10.1038/s41586-024-08352-6

The researchers identified a unique subset of HSCs that express high levels of NO (termed "NO^{hi} HSCs") and discovered these cells also contain high levels of the immunomodulatory receptor CD200R—a protein that plays a critical role in immune suppression and tolerance.

They also identified that survival of these NO^{hi} HSCs depended on their location near specialized [blood vessels](#) that have a distinctive hairpin-curve shape. The scientists concluded that the curved nature of these capillaries affects blood flow dynamics, creating increased shear stress—the force of blood moving along vessel walls. Shear stress regulates the behavior of stem cells by increasing NO levels, which plays an important role in the maintenance, survival, and function of stem cells by modulating cellular signaling pathways.

Combining shear stress and higher NO levels in these specialized capillaries creates an optimal microenvironment. These findings may explain how NO^{hi} HSCs can survive and proliferate while evading immune detection.

Beyond providing insights into stem cell survival, these findings reshape our understanding of blood vessels. They reveal that blood vessels function as gatekeepers, regulating stem cell activity and immune responses within surrounding tissues—a role that extends far beyond simply transporting blood.

This research should pave the way for advances in [regenerative medicine](#) and immunotherapy, highlighting the critical role of blood vessels in maintaining stem cell function and immune balance.

"Understanding how [shear stress](#) and immune regulatory molecules influence [stem cells](#) could inform the development of new immunosuppressive and anti-inflammatory treatments," Furuhashi said. "In addition, these findings may revolutionize [cancer treatment](#), as similar mechanisms involving CD200 have been identified in tumor-associated blood vessels, potentially leading to targeted cancer therapies."

More information: Kazuhiro Furuhashi et al, Bone marrow niches orchestrate stem-cell hierarchy and immune tolerance, *Nature* (2025). DOI: [10.1038/s41586-024-08352-6](https://doi.org/10.1038/s41586-024-08352-6)

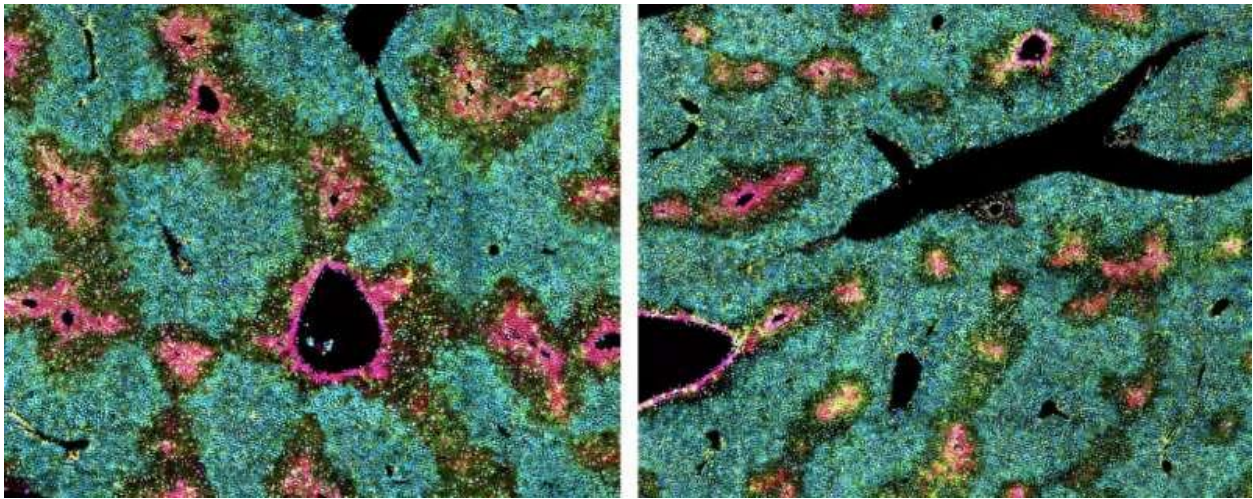
Journal information: [Nature](#)

Provided by [Nagoya University](#)

MARCH 12, 2025

Secret boss of the liver: Star-shaped cells that promote fibrosis also regulate liver health

by [Columbia University Irving Medical Center](#)



Stellate cells control zonation in the normal liver. These two images show activity of different zonation genes in normal liver (left) and a liver without stellate cells (right). Credit: Robert Schwabe / Columbia University Vagelos College of Physicians and Surgeons. Researchers from Columbia University and the German Cancer Center have found that stellate cells—star-shaped liver cells long known as the main perpetrators of liver fibrosis—have a commanding role in protecting and sustaining the liver's organization and function before they go rogue and cause liver damage.

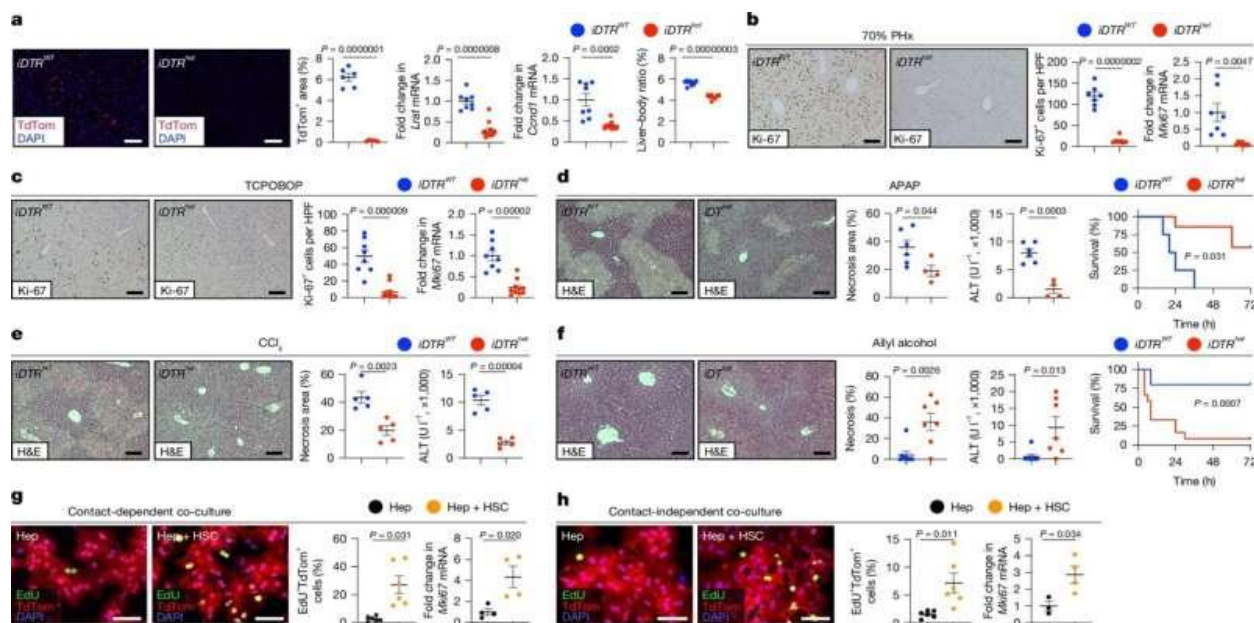
The discovery could be especially important for hundreds of millions of people, including one-third of American adults who have metabolic liver disease. As the metabolic hub of our body, impaired liver function can predispose to liver and [cardiovascular disease](#).

"Our research shows a surprising role for stellate cells in the normal liver, where they act like 'secret bosses,' organizing its structure and instructing the work of other cells that perform the liver's main functions, namely metabolism and detoxification," says study leader Robert F. Schwabe, MD, professor of medicine and director of the Digestive and Liver Disease Research Center at Columbia University Vagelos College of Physicians and Surgeons.

"But the cells lose these protective functions as liver disease progresses, turning from good into bad guys."

"If we can reprogram diseased stellate cells back to their healthy state, we could potentially halt liver scarring and simultaneously improve liver function, which may be most helpful for patients in advanced disease stages who are not helped by current therapies," adds Schwabe.

The findings appear in *Nature*.



HSCs regulate liver regeneration and injury. Credit: *Nature* (2025). DOI: 10.1038/s41586-025-08677-w

In the past 40 years, research on the liver's stellate cells has focused on their role in driving diseases that scar the liver.

"Evolutionary pressure ensures that we do not have cells in our bodies that only do bad things," Schwabe says. "Every cell must serve some purpose. We were puzzled that the beneficial functions of stellate cells have not been really understood."

To understand the normal functions of the stellate cells in a healthy liver, the researchers genetically engineered mice to eliminate most stellate cells. In these mice, the researchers found that the liver became smaller, disorganized, and had trouble healing injuries, detoxifying drugs, and regulating the liver's metabolism.

Eliminating a single molecule inside the stellate cells—called RSP03—triggered the same changes as removing stellate cells entirely, including a reduction in liver size, disorganization, an inability to detoxify certain substances and regenerate. Moreover, RSP03 was found to protect from metabolic dysfunction-associated liver disease (MASLD) and alcohol-associated liver disease in mice.

The researchers also found that in patients with metabolic or alcohol-associated liver disease, the two most common forms of fatty liver disease, declining levels of RSPO3 were associated with worsened disease, suggesting that RSPO3 plays a similar role in people.

The number of people with metabolic liver disease is rapidly increasing, and the disease is poised to become the most common reason for [liver transplantation](#) and liver cancer in the U.S.

Restoring stellate cells to their healthy and protective state represents a conceptually new therapeutic approach to liver disease that could simultaneously reduce liver scarring and improve liver function.

"A key problem in patients with metabolic liver disease is that today's drugs only target the metabolic alterations," Schwabe says, "but this approach is less effective in advanced disease stages, where scarring dominates."

Restoring stellate cell balance could increase the RSPO3 levels in patients and potentially help the liver regain its normal functions and restore metabolism, reduce fibrosis, and heal the liver.

The Columbia researchers are now looking for ways to increase RSPO3 and exploring other avenues for restoring [stellate cells](#) to their healthy state.

More information: Atsushi Sugimoto et al, Hepatic stellate cells control liver zonation, size and functions via R-spondin 3, *Nature* (2025). DOI: [10.1038/s41586-025-08677-w](https://doi.org/10.1038/s41586-025-08677-w)

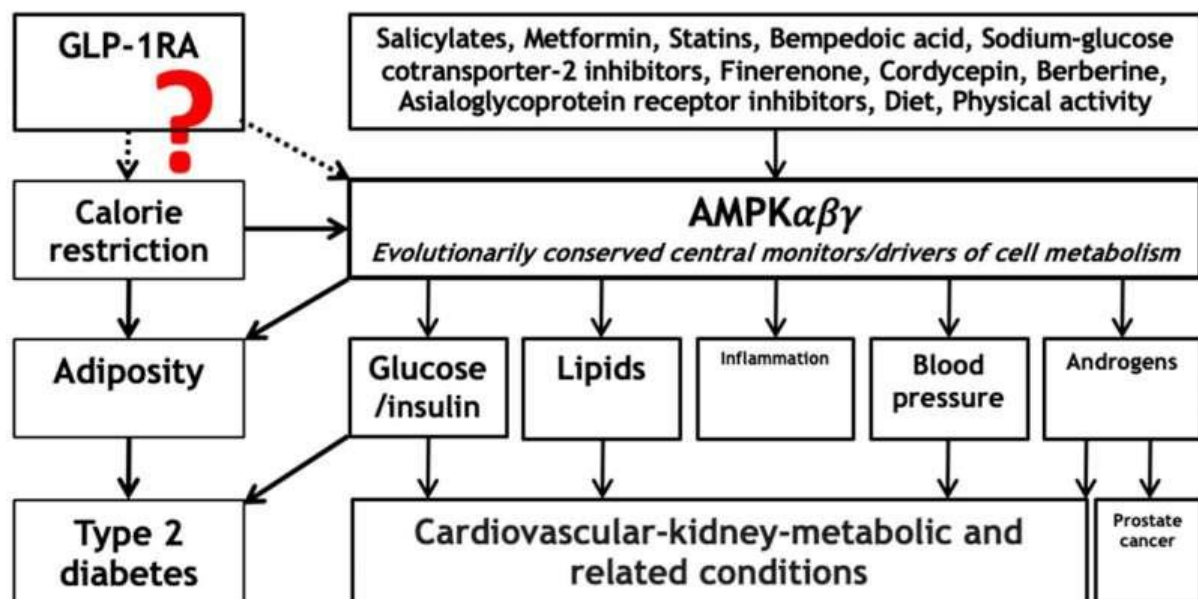
Journal information: [Nature](#)

Provided by [Columbia University Irving Medical Center](#)

MARCH 12, 2025

Popular weight loss drugs bring unexpected heart health benefits—researchers discuss implications

by [The City University of New York](#)



Hypothesized relations of GLP1-RAs with calorie restriction and AMPK (dotted arrows) and their established relations with cardiovascular–kidney–metabolic health and related diseases, and their major risk factors, along with other effective means of preventing or treating cardiovascular–kidney–metabolic and other diseases likely also operating via AMPK (solid arrows). Abbreviations: GLP-1RA: glucagon-like peptide-1 receptor agonist and AMPK: adenosine monophosphate-activated protein kinase. Credit: *Life* (2025). DOI: 10.3390/life15020253

Weight loss drugs like Ozempic deliver more health benefits than expected.

In a study [published](#) in the journal *Life*, Professor Mary Schooling, Professor Ghada Soliman, and colleagues note that people using glucagon-like peptide-1 receptor agonists (GLP-1RAs) like semaglutide (Ozempic) have a reduced risk of [cardiovascular disease](#), even before substantial weight loss occurs.

The authors explain that semaglutide likely operates immediately via [calorie restriction](#) and activation of adenosine monophosphate-activated protein kinase (AMPK), which essentially

controls the body's metabolism. Several effective means of preventing and treating type 2 diabetes and cardiovascular disease, such as metformin and statins respectively, also act via AMPK.

"Our hypothesis is that AMPK activation is a necessary lever for effective prevention and treatment of type 2 diabetes, cardiovascular disease, and other [metabolic diseases](#) and related conditions, such as liver and [kidney disease](#)," says Dr. Schooling.

"As such, the likely effectiveness of existing or potential interventions, including diet and lifestyle, for these conditions, from any tradition, depends on their effect on AMPK, directly or via calorie restriction."

The authors say the hypothesis provides an over-arching physiological theory concerning the means of preventing and treating some of the chronic diseases that play a major role in population health.

More information: C. Mary Schooling et al, A Hypothesis That Glucagon-like Peptide-1 Receptor Agonists Exert Immediate and Multifaceted Effects by Activating Adenosine Monophosphate-Activate Protein Kinase (AMPK), *Life* (2025). DOI: [10.3390/life15020253](https://doi.org/10.3390/life15020253)
Provided by [The City University of New York](#)

MARCH 12, 2025

What do we mean by 'brain health' and why should you care about it?

by [American Heart Association](#)



Credit: Pixabay/CC0 Public Domain

The average adult brain only weighs about 3 pounds, yet it is one of the most complex and vital organs of the human body. Cognition may decline and our [brains become prone to disease as we age](#), so as medical advances and other factors help the world's population live longer the prevalence of brain disease, including dementia, is on the rise. However, keeping our brains healthy may be easier than people realize with some helpful guidance from the American Heart Association, a global force changing the future of health of all.

Optimal brain health includes the functional ability to perform all the diverse tasks for which the brain is responsible—including thinking, moving and feeling. Many [modifiable risk factors](#) for cognitive loss, such as an unhealthy diet and sedentary lifestyle, develop as early as childhood and adolescence. As we age, our ability to remember, problem-solve, think and communicate decreases.

"We now know that many of the same health risk factors that cause [heart disease](#) and stroke also contribute to a decline in overall brain health," said Mitchell S. V. Elkind, M.D.,

M.S., FAHA, a neurologist and former volunteer American Heart Association president and currently its chief clinical science officer.

"Just like with heart disease and stroke, most brain disease is preventable. However, the combination of an aging population and projected substantial increases in [high blood pressure](#), obesity and diabetes are likely to lead to unprecedented growth in many types of brain disease."

According to data reported in the [2025 Heart Disease and Stroke Statistics: A Report of U.S. and Global Data From the American Heart Association](#):

- Alzheimer's disease is the 7th leading cause of death in the U.S. and the leading cause of death among all neurological disorders, including stroke.
- More females than males die of [dementia](#) each year because of the higher prevalence of elderly females compared with males. Females accounted for 66.7% of U.S. dementia deaths in 2022.
- More than 6.9 million people in the U.S. are living with Alzheimer's disease.
- An analysis of Medicare data reported in the update estimates that prevalence will more than double to 13.9 million Americans by 2060.

Also reported in the statistical update:

- Worldwide, nearly 57 million people had Alzheimer's disease and other dementias in 2021, a 45% increase since 2010 and a 160% increase over the past 30 years (1990–2021). For comparison, the prevalence of cardiovascular disease increased 33% over the past decade and 111% over the past 30 years
- The increase in global deaths from Alzheimer's disease and other dementias is outpacing that of [cardiovascular disease](#) even more—dementia deaths increased by nearly 195% since 1990, compared to a 57% increase in cardiovascular deaths during that same time.
- Estimated U.S. health care spending on dementia more than doubled from \$38.6 billion in 1996 to \$79.2 billion in 2016. Spending on dementias was among the top 10 [health care costs](#) in the United States in 2016.

"The burden of brain disorders is high. Dementia as a cause of death is growing faster than any other disease, including heart disease, the number one cause of death worldwide. Paradoxically, as we get better at treating other conditions, like heart disease, stroke and cancer, dementia as a cause of death increases," Elkind said.

"Using many of the same tools and information that have helped us successfully address cardiovascular risk factors and reduce the burden of heart disease over the past several decades, we should be able to do the same for brain disorders and promote brain health."

Elkind said following the American Heart Association's [Life Essential 8](#) can be as beneficial for brain health as it is for heart health. These include 4 health behaviors and 4 health factors identified as key measures for improving and maintaining cardiovascular health:

- Health Behaviors: Eat Better
- Health Behaviors: Be More Active
- Health Behaviors: Quit Tobacco
- Health Behaviors: Get Healthy Sleep
- Health Factors: Manage Weight
- Health Factors: Control Cholesterol
- Health Factors: Manage Blood Sugar
- Health Factors: Manage Blood Pressure

"The American Heart Association is committed to advancing brain science through innovative research that will help scientists shed new light on the causes and contributors to cognitive impairment and dementia, particularly as it relates to heart and vascular health," Elkind said.

"Additionally, we can support individuals and communities in thinking of brain health not only in terms of an absence of disease, but also in a more positive way. We can look at how we optimize brain function to include positive cognitive traits like creativity, adaptability, resilience, empathy and others."

He said the increasing cost of poor brain health in lives and dollars makes the Association's ongoing commitment to better understand how brains age and how vascular health impacts brain health and overall well-being even more imperative.

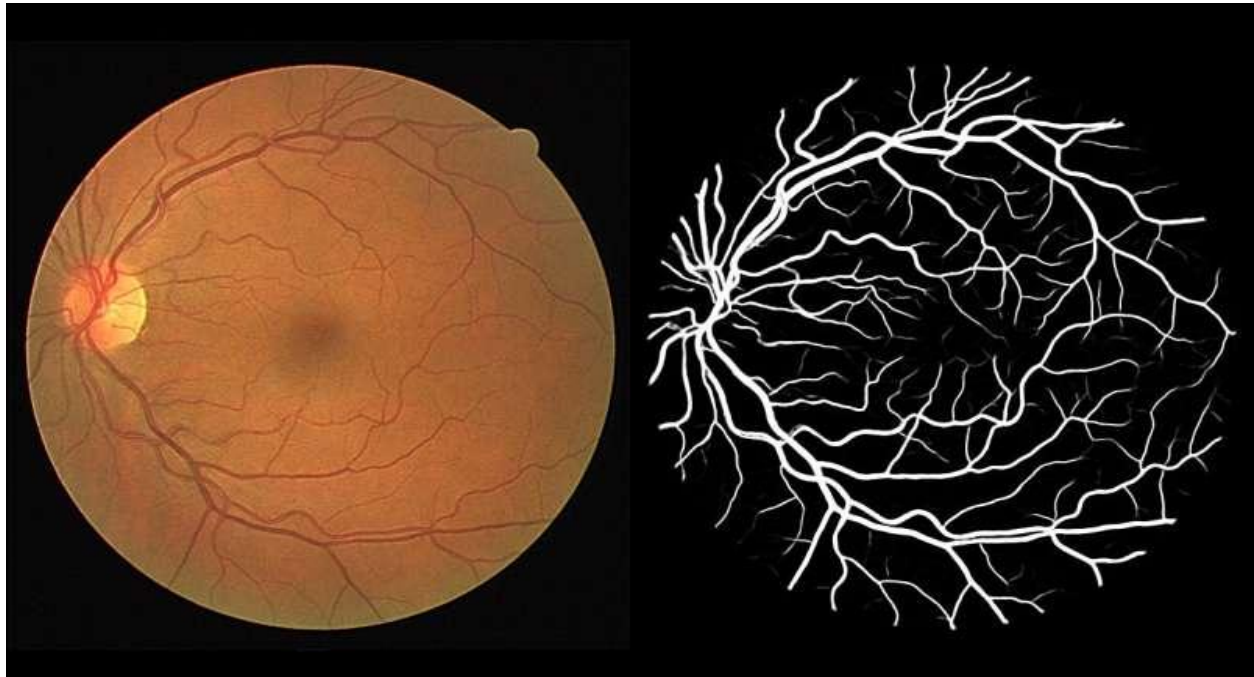
"When people are asked what health conditions they fear the most with aging, dementia tops the list, surpassing even cancer, heart disease and stroke," Elkind said. "It's critical that as a society and as individuals we understand and make the changes needed to improve health outcomes from brain disease and, more importantly, prevent them to begin with."

Provided by [American Heart Association](#)

MARCH 12, 2025

AI maps blood vessels in the retina for better diagnostics

by Nicolas Posunko, [Skolkovo Institute of Science and Technology](#)



Left: an image of the eye retina captured by a specialized fundus camera. Right: a corresponding vessel segmentation map obtained by the model. Such a map gives eye doctors an easier and more reliable way to assess the vessel structure for making a diagnosis. Credit: Modified from *Pattern Recognition Letters* (2025). DOI: 10.1016/j.patrec.2025.01.019

Researchers from a joint Skoltech-University of Sharjah laboratory and AIRI Institute have automated the analysis of retina images used to diagnose diabetic retinopathy. This refers to retinal damage in diabetes patients that can potentially cause permanent blindness.

Depending on the details of the case and the skill of the physician, it can take them anywhere from 10 to 40 minutes to examine the blood vessel network in the retina image and make a diagnosis. In an article [published](#) in *Pattern Recognition Letters*, the team's AI solution delivers the result instantaneously, leaving it to the eye doctor to review and confirm the findings.

Eye care professionals use specialized cameras to take retina images and study them, manually segmenting the photo. This involves differentiating between the background and blood vessels of varying length, width, and tortuosity—the latter refers to a swelling pattern.

Features of the retinal blood vessel network can point to [diabetic retinopathy](#), as well as other eye and cardiovascular diseases—even atherosclerosis. However, manual image segmentation is very difficult, time-consuming, and error-prone.

Now, researchers have automated this daunting task in a way that promises not just to save time for eye doctors but possibly to eliminate some human errors. By training their AI system on a highly reliable sample of double-checked cases studied by top physicians, the team has achieved exceptionally good performance in tests on three state-of-the-art datasets. That includes an accuracy of more than 97% and a sensitivity of more than 84% on the industry-standard database called DRIVE.

"For this research, achieving 97% accuracy is not that difficult due to the nature of the data. It is the sensitivity that matters the most. It reflects the ability of the model to identify microvessels, which the previous models struggled with," the paper's lead author Melaku Getahun, a Skoltech Ph.D. student in the Engineering Systems program, explained.

What makes this kind of segmentation particularly challenging are the fine details in the retinal photos, which have to be accounted for and yet often elude both the [neural networks](#) developed for the task earlier and some of the eye specialists analyzing these images manually.

"In this study, we propose a neural network architecture different from those used by prior approaches, which tend to overlook the microvessels found in the retina," Getahun said. "We also introduced an algorithm for tuning the output of the model by understanding the underlying nature of the retina vessel image data. This helps avoid the misclassification of vessel pixels as background."

One of the challenges faced by the team was the limited size of the dataset: While the images were twice segmented by experts and used to train the neural network, they were quite reliable, there weren't as many of them available as one would ideally want.

"This hindered the model's ability to generalize effectively to unseen data. However, through the careful application of data augmentation and processing techniques, we managed to significantly improve the model's performance," said the study's principal investigator on the Russian side, Senior Research Scientist Oleg Rogov from Skoltech AI, who heads the Reliable and Secure Intelligent Systems group at AIRI.

"Also, even with our new neural network architecture, the issue with certain microvessel pixels getting misclassified as background persisted. To address this, we implemented an adaptive threshold algorithm, which delivered a substantial improvement in sensitivity and accuracy."

Asked about the solution's future prospects, the team commented that the ability to spot tiny unhealthy [blood vessels](#) should be valuable for [clinical use](#). As the system continues to develop, the researchers said, it could become a standard tool for eye disease screening, helping ophthalmologists diagnose conditions faster and more accurately. The work opens

new possibilities for early detection of eye diseases and could lead to better patient outcomes through earlier intervention, because the small vessels often show the first signs of eye-related pathologies.

"This can help in the early diagnosis and prevention of eye diseases that are difficult to treat, such as diabetic retinopathy, which is prevalent in populations with high incidence of diabetes, as well as other related microvessel eye diseases," study co-author and University of Sharjah Professor Rifat Hamoudi added.

The study reported in this story was carried out by the Biomedically Informed Artificial Intelligence Laboratory (BIMAI-Lab), which is a Skoltech-University of Sharjah research laboratory jointly headed by Assistant Professor Maxim Sharaev from Skoltech and Professor Rifat Hamoudi from UoS. BIMAI-Lab's team includes Professor Ahmed Bouridane, the co-investigator of the project at the University of Sharjah, who has extensive expertise in applying artificial intelligence to medical data analytics.

More information: Melaku N. Getahun et al, FS-Net: Full scale network and adaptive threshold for improving extraction of micro-retinal vessel structures, *Pattern Recognition Letters* (2025). DOI: [10.1016/j.patrec.2025.01.019](https://doi.org/10.1016/j.patrec.2025.01.019)
Provided by [Skolkovo Institute of Science and Technology](#)

MARCH 12, 2025

Exoskeleton and digital twin speed up stroke recovery

by [Technical University Munich](#)



Wolfgang Korisanski is one of the 24 patients who have already tested the new exoskeleton and electrical stimulation system for a study. In the background: Hossein Kavarianirad (left) and Neha Das, researchers from Prof. Sandra Hirche's department. Credit: Sabrina Bauer / TUM

Researchers at the Technical University of Munich (TUM) have developed a system that helps patients learn to move their paralyzed arms and hands quickly after a stroke. This requires targeted stimulation of the muscles in the forearm and the support of an exoskeleton. Twenty-four stroke patients have already tested the system at the Schön Klinik Bad Aibling.

The study is [published](#) in *2024 10th IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics (BioRob)*.

The researchers use functional electrical stimulation (FES) to stimulate specific muscles in the forearm. This is necessary, for example, for moving fingers, grasping objects or catching a ball. However, one-sided paralysis following a stroke usually affects not only the

hand, but the entire side of the body. For that reason, a scaffold also supports the entire arm up to the shoulder.

The stroke patients have already used the complete system, consisting of an exoskeleton for the arm and shoulder in combination with FES as part of the ReHyb research project. Half of them were patients at the Schön Klinik Bad Aibling Harthausen, which is leading the study.

The researchers also used a computer game that automatically adapts to the individual player's capabilities. It trains them to grip and move their arms shortly after a stroke by reacting to colored balls flying toward them at varying speeds on a screen. The task is to catch the balls and match them with color-coded boxes.

The secret of success: Digital twin of muscle activity, muscle stimulation strength and an exoskeleton

At the center of TUM Professor Sandra Hirche's setup is a [digital twin](#) that records the individual requirements of each patient and places them in a control loop. Among other things, the researchers have to determine how well each patient can move their arm and hand. In the event of a stroke, for example, paralysis can be caused by damage to the motor area in the brain responsible for movement. However, it is impossible to predict how severely the signals transmitted from the brain to the muscles in the forearm will be impaired after the stroke.

"Individual [muscle](#) strands in the forearm can be stimulated to the right extent for hands and fingers to move," says Prof. Hirche, who holds the Chair of Information-Oriented Control at TUM.

In addition to information on muscle activity in the forearm, the researchers need to know how strongly the muscles should be stimulated in conjunction with the exoskeleton assistance. "We use algorithms to bring this individual information together in a control loop," says the control engineering expert. Consequently, the digital twin is needed to provide individualized support for the arm and hand movements of affected persons.

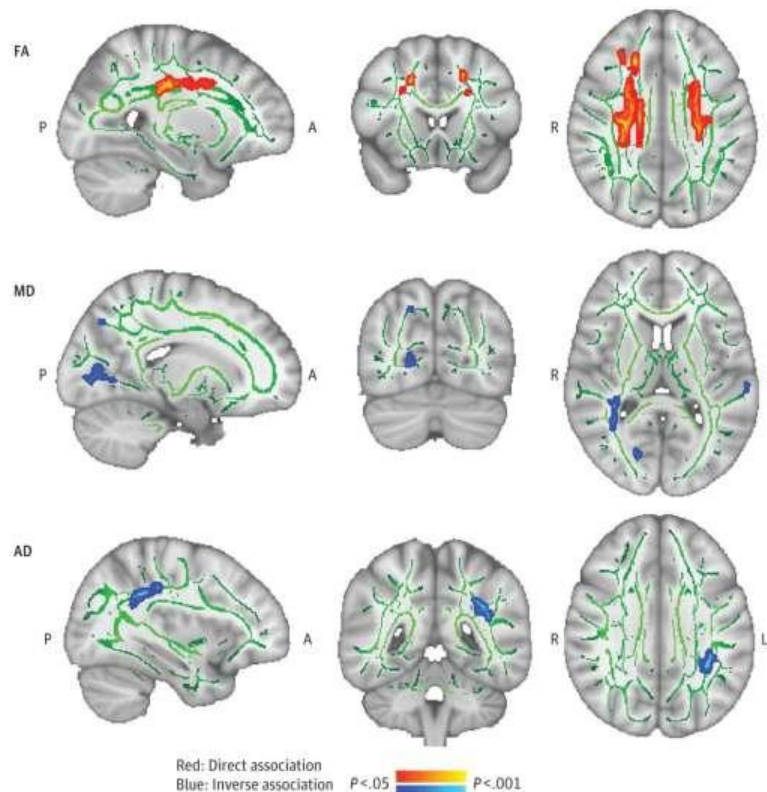
Prof. Hirche uses the phrase "intention-controlled intelligent control" to refer to the fact that patients can use this technology to move as much as they want after a stroke. Carmen Krewer, team lead of the research group at the Schön Klinik cooperation partner in Bad Aibling, states, "Such a modular system with electrical stimulation and exoskeleton has never existed. It also enables stroke sufferers to continue training at home without the support of others."

More information: Neha Das et al, Framework for Learning a Hand Intent Recognition Model from sEMG for FES-Based control, *2024 10th IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics (BioRob)* (2024). DOI: [10.1109/BioRob60516.2024.10719910](https://doi.org/10.1109/BioRob60516.2024.10719910) Provided by [Technical University Munich](#)

MARCH 13, 2025

Lower waist-to-hip ratio in midlife linked to longer lasting cognitive function

by Justin Jackson , Medical Xpress



Longitudinal Change in Alternative Healthy Eating Index–2010 (AHEI-2010) Score Associated With White Matter (WM) Connectivity of Fractional Anisotropy (FA), Mean Diffusivity (MD), and Axial Diffusivity (AD). The panels show familywise error–corrected, threshold-free cluster enhancement statistical maps overlaid on a standard image. Green tracts represent the mean FA skeleton. A indicates anterior; L, left; P, posterior; and R, right. Credit: *JAMA Network Open* (2025). DOI: 10.1001/jamanetworkopen.2025.0171

Researchers from Oxford University, University College London, and collaborating institutions across Germany, France, and the Netherlands, found that diet quality and waist-to-hip ratio during midlife are associated with brain connectivity and cognitive performance in later life. Examining data from the Whitehall II Study, a longitudinal cohort of British civil service workers, the team concluded that healthier diets and lower waist-to-hip ratio during midlife correlate with improved brain health in older age.

Global shifts in [dietary habits](#) have contributed to rising rates of obesity, cardiovascular disease, and diabetes, all of which are linked to an increased risk of dementia. Research into the relationship between diet, metabolic health, and brain function has primarily focused on individual nutrients, with fewer studies assessing overall [diet quality](#) and body fat distribution over extended periods.

Previous studies have suggested that midlife is a critical window for cognitive health interventions, yet long-term study evidence on diet and [brain connectivity](#) remains limited.

In the study, "Association of Diet and Waist-to-Hip Ratio With Brain Connectivity and Memory in Aging," [published](#) in *JAMA Network Open*, researchers conducted a [cohort study](#) using data from the Whitehall II Study at University College London and the Whitehall II Imaging Substudy at the University of Oxford. The study analyzed longitudinal changes in diet quality and waist-to-hip ratio to assess their association with hippocampal connectivity and cognitive function in aging.

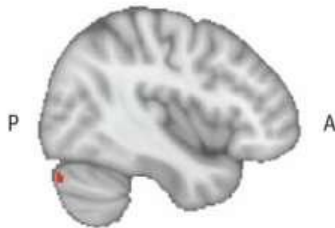
The cohort included 512 participants in the diet quality analysis and 664 in the waist-to-hip ratio analysis. Participants were drawn from the Whitehall II Imaging Study, a subset of the larger Whitehall II Study that has followed over 10,000 British civil service workers since 1985. Data collection for the imaging substudy took place between 2012 and 2016, with brain imaging and cognitive assessments performed at an average age of 70 years.

Researchers assessed diet quality using the Alternative Healthy Eating Index–2010 (AHEI-2010), a scoring system designed to evaluate overall dietary intake. Waist-to-hip ratio was measured at five time points over a 21-year period.

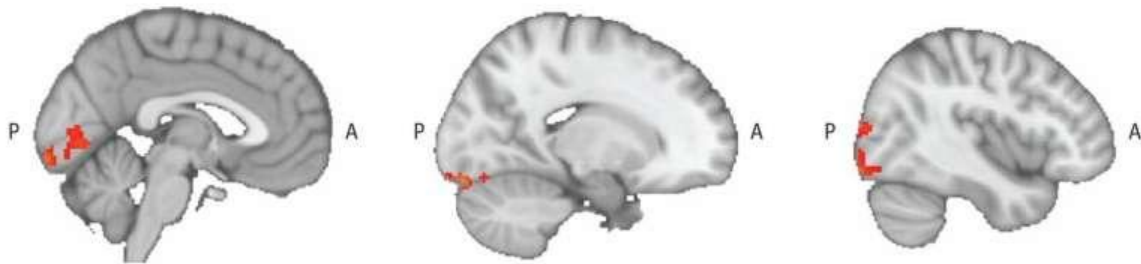
Structural and functional brain connectivity was assessed using diffusion tensor imaging (DTI) and resting-state functional magnetic resonance imaging (fMRI). Cognitive function was measured using tests of working memory, executive function, and fluency.

Higher AHEI-2010 scores in midlife and across middle to older age were associated with increased hippocampal functional connectivity to the occipital lobe and cerebellum. Higher diet quality was also linked to better white matter integrity, as indicated by higher fractional anisotropy and lower mean diffusivity in brain scans.

A Small cluster in the right cerebellum



B Bigger clusters in the occipital lobe and right cerebellum



Red: Direct association $P < .05$ $P < .001$

Association Between the Intercept of the Alternative Healthy Eating Index–2010 (AHEI-2010) Score and Hippocampal Functional Connectivity. A, Higher functional connectivity of the right hippocampus to a small cluster in the right cerebellum was associated with higher AHEI-2010 scores in midlife (ie, the intercept measured 21 years before the magnetic resonance imaging scan). B, Higher functional connectivity of the left hippocampus to bigger clusters in the occipital lobe and the right cerebellum was associated with higher AHEI-2010 scores in midlife. Images show familywise error–corrected, threshold-free cluster enhancement statistical maps overlaid on a template. A indicates anterior; P, posterior. Credit: *JAMA Network Open* (2025). DOI: 10.1001/jamanetworkopen.2025.0171 Healthier diet quality in midlife was associated with better working memory, executive function, and overall cognitive performance, with improvements in working memory and executive function partially explained by better white matter integrity.

Higher waist-to-hip ratio in midlife was associated with widespread decreases in white matter integrity. Higher waist-to-hip ratio correlated with increased mean diffusivity and radial diffusivity in major white matter tracts, including the cingulum and inferior longitudinal fasciculus, which are implicated in memory and executive function. Reduced fractional anisotropy in these regions was linked to poorer [cognitive performance](#). Mediation analyses indicated that the association between waist-to-hip ratio and cognitive decline was partially explained by changes in white matter connectivity.

Findings suggest that diet quality and abdominal obesity in midlife are predictive of brain connectivity and cognitive function in later life.

In an invited commentary, "Midlife Dietary Quality and Body Composition Relevance for Brain Connectivity and Cognitive Performance in Later Life," [published](#) alongside the study in *JAMA Network Open*, Sharmili Edwin Thanarajah, MD, from Goethe University Frankfurt,

contextualized the findings within the broader public health challenge of dementia prevention.

Public health challenges related to obesity and poor diet require systemic interventions beyond individual choices. Thanarajah pointed to the worsening global obesity rates, where approximately 43% of adults and 20% of children are overweight, as a barrier to implementing effective cognitive health strategies. Strategies focused solely on personal responsibility may not be sufficient if food environments continue to promote high-calorie, nutrient-poor diets.

Sex differences in dietary behavior and metabolism were identified as a key gap in the current study. With only 20% of participants being female, the study leaves questions about whether the observed diet-brain associations apply equally to women. Differences in body fat distribution, hormonal influences on metabolism, and potential variations in brain aging between sexes warrant further study.

Thanarajah also noted that while higher alcohol consumption was associated with poorer dietary quality in the cohort, its role as an independent factor in brain aging remains difficult to disentangle. Alcohol's effects on white matter integrity, vascular health, and inflammation could complicate interpretations of diet-related cognitive outcomes. Future studies may benefit from more detailed assessments of alcohol intake patterns in relation to both diet and [brain function](#).

Longitudinal studies like this one suggest that dietary improvements in midlife may benefit brain structure and function decades later, yet demonstrating causality remains challenging. Thanarajah argues that intervention studies targeting diet and obesity during midlife are needed to confirm whether modifying these factors can directly alter brain aging trajectories.

More information: Daria E. A. Jensen et al, Association of Diet and Waist-to-Hip Ratio With Brain Connectivity and Memory in Aging, *JAMA Network Open* (2025). DOI: [10.1001/jamanetworkopen.2025.0171](https://doi.org/10.1001/jamanetworkopen.2025.0171)

Sharmili Edwin Thanarajah, Midlife Dietary Quality and Body Composition Relevance for Brain Connectivity and Cognitive Performance in Later Life, *JAMA Network Open* (2025). DOI: [10.1001/jamanetworkopen.2025.0181](https://doi.org/10.1001/jamanetworkopen.2025.0181)
Journal information: [JAMA Network Open](#)

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MARCH 19, 2025

Thermal imaging could be a simple, highly accurate way to track vital signs

by Joshua Stewart, [Georgia Institute of Technology](#)



The image immediately above shows the additional detail and contours of temperature and shirt material in a processed phasor thermographic image. Credit: Candler Hobbs, Dingding Han

Biomedical engineers at Georgia Tech have developed a system for collecting and processing thermal images that allows for reliable, detailed measurement of vital signs such as respiration and heart rate or body temperature.

Their monitoring approach is passive and requires no contact. The system could one day lead to early detection for cancer or other diseases by flagging subtle changes in body tissues.

The researchers have overcome the spectral ambiguity inherent in conventional thermal imaging, sharpening the texture and detail they can extract from images and removing the effects of heat from the environment surrounding a subject. They have [published](#) details of their work in the journal *Cell Reports Physical Science*.

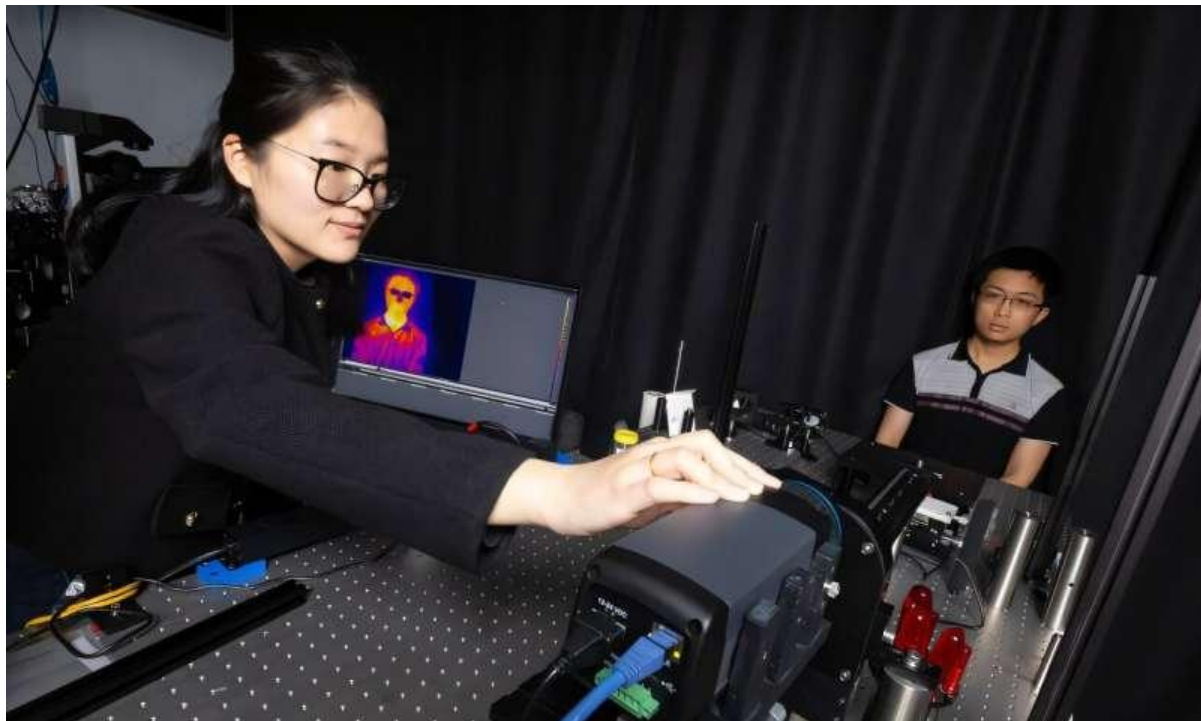
"This could be a cornerstone for future broad biomedical diagnosis," said Dingding Han, lead author on the study and a postdoctoral scholar in the George W. Woodruff School of Mechanical Engineering. "With this phasor thermographic technology, we can enhance the accuracy and efficiency of thermal imaging to detect abnormalities. Phasor thermography has the capability of getting material segmentation, which is not possible with only pure thermal imaging."

What drives the improvement in Han's system is its ability to eliminate the "fuzziness" of typical [thermal images](#). Usually, they don't sharply differentiate between subtle temperature variations, and heat in the environment can make the images too noisy for precise measurement of physiological signals.

In the study, the researchers showed they were able to precisely measure heart rate, respiration rate, and body temperature from multiple parts of the body. They reported the tool effectively differentiated vital signs in scenes with multiple people. It also accurately captured variations in respiration rate before and after exercise.

ADVERTISING

Han and the research team used a series of filters to capture 10 images of different parts of the infrared spectrum—specifically long-wavelength infrared. This part of the electromagnetic spectrum is beyond the light visible with the human eye. Long-wavelength infrared is the area where thermal radiation is detected.



Postdoctoral scholar Dingding Han adjusts a thermal camera capturing an image of Ph.D. student Corey Zheng. Using an advanced processing technique on the raw thermal image, Han, Zheng, and their collaborators can accurately measure body temperature, heart rate,

and respiration rate. Their noncontact technology could open new possibilities for vital sign monitoring and early disease detection. Credit: Candler Hobbs

With those 10 images, they deployed a powerful mathematical tool borrowed from signal processing called thermal phasor analysis. Their algorithms resolved textures in three dimensions smaller than a millimeter. That detail enabled them to effectively distinguish fine thermal variations—for example, facial skin, thick hair near the scalp, thinner hair of eyebrows, and even metal rims of eyeglasses on a human subject.

What's more, Han said, the system uses common equipment, making it powerfully adaptable.

"We used a thermal camera and the filters to get the hyperspectral image data. So, it's scalable," she said. "You could integrate this setup into virtually any thermal imaging platform."

As a result, Han said the system could easily integrate into hospital or other health care settings. She's working to further develop her [prototype system](#) and work with doctors to apply it specifically to spotting breast cancer tumors.

"Thermography could give us an advantage in early detection, because it could noninvasively detect abnormal cell activity that indicates early cancer," Han said. "For example, [tumor cells](#) need more oxygen to reproduce, so their temperature will be a little bit higher than normal tissue. With this phasor thermography approach, we could spot that."

Han developed the system while working in Shu Jia's lab in the Wallace H. Coulter Department of Biomedical Engineering. Jia is the senior author on the study describing the system; other co-authors are Ph.D. students Corey Zheng and Zhi Ling.

"This can be the first step for the next generation of biomedical thermography for early detection and diagnosis of cancer. That's what I'm working toward," Han said. "It's the first prototype with an ultimate goal of evolving the next versions and making it easier to use in hospitals and clinics."

More information: Dingding Han et al, Hyperspectral phasor thermography, *Cell Reports Physical Science* (2025). DOI: [10.1016/j.xcrp.2025.102501](https://doi.org/10.1016/j.xcrp.2025.102501)

Journal information: [Cell Reports Physical Science](#)

Provided by [Georgia Institute of Technology](#)

How our lungs back up the bone marrow to make our blood

Scientists at the University of California, San Francisco uncovered a lung-based stem cell reservoir that can restore bone marrow.

From University of California – San Francisco 14/03/25 (first released 27/02/25)



Illustration by Superinnovators x AI

Red blood cells carry oxygen from the lungs to every other organ, and blood-forming stem cells must make about 200 billion new red blood cells each day to keep the oxygen flowing.

For many years, scientists assumed that blood production took place in the bone marrow.

But now, researchers at UCSF are showing it's also happening in the lungs.

They found hematopoietic stem cells (HSCs) in human lung tissue that make red blood cells, as well as megakaryocytes, which produce the platelets that form blood clots.

The findings appear Feb. 27 in *Blood*.

The work, which was supported by the National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health (NIH), suggests the lungs could be a potent source for life-saving stem cell transplants.

“For decades, bone marrow transplants have been a lynchpin in the treatment of cancers like leukemia,” said Mark Looney, MD, professor of medicine and laboratory medicine at UCSF and senior author of the paper.

“The lung HSCs could prove to be a second and significant reservoir of these precious stem cells.”

From mouse to human

In 2017, the UCSF team found cells in the mouse lung making 50% of the mouse’s platelets.

They also discovered lung stem cells in mice that made all the constituents of blood, including red blood cells, megakaryocytes and several types of immune cells.

Looney’s group wanted to prove this was also happening in people.

So, they obtained donated samples of lung, bone marrow and blood, and compared what they found in each tissue.

Screening a golf-ball-sized volume of lung tissue, the scientists found stem cells in the lung that strongly resembled the well-known HSCs of bone marrow.

Surprisingly, the HSCs were found at similar rates in both lung and bone marrow.

“The lung HSCs weren’t one-offs – they were a reliable presence in the lungs,” said Catharina Conrad, MD, PhD, postdoctoral scholar in Looney’s lab and first author of the paper.

“But we still needed to know that they were actually capable of making blood.”

So, the scientists coaxed lung and bone marrow HSCs to mature in petri dishes and found the lung HSCs were productive just like the bone marrow HSCs.

“Both types of HSCs thrived in our gold-standard stem cell experiment, but the lung HSC colonies made more red blood cells and megakaryocytes, while the bone marrow colonies tended to make more immune cells,” Looney said.

The human lung HSCs also could restore bone marrow in HSC-deficient mice.

The discovery confirmed Looney’s earlier discovery that the mouse lung and bone marrow complemented one another in producing blood, even sending stem cells to restore one another.

“We think these HSCs could be a reservoir of hematopoiesis in a particular organ, in this case the lung, that gets activated whenever the body needs more of any part of the blood, whether it’s platelets, red blood cells or immune cells,” Looney said.

Getting to know the new HSC in town

To show that the lung HSCs truly resided in the lung, and weren’t just escapees from the bone marrow, Conrad and Looney looked for the HSCs in human lung tissue samples.

They found them between blood vessels in an arrangement that was reminiscent of what’s seen in bone marrow.

“They really seem to live there and aren’t just passing through,” Conrad said.

Lastly, the team analyzed the output of routine bone marrow transplants, which today begin with a blood draw from a donor followed by a screen for stem cells.

Remarkably, nearly a fifth of the stem cells isolated for bone marrow transplant carried the signature of lung HSCs – suggesting that cells in “bone marrow transplants” aren’t only from bone marrow.

There’s a lot more to learn about the lung HSCs.

Could the different pools of HSCs serve different therapeutic roles in medicine?

Why do the lungs themselves need to make blood?

“The lungs are critical to blood circulation, so it’s tantalizing to see the lung HSCs as an emergency reservoir for red blood cell and platelet production,” Looney said.

“Now that we know they exist, it opens up a lot of new opportunities for a therapy, hematopoietic stem cell transplantation, that is very commonly used for patients with the need.”

Authors: Other UCSF authors are Mélia Magnen, PhD, Jessica Tsui, Harrison Wismer, Mohammad Naser, MSc, Urmila Venkataramani, Bushra Samad, MS, Simon J. Cleary, PhD, Longhui Qiu, Jennifer J. Tian, MA, Marco De Giovanni, PhD, Andrew D. Leavitt, MD, and Alexis J. Combes, PhD.

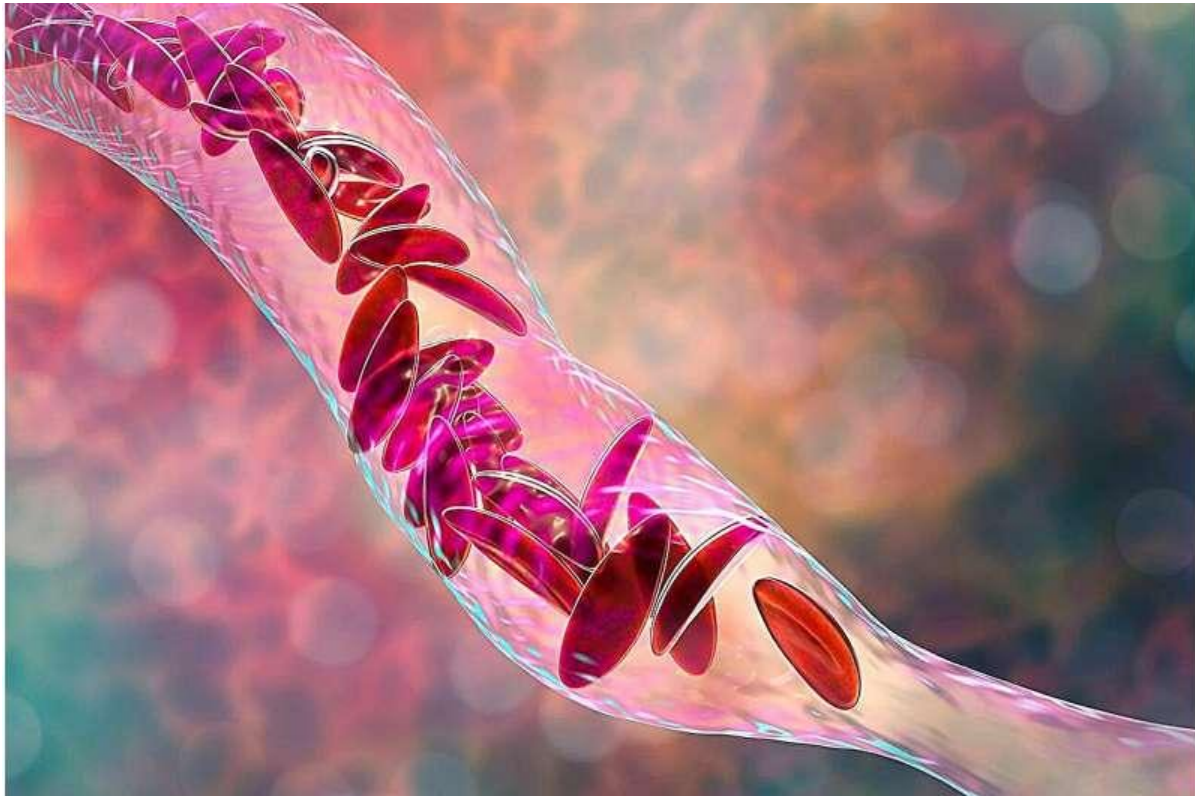
For all authors see the paper.

Funding: This work was supported in part by the Wellcome Trust, the UKRI Medical Research Council, the National Institutes of Health (R35HL161241, 1S10OD028511-01).

MARCH 17, 2025

First patient in New York has been cured of sickle cell anemia with advanced treatment

by I. Edwards



For 21 years, Sebastien Beauzile lived with the chronic pain of sickle cell anemia. Now, thanks to a groundbreaking genetic treatment, he is the first person in New York to be cured of the disease.

"Sickle cell was like a blockade for me, but now it's just like a wall that I just jumped over," Beauzile said in a report published by CBS News.

The hospital used an advanced therapy called Lyfgenia, which modifies a patient's own bone marrow to produce healthy red blood cells.

"When we could use Sebastien's own stem cells to do this therapy, we were delighted," said Dr. Banu Aygun, a New York-based physician who specializes in Pediatric Hematology Oncology at Northwell Health in New Hyde Park, N.Y.

Sickle cell anemia, first described in 1910, primarily affects people of African, Mediterranean and Middle Eastern descent.

"Here we are over 100 years later, and this is the first cure you are seeing," said Dr. Jeffrey Lipton, another physician who specializes in Pediatric Hematology Oncology at Northwell Health.

Doctors at Cohen Children's Medical Center say they are excited to offer this life-changing therapy to more patients.

"We feel blessed to be able to offer, be the first ones to be able to offer this," Dr. Jonathan Davi Fish, a pediatric hematologist/oncologist at Northwell Health, added.

"Sebastien has been coming to this hospital since he was two months old. "There are not enough words to show you how grateful I am," Magda Lamour, Beauzile's mother, told CBS News.

Now free from the disease, Beauzile looks forward to traveling, exercising and pursuing his education. He hopes to work in the medical field.

"I can't wait to get back to my day-to-day life because now I feel unstoppable," he said.

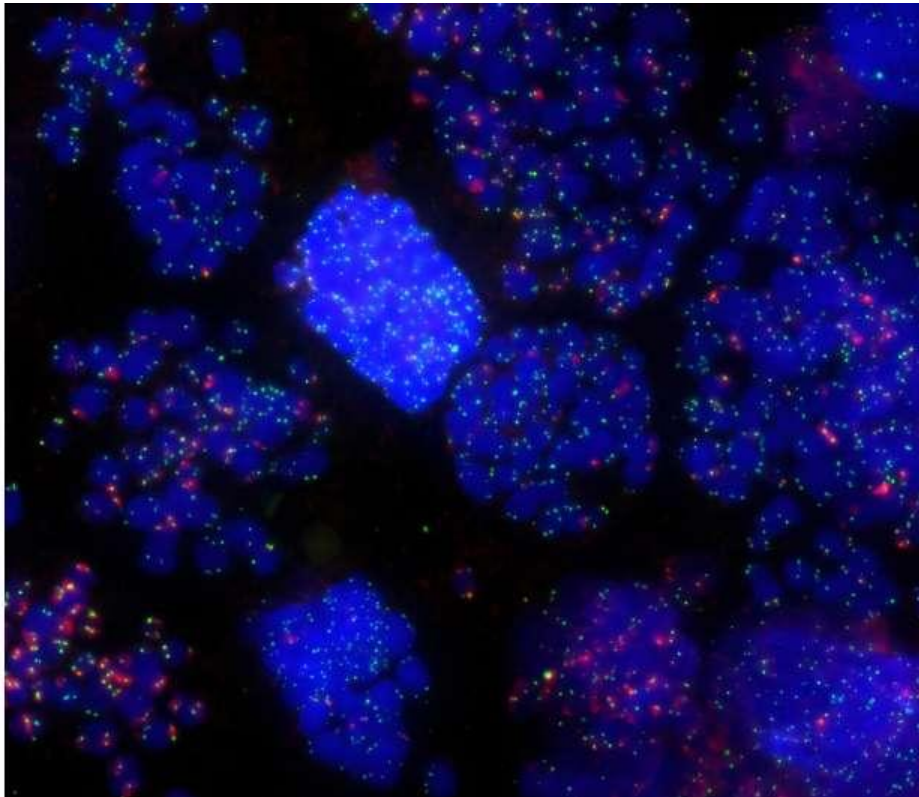
In [support](#) of continued sickle cell treatment efforts, civil rights attorney Ben Crump announced a \$100,000 donation to Northwell Health.

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MARCH 17, 2025

Unexpected discovery shows how cells use telomeres to avoid cancer

by Children's Medical Research Institute



Credit: Genome Integrity Unit at CMRI

Cancer researchers at Children's Medical Research Institute have discovered an "unexpected mechanism" that our cells use to avoid cancer.

Telomeres are the protective caps at chromosome ends and are involved in aging and cancer. As we age, [telomere length](#) naturally decreases. Over the course of a lifetime, telomere shortening instructs aging cells to stop dividing. This normally functions as a critical barrier to stop cancer.

Professor Tony Cesare's Genome Integrity Unit at CMRI are experts in this area. In this latest [publication](#) in *Nature Communications*, Prof. Cesare and his team worked with their collaborators at the University of Kyoto to understand the "active" role that telomeres can play in avoiding cancer.

"Most people think of telomeres as a passive entity that shorten with [cell division](#); this is a passive fail-safe used during aging," Prof. Cesare said. "Our data shows telomeres are much more active. They can acutely respond to stress and actively open up to turn on a cellular response that looks like aging. They do this to avoid cancer.

"This can lead to cell cycle arrest, or death, to prevent these damaged cells with chromosome errors from dividing further. This suggests telomeres have another anti-cancer mechanism that was previously unknown."

Prof. Cesare said as well as this being an important discovery for the telomere field—this could allow researchers to potentially target [telomeres](#) to induce [cell death](#) in [cancer treatment](#).

More information: Diana Romero-Zamora et al, A CPC-shelterin-BTR axis regulates mitotic telomere deprotection, *Nature Communications* (2025). DOI: [10.1038/s41467-025-57456-8](https://doi.org/10.1038/s41467-025-57456-8)

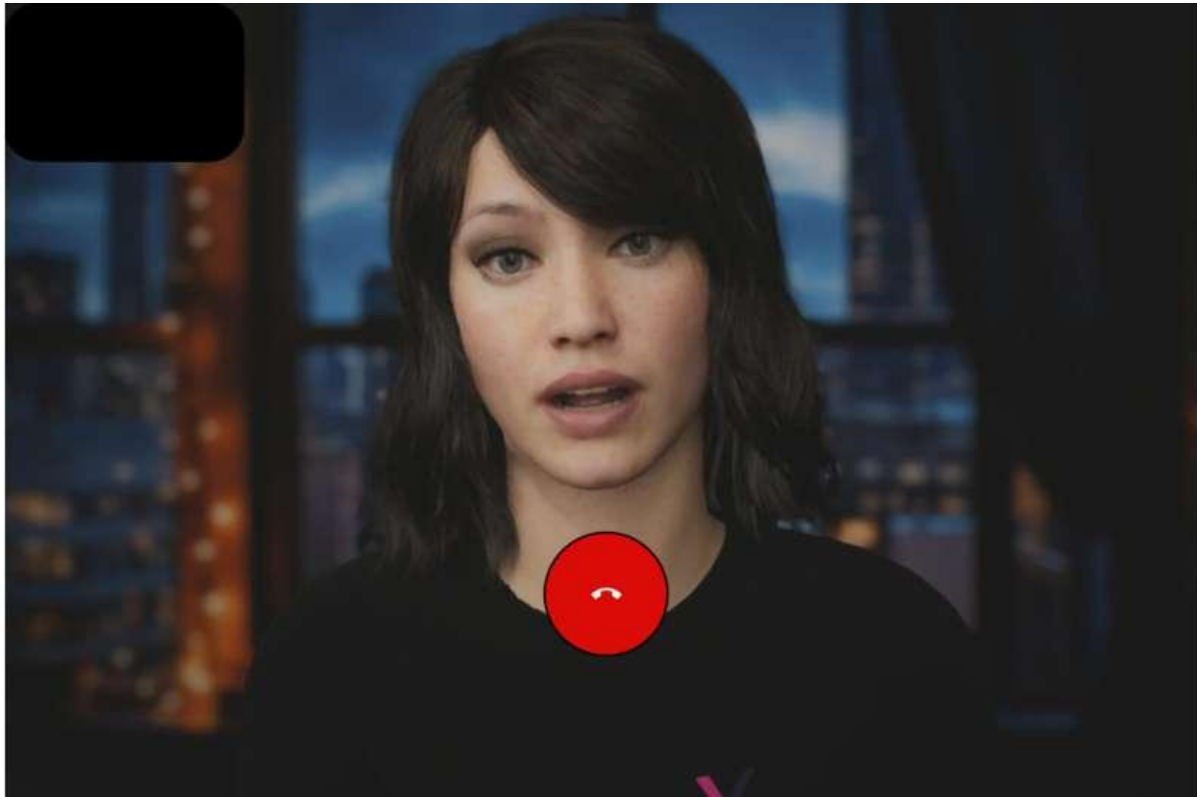
Journal information: [Nature Communications](#)

Provided by Children's Medical Research Institute

MARCH 17, 2025

As AI nurses reshape hospital care, human nurses are pushing back

by Matthew Perrone



This March 2025 image from the website of artificial intelligence company Xoltar shows a demonstration of one of their avatars for conducting video calls with a patients. Credit: Xoltar via AP

The next time you're due for a medical exam you may get a call from someone like Ana: a friendly voice that can help you prepare for your appointment and answer any pressing questions you might have.

With her calm, warm demeanor, Ana has been trained to put patients at ease—like many nurses across the U.S. But unlike them, she is also available to chat 24-7, in multiple languages, from Hindi to Haitian Creole.

That's because [Ana isn't human](#), but an artificial intelligence program created by Hippocratic AI, one of a number of new companies offering ways to automate time-consuming tasks usually performed by nurses and medical assistants.

It's the most visible sign of AI's inroads into health care, where hundreds of hospitals are using increasingly sophisticated computer programs to monitor patients' vital signs, flag emergency situations and trigger step-by-step action plans for care—jobs that were all previously handled by nurses and other [health professionals](#).

Hospitals say AI is helping their nurses work more efficiently while addressing burnout and understaffing. But nursing unions argue that this poorly understood technology is overriding nurses' expertise and degrading the quality of care patients receive.

"Hospitals have been waiting for the moment when they have something that appears to have enough legitimacy to replace nurses," said Michelle Mahon of National Nurses United. "The entire ecosystem is designed to automate, de-skill and ultimately replace caregivers."

Mahon's group, the largest nursing union in the U.S., has helped organize more than 20 demonstrations at hospitals across the country, pushing for the right to have say in how AI can be used—and protection from discipline if nurses decide to disregard automated advice. The group raised new alarms in January when Robert F. Kennedy Jr., the incoming health secretary, suggested AI nurses "as good as any doctor" could help deliver care in rural areas. On Friday, Dr. Mehmet Oz, who's been nominated to oversee Medicare and Medicaid, said he believes AI can "liberate doctors and nurses from all the paperwork."

Hippocratic AI initially promoted a rate of \$9 an hour for its AI assistants, compared with about \$40 an hour for a registered nurse. It has since dropped that language, instead touting its services and seeking to assure customers that they have been carefully tested. The company did not grant requests for an interview.



In this photo provided by National Nurses United, Melissa Beebe, foreground, and other nurses hold a rally in San Francisco on April 22, 2024, to highlight safety concerns about using artificial intelligence in health care. Credit: National Nurses United via AP

AI in the hospital can generate false alarms and dangerous advice

Hospitals have been experimenting for years with technology designed to improve care and streamline costs, including sensors, microphones and motion-sensing cameras. Now that data is being linked with [electronic medical records](#) and analyzed in an effort to predict [medical problems](#) and direct nurses' care—sometimes before they've evaluated the patient themselves.

Adam Hart was working in the emergency room at Dignity Health in Henderson, Nevada, when the hospital's computer system flagged a newly arrived patient for sepsis, a life-threatening reaction to infection. Under the hospital's protocol, he was supposed to immediately administer a large dose of IV fluids. But after further examination, Hart determined that he was treating a dialysis patient, or someone with kidney failure. Such patients have to be carefully managed to avoid overloading their kidneys with fluid.

Hart raised his concern with the supervising nurse but was told to just follow the standard protocol. Only after a nearby physician intervened did the patient instead begin to receive a slow infusion of IV fluids.

"You need to keep your thinking cap on— that's why you're being paid as a nurse," Hart said. "Turning over our thought processes to these devices is reckless and dangerous."

Hart and other nurses say they understand the goal of AI: to make it easier for nurses to monitor multiple patients and quickly respond to problems. But the reality is often a barrage of false alarms, sometimes erroneously flagging basic bodily functions—such as a patient having a bowel movement—as an emergency.

"You're trying to focus on your work but then you're getting all these distracting alerts that may or may not mean something," said Melissa Beebe, a cancer nurse at UC Davis Medical Center in Sacramento. "It's hard to even tell when it's accurate and when it's not because there are so many false alarms."

Sarah



Personality: Empathetic and professional, Sarah is ideal for those seeking friendly and supportive interaction. She listens attentively and responds thoughtfully.

Vibe: Calm and approachable, creates a welcoming space where you can comfortably express yourself.

TALK TO SARAH

Carlos



Personalidad: Extrovertido y lleno de energía, Carlos aporta entusiasmo a cada conversación, asegurando una interacción divertida y dinámica.

Ambiente: Carlos crea un ambiente animado, perfecto para quienes disfrutan de una compañía alegre y vibrante.

HABLA CON CARLOS

This March 2025 image from the website of artificial intelligence company Xoltar, shows two of their demonstration avatars for conducting video calls with patients. Credit: Xoltar via AP

Can AI help in the hospital?

Even the most sophisticated technology will miss signs that nurses routinely pick up on, such as [facial expressions](#) and odors, notes Michelle Collins, dean of Loyola University's College of Nursing. But people aren't perfect either.

"It would be foolish to turn our back on this completely," Collins said. "We should embrace what it can do to augment our care, but we should also be careful it doesn't replace the human element."

More than 100,000 nurses left the workforce during the COVID-19 pandemic, according to one estimate, the biggest staffing drop in 40 years. As the U.S. population ages and nurses retire, the U.S. government estimates there will be more than 190,000 new openings for nurses every year through 2032.

Faced with this trend, hospital administrators see AI filling a vital role: not taking over care, but helping [nurses](#) and doctors gather information and communicate with patients.

'Sometimes they are talking to a human and sometimes they're not'

At the University of Arkansas Medical Sciences in Little Rock, staffers need to make hundreds of calls every week to prepare patients for surgery. Nurses confirm information about prescriptions, heart conditions and other issues—like sleep apnea—that must be carefully reviewed before anesthesia.

The problem: many patients only answer their phones in the evening, usually between dinner and their children's bedtime.



In this photo provided by National Nurses United, nurses hold a rally in San Francisco on April 22, 2024, to highlight safety concerns about using artificial intelligence in health care.

Credit: National Nurses United via AP

"So what we need to do is find a way to call several hundred people in a 120-minute window—but I really don't want to pay my staff overtime to do so," said Dr. Joseph Sanford, who oversees the center's health IT.

Since January, the hospital has used an AI assistant from Qventus to contact patients and health providers, send and receive medical records and summarize their contents for human staffers. Qventus says 115 hospitals are using its technology, which aims to boost [hospital](#) earnings through quicker surgical turnarounds, fewer cancellations and reduced burnout.

Each call begins with the program identifying itself as an AI assistant.

"We always want to be fully transparent with our patients that sometimes they are talking to a human and sometimes they're not," Sanford said.

While companies like Qventus are providing an administrative service, other AI developers see a bigger role for their technology.

Israeli startup Xoltar specializes in humanlike avatars that conduct video calls with patients. The company is working with the Mayo Clinic on an AI assistant that teaches patients cognitive techniques for managing chronic pain. The company is also developing an avatar to help smokers quit. In early testing, patients spend about 14 minutes talking to the

program, which can pickup on facial expressions, body language and other cues, according to Xoltar.

Nursing experts who study AI say such programs may work for people who are relatively healthy and proactive about their care. But that's not most people in the health system.

"It's the very sick who are taking up the bulk of health care in the U.S. and whether or not chatbots are positioned for those folks is something we really have to consider," said Roschelle Fritz of the University of California Davis School of Nursing.

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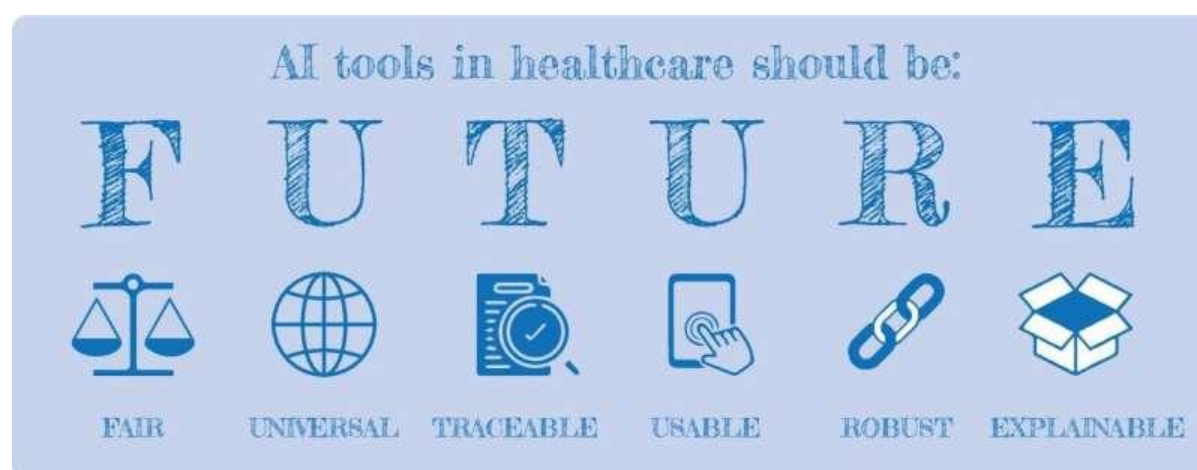
Explore further

[Sacramento nurses call for safeguards against AI-based technology in hospitals](#)

MARCH 17, 2025

New guidelines establish framework for trustworthy AI in health care

by [NDORMS, University of Oxford](#)



The six guiding principles of using AI tools in healthcare. Credit: FUTURE-AI consortium
A new set of guidelines have been launched to create trustworthy AI systems in health care. The first of its kind, the FUTURE-AI guideline provides recommendations covering the entire lifecycle of medical AI, from design, development and validation to regulation, deployment, and monitoring.

In recent years, [artificial intelligence](#) (AI) has made significant strides in health care, helping with tasks like disease diagnosis and predicting treatment outcomes. However, despite these advances, many health care professionals and patients are still hesitant to fully embrace AI technologies. This hesitation largely stems from concerns about trust, safety, and ethics.

In particular, existing research has shown that AI tools in health care can be prone to errors and patient harm, biases and increased health inequalities, lack of transparency and accountability, as well as data privacy and security breaches.

To overcome these challenges the FUTURE-AI Consortium has developed a comprehensive set of guidelines [published](#) in the *BMJ*. Developed by an [international consortium](#) of 117 experts from 50 countries the new guidelines called FUTURE-AI provide a roadmap for creating trustworthy and responsible AI tools for health care.

The FUTURE-AI guidelines are built around six guiding principles:

1. Fairness: AI should treat all patients equitably and without bias.
2. Universality: AI solutions should be applicable across different health care contexts and populations.
3. Traceability: It should be possible to track how AI systems make decisions.
4. Usability: AI tools must be user-friendly for [health care professionals](#) and patients alike.
5. Robustness: AI systems should perform reliably under various conditions.
6. Explainability: Patients and clinicians need clear explanations of how AI arrives at its conclusions.

Gary Collins, Professor of Medical Statistics at the Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences (NDORMS), University of Oxford, and author of FUTURE-AI said, "These guidelines fill an important gap in the field of health care AI to give clinicians, [patients](#), and [health authorities](#) the confidence to adopt AI tools knowing they are technically sound, clinically safe, and ethically aligned. The FUTURE-AI framework is designed to evolve over time, adapting to new technologies, challenges, and stakeholder feedback. This dynamic approach ensures the guidelines remain relevant and useful as the field of health care AI continues to rapidly advance."

More information: Karim Lekadir et al, FUTURE-AI: international consensus guideline for trustworthy and deployable artificial intelligence in healthcare, *BMJ* (2025). DOI: [10.1136/bmj-2024-081554](https://doi.org/10.1136/bmj-2024-081554)

Journal information: [British Medical Journal \(BMJ\)](#)
Provided by [NDORMS, University of Oxford](#)

New thesis investigates the role of memory T cells in viral infections and their importance for long-term immunity

Lymph node

T cell zone
 ↑ CCL19, CCL21
 ↓ CXCL13

B cell follicle
 ↓ CCL19, CCL21
 ↑ CXCL13

Germinal center
 B cell maturation and somatic hypermutation

Light zone

Dark zone
 B cell

APC
 MHCII/TCR
 T cell
 Activation, migration

T_H cell
 CXCR5
 CD40/CD40L
 ICOS/ICOSL
 B cell

FDC
 PD-1
 T_H cell
 B cell

Memory B cell

Plasmablast
 Antibodies

T_H cell

BCL6, ICOS, CXCR5, CXCL13, PD-1

https://openarchive.ki.se/articles/thesis/Circulating_and_memory_T_cell_functions_in_viral_diseases/28194287/2?file=52417223

What is the main focus of your thesis?

222

these memory T cells work in different viral infections, with a focus on Epstein-Barr virus (EBV), Human Immunodeficiency virus (HIV) and SARS-CoV-2 virus.

First, we discovered that a specific type of T cell (CXCR5⁺ CD8⁺) resides in the tonsils, where EBV persists in the body, suggesting a role in controlling latent infection. Second, our findings indicate that in people living with HIV, the T cell compartment does not fully recover after therapy, neither in the blood nor in the gut—where we also show HIV is more commonly hidden.

Finally, we show that functional T cell responses develop following SARS-CoV-2 infection, and that COVID-19 vaccination enhances both the frequency and function of these cells, contributing to long-lasting immunity.

By exploring how different immune cells fight viral infections, this research aims to improve our understanding of immunity and contribute to the development of future vaccines and treatments against viral infections.

What are your future ambitions?

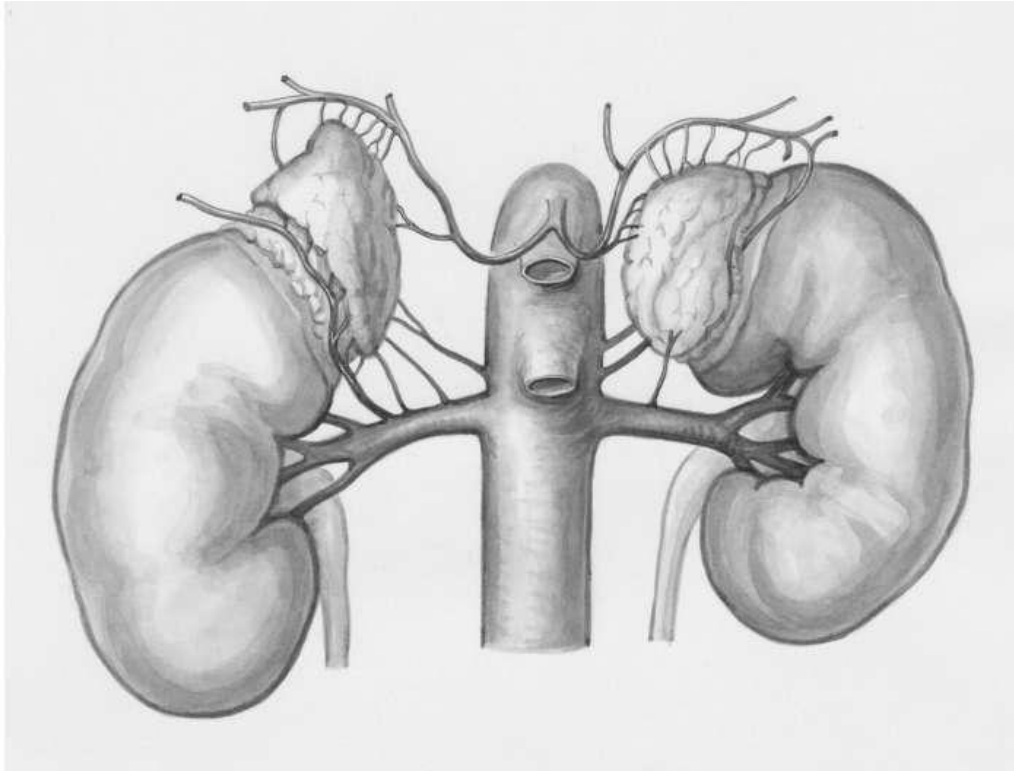
I would like to apply the scientific, analytical, and soft skills I have developed during my Ph.D. to a different field of work. Among the various viral infections I have studied over the years, I am particularly interested in HIV infection. I am eager to continue my career in a role where I can contribute to improving global access to HIV treatments and make a meaningful impact on public health.

More information: Circulating and Resident Memory T cell functions in viral diseases. openarchive.ki.se/articles/the ... 4287/2?file=52417223
Provided by [Karolinska Institutet](#)

MARCH 31, 2025

Tirzepatide benefits people with obesity, kidney disease and heart failure

by [American College of Cardiology](#)



Credit: Unsplash/CC0 Public Domain

The drug tirzepatide improved kidney function and cardiovascular outcomes among patients with obesity and heart failure with preserved ejection fraction (HFpEF) compared with placebo at one year, according to featured clinical research presented at the [American College of Cardiology's Annual Scientific Session \(ACC.25\)](#) and simultaneously published in *JACC*.

The overall rate of cardiovascular death or worsening [heart failure](#), the trial's primary endpoint, was higher in the 60% of study participants who also had [chronic kidney disease](#). However, tirzepatide reduced the risk of the primary endpoint to a similar degree in patients with and without kidney disease.

In the new analysis of data from the SUMMIT trial, researchers focused on patients with obesity, chronic kidney disease and HFpEF because they commonly have interacting root causes and are associated with poor outcomes, indicating a significant unmet need.

"The interplay of these three conditions identifies a patient population as exceptionally high risk, which means it's a patient population that is exceptionally in need of treatments that work," said Milton Packer, MD, Distinguished Scholar in Cardiovascular Science at Baylor University Medical Center in Dallas and the study's first author. "This drug improves kidney function, obesity and HFpEF outcomes, thus improving all three elements that interact to create this syndrome."

HFpEF occurs when the heart muscle cannot enlarge sufficiently to accommodate the blood it receives, causing pressure in the heart to become elevated. Chronic kidney disease occurs when the kidneys do not filter waste from the blood as they should, leading to a buildup of toxins. Both are [chronic conditions](#) that progressively worsen over time.

Tirzepatide targets two receptors in order to shrink fat cells and reduce the impacts that enlarged fat cells have on heart and kidney health. The drug is approved by the U.S. Food and Drug Administration for treating obesity through its impact on weight loss, as well as for treating Type 2 diabetes through its impact on blood sugar levels.

Previous studies have shown improved kidney function with other drugs in the same class, but this trial is the first to assess tirzepatide's impact on kidney and [cardiovascular outcomes](#) in people with obesity, chronic kidney disease and HFpEF, a triad of conditions estimated to affect about 2 million to 3 million U.S. adults.

The SUMMIT trial enrolled 731 patients with HFpEF and a body mass index of 30 m²/kg or higher. About 60% of the study participants also had chronic kidney disease. Half were randomly assigned to receive tirzepatide and half received a placebo. Neither patients nor their clinicians were aware of which regimen they had been assigned.

At one year, patients taking tirzepatide had a 38% lower rate of cardiovascular death or worsening heart failure (defined as worsening heart failure symptoms in addition to hospitalization or the intensification of diuretic medications) compared with the placebo group. Participants taking tirzepatide also had a better average Kansas City Cardiomyopathy Questionnaire Clinical Summary Score (KCCQ-CSS) than the [placebo group](#), showing a significant improvement in terms of the study's second primary endpoint, a measure of heart failure severity.

For both of these primary endpoints, researchers observed similar improvement with tirzepatide in patients with and without chronic kidney disease. Overall, participants with chronic kidney disease faced poorer outcomes across multiple metrics compared to participants without chronic kidney disease, experiencing more severe heart failure symptoms on average and seeing twice the risk of worsening heart failure during the study.

The researchers used two strategies for assessing kidney function, measuring creatinine and cystatin C at 12, 24 and 52 weeks. Ultimately, participants taking tirzepatide showed significant improvements over those taking placebo in terms of both markers of kidney function, although the results showed different patterns over time and among different patient groups.

"Most patients with obesity who have HFpEF and chronic kidney disease are not getting any effective treatment," Packer said. "We were very pleased to see the improvement in kidney function, which paralleled the favorable effects on the heart and on obesity."

Researchers said that both creatinine and cystatin C levels can be affected by factors such as obesity and skeletal muscle mass. Despite this potential confounder, the agreement between the two measurements in terms of the direction of change among study groups offers confirmation of the positive impact of tirzepatide on kidney functioning, Packer said.

The researchers plan to continue to analyze data from the SUMMIT trial for further insights into the [molecular mechanisms](#) that contribute to the interplay between [obesity](#), kidney disease and heart failure.

More information: *Journal of the American College of Cardiology* (2025). DOI: [10.1016/j.jacc.2025.03.009](https://doi.org/10.1016/j.jacc.2025.03.009)

Journal information: [Journal of the American College of Cardiology](#)
Provided by [American College of Cardiology](#)

MARCH 31, 2025

Semaglutide boosts walking ability in diabetes patients with peripheral artery disease, clinical trial finds

by [American College of Cardiology](#)

Credit: Unsplash/CC0 Public Domain

Semaglutide, a glucagon-like peptide 1 (GLP-1) agonist, significantly improved maximal walking distance in people with symptomatic peripheral artery disease (PAD) and type 2 diabetes in the first-of-its kind trial to evaluate the use of a GLP-1 agonist to manage PAD. In addition to improvements in walking ability and function, people taking semaglutide also saw significant improvements in both symptoms and quality of life compared with those taking a placebo.

PAD, which affects an estimated 12 million U.S. adults and over 200 million people worldwide, occurs when there is a buildup of fat and cholesterol, most commonly in the arteries of the legs. It's often associated with difficulty walking and poor circulation that can lead to non-healing wounds and a high rate of limb loss.

People with PAD are at very high risk for serious complications, including acute limb ischemia—similar to a [heart attack](#) or stroke of the leg—that can lead to limb amputation or

death if not treated quickly. The last drug approved by the U.S. Food and Drug Administration for improving functional outcomes in PAD was cilostazol in 2000.

"Even at very early stages of PAD, people can't walk well, but they often don't know it's PAD. They may say, 'I've just slowed down,' 'I'm getting older,' or 'I have arthritis,' but they're actually severely functionally impaired and they often will self-limit what they are doing," said Marc P. Bonaca, MD, MPH, professor of medicine and director of vascular research at the University of Colorado School of Medicine in Aurora, Colorado, and the study's lead author.

"The only drug we have available and is guideline recommended for symptoms is contraindicated in people with heart failure, has no benefits beyond improvement in symptoms and causes a lot of side effects, so overall it's used in less than 10% of people and so we really have limited options to improve function in PAD," he said.

"The [issue] is that as PAD progresses, patients go on to get revascularization procedures to open arteries and become at high risk for adverse cardiovascular and limb events."

GLP-1 agonists are a class of medication currently used to treat type 2 diabetes, obesity, [kidney disease](#), [cardiovascular disease](#) including atherosclerotic vascular disease and heart failure. In the trial called STRIDE, 792 people with type 2 diabetes and early-stage symptomatic PAD were enrolled at 112 medical centers in 20 countries. Participants were on average 67 years old, about 25% were women and 67% were white.

All were randomly assigned to receive semaglutide (1 mg) or placebo for one year (52 weeks). Researchers assessed maximal [walking distance](#)—the maximum distance that patients were able to walk on a treadmill at 2 miles per hour at a 12% grade (similar to walking up a moderate hill). Function was assessed at baseline (median maximal walk distance was 186 meters), week 26, week 52 (primary endpoint) and week 57 (five weeks after stopping treatment).

"Despite the fact that people were recruited on the basis of reporting early-stage PAD, we observed that they were actually severely impaired and could only walk about one-tenth of a mile with symptom onset significantly earlier," Bonaca said. "We saw that the drug clearly worked. There was a clear early benefit at six months that continued to increase at one year."

Overall, patients in the semaglutide arm had a median improvement in walking distance of 26 meters and an average improvement of 40 meters, representing a statistically significant 13% improvement at one year.

"To put that into context, we usually think an increase in walking distance of 10 meters to 20 meters is clinically important in PAD, so this exceeded those expectations," he said.

The results were further supported by confirmatory secondary endpoints showing significant improvements in quality of life (as measured by the Vascular Quality of Life

Questionnaire-6 score), including pain-free walking distance and sustained improvement in maximal walking distance at five weeks after stopping therapy. Safety was similar to earlier trials, with non-serious gastrointestinal side effects the most reported side effect among patients taking semaglutide.

Patients' ankle brachial index, a measure of blood flow in the legs, was significantly improved among those taking semaglutide compared with placebo. A post-hoc analysis looking at time to rescue treatment (the need for revascularization due to worsening symptoms) or death was also lower.

Within one-year of treatment, patients taking semaglutide had a 54% reduction in their risk of dying or needing a medication or procedure to open blocked arteries in their legs due to worsening symptoms compared with those receiving a placebo (14 patients vs. 30 patients).

"Taken together, the data support semaglutide for people with PAD and type 2 [diabetes mellitus](#) as a therapy that has cardiometabolic, cardiovascular and kidney benefits and improves function, symptoms and quality of life," Bonaca said.

"There is more work to be done to understand the mechanism of benefit as the population had a median [body mass index](#) of 28.6 and the relationship between the outcome and weight loss was very weak. This coupled with the increase in ankle brachial index really suggests a direct vascular effect. This also raises the question of whether patients with PAD and without type 2 diabetes mellitus could benefit and that should be investigated in future studies."

The study was limited in that it was only in patients who also had type 2 diabetes. In addition, approximately 14% of the study population was enrolled in North America, while 57% were enrolled in Europe and 29% in Asia. As a result, there were few Black patients.

This study was funded by Novo Nordisk. It was simultaneously [published](#) online in *The Lancet* at the time of presentation.

More information: Marc P Bonaca et al, Semaglutide and walking capacity in people with symptomatic peripheral artery disease and type 2 diabetes (STRIDE): a phase 3b, double-blind, randomised, placebo-controlled trial, *The Lancet* (2025). DOI: [10.1016/S0140-6736\(25\)00509-4](https://doi.org/10.1016/S0140-6736(25)00509-4)

Journal information: [The Lancet](#)
Provided by [American College of Cardiology](#)

MARCH 31, 2025

Clinical trial shows oral semaglutide vastly reduces heart attacks, strokes in people with type 2 diabetes

by [University of North Carolina Health Care](#)



Credit: Pixabay/CC0 Public Domain

Both the injectable and oral forms of semaglutide, a glucagon-like peptide-1 receptor agonist, have gained recent attention for their effectiveness against weight gain, [high blood sugar](#), and even [alcohol cravings](#).

A new clinical trial, co-led by endocrinologist and diabetes expert John Buse, MD, Ph.D., and interventional cardiologist Matthew Cavender, MD, MPH, at the UNC School of Medicine, has shown that the oral form of semaglutide can significantly reduce [cardiovascular events](#) in people with type 2 diabetes, [atherosclerotic cardiovascular disease](#), and/or chronic kidney disease.

"Heart attacks and strokes are among the most common and devastating complications of diabetes," said Buse, who is the Verne S. Caviness Distinguished Professor of Medicine and Director of the UNC Diabetes Care Center.

"Semaglutide has been a mainstay of our efforts to reduce [heart attack](#) and stroke in people with diabetes. Having an oral option to deliver this highly effective therapy is a big advance."

Results from the large, international trial were [published](#) in the *New England Journal of Medicine* and presented at the American College of Cardiology's Annual Scientific Session & Expo in Chicago, Illinois.

Type 2 diabetes is a progressive disease that affects one's ability to control blood sugar levels.

People with the condition need to closely monitor their diet and activity and may need to take medications as their blood sugar becomes more difficult to manage. Those with type 2 diabetes are at a significantly higher risk of cardiovascular disease because they may develop [high blood pressure](#), high cholesterol, or both, as a result of uncontrolled blood sugar.

Glucagon-like peptide-1 (GLP-1) receptor agonists, such as semaglutide, have shown much potential for lowering blood sugar, but little is known about whether the oral form of semaglutide actually decreases major cardiovascular events, such as heart attacks and stroke.

The Semaglutide cardiovascular Outcomes trial (SOUL) recruited 9,650 people for the study who had pre-existing cardiovascular disease, such as coronary artery disease, symptomatic peripheral arterial disease, cerebrovascular disease, or [chronic kidney disease](#).

Participants were divided into a [placebo group](#) and a drug group to see if those taking oral semaglutide were more or less likely to experience major cardiac events. Both groups were given standard-of-care glucose-lowering and cardiovascular risk-reducing therapies according to local guidelines. Those in the medication group took a once-daily 14mg dose of oral semaglutide.

Researchers found that oral semaglutide decreased the risk of major cardiovascular events by 14% compared to placebo across age and gender. Of all types of major cardiac events studied in the clinical trial, nonfatal myocardial infarction saw the greatest reductions in risk.

The effect of oral semaglutide on cardiovascular outcomes was consistent with other clinical trials involving injectable semaglutide, but more trials are needed to determine if one method may be more effective than the other at reducing major cardiovascular events.

More information: Darren K. McGuire et al, Oral Semaglutide and Cardiovascular Outcomes in High-Risk Type 2 Diabetes, *New England Journal of Medicine* (2025). DOI: [10.1056/NEJMoa2501006](https://doi.org/10.1056/NEJMoa2501006)

Journal information: [New England Journal of Medicine](#)
Provided by [University of North Carolina Health Care](#)

MARCH 31, 2025

Highly accurate blood test diagnoses Alzheimer's disease, measures extent of dementia

by Tamara Schneider, [Washington University in St. Louis](#)

A newly developed blood test for Alzheimer's disease not only aids in the diagnosis of the neurodegenerative condition but also indicates how far it has progressed, according to a study by researchers at Washington University School of Medicine in St. Louis and Lund University in Sweden.

Several blood tests for Alzheimer's disease are already clinically available, including two based on technology licensed from WashU. Such tests help doctors diagnose the disease in people with [cognitive symptoms](#), but do not indicate the clinical stage of the disease symptoms—that is, the degree of impairment in thinking or memory due to Alzheimer's dementia.

Current Alzheimer's therapies are most effective in the early stages of the disease, so having a relatively easy and reliable way to gauge how far the disease has progressed could help doctors determine which patients are likely to benefit from [drug treatment](#) and to what extent. The new test can also provide insight into whether a person's symptoms are likely due to Alzheimer's versus some other cause.

The study is [published](#) in *Nature Medicine*.

In the study, the researchers found that levels of a protein called MTBR-tau243 in the blood accurately reflect the amount of toxic accumulation of tau aggregates in the brain and correlate with the severity of Alzheimer's disease.

Analyzing blood levels of MTBR-tau243 from a group of people with cognitive decline, the researchers were able to distinguish between people with early- or later-stage Alzheimer's disease and separate both groups of Alzheimer's patients from people whose symptoms were caused by something other than Alzheimer's disease.

"This blood test clearly identifies Alzheimer's tau tangles, which is our best biomarker measure of Alzheimer's symptoms and dementia," said co-senior author Randall J.

Bateman, MD, the Charles F. and Joanne Knight Distinguished Professor of Neurology at WashU Medicine.

"In clinical practice right now, we don't have easy or accessible measures of Alzheimer's tangles and dementia, and so a tangle blood test like this can provide a much better indication if the symptoms are due to Alzheimer's and may also help doctors decide which treatments are best for their patients."

Tracking Alzheimer's disease progression from blood

Alzheimer's disease involves a buildup of a protein, called amyloid, into plaques in the brain, followed by the development of tangles of tau protein years later. Cognitive symptoms emerge around the time tau tangles become detectable, and symptoms worsen as the tangles spread.

The gold standard for staging Alzheimer's disease is positron emission tomography (PET) brain scans for [amyloid plaques](#) and tau tangles. Amyloid scans yield information about the presymptomatic and early symptomatic stages, while tau scans are useful for tracking later stages of the disease.

PET brain scans are highly accurate but expensive, time-consuming and frequently unavailable outside of major research centers, so they are not widely used.

Bateman leads a team that is developing blood tests for Alzheimer's disease as a more accessible alternative to brain scans. They have developed [two blood tests](#) that correlate closely with the amount of amyloid plaques in the brain. Both are now used by doctors to aid diagnosis. But until now, there has been no blood test that reports on tau levels in the brain.

[In a previous study](#), Bateman and colleagues—including co-first authors Kanta Horie, Ph.D., a research associate professor of neurology at WashU Medicine, and Gemma Salvadó, Ph.D., then a postdoctoral researcher at Lund University, and co-senior author Oskar Hansson, MD, Ph.D., a professor of neurology at Lund University—showed that cerebrospinal fluid levels of MTBR-tau243 correlate closely with tau tangles in the brain.

In the current study, the team extended the analysis to blood. A blood sample is easier to collect than cerebrospinal fluid, which is obtained via spinal tap.

The researchers developed a technique to measure MTBR-tau243 levels in people's blood and compared it to the amount of tau tangles in their brains as measured by brain scans.

They piloted the approach on data from two cohorts: volunteers at WashU Medicine's Charles F. and Joanne Knight Alzheimer Disease Research Center, which included 108 people, and a subset of 55 people from the Swedish BioFINDER-2 cohort.

To assess whether the approach was generalizable, they validated it in an independent dataset consisting of the remaining 739 people in the BioFINDER-2 cohort.

The people in the two cohorts represented all but the most severe end of the spectrum of Alzheimer's disease, from the presymptomatic stage when brain amyloid levels are elevated but people remain cognitively healthy, through early-stage disease with mild cognitive impairments, to late symptomatic disease when patients exhibit full-blown dementia.

For comparison, cognitively healthy people with normal amyloid levels, and people with cognitive symptoms due to conditions other than Alzheimer's disease, were included.

The researchers' analysis showed that blood MTBR-tau243 levels reflected the amount of tau tangles in the brain with 92% accuracy. MTBR-tau243 levels in the blood were normal in asymptomatic people regardless of amyloid status, meaning that blood MTBR-tau243 levels do not change between healthy people and people in the presymptomatic stage of Alzheimer's disease with amyloid plaques.

Among people with cognitive symptoms due to Alzheimer's disease, MTBR-tau243 levels were significantly elevated for people in the mild cognitive impairment phase of Alzheimer's disease and much higher—up to 200 times—for those in the dementia phase. Those differences translated into clear separation of people with early- and late-stage Alzheimer's disease.

At the same time, MTBR-tau243 levels were normal in people with cognitive symptoms due to diseases other than Alzheimer's, meaning that the test effectively distinguished Alzheimer's dementia from other kinds of dementia.

The technology underlying the blood test for tau aggregates has been licensed by WashU to C2N Diagnostics, a WashU startup that developed the blood tests for amyloid. These amyloid tests incorporate measures of another form of tau called p-tau217.

"I believe we will use blood-based p-tau217 to determine whether an individual has Alzheimer's disease, but MTBR-tau243 will be a highly valuable complement in both clinical settings and research trials," said Hansson.

"When both of these biomarkers are positive, the likelihood that Alzheimer's is the underlying cause of a person's cognitive symptoms increases significantly, compared to when only p-tau217 is abnormal. This distinction is crucial for selecting the most appropriate treatment for each patient."

Blood tests could inform personalized Alzheimer's treatment

Two Alzheimer's therapies have been approved by the Food and Drug Administration (FDA) to slow progression of the disease, and both work by lowering amyloid levels in the brain.

Horie said the number and variety of available Alzheimer's medications may soon be expanding, as several experimental drugs that target tau or other aspects of Alzheimer's disease are in the pipeline. With blood tests to diagnose and stage the disease, doctors would be able to tailor treatments to the patient's particular disease state.

"We're about to enter the era of personalized medicine for Alzheimer's disease," Horie said.

"For early stages with low tau tangles, anti-amyloid therapies could be more efficacious than in late stages. But after the onset of dementia with high tau tangles, anti-tau therapy or one of the many other experimental approaches may be more effective.

"Once we have a clinically available [blood test](#) for staging, plus treatments that work at different stages of the disease, doctors will be able to optimize their treatment plans for the specific needs of each patient."

More information: Kanta Horie et al, Plasma MTBR-tau243 biomarker identifies tau tangle pathology in Alzheimer's disease, *Nature Medicine* (2025). DOI: [10.1038/s41591-025-03617-7](https://doi.org/10.1038/s41591-025-03617-7)

Journal information: [Nature Medicine](#)

MARCH 29, 2025

The Colorado psychedelic mushroom experiment has arrived

by Kate Ruder



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Colorado regulators are issuing licenses for providing psychedelic mushrooms and are planning to authorize the state's first "healing centers," where the mushrooms can be ingested under supervision, in late spring or early summer.

The dawn of state-regulated psychedelic mushrooms has arrived in Colorado, nearly two years since Oregon began offering them. The mushrooms are a Schedule I drug and illegal under federal law except for [clinical research](#). But more than a dozen cities nationwide have deprioritized or decriminalized them in the past five years, and many eyes are turned toward Oregon's and Colorado's state-regulated programs.

"In Oregon and Colorado, we're going to learn a lot about the administration of psychedelics outside of clinical, religious, and underground settings because they're the first to try this in the U.S.," said William R. Smith, an assistant professor of psychiatry at the University of North Carolina School of Medicine.

Psychedelic mushrooms and their psychoactive compound psilocybin have the potential to treat people with depression and anxiety, including those unresponsive to other medications or therapy.

The National Institute on Drug Abuse, part of the National Institutes of Health, says the risk of mental health problems caused by ingesting mushrooms in a supervised clinical setting is low, but may be higher outside of a clinical setting. Robert F. Kennedy Jr. said in a social media post last year, before his nomination as U.S. health secretary, that his "mind is open to the idea of psychedelics for treatment."

Medical experts say more research is needed, particularly in people with a diagnosis or family history of psychotic or bipolar disorder. Adverse effects of psilocybin, including headache and nausea, typically resolve within one to two days.

However, extended difficulties from using psychedelics can last weeks, months, or years; anxiety and fear, existential struggle, social disconnection, and feeling detached from oneself and one's surroundings are most common. After the decriminalization and legalization in Oregon and Colorado, psychedelic mushroom exposures reported to poison control centers ticked up in these states and nationally.

In February, about 40 people organized by the psychedelic advocacy group the Nowak Society gathered in Boulder to talk about the coming changes in Colorado. They included Mandy Grace, who received her state license to administer psychedelic mushrooms, and Amanda Clark, a licensed mental health counselor from Denver, who both praised the therapeutic power of mushrooms.

"You get discouraged in your practice because the current therapies are not enough for people," Clark said.

Colorado voters approved Proposition 122 in 2022 to legalize natural psychedelics, after Oregon voters in 2020 approved legalizing psilocybin for therapeutic use. Colorado's program is modeled after, but not the same as, Oregon's, under which 21,246 psilocybin products have been sold as of March, a total that could include secondary doses, according to the Oregon Health Authority.

As of mid-March, Colorado has received applications for at least 15 healing center licenses, nine cultivation licenses, four manufacturer licenses, and one testing facility license for growing and preparing the mushrooms, under rules developed over two years by the governor-appointed Natural Medicine Advisory Board.

Psychedelic treatments in Oregon are expensive, and are likely to be so in Colorado, too, said Tasia Poinsett, Colorado director of the nonprofit Healing Advocacy Fund, which supports state-regulated programs for psychedelic therapy. In Oregon, psychedelic mushroom sessions are typically \$1,000 to \$3,000, are not covered by insurance, and must be paid for up front.

The mushrooms themselves are not expensive, Poinsett said, but a facilitator's time and support services are costly, and there are state fees. In Colorado, for doses over 2 milligrams, facilitators will screen participants at least 24 hours in advance, then supervise the session in which the participant consumes and experiences mushrooms, lasting several hours, plus a later meeting to integrate the experience.

Facilitators, who may not have experience with mental health emergencies, need training in screening, informed consent, and postsession monitoring, Smith said. "Because these models are new, we need to gather data from Colorado and Oregon to ensure safety."

Facilitators generally pay a \$420 training fee, which allows them to pursue the necessary consultation hours, and roughly \$900 a year for a license, and healing centers pay \$3,000 to \$6,000 for initial licenses in Colorado. But the up-front cost for facilitators is significant: The required 150 hours in a state-accredited program and 80 hours of hands-on training can cost \$10,000 or more, and Clark said she wouldn't pursue a facilitator license due to the prohibitive time and cost.

To increase affordability for patients in Colorado, Poinsett said, healing centers plan to offer sliding-scale pay options, and discounts for veterans, Medicaid enrollees, and those with low incomes. Group sessions are another option to lower costs.

Colorado law does not allow retail sales of psilocybin, unlike cannabis, which can be sold both recreationally and medically in the state. But it allows adults 21 and older to grow, use, and share psychedelic mushrooms for personal use.

Despite the retail ban, adjacent businesses have mushroomed. Inside the warehouse and laboratory of Activated Brands in Arvada, brown bags of sterilized grains such as corn, millet, and sorghum and plastic bags of soil substrate are for sale, along with genetic materials and ready-to-grow kits.

Co-founder Sean Winfield sells these supplies for growing psychedelic or functional mushrooms such as lion's mane to people hoping to grow their own at home. Soon, Activated Brands will host cultivation and education classes for the public, Winfield said.

Winfield and co-founder Shawn Cox recently hosted a psychedelic potluck at which experts studying and cultivating psychedelic mushrooms discussed genetics, extraction, and specialized equipment.

Psychedelic mushrooms have a long history in Indigenous cultures, and provisions for their use in spiritual, cultural, or religious ceremonies are included in Colorado law, along with recognition of the cultural harm that could occur to federally recognized tribes and Indigenous people if natural medicine is overly commercialized or exploited.

Several studies over the past five years have shown the long-term benefits of psilocybin for treatment-resistant major depressive disorder, and the Food and Drug Administration designated it a breakthrough therapy. Late-stage trials, often a precursor to application for FDA approval, are underway.

Smith said psilocybin is a promising tool for treating mental health disorders but has not yet been shown to be better than other advanced treatments. Joshua Woolley, an associate professor of psychiatry and behavioral sciences at the University of California-San Francisco, said he has seen the benefits of psilocybin as an investigator in clinical trials.

"People can change hard-set habits. They can become unstuck. They can see things in new ways," he said of treating patients with a combination of psilocybin and psychotherapy.

Colorado, unlike Oregon, allows integration of psilocybin into existing mental health and medical practices with a clinical facilitator license, and through micro-healing centers that are more limited in the amounts of mushrooms they can store.

Still, Woolley said, between the federal ban and new state laws for psychedelics, this is uncharted territory. Most drugs used to treat mental health disorders are regulated by the FDA, something that Colorado is "taking into its own hands" by setting up its own program to regulate the manufacturing and administration of psilocybin.

The U.S. Attorney's Office for the District of Colorado declined to comment on its policy toward state-regulated [psychedelic](#) programs or personal use provisions, but Poinsett hopes the same federal hands-off approach to marijuana will be taken for psilocybin in Oregon and Colorado.

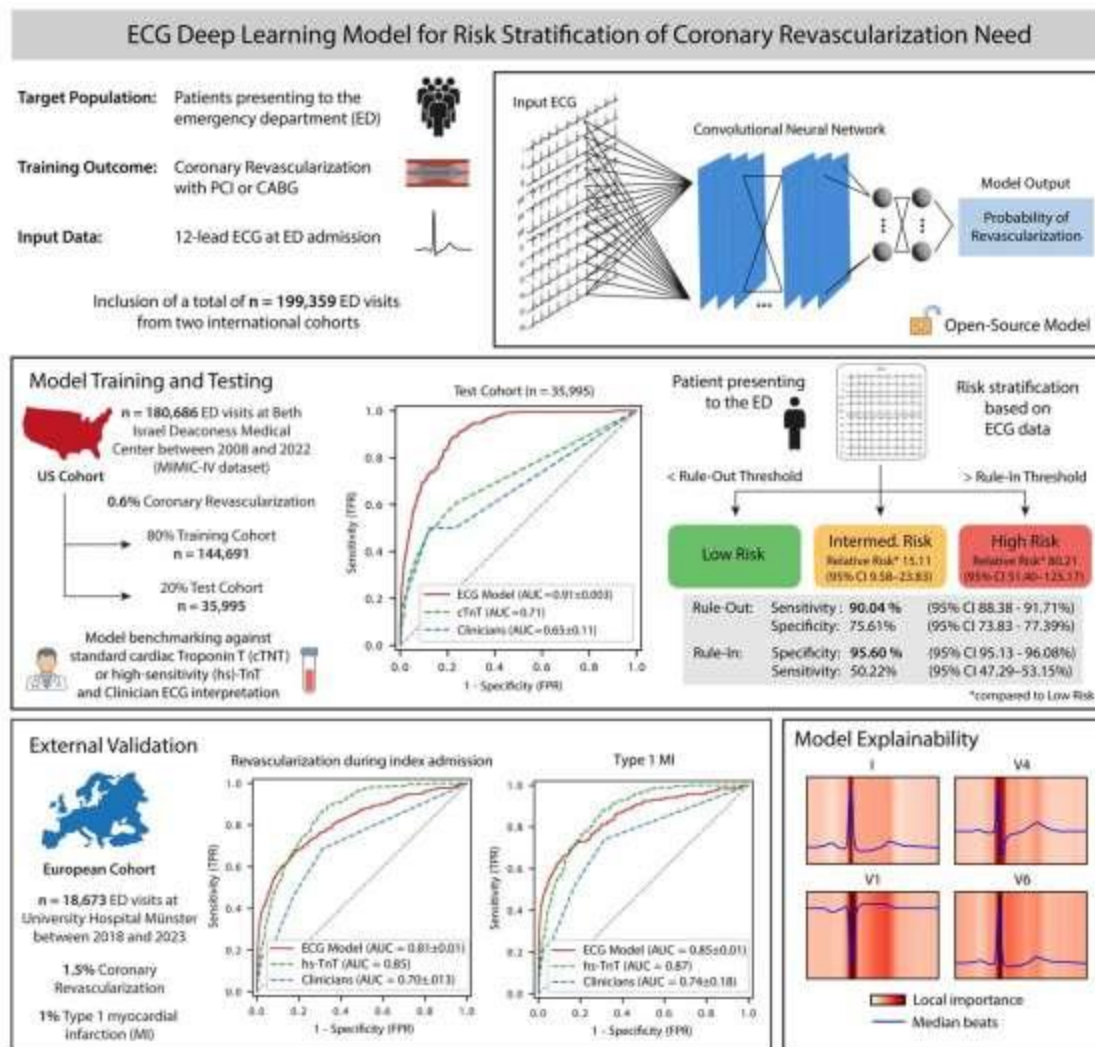
Winfield said he looks forward to the upcoming rollout and potential addition of other plant psychedelics, such as mescaline. "We're talking about clandestine industries coming into the light," he said.

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MARCH 31, 2025

AI model shows high accuracy in heart attack detection

by American College of Cardiology



Credit: *European Heart Journal* (2025). DOI: 10.1093/eurheartj/ehaf254.

<https://academic.oup.com/eurheartj/advance-article/doi/10.1093/eurheartj/ehaf254/8098552>

An artificial intelligence (AI) model trained to detect blocked coronary arteries based on electrocardiogram (ECG) readings performed better than expert clinicians and was on par with troponin T testing, according to research presented at the American College of Cardiology's Annual Scientific Session ([ACC.25](#)) on March 29 in Chicago. The results were

simultaneously [published](#) in the *European Heart Journal*. The findings suggest that the freely available open-source AI model could help physicians more quickly identify patients who require urgent treatment for a heart attack.

Other AI tools have been developed with a similar goal, but the new model is the first to be explicitly designed for broad applicability in a general [emergency department](#) population rather than a pre-selected high-risk population. Researchers expect it to be especially beneficial in the detection of heart attack without ST segment elevation (NSTEMI), the most difficult type of heart attack for clinicians to diagnose.

"ECG analysis in the emergency department often has high variability," said Antonius Büscher, MD, a clinician scientist at University Hospital Münster in Münster, Germany, and the study's first author. "Whereas patients with ST segment elevation have changes in the ECG that are quite distinct, there are a large number of patients who need urgent coronary revascularization who do not have ST segment elevation; because the alterations on the ECG are not as clear-cut, those patients can experience treatment delays. Our goal was to accelerate this process to identify patients who might need revascularization earlier."

The study focused on type 1 heart attacks, which include both STEMI and NSTEMI heart attacks and occur when plaque builds up in the heart's arteries and ruptures, blocking or reducing blood flow to the heart muscle. The amount of damage depends on the amount of heart muscle that is deprived of oxygen and the time to treatment with coronary revascularization, a procedure to open blocked arteries.

The two main instruments for diagnosing heart attacks are ECGs, which can be performed quickly to detect signatures of a heart attack based on patterns in the heart's electrical activity, and troponin T blood tests, which are more sensitive but are also frequently positive in many conditions other than a type 1 heart attack, which can complicate their interpretation and increase diagnostic uncertainty.

Emergency departments see high volumes of patients with possible heart attack symptoms, and there is an urgent need for complementary methods to better identify which patients require revascularization therapy.

For the new study, researchers developed a [deep learning model](#) to detect features of an ECG that indicate whether a patient is likely to require urgent revascularization. They trained the model on health records from almost 145,000 emergency department visits at a single center in the United States and tested it on a cohort of over 35,000 visits from the same source.

They then performed external validation using records from over 18,000 emergency department visits at a center in Germany. The model was validated for the initial training outcome of coronary revascularization and the clinically more relevant endpoint of type 1 heart attack diagnosis. The model classified each patient as low, intermediate or high risk based on ECG readings alone.

Using a metric commonly used to assess model performance known as area under the receiver operating characteristic curve, or AUC, where a value of one means perfect discrimination and 0.5 means no discrimination, the researchers compared the accuracy of the model results to that of clinicians, conventional troponin testing and high-sensitivity troponin T testing.

According to the results, the model achieved an AUC of 0.91 in the internal test cohort, outperforming both clinician ECG interpretation (0.65) and conventional troponin testing (0.71). In the external validation cohort, the model achieved an AUC of 0.85 to detect patients with type 1 heart attack and 0.81 to predict revascularization. Overall diagnostic accuracy was higher than clinicians (0.74 and 0.70), and detection of type 1 heart attack was on par with contemporary high-sensitivity troponin T (0.87), which had higher sensitivity but lower specificity.

"We saw that performance of the model was better than human interpretation and nearly matched the accuracy of high-sensitivity troponin testing," said Büscher. "While the model is not intended to serve as a standalone diagnostic test, it could greatly enhance ECG interpretation in the emergency department and reduce uncertainty during the emergency department workup."

In the validation cohort, the researchers discovered a series of cases where a heart attack had occurred but was initially not diagnosed. Noting that the model would have identified these cases several hours earlier, Büscher suggested that the model could be used to alert medical staff or automatically trigger high-sensitivity troponin testing to confirm or rule out a [heart attack](#).

Büscher said that one strength of the model compared to other AI tools is its self-explainability, meaning that researchers were able to identify the features the model used to make decisions and connect them with clinically established markers. This makes the work an important step in the broader trend toward integrating AI tools into medical decision support.

"A common goal with these types of models is to make most use of the data that we have, and to complement physicians' clinical reasoning by picking up some nuances in the data that might be obscure to the human eye," Büscher said. "I think we are still at the beginning in this field, but in the not too far future, these types of models will be used as routine diagnostic tests."

While performance is always expected to go down when a model is used in a different population than it was trained in, the model should be applicable in most developed countries, Büscher said. Since it is being made openly available, researchers or hospitals could also fine-tune the model with their own data to increase its accuracy in specific populations.

A prospective study to assess the model's practical utility and potential benefits in a clinical context is currently in the planning phases.

More information: Antonius Büscher et al, Deep Learning Electrocardiogram Model for Risk Stratification of Coronary Revascularization Need in the Emergency Department, *European Heart Journal* (2025). DOI: [10.1093/eurheartj/ehaf254](https://doi.org/10.1093/eurheartj/ehaf254). [academic.oup.com/eurheartj/adv ... artj/ehaf254/8098552](https://academic.oup.com/eurheartj/advance-article/doi/10.1093/eurheartj/ehaf254/8098552)

Journal information: [European Heart Journal](#)
Provided by [American College of Cardiology](#)

MARCH 31, 2025

Autistic stimming explained—and why stopping it can lead to burnout

by Aimee Grant, [The Conversation](#)

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Stimming—short for "self-stimulatory behavior"—is a form of self-soothing commonly seen in autistic people. It can involve repetitive movements, sounds, or actions and is commonly regarded in medical literature as part of "rigid and repetitive behavior."

This type of framing tends to cast stimming in a negative light, leading [health professionals](#), teachers and even parents to try to stop it. But stimming is a vital self-protective strategy for autistic people, and suppressing it can have serious consequences.

While stimming isn't unique to autism, autistic people tend to [stim more](#) frequently and sometimes in more noticeable ways. It often involves physical movements such as hand-flapping, rocking, spinning or tiptoeing. Many autistic people also use different objects in repetitive ways, such as lining them up in patterns or keeping their hands busy with everyday items or stim toys.

But stimming goes beyond movement—it can involve any of the senses. Some people stim through sound, repeating words or phrases because they are satisfying to say or hear. Others engage in "scripting," like having conversations that follow a set pattern or re-watching favorite films for the comfort of predictability. Oral stims, such as chewing on pens, clothing or "chewllery" are also common.

When considered in this broader sense, many people—autistic or not—have at least one form of stimming. Yet [autistic children](#) are often encouraged to [stop theirs](#), with alternatives like keeping their hands in their pockets suggested instead. These substitutes don't offer the same [sensory input](#), however, and can make [self-regulation](#) more difficult.

Many autistic adults report having [lost](#) their natural stims over time. This is either through conscious suppression or because they were conditioned to stop in childhood. Some still [suppress stimming](#) out of fear of negative reactions from others, despite it being

beneficial to their well-being. There is also evidence that some autistic people are [discouraged](#) from stimming in the workplace.

Masking

The exact mechanisms behind stimming aren't fully understood yet. But it is widely acknowledged that it provides soothing sensory input, helping autistic people [cope](#) with overwhelming environments. Suppressing stimming is [uncomfortable](#) and is one aspect of "[masking](#)," which is the conscious or unconscious act of not doing natural autistic traits to avoid negative social consequences.

Masking is particularly common among [autistic women](#) and has been [linked to](#) increased anxiety, burnout and even suicide. It can also [affect](#) education, work, relationships and overall quality of life.

It's crucial for society—especially parents, teachers and employers—to become more accepting of stimming. [Research shows](#) that greater understanding leads to greater acceptance.

The only instances where intervention might be necessary are when stimming is self-injurious or poses a risk to others, in which case a safer alternative stim should be encouraged. Otherwise, the best response is simple—let people stim freely. And if you're autistic, research shows you can use it to [bond](#) with other autistic people.

So, if you see an autistic child or adult stimming, there's no need to comment or intervene. My mom used to say that "if you can't say anything nice, don't say anything at all"—that principle that applies here too.

Provided by [The Conversation](#)

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MARCH 31, 2025

Artificial intelligence can aid in the prevention of sudden cardiac death

by [Institut National de la Sante et de la Recherche Medicale](#)

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Many cases of sudden cardiac death could be avoided thanks to artificial intelligence. As part of a new study [published](#) in the *European Heart Journal*, a network of artificial neurons imitating the human brain was developed by researchers from Inserm, Paris Cité University and the Paris public hospitals group (AP-HP), in collaboration with their colleagues in the U.S.

During the analysis of data from over 240,000 ambulatory electrocardiograms, this algorithm identified patients at risk of a serious arrhythmia that was capable of triggering [cardiac arrest](#) within the following two weeks in over 70% of cases.

Each year, sudden cardiac death is responsible for over 5 million deaths worldwide. Many of these cardiac arrests occur out of the blue with no identifiable warning signs, striking individuals from the general population who do not always have a known history of heart disease.

Artificial intelligence could help to improve the anticipation of arrhythmias—unexplained heart rhythm disorders which, if severe, can cause fatal cardiac arrest—according to a new study led by a team of researchers from Inserm, Paris Cité University and the Paris public hospitals group (AP-HP), in collaboration with their colleagues in the U.S.

As part of this study, a network of artificial neurons was developed by a team of engineers from the company Cardiologs (Philips group) in collaboration with the universities of Paris Cité and Harvard. What this algorithm does is imitate the functions of the human brain in order to improve the prevention of cardiac sudden death.

The researchers analyzed several million hours of heartbeats thanks to data from 240,000 ambulatory electrocardiograms collected in six countries (U.S., France, UK, South Africa, India and Czechia).

Thanks to artificial intelligence, the researchers were able to identify new weak signals that herald the risk of arrhythmia. They were particularly interested in the time needed to electrically stimulate and relax the heart ventricles during a complete cycle of cardiac contraction and relaxation.

"By analyzing their [electrical signal](#) for 24 hours, we realized that we could identify the subjects susceptible of developing a serious heart arrhythmia within the next two weeks. If left untreated, this type of arrhythmia can progress towards a fatal cardiac arrest," explains Dr. Laurent Fiorina, first author of the study, researcher at the Paris Cardiovascular Research Center (PARCC) (Inserm/Paris Cité University), cardiologist at Cardiovascular Institute Paris-Sud (ICPS) (Ramsay, Massy), and medical director in charge of artificial intelligence at Philips.

While the [artificial neural network](#) is still in the evaluation phase, it showed itself in this study to be capable of detecting at-risk patients in 70% of cases, and no-risk patients in 99.9% of cases.

In the future, this algorithm could be used to monitor at-risk patients in hospital. If its performances are refined, it could also be used in devices such as ambulatory Holters that measure blood pressure to reveal hypertension risks. It could even be used in smartwatches.

"What we're proposing here is a paradigm change in the prevention of sudden death," comments Eloi Marijon, Inserm research director at PARCC (Inserm/Paris Cité University), professor of cardiology at Paris Cité University and head of the cardiology department at Georges Pompidou European Hospital AP-HP.

"Until now, we'd been trying to identify patients at risk over the medium and long term, but were incapable of predicting what could happen in the minutes, hours or days that precede a cardiac arrest. Now, thanks to artificial intelligence, we can predict these events in the very short term and potentially take action before it's too late."

The researchers now wish to conduct prospective clinical studies to test the efficacy of this model under real-world conditions.

"It's essential for this technology to be evaluated in [clinical trials](#) before being used in [medical practice](#)," insists Dr. Fiorina. "But what we've already shown is that AI has the potential to radically transform the prevention of serious arrhythmias."

More information: Eloi Marijon et al, Near-term prediction of sustained ventricular arrhythmias applying artificial intelligence to single-lead ambulatory electrocardiogram, *European Heart Journal* (2025). DOI: [10.1093/eurheartj/ehaf073](https://doi.org/10.1093/eurheartj/ehaf073). [academic.oup.com/eurheartj/adv ... artj/ehaf073/8097753](https://academic.oup.com/eurheartj/adv...artj/ehaf073/8097753)

Journal information: [European Heart Journal](#)

Provided by [Institut National de la Sante et de la Recherche Medicale](#)

MARCH 31, 2025

New drug may cut sudden heart risk by 94%

by I. Edwards

A new drug may help protect millions of people from heart attacks and strokes by lowering a little-known risk factor in the blood.

The drug, made by Eli Lilly and called lepodisiran, lowered levels of a tiny particle called Lp(a) by 94% with a single shot, the study shows. Lp(a) is a mix of protein and lipids.

The drug's effects lasted six months with no major side effects, according to new research presented in Chicago on Sunday at an American College of Cardiology meeting and also [published](#) in the *New England Journal of Medicine*.

About 1 in 5 folks in the U.S.—or 64 million Americans—have high Lp(a) levels, which are linked to a higher risk of [heart attack](#) and stroke. But few doctors test for it, so most folks don't know they have it.

Dr. David Maron is a preventive cardiologist at Stanford who was not involved in the Eli Lilly research. He told The New York Times the evidence of profound and long-lasting reduction in lipoprotein levels with lepodisiran was "thrilling."

More studies are needed to confirm whether lowering Lp(a) also lowers the risk of heart attacks and strokes.

A large trial for lepodisiran is expected to wrap up in 2029, but results from a similar drug being tested by Novartis could come next year.

Lp(a) was discovered in 1974 and is mostly controlled by genes. Diet and exercise don't help. People with slightly high levels have a 25% greater risk of heart disease, and those with very high levels—about 10% of people—have double the risk.

What's more, doctors say it's often the hidden reason behind heart attacks in young or healthy people.

"If you go into the coronary care unit and see someone who is 40 years old with a [heart attack], you need to know the level of their Lp(a)," said Dr. Steven Nissen, a preventive cardiologist at the Cleveland Clinic.

Nissen is leading Lilly's trial and others on similar drugs, according to The Times.

He said people with high Lp(a) need to treat all other heart risk factors, like cholesterol and [blood pressure](#).

Dr. Martha Gulati is a preventive cardiologist at Cedars-Sinai Medical Center who was not involved in the study.

She noted that one study indicated that fewer than 1% of Americans have had an Lp(a) test, even though it's covered by insurance. Just 3% of those with heart disease have been tested, she added.

She and others think all adults should be tested at least once since Lp(a) doesn't change over time.

One patient, 71-year-old Monte Wooden, had normal blood pressure and didn't smoke, but still had a heart attack in 2006. It turned out his Lp(a) level was over 400—far above the normal limit of 75, according to The Times.

With treatment and a clinical trial [drug](#), his symptoms disappeared. But when the trial ended, they returned, and he needed a quadruple bypass.

"It's anecdotal," Maron said, "But it speaks to the likelihood that these drugs prevent heart attacks."

More information: Steven E. Nissen et al, Lepodisiran — A Long-Duration Small Interfering RNA Targeting Lipoprotein(a), *New England Journal of Medicine* (2025). DOI: [10.1056/NEJMoa2415818](https://doi.org/10.1056/NEJMoa2415818)

The Cleveland Clinic has more on [lipoproteins](#).

Journal information: [New England Journal of Medicine](#)

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