

The HealthTech Herald

Your trusted source for the latest breakthroughs at the intersection of health and technology.

EDITION 1 · JULY 2026

IN THIS EDITION

The HealthTech Herald, first edition

Breakthroughs where health and technology meet

How many senses have you opened in yourself?
A look beyond the five senses

Reversing liver ageing
What a study of young gut bacteria found

Dr Sukh Rashpal Sandhu | Subscribe free on LinkedIn

EDITION 1 | JULY 2026

Contents

The HealthTech Herald: July 2026 3
The HealthTech Herald: First Edition 4
How many senses have you opened in yourself? 24
Stunning Study: Scientists Reversed Liver Aging with Young Gut Bacteria, Youthful Gut Microbiome May Help Slow Aging and Cancer 36
Follow us on LinkedIn 42
About The HealthTech Herald 44

INTRODUCTION

The HealthTech Herald: July 2026

By Dr Sukh Rashpal Sandhu

Edition 1 of The HealthTech Herald: 3 pieces for July 2026.

Your trusted source for the latest breakthroughs at the intersection of health and technology.

This edition brings together 3 pieces first published in The HealthTech Herald on LinkedIn, each carrying the date it first appeared. Republished pieces appear as they were first published, with their original images; facts, figures and links are as they stood on that date.

In this edition

- The HealthTech Herald: First Edition
- How many senses have you opened in yourself?
- Stunning Study: Scientists Reversed Liver Aging with Young Gut Bacteria, Youthful Gut Microbiome May Help Slow Aging and Cancer

Thank you to every reader who subscribes, shares and responds.

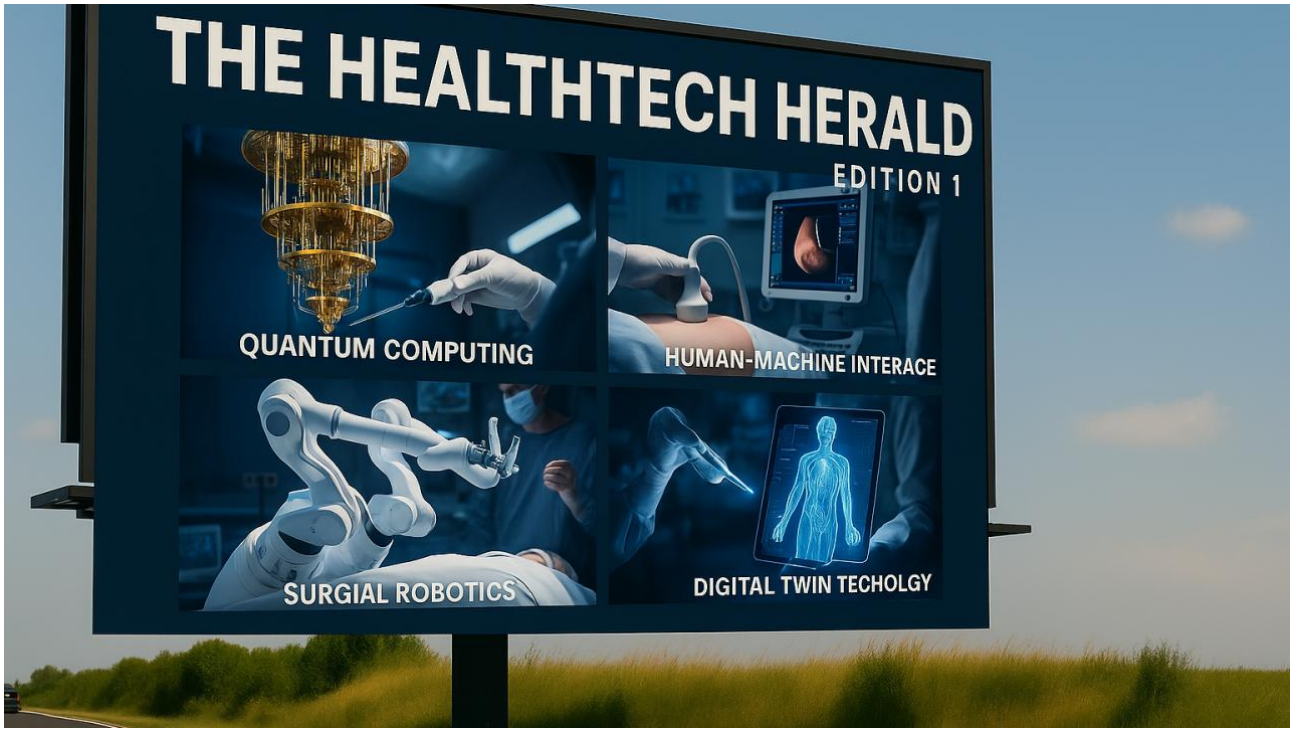
Warm regards,
Dr Sukh Rashpal Sandhu
Author, The HealthTech Herald

THE HEALTHTECH HERALD

The HealthTech Herald: First Edition

By Dr Sukh Rashpal Sandhu | First published 14 June 2025

Today marks a pivotal moment in the field of healthcare journalism. As we launch the inaugural edition of The HealthTech Herald, we stand at the threshold of what may be the most transformative decade in medical history.



Editorial: Welcome to the Dawn of Healthcare's Tomorrow

The HealthTech Herald: First Edition

Today marks a pivotal moment in the field of healthcare journalism. As we launch the inaugural edition of The HealthTech Herald, we stand at the threshold of what may be the most transformative decade in medical history. This isn't just another publication; it's a witness to revolution.

Why Now? Why This Matters?

We live in an era where the impossible becomes inevitable with breathtaking speed. Artificial blood that works universally. Robots that perform surgery with superhuman precision. Breath-controlled interfaces that cost $2 but restore dignity to millions. Brain-computer connections that translate thoughts into action. These aren't distant fantasies; they're clinical realities reshaping lives today. The stories in this edition represent more than technological achievement; they embody humanity's relentless pursuit of healing, hope, and human potential. From Japan's revolutionary hemoglobin vesicles addressing

global blood shortages to the promise of quantum computing in accelerating drug discovery, we're witnessing the convergence of compassion and cutting-edge science.

The Human Story Behind the Headlines

What strikes us most about today's healthcare innovations isn't their complexity; it's their humanity. The researchers in Nara who transform expired blood donations into lifesaving universal substitutes. The engineers at Case Western see breath as a pathway to independence. The surgeons who use AI and robotics not to replace human touch, but to enhance it with unprecedented precision. Each breakthrough featured in this edition solves a deeply human problem: the mother facing postpartum hemorrhage in a remote clinic, the veteran with paralysis seeking to communicate, the grandmother hoping to age with dignity rather than decline.

Our Gratitude and Vision

The HealthTech Herald exists because of the extraordinary collaboration between visionaries, researchers, and practitioners who dare to imagine a healthier world. We extend our deepest gratitude to the health experts working with CAQA Groups who have been instrumental in bringing these stories to light. Their insights, expertise, and dedication to advancing healthcare knowledge have made this publication possible. We're equally thankful to the researchers, clinicians, and innovators we've had the privilege to interview for this edition. Their voices, sharing not just what they've discovered but why it matters, are currently being edited for release across our YouTube and social media channels. These conversations reveal the passion, persistence, and profound hope that drive medical innovation forward.

Looking Forward: The Promise Ahead

As we scan the horizon of healthcare's future, we see unprecedented convergence. Artificial intelligence meets ancient wisdom about nutrition. Quantum computing accelerates the discovery of tomorrow's medicines. 5D printing creates devices that adapt to our bodies' needs. Senolytics promise to redefine aging itself. Yet for all the technological sophistication in these pages, the most powerful force remains unchanged: the human desire to heal, to help, and to hope. Every algorithm serves this purpose. Every innovation answers this call.

Our Commitment to You

The HealthTech Herald commits to being your trusted guide through this transformation. We will celebrate breakthroughs while examining implications. We will explain complex science in accessible terms while honouring its sophistication. Most importantly, we will never lose sight of the human lives these technologies aim to improve. This is more than healthcare journalism's documentation of humanity's greatest endeavour: the conquest of suffering and the expansion of human potential.

Welcome to The HealthTech Herald. Welcome to the future of health.

The Editorial Team The HealthTech Herald First Edition, 2025

In This Edition:

- Artificial Blood Revolution: Japan's Universal Life-Saver
- Surgical Robotics & Digital Twins: Precision Redefined
- $2 Breath Interface: Accessibility Innovation
- AI in Brain Disease Detection: The Silent Signal
- Brain-Computer Interfaces: The Mind Unplugged
- Quantum Computing's Healthcare Leap
- Breast Cancer Surgery Precision: Multi-Guide Technology
- 5D Printing: Beyond Dimensions in Medicine
- Senolytics: The End of Aging as We Know It
- AI Nutrition Personalizers: Feeding the Future

Follow us for video interviews and in-depth analysis on our social channels.

Artificial Blood, Real Hope: How Japan's Lifesaving Innovation Could Reshape Global Healthcare

In our Letters of the Heart, Edition 5: Technologies, Inventions and Breakthroughs That Will Transform Humanity Forever, https://www.linkedin.com/pulse/letters-heart-edition-5-technologies-inventions-transform-sandhu-alvzc/?trackingId=G52%2FHvWmSyqcyUXH2UyJdg%3D%3D, we highlighted a quiet but revolutionary development poised to transform emergency medicine and save countless lives. Today, we return to that breakthrough to explore the latest updates, real-world implications, and the data driving what could become one of the most important innovations in medical science: artificial blood.

At the centre of this research is a team of scientists from Nara Medical University in Japan, led by Professor Hiromi Sakai. Their work focuses on hemoglobin vesicles, synthetic substitutes for human blood that could dramatically change how we respond to trauma, disaster, and surgical needs. These vesicles are created by repurposing expired donated blood, extracting the hemoglobin and encapsulating it within stable lipid membranes. The result is a blood substitute that removes traditional compatibility concerns, allowing it to be used for patients of any blood type without risk of immune rejection. This development is particularly significant for countries like Japan, where only four percent of the population donates blood, and where nearly thirty percent of citizens are over the age of sixty-five. With an aging population and a declining donor base, the need for alternatives is urgent. Globally, the situation is even more dire. The World Health Organisation estimates a shortfall of one hundred million units of blood each year, especially in low-income countries where access is severely limited. Compounding the issue is waste. As much as ten percent of donated blood is discarded before use because it expires within forty-two days even under ideal refrigeration conditions.

Creating Artificial Blood to Save Lives, Science View | NHK WORLD-JAPAN

Hemoglobin vesicles offer a compelling solution. They remain effective for two years at room temperature and up to five years when refrigerated. That represents a seismic shift in blood storage and distribution, especially for remote and disaster-prone regions where cold-chain logistics are unreliable or nonexistent. Clinical trials are now entering their first phase, with sixteen healthy volunteers set to receive transfusions of one hundred to four hundred millilitres to evaluate safety and efficacy. These trials build on promising results

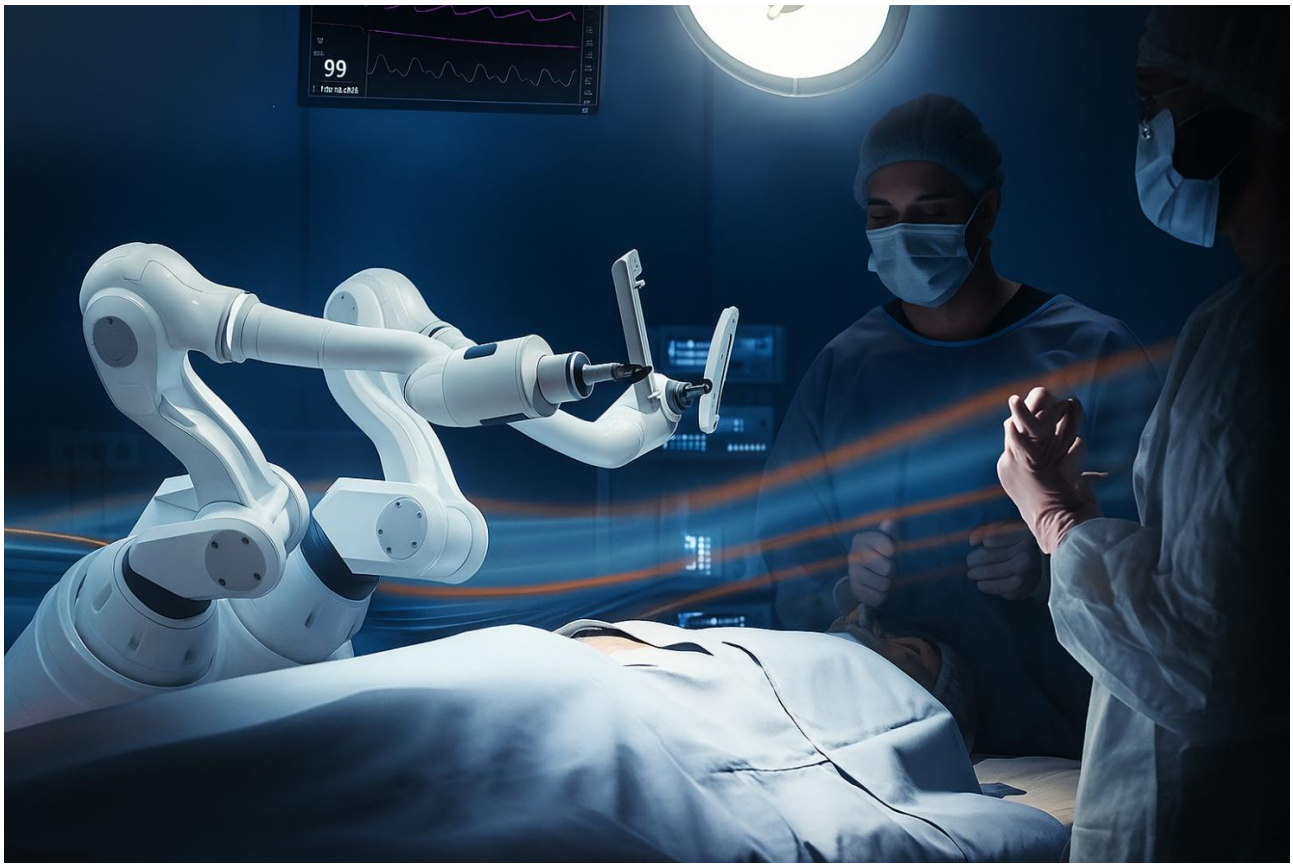
from animal studies and mark the first human application of this next-generation transfusion technology. The potential applications are vast. In disaster relief scenarios, these vesicles could be transported without refrigeration to clinics in the Pacific Islands, where one in four facilities lack proper storage. Military and battlefield medicine also stand to benefit, with the United States Department of Defense already investing forty-six million dollars into synthetic blood research to protect service members in combat. Even the aerospace sector is taking note. NASA and JAXA are exploring hemoglobin vesicles as a solution for future space missions, where conventional blood banks would be impractical or impossible to manage.

The economic implications are equally impressive. The cost to manufacture a unit of artificial blood has dropped from ninety thousand dollars to just five thousand, thanks to improvements in scalability. By 2030, the global artificial blood market is projected to reach fifteen billion dollars, driven by increasing demand in trauma care, surgical medicine, and global health equity. Beyond economics, the humanitarian impact could be extraordinary. An estimated 1.5 million deaths occur each year from postpartum haemorrhage in low-resource settings, a burden that could be significantly reduced with a shelf-stable, universal blood supply. At its core, the development of hemoglobin vesicles is more than a technological achievement. It is a humanitarian leap forward. By transforming expired donations into a universally compatible and long-lasting resource, researchers are helping ensure that access to lifesaving transfusions no longer depends on geography, infrastructure, or donor supply. This is not just about inventing a substitute for blood; it is about redefining who gets to survive, recover, and live with dignity.

Watch the video

The Health Tech Herald will continue tracking this pivotal trial and its global consequences. As artificial blood transitions from theory to therapy, we stand at the edge of a medical revolution, one where technology and compassion converge to meet humanity’s most urgent needs.

Precision Reimagined: How Surgical Robotics and Digital Twins Are Reshaping the Future of Medicine



Source: CAQA Groups

Modern surgery is undergoing a quiet revolution, powered by two transformative technologies, surgical robotics and digital twin models. Together, they are redefining how healthcare professionals approach procedures, patient safety, and even medical education. What was once science fiction is now a clinical reality, with outcomes improving not only in operating theatres but also in lives around the world. Robotic surgery systems, such as the widely adopted da Vinci Surgical System, have already been used in more than ten million procedures globally. These robots offer surgeons unparalleled control, enhanced dexterity, and higher visual clarity during operations. With smaller incisions and greater precision, patients experience less pain, shorter hospital stays, and faster recoveries. The next generation of these systems is taking things even further, incorporating real-time imaging, AI-guided feedback, and tactile sensors that simulate the sensation of touch, bringing human and machine closer in function than ever before.

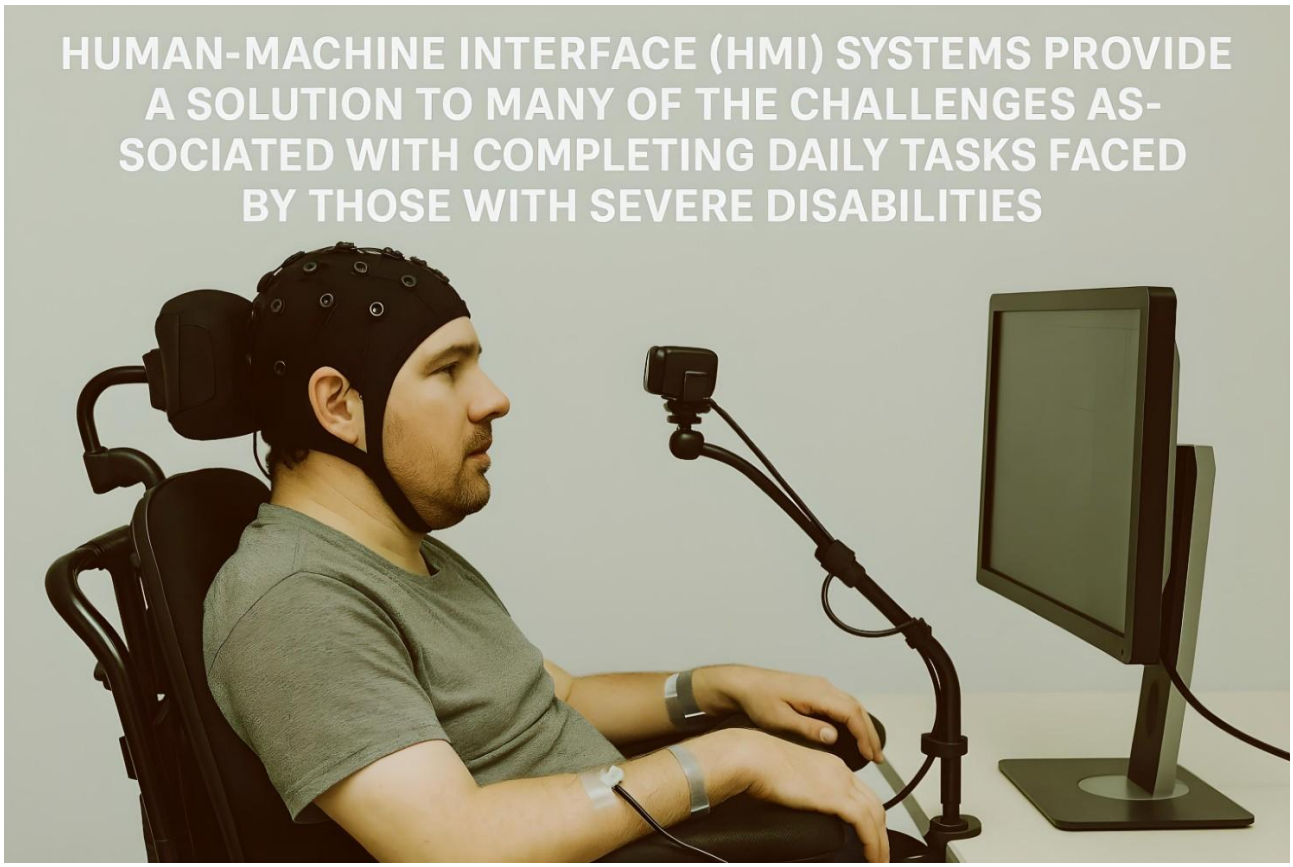
> *Surgical robotics* ***involves using robotic systems to assist surgeons during procedures, enhancing precision, dexterity, and visualization****. It's not about autonomous robots performing surgery entirely, but rather about surgeons using robotic systems to improve their capabilities. These systems translate the surgeon's movements into precise actions of instruments inside the patient's body, often in minimally invasive procedures.*

The numbers speak for themselves. The global surgical robotics market, valued at 8.3 billion US dollars in 2023, is projected to grow to 18.4 billion by 2030. This expansion reflects not only innovation, but proven results. Studies from leading journals, including JAMA Surgery, show that robotic-assisted procedures can reduce complication rates by as much as 30 percent and shorten hospital stays by nearly 20 percent. Some reports also suggest that post-operative pain can be reduced by up to 50 percent, helping patients return to daily life more quickly and with fewer long-term effects. In parallel, another digital innovation is quietly gaining traction: the use of digital twins in medicine. A digital twin is a highly detailed virtual representation of an individual patient, constructed using data from MRIs, CT scans, lab results, and even wearable devices. These models allow surgeons to plan and rehearse complex procedures with exacting precision before ever entering the operating room. In one standout case, the University Hospital of Strasbourg used a digital twin to prepare for a liver transplant, reducing operating time by 30 percent and improving surgical accuracy. As a tool for personalised medicine, the implications are immense. Doctors can test different approaches virtually, predicting how a patient will respond to treatment and avoiding complications before they occur.

> *A digital twin is **a virtual representation of a real-world physical object, system, or process, updated in real-time with data from sensors and other sources**. It provides a digital counterpart that mirrors the behavior, characteristics, and performance of its physical counterpart, enabling monitoring, analysis, simulation, and optimization.*

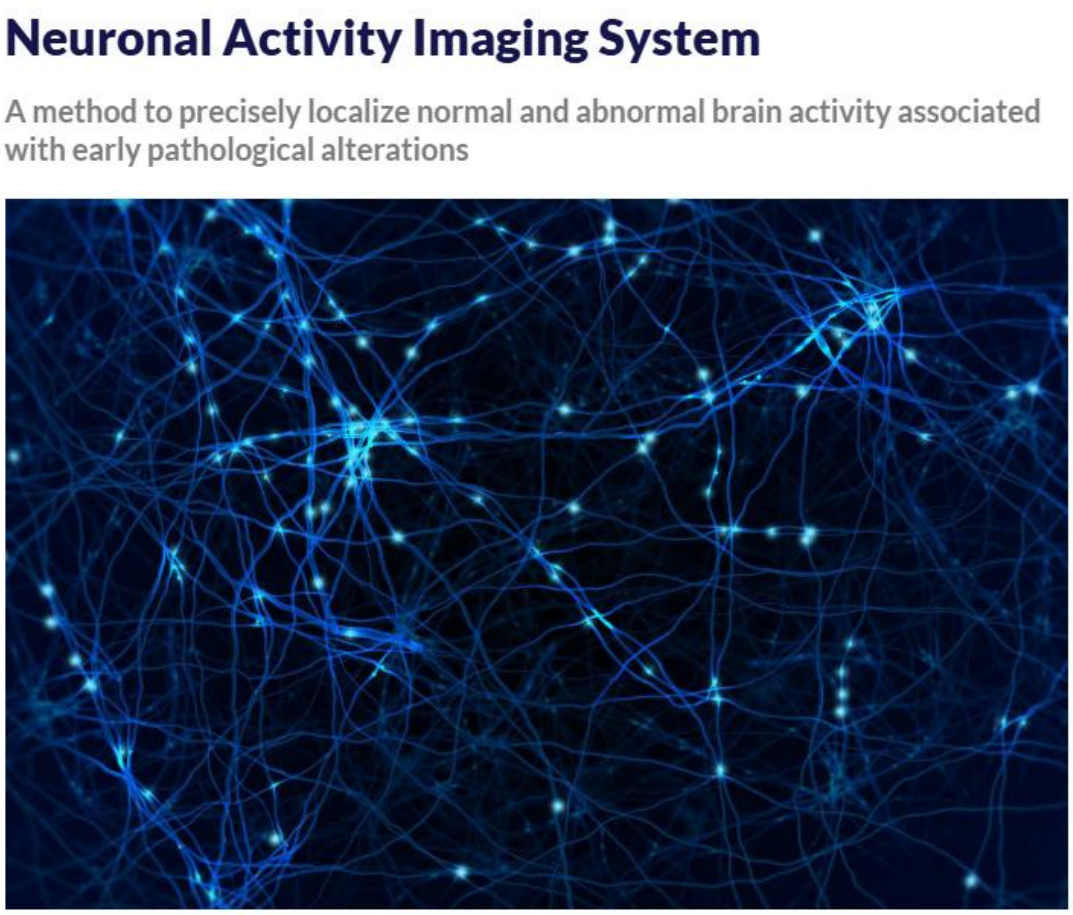
The healthcare sector is taking notice. The digital twin market in healthcare, valued at 1.2 billion US dollars in 2023, is projected to rise to 5.6 billion by 2030, reflecting growing demand for more personalised and predictive care. Meanwhile, hospitals are investing in the infrastructure needed to support these tools, from secure data systems to training programs for staff. These investments are not only improving care, they are equipping surgeons for a future where precision is not optional but essential. Education and training are also being transformed. Aspiring surgeons can now practice using digital twin simulations and robotic surgery platforms in a safe, controlled environment. According to recent surveys, more than three-quarters of surgical residency programs in the United States now use these simulators. Studies show that this style of training improves surgical skill acquisition by as much as 40 percent compared to traditional methods. With more than two thousand hospitals worldwide already incorporating simulation-based learning, the future of medical education is hands-on, high-tech, and deeply human. Looking ahead, the integration of surgical robotics and digital twin technology promises even more sophisticated tools. AI-guided robotic systems may one day conduct parts of operations autonomously, while quantum computing could enhance imaging speed and detail beyond current capabilities. However, as hospitals embrace this next wave of technology, leaders must also prioritise secure and ethical management of patient data. Data is the backbone of every digital twin and robotic platform, and ensuring its protection will be critical to maintaining trust and safety.

Breathing New Life into Accessibility: A Low-Cost Interface That Listens to Your Lungs



For people with severe disabilities like ALS or spinal cord injuries, even simple tasks, such as turning on a light, typing a message, or calling for help, can feel impossible. Traditional human-machine interfaces (HMIs), such as brain implants or eye-tracking systems, often require surgery, extensive training, or costly hardware (some exceeding $15,000). But researchers at **Case Western Reserve University** have pioneered a revolutionary alternative: a sensor that translates breath patterns into commands. Imagine blowing into a straw to scroll through a smartphone or inhaling sharply to activate an emergency alert. This system uses a small, flexible tube placed near the nostrils or mouth to detect changes in airflow, converting breaths into digital signals with 95% accuracy. At just $2 to produce, it's 1,000 times cheaper than many existing HMIs. Early trials indicate that it can control wheelchairs, smart home devices, and communication tools, all without requiring invasive procedures. One participant, a 34-year-old with locked-in syndrome, used it to type messages at 12 words per minute, a life-changing improvement from his previous rate of 2 words per minute using eye blinks. Beyond accessibility, this innovation could reshape industries: firefighters might use breath commands in smoke-filled environments, or surgeons could navigate imaging tools hands-free. As one lead researcher noted, *"Breath is universal. Harnessing it as a control tool isn't just practical, it's deeply human."* With over 75 million people worldwide needing assistive technologies, this $2 solution proves that cutting-edge innovation doesn't have to come at a cutting-edge price.

The Silent Signal: How Machine Learning is Transforming the Early Detection of Brain Diseases



Source: Read the full project summary: https://app.in-part.com/login-preview?returnTo=/opportunities/edeb9bf3-784b-4378-9c87-8edada06a4d5?utm_campaign=top%20healthcare%20innovation%20technologies

Neurodegenerative diseases such as Alzheimer's and Parkinson's affect around 44 million people across the globe. These conditions gradually damage the brain and nervous system, leading to memory decline, impaired movement, and a cascade of health challenges. The economic impact is staggering, but the personal cost, loss of independence, identity, and connection, is even greater. Experts agree that early detection is key. The sooner a disease is identified, the more effectively its progression can be managed. Until recently, however, spotting these illnesses in their earliest stages has been difficult and often invasive. Today, that is changing. Researchers are harnessing the power of machine learning computer systems that learn and improve from patterns in data to uncover the subtle, early signs of brain disease before symptoms appear. This innovation represents a profound shift in how we diagnose and respond to neurological decline. Where traditional tests may rely on costly, invasive scans or subjective assessments, machine learning can analyse digital health data to uncover what human eyes might miss.

These intelligent systems work by examining brain scans and physiological data, often collected through everyday technology such as wearable fitness trackers. Algorithms study

these inputs for patterns, identifying tiny changes in brain structure or function. These changes may be so subtle that they would not register in traditional assessments. In some cases, researchers have eliminated the need for radioactive tracers, making scans safer while improving precision. In one study, a machine learning model detected early signs of Alzheimer's disease with up to 98 per cent accuracy, far outperforming standard diagnostic tools. Real-world progress is being made in several key research hubs. At Western University in Canada, scientists have developed a system that analyses specific brain regions to detect early-stage Parkinson's disease. This tool demonstrated an accuracy rate of 86 percent, providing doctors with earlier insight and enabling personalised care strategies. In the United Kingdom, researchers working with the UK Biobank combined brain imaging, wearable device data, and genetic profiles from nearly 20,000 individuals. Their model showed remarkable accuracy in predicting the onset of neurodegenerative disease, reinforcing the idea that the best outcomes come from combining multiple forms of health data.

Institutions like Stanford University and Imperial College London are also pushing the boundaries. Their teams have improved brain imaging techniques using artificial intelligence, reducing the need for high radiation while enhancing the detail and reliability of the scans. These models can now detect signs of brain shrinkage, a key indicator of Alzheimer's, much earlier than previously possible. This extra lead time could mean access to clinical trials, the chance to adjust treatment plans, or more time to make informed life decisions. The implications of this breakthrough are far-reaching. Early diagnosis means that patients can begin treatments sooner, potentially slowing the onset of memory and movement loss. It allows families to plan, to understand, and to support their loved ones with clarity and purpose. Just as importantly, it opens the door to clinical trials and emerging therapies that may one day halt or reverse the course of these diseases. In essence, machine learning is rewriting the story of how we confront one of the greatest health challenges of our time. By using digital intelligence and everyday health information, we are beginning to outpace conditions that have, for too long, remained hidden until it was too late. Millions of people around the world stand to benefit from earlier answers, more effective support, and above all, renewed hope.

The Mind Unplugged: How Brain-Computer Interfaces Will Redefine Humanity

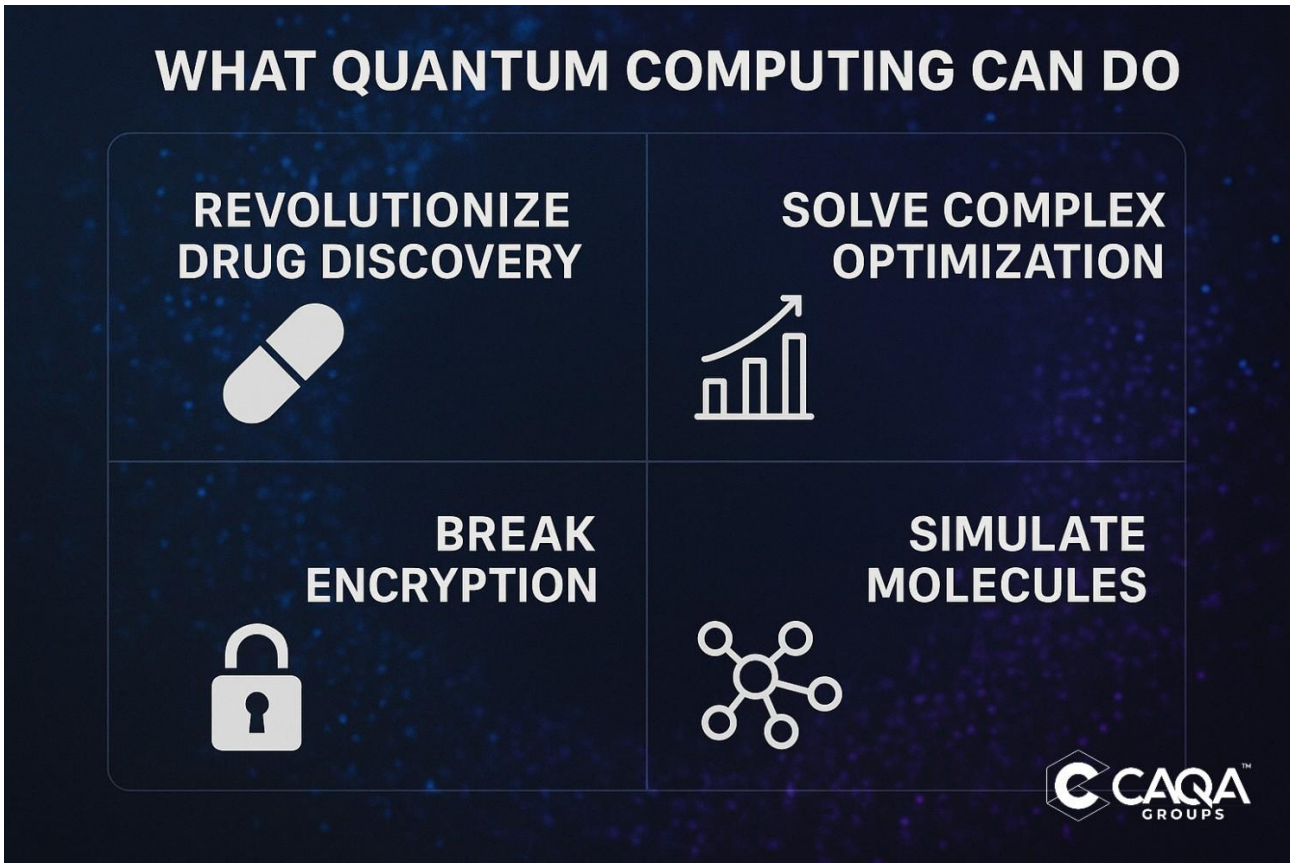
Imagine a world where a single thought allows you to control your computer, move a prosthetic limb, or navigate through a digital environment. What once belonged in the realm of science fiction is fast becoming reality. Brain-computer interfaces, or BCIs, are emerging as a transformative technology that connects the human brain directly to external devices, translating mental activity into digital instructions. This advancement is not just a technical innovation, it represents a profound shift in how humans may soon interact with the world. BCIs function by detecting and decoding electrical signals generated by the brain. These signals are captured using sensors placed either on the scalp or, in some cases, directly on brain tissue. Advanced algorithms then convert these signals into commands that control machines and systems. The possibilities are wide-ranging, from manipulating a robotic arm to adjusting settings on a smart home system, all through thought alone.

Beyond their impressive technical design, BCIs hold incredible promise for enhancing human lives. For the estimated 15 million people who experience a stroke each year, and many others living with paralysis or degenerative neurological conditions, this technology can be life-changing. It provides a pathway for individuals to regain the ability to communicate, move, and function more independently. With applications in assistive communication, wheelchair control, and the operation of prosthetic limbs, BCIs are restoring a sense of agency and dignity to those who have lost it. BCIs are also expected to revolutionise human interaction with machines. Traditional methods such as typing, swiping, or voice input could soon be replaced by direct mental control. This seamless interface could benefit users across a variety of sectors, from gamers seeking a deeper immersive experience to professionals in fields like aviation, medicine, or manufacturing who require rapid, hands-free operation of equipment.

Even more futuristic is the research into cognitive enhancement through BCIs. Scientists are exploring how this technology could support memory improvement, enable direct brain-to-brain communication, and even facilitate the sharing of knowledge between individuals. These developments suggest a future where the boundaries of human capability are significantly expanded. The commercial landscape for BCIs is also rapidly growing. The global market is projected to increase from 2.05 billion Australian dollars in 2024 to 2.37 billion in 2025, with an annual growth rate of more than fifteen percent. By 2029, the market is expected to reach beyond 4.13 billion, driven by advances in healthcare, assistive technology, and digital entertainment. Non-invasive BCIs, those that do not require surgical procedures, are expected to lead the way, particularly through wearable devices using electroencephalogram or EEG technology. These tools are being developed for both clinical and everyday consumer use.

At its heart, the rise of brain-computer interfaces is about more than just connecting to machines. It is about amplifying what it means to be human. This technology promises to restore abilities that have been lost, create new forms of expression, and break down the barriers between mind and environment. It holds the potential to reshape our understanding of communication, creativity, and capability. As we step into this next chapter of human innovation, it becomes clear that the journey is not just about technological progress. It is about unlocking a richer, more inclusive future one where every individual has the opportunity to engage with the world on their own terms, powered by the strength of thought itself.

The Quantum Leap: How 2025's Global Momentum Is Rewriting Science's Playbook



Source: CAQA Groups

Quantum computing is a revolutionary new approach to solving problems that are too complex for today's most powerful computers. Unlike regular computers that use bits, which are either a zero or a one, quantum computers use qubits. These special units can exist as both zero and one at the same time, allowing quantum computers to work through multiple possibilities at once. This makes them incredibly powerful for solving certain kinds of problems in a fraction of the time it would take a traditional computer. The year 2025 is shaping up to be a turning point in this field. The United Nations has declared it the International Year of Quantum Science and Technology. This global spotlight means that quantum research and its real-world applications will be front and centre, not just in scientific circles but also in the mainstream. It is a signal that quantum technology is moving from theory and lab experiments into tools and solutions we might use in everyday life.

One of the most promising areas where quantum computing is already making an impact is healthcare. These computers can simulate how molecules and proteins behave, making it possible for scientists to discover new medicines more quickly and with greater accuracy. A great example of this is the Cleveland Clinic in the United States, which, in partnership with IBM, has launched the first quantum computer dedicated solely to health research. It is already being used to tackle medical problems that were previously considered too difficult for conventional technology. Quantum computing is also showing real promise in agriculture. Farmers could soon benefit from its ability to analyse soil,

weather, and crop data to optimise how they grow food. This could mean using less water, applying fertilisers more effectively, and improving crop yields without harming the environment. Scientists are already experimenting with quantum models to forecast the most efficient times and methods for planting, watering, and fertilising crops. Another exciting use of quantum computing is in weather forecasting. Predicting the weather accurately requires massive amounts of data to be processed quickly. Quantum computers are especially good at managing and interpreting these kinds of data sets. In the future, we could see faster and more accurate weather predictions, giving communities more time to prepare for storms, floods, and other extreme weather events. Right now, the race is on among some of the world's biggest tech companies. Google, Microsoft, and Atom Computing are all working to build quantum machines that are not just scientifically impressive but commercially useful. By 2026, it is expected that the first generation of quantum computers built for business applications, not just for researchers, will start to emerge. This marks a major shift from experimental prototypes to tools that can support industries and solve real-world problems. The possibilities are enormous. With quantum computing, we could find cures for diseases faster, grow more food using fewer resources, and forecast dangerous weather with greater accuracy. However, there are still major challenges to overcome. These include improving the stability of quantum systems and making them affordable and accessible to users outside of high-tech labs.

Precision in the Palm of Their Hands: The Tech Giving Breast Cancer Survivors a Better Tomorrow



Every year, more than two million women worldwide undergo lumpectomies, a breast-conserving surgery designed to remove tumours while saving as much healthy tissue as possible. Yet, despite the dedication of medical teams, one in four women still require a second operation. The reason is often the same: tiny clusters of cancer cells left behind or tumour boundaries that are difficult to see during surgery. These repeat procedures are not only physically and emotionally taxing, but also costly and time-consuming. A new era

of surgical precision is emerging in the fight against breast cancer, led by a groundbreaking system developed at Queen's University in Canada. Known as Multi-Guide, this advanced platform brings together real-time three-dimensional ultrasound, electromagnetic tracking of surgical tools, and artificial intelligence-powered analytics to deliver unmatched accuracy during lumpectomy procedures. These surgeries aim to remove tumours while preserving healthy breast tissue, a delicate balance that has, until now, often fallen short.

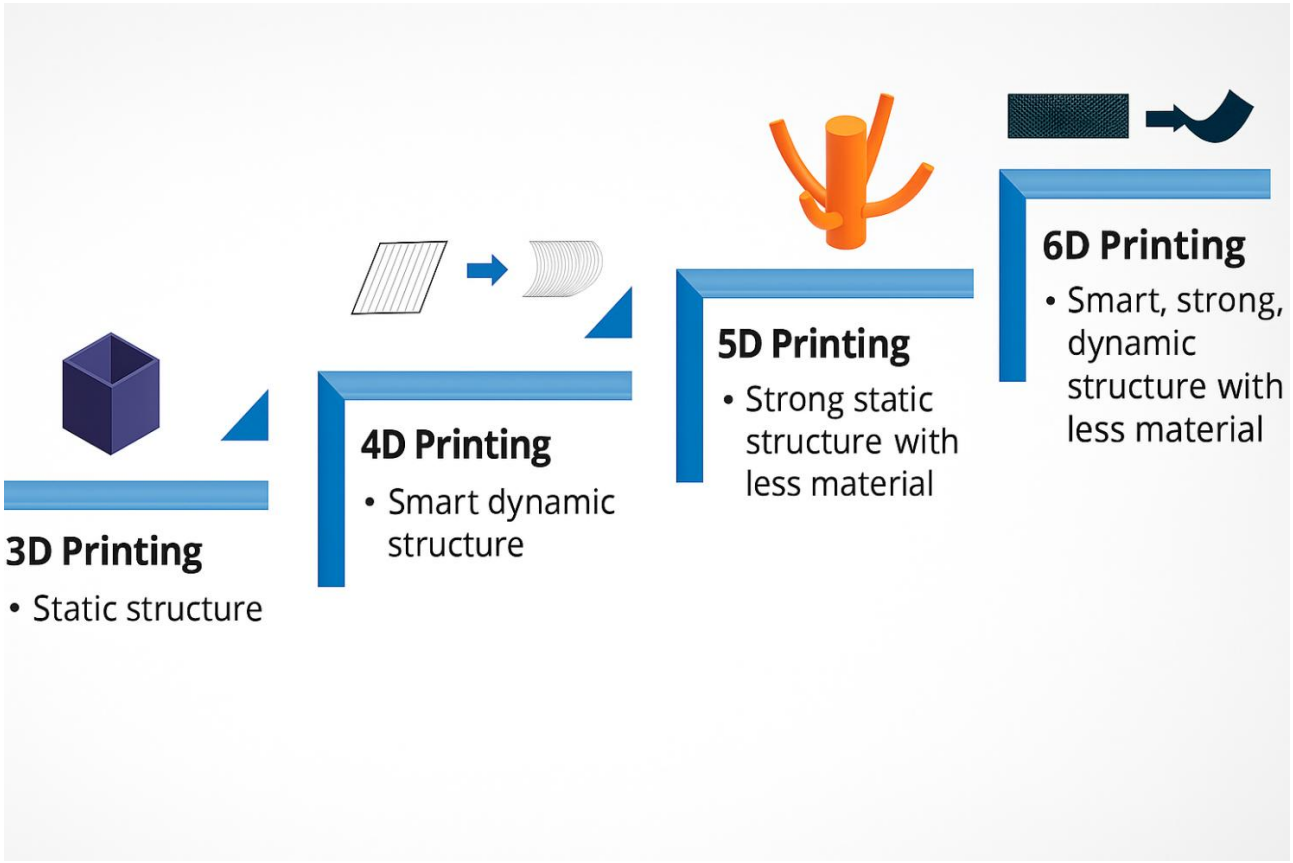
For decades, surgeons have faced a significant challenge. Standard techniques miss tumour margins in roughly one in four cases, forcing patients to return for repeat surgeries. These follow-up procedures extend recovery times, add emotional and physical strain, and increase healthcare costs. Clinical trials of the Multi-Guide system, however, show a dramatic improvement. Surgeons using this technology achieved complete tumour removal in 97 percent of cases on the first attempt, compared to just 73 percent using traditional methods. The number of repeat operations dropped by 64 percent, offering patients a smoother, less traumatic journey to recovery.

> *"Multi-guide technology" in the context of breast cancer research refers to* ***a CRISPR-based gene editing approach that uses multiple guide RNAs (sgRNAs) to target a gene****. This method aims to increase the efficiency and reliability of gene knockout, particularly in breast cancer research, by minimizing the chance of false negatives.*

The benefits do not end there. Multi-Guide also improves cosmetic outcomes, with a notable rise in patient satisfaction following surgery. By adapting to natural shifts in breast tissue that occur during procedures, the system maintains a consistent level of accuracy even as the surgical landscape changes. This adaptability is one of its most important features, ensuring that surgical plans remain precise from start to finish. Experts involved in the development of Multi-Guide describe it as a paradigm shift in breast cancer care. Rather than relying on a surgeon's instinct and static imaging, the system offers a dynamic, data-rich view of the anatomy, highlighting high-risk areas with visual cues that support decision-making in real time. It is not simply a technical improvement, it is a transformation of how care is delivered, offering better outcomes with less harm. This innovation comes at a crucial time. Breast cancer rates are rising steadily across the globe, with the World Health Organization reporting more than 2.3 million new cases each year. The need for safe, effective, and accessible surgical tools has never been greater. While existing navigation systems often cost more than thirty-five thousand dollars, the Multi-Guide system has been developed with affordability in mind. Its lower price point significantly increases the potential for widespread adoption, making advanced care available to a broader range of healthcare providers and patients. In addition to improving patient outcomes, the reduction in repeat surgeries translates into significant efficiency gains for hospitals. Each avoided operation frees up valuable time and resources, including access to operating theatres, surgical teams, and post-operative care. For hospitals operating under pressure, this increase in capacity can make a meaningful difference in their ability to meet broader community health needs.

Looking forward, the Multi-Guide platform may serve as the foundation for even more advanced systems. Researchers envision future iterations that incorporate quantum computing for enhanced imaging, robotic tools guided by artificial intelligence, and digital models tailored to each patient's unique anatomy. But even as these possibilities lie on the horizon, the current generation of Multi-Guide technology is already making a profound impact. At its core, this breakthrough is about more than algorithms and instruments. It represents a merging of precision and compassion, offering women a clearer path to healing, a stronger chance at preserving their quality of life, and a deeply human experience of care at one of life's most vulnerable moments. Multi-Guide is not just a better way to operate, it is a better way to support those facing the realities of breast cancer.

Beyond Dimensions: How 5D Printing is Forging the Future of Precision Medicine



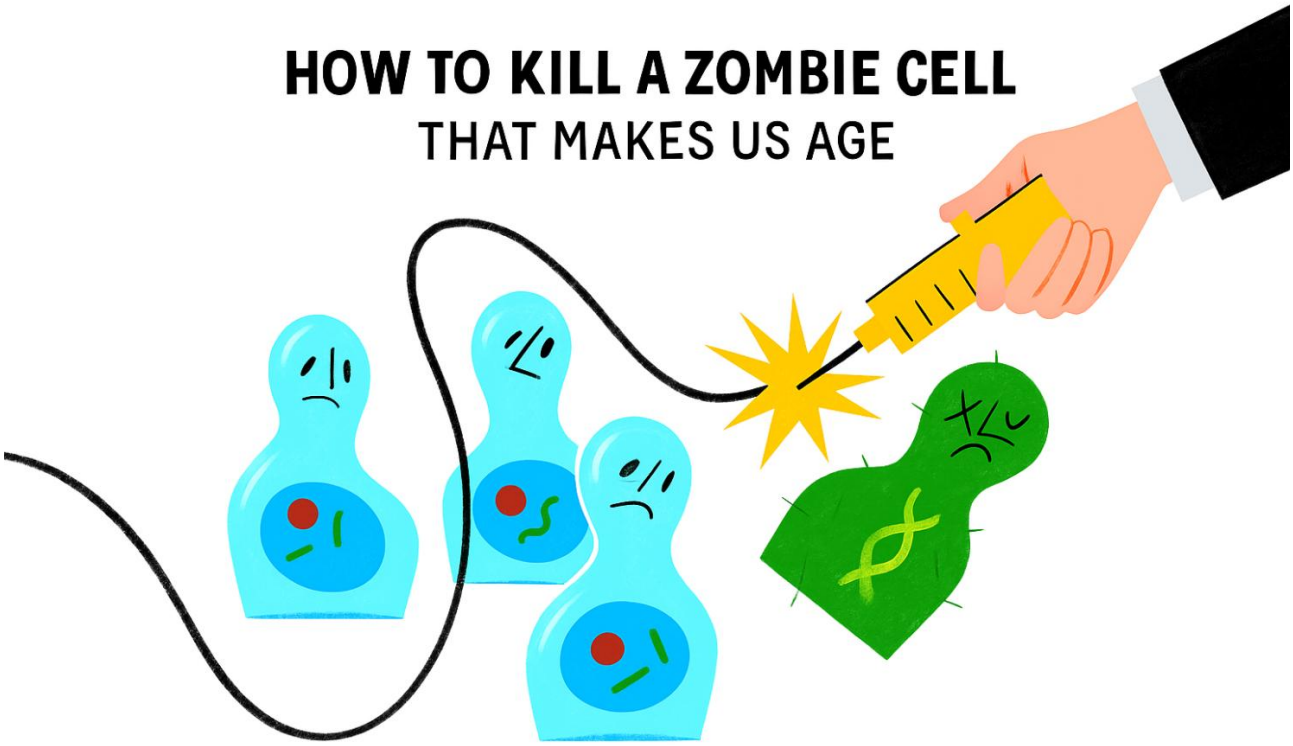
A new frontier in healthcare manufacturing is quietly taking shape, one that bends the rules of geometry, strengthens what was once fragile, and puts patient specificity at the core of innovation. Known as 5D printing, or five-axis additive manufacturing, this breakthrough method is poised to redefine the way we design and deliver medical devices. While 3D printing revolutionised how we prototype and personalise in medicine, 5D printing takes the next leap by adding two rotational axes to the standard three. This allows for curved, organic geometries with structural integrity and material efficiency previously thought unachievable. The uniqueness of 5D printing lies in its five-axis motion, which enables full 360-degree fabrication. Instead of stacking layers on a flat plane, 5D printers rotate the print head or the platform itself, building from multiple directions. This

not only eliminates the weak layer lines found in 3D-printed structures but also significantly reduces waste. Recent studies report that material usage drops by up to fifty percent compared to conventional 3D printing processes. More importantly, the curved deposition of materials has been shown to improve fatigue resistance. In one study published in Nature Communications, titanium orthopaedic implants printed with 5D technology demonstrated twenty-two percent greater strength than their 3D counterparts.

Clinical applications of 5D printing are advancing rapidly. Dental laboratories are using 5D-printed zirconia to fabricate crowns with remarkable precision, achieving ninety-eight percent accuracy compared to ninety-two percent for traditional 3D models. This increased fidelity translates to less time spent adjusting the device in the patient's mouth and shorter chair time overall. In spinal surgery, porous titanium cages created with 5D techniques have promoted bone ingrowth up to fifty percent faster than standard implants, thanks to their highly optimised lattice structures. The U.S. Food and Drug Administration has already cleared several of these designs, marking a shift toward widespread regulatory acceptance. In the operating theatre, surgeons are benefiting from custom 5D-printed tools such as patient-specific guides that reduce surgical time and improve outcomes. At Johns Hopkins Hospital, trials showed that hip replacement surgeries using these guides were completed twenty-five percent faster, with no loss in precision. At a more microscopic level, researchers are using 5D printers to produce vascular stents with tolerances as tight as one-tenth of a millimetre, an innovation crucial for delicate procedures in paediatric cardiology.

5D printing also merges powerfully with 4D bioprinting, which incorporates smart materials that change shape in response to physiological conditions. Boston Children's Hospital, for example, is testing shape-shifting tracheal splints that expand as a child grows, reducing the need for repeat surgeries. These splints are manufactured using 5D techniques that ensure strength, flexibility, and perfect anatomical fit. The economic and market outlook is equally impressive. The global medical 3D printing market, currently valued at 2.4 billion dollars, is expected to exceed 8.6 billion by the end of this decade. Industry forecasts suggest that 5D printing could account for at least a quarter of this market by enabling complex, customisable, and regulatory-approved devices. Cost savings are already being realised. Cranial implants, which once cost over 3,500 dollars when machined traditionally, can now be produced using 5D methods for approximately 1,200 dollars. This is not merely a revolution in printing. It is a reimagination of what it means to care with accuracy, to heal with data, and to manufacture hope at the intersection of design and humanity.

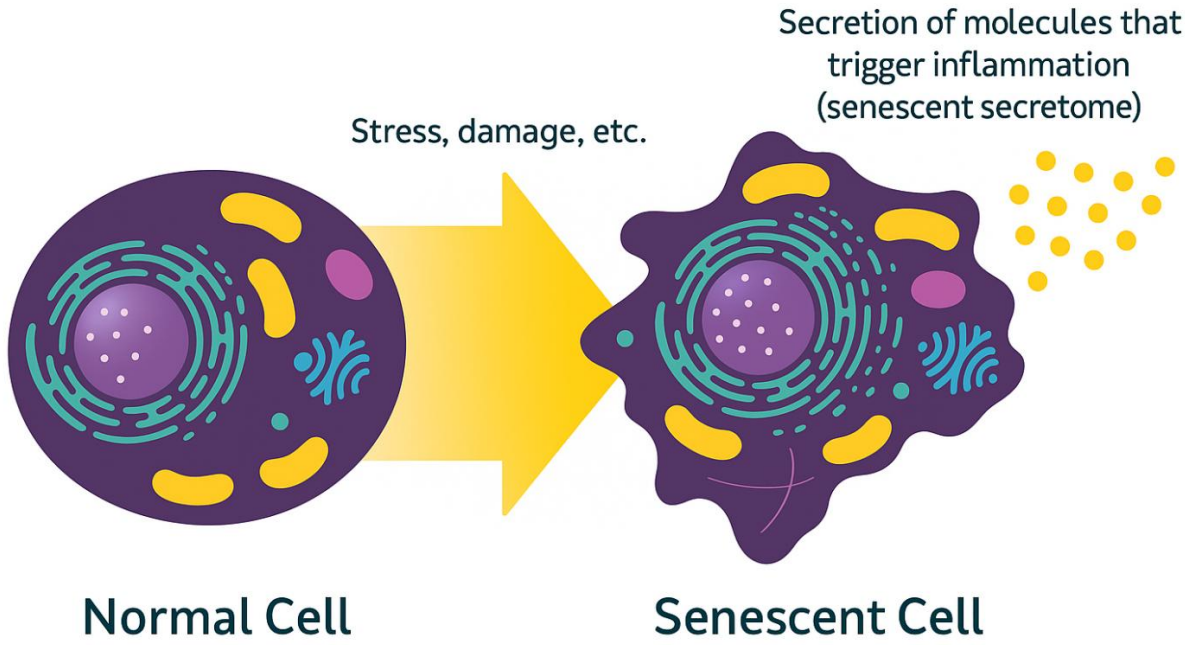
The End of Aging as We Know It: How Senolytics Are Giving New Life to Our Later Years



The way we age is undergoing a fundamental redefinition, and the breakthrough at the heart of it all is a class of drugs known as senolytics. These therapies are designed to target and remove senescent cells, often referred to as zombie cells, which linger in the body long after they stop functioning. Rather than quietly disappearing, these cells remain metabolically active, secreting inflammatory compounds that contribute to a host of chronic diseases, from Alzheimer's and osteoarthritis to heart failure. By age sixty, approximately fifteen percent of the cells in tissues such as skin, fat, and lungs become senescent, acting as silent saboteurs of the body's resilience. Enter senolytics. The most promising among them is a cocktail known as dasatinib and quercetin, or D plus Q. Dasatinib, originally developed and approved as a treatment for leukaemia, blocks the survival pathways that keep senescent cells alive. Quercetin, a plant-derived flavonoid found in foods like apples and onions, disrupts energy production in these cells. Together, they induce apoptosis, a form of programmed cell death, without damaging surrounding healthy tissue. According to recent findings in Aging Cell, this targeted approach shows striking precision in eliminating the very cells that accelerate aging and disease.

The science is not confined to theory. In a landmark Mayo Clinic study, mice treated with the D plus Q combination lived thirty-six percent longer and showed marked improvements in strength and mobility. Human trials are now validating these results. In a Phase One study focused on idiopathic pulmonary fibrosis, patients experienced a fifty percent reduction in senescent cell load and improved their walking capacity, with seventy percent showing measurable gains. A separate trial involving postmenopausal women

reported a four-point-three percent increase in bone density and an eight percent improvement in grip strength over six months, important markers of ageing slowed or even reversed. The pipeline of senolytic research is expanding rapidly. Fisetin, another naturally occurring compound found in strawberries, reduced senescent cell levels by sixty percent in patients with diabetic kidney disease. Navitoclax, a cancer drug now being studied for Alzheimer's, has demonstrated a thirty percent reduction in amyloid plaque buildup in preclinical models. As a sector, the global senolytic drug market is forecast to grow to over twenty-seven billion dollars by the end of this decade, fuelled by the world's rapidly ageing population and growing interest in longevity research.



The potential benefits of senolytics extend well beyond isolated cases. Inflammation markers such as interleukin six have dropped by twenty-five percent in patients with osteoarthritis. Cardiovascular studies in animals indicate a forty percent lower risk of heart-related events following senolytic treatment. Yet like any pioneering therapy, there are hurdles. Side effects such as fatigue and anaemia have been observed in around twenty percent of participants in clinical trials. Cost remains a barrier as well. While quercetin is affordable and widely available, dasatinib can cost up to ten thousand dollars per year, placing it out of reach for many. The future, however, looks increasingly personalised. Companies such as Unity Biotechnology are developing biomarkers that can identify patients most likely to benefit from senolytics. Other research teams are exploring how combining these drugs with NAD boosters or gene-editing tools like CRISPR could yield synergistic effects that go far beyond cellular cleanup. With the integration of artificial intelligence and genomic profiling, treatments may soon be tailored not just to diseases but to individual ageing profiles.

Why does this matter? Because by the year 2050, one in six people around the world will be over the age of sixty-five. The goal of senolytics is not simply to extend life, but to compress the period of morbidity that often comes with age. Rather than adding more years of decline, the aim is to add life to those years, years of energy, clarity, and purpose. As Dr James Kirkland of the Mayo Clinic so aptly states, we are moving toward a future where aging itself is not an inevitable decline, but a manageable and treatable condition. Senolytics are not just opening the door to healthier ageing. They are pointing toward an entirely new chapter in human health, one in which the final decades of life may be lived not in fragility, but in freedom.

The Health Tech Herald will continue to follow how senolytics converge with genomics, artificial intelligence, and regenerative medicine to redefine what it means to grow older in the twenty-first century.

Feeding the Future: How AI Nutrition Personalizers Are Turning Gut Data into Lifesaving Diets



A revolution is quietly unfolding at the intersection of food, artificial intelligence, and the human microbiome. No longer confined to broad dietary guidelines or one-size-fits-all meal plans, a new class of health technologies is emerging that promises to personalise nutrition with unprecedented precision. Known as AI Nutrition Personalizers, these systems combine microbiome science and machine learning to craft dynamic, data-driven diets tailored to each individual's unique biology, starting with the microscopic life within their gut. At the core of these technologies lies an intimate understanding of the gut microbiome. The process typically begins with a stool sample, which undergoes next-

generation sequencing to reveal the precise composition and diversity of gut bacteria. This microbial fingerprint is then merged with other health metrics such as genetics, lifestyle, and medical history to form a comprehensive health profile. What follows is a level of dietary personalisation that traditional nutrition advice cannot hope to match.

Artificial intelligence interprets this rich dataset to identify imbalances or deficiencies in the microbial ecosystem. Using sophisticated algorithms, the system links specific foods and nutrients to the needs of the individual's microbiome. The result is a personalised meal plan that is not only tailored to the person but evolves over time. As users follow the plan, their physiological responses and microbiome composition are continuously monitored through wearables and mobile tracking apps. This creates a feedback loop, enabling the AI to refine and adapt recommendations in real time, responding to even subtle biological changes. The clinical results are already compelling. In recent trials, AI-personalised nutrition programs significantly boosted microbial diversity and increased populations of beneficial bacteria. In a six-week intervention involving healthy individuals, researchers observed improvements in gut richness, decreased intake of inflammatory foods, and reductions in waist circumference. For patients with irritable bowel syndrome, AI-tailored diets have outperformed traditional approaches such as the low-FODMAP plan, leading to marked reductions in pain, bloating, and discomfort, along with improvements in daily function and mental wellbeing. These benefits extend well beyond digestive health. Enhanced microbiome diversity has been linked to improved immunity, better metabolic function, and reduced inflammation, all of which play a critical role in preventing chronic diseases. Early studies suggest that AI-driven nutrition may offer new strategies for managing diabetes, obesity, and cardiovascular risk by optimising the gut environment, improving dietary compliance, and providing more sustainable lifestyle changes.

What makes this technology so transformative is its capacity to learn and adapt. Unlike static meal plans or restrictive diets, AI Nutrition Personalizers grow smarter with every meal, every bite, and every biological response. This makes them not only powerful tools for disease management but also guides for lifelong wellness. For the first time, nutrition is becoming as unique as the individual, and the future of food is being shaped one microbe at a time. As AI continues to redefine the landscape of personalised medicine, these systems remind us that the path to optimal health may begin in the most unexpected place, the gut. And thanks to machine learning, that journey is now guided by real-time data, tailored insight, and a deeper understanding of what it truly means to eat for life.

As we embark on this journey together, we invite you to witness not just the evolution of medicine, but the elevation of hope itself. From artificial blood that knows no borders to breath interfaces that restore voice to the voiceless, from quantum computers that accelerate healing to senolytic drugs that redefine aging, we stand at the intersection of science and miracle. The innovations featured in this inaugural edition represent more than technological triumph; they embody humanity's unwavering commitment to healing, hope, and the expansion of what's possible. Each breakthrough carries within it the stories of countless researchers who refused to accept limitations, patients who dared to dream of better outcomes, and healthcare providers who see technology not as a replacement for human compassion, but as its most powerful amplifier. As we move forward, The

HealthTech Herald will continue to chronicle this remarkable transformation, always remembering that behind every algorithm, every robotic surgery, every personalised treatment plan, lies the simple yet profound desire to ease suffering and extend life's precious possibilities. Welcome to The HealthTech Herald. Welcome to the future of health, where every breakthrough brings us closer to a world where technology serves humanity's deepest need: the chance to live, heal, and thrive with dignity.

The Editorial Team, The HealthTech, HeraldFirst Edition, 2025

Disclaimer

The information presented in The HealthTech Herald is for educational and informational purposes only and should not be construed as medical advice, diagnosis, or treatment recommendations. The content featured in this publication is based on current research, clinical trials, and technological developments in healthcare as of the publication date. Readers should not make any healthcare decisions based solely on the information provided herein. Always consult with qualified healthcare professionals before making any medical decisions or changes to treatment plans. The HealthTech Herald, CAQA Groups, and contributing experts do not endorse any specific treatments, devices, or interventions mentioned in this publication. While we strive for accuracy, medical research is rapidly evolving, and information may become outdated. Some technologies and treatments discussed may be experimental, investigational, or not yet approved by regulatory authorities in all jurisdictions. Individual results may vary, and not all innovations may be suitable or available for every patient or condition. The HealthTech Herald disclaims any liability for decisions made based on the content provided. For personalised medical advice, please consult your healthcare provider.

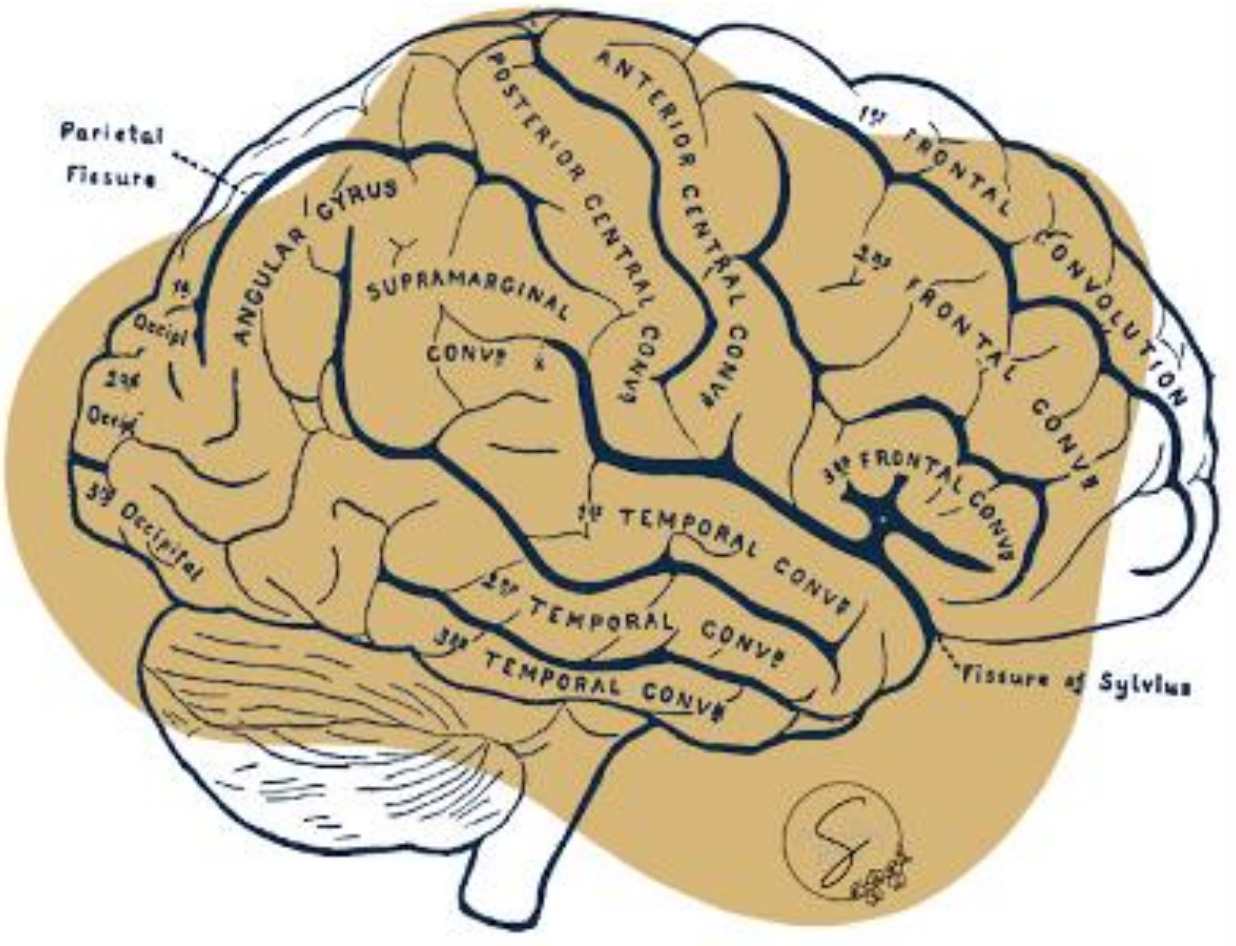
THE HEALTHTECH HERALD

How many senses have you opened in yourself?

By Dr Sukh Rashpal Sandhu | First published 15 August 2025

We often think we only have five senses: sight, hearing, smell, taste, and touch. But science, experience, and even ancient wisdom tell us there's so much more.





From the subtle balance that keeps you upright, to the quiet voice that tells you when something feels "off," to the mysterious flashes of intuition you can't explain, your senses are more than just physical tools. They are your bridge to the world, to others, and to yourself.

Some of us live with only a few senses fully awakened. Others explore deeper, tuning into body signals, emotional currents, environmental changes, and perhaps even the realms science hasn't yet proven.

List of senses that humans may possess

Sight (Vision): Perceiving colour through cones, brightness/light through rods, movement, low-light vision, and even subtle subconscious colour cues.

The human eye, under clear atmospheric conditions, can perceive large objects or light sources up to 20 miles away, demonstrating surprising spatial sensitivity.

Researchers have developed *optical sensors* and *quantum dot machine vision sensors* that mimic the human eye's ability to adapt rapidly to changing light, process images, and react to intense brightness, sometimes beating natural vision speed by orders of magnitude.

Chinese scientists create visual sensor that adapts to light changes in seconds

Bionic eyes provide visual input for blind or severely vision-impaired patients. These prosthetic devices translate light into electrical signals for the brain, with clinical trials restoring rudimentary vision and object recognition to users.

The Bionic Eye | Fighting Blindness Canada

Tiny neuromorphic devices can "see" and form memories like biological eyes, paving the way for advanced AI and robotics with sensory processing inspired by human perceptual circuits.

Tiny device mimics human vision and memory abilities

Hearing (Audition): Detecting sounds in air or water, picking up ultrasonic frequencies through bone conduction, sensing deep vibrations, and even using human echolocation.

Some people experience synesthesia, where they perceive sound as colour or shape, a phenomenon explored in documentaries and peer-reviewed studies. This shows senses merging beyond the typical boundaries.

Watch the video

McGurk Effect: Videos illustrate that when visual mouth movements mismatch audio, humans often hear a sound that matches the visual cue, demonstrating auditory-visual integration. The famous "ba/ga" video is widely used in psychology lectures and labs.

Watch the video

A landmark clinical trial at UCL/UCLH tested an injectable drug which showed measurable hearing recovery for some patients. This drug (LY3056480) could potentially *restore lost hearing*, signaling a new era in therapy beyond mechanical intervention.

Modern hearing aids now use *directional microphone arrays*, real-time *speech enhancement*, and *artificial intelligence* to distinguish voices from background noise, vastly improving clarity for the hearing impaired.

Smell (Olfaction): Recognising general odours, detecting specific chemicals, and responding to scent influences without conscious awareness.

Humans may distinguish up to 1 trillion scents. Contrary to popular belief, recent research estimates the human nose can distinguish as many as 1 trillion different smells, far more than the 10,000 previously thought.

Smell is directly wired to emotion and memory. Unlike sight or sound, smell signals travel straight to the limbic system in the brain, including the amygdala and hippocampus, making scent the most closely linked sense to our feelings and personal memories. This explains why a whiff of a familiar perfume can trigger vivid recollections or emotions instantly.

Your "odor identity" is unique, like a fingerprint. Every individual has a unique scent signature, except identical twins. This scent is used subconsciously by humans (and recognized by some animals, including dogs) for social and familial recognition.

Smell shuts down while you sleep. Unlike other senses, your olfactory system goes offline during sleep, which is why smoke or harmful odors might not wake you up, making working smoke detectors critical at night.

Women have stronger smell sensitivity than men. Due to genetic and hormonal differences, females usually outperform males in both odor detection and identification.

Innovations such as the *Aroma Shooter*, *Vaqso VR Dev Kit*, and *smelling screens* let users smell digital content in VR, video games, and cinemas. Electronic noses now precisely identify thousands of molecules for medical, food, and environmental monitoring.

Graphene-based olfactory sensors dramatically increase sensitivity, rivaling the nose's ability to detect trace organic compounds, potentially up to a trillion scent combinations, as new research suggests.

Taste (Gustation): Experiencing sweet, salty, sour, bitter, and umami flavours, with some people having "super-taster" sensitivity and cravings linked to nutrient needs.

Roughly 25% of people are "supertasters," possessing far more taste buds and papillae than average. This makes them experience flavours, especially bitterness, much more strongly, sometimes to the point of aversion to certain foods like broccoli or coffee. The number of taste buds ranges from 2,000 to 8,000, with subtle differences in sensitivity to the five basic tastes: sweet, sour, salty, bitter, and umami. About 80% of the flavor you experience actually comes from your sense of smell. This is why food tastes bland when you have a blocked nose. Specific genes (e.g., TAS2R38) determine how strongly you experience certain tastes like bitterness, and even influence your food preferences and dietary habits. **Taste buds**also exist in places like your cheeks, soft palate, and even the epiglottis, expanding the regions where taste perception occurs.

Electronic tongues (e.g., TS-5000Z system) use polymer membranes to create quantitative scales of bitterness, sweetness, salt, umami, etc., aiding the food and pharmaceutical industries in quality and safety.

Startups and researchers are exploring fMRI and electrical stimulation trials to map and alter taste perception for therapeutic purposes and virtual reality applications.

Touch (Tactition): Feeling pressure, texture, itch, and vibration through skin contact.

Our skin and nervous system are so sensitive that people can distinguish between surfaces that differ by only one molecular layer. **The skin is the body's largest sensory organ.** It contains millions of nerve endings, some specialized for pressure, some for vibration, some strictly for detecting temperature or pain. Special nerve fibers (C tactile fibers) transmit slow, gentle touch directly to brain regions responsible for emotional processing, which is why hugs, caresses, and even a gentle pat convey feelings of comfort and bonding. Research demonstrates that even fleeting physical contact (like a handshake or a pat on the arm) triggers measurable reductions in stress hormones, showing touch is essential for well-being and social functioning.

Pioneering inventions such as the *resistive touch screen* (Elographics, 1977), optical touch arrays (Plato IV, University of Illinois), and the development of multi-touch displays have revolutionized human-computer interaction, turning touch into a primary control mechanism.

Haptic feedback clothing and gloves translate digital signals into precise vibrations, pressure, and temperature for VR, prosthetics, and rehabilitation.

Medical devices now use *touch sensors* for palpation, diagnostics (e.g., measuring skin softness or roughness at the molecular level), and robotic surgery with enhanced tactile feedback.

Temperature Sense (Thermoception): Sensing heat, cold, internal body temperature, infrared warmth, and overall thermal comfort.

Wim Hof, known as "The Iceman," can withstand extreme cold for hours, sitting in ice baths or climbing snowy mountains shirtless. Researchers found he can consciously influence his autonomic nervous system to control skin and core temperature.



Some pit vipers, certain beetles, and vampire bats detect infrared heat; while humans can't see it, some blind individuals report feeling subtle warmth cues through exposed skin.

An *infrared light bulb system* measures an individual's awareness of hand temperature shifts, dissociating thermal awareness from cardiac perception. This enables new research into interception, accurately tracking awareness of subtle body temperature changes without tactile confounds.

Wearable devices monitor and feedback core/peripheral temperature, helping prevent heatstroke or hypothermia in athletes and risk populations.

Balance & Motion (Equilibrioception): Detecting gravity, acceleration, and movement through the inner ear's vestibular system.

Tightrope walker Philippe Petit crossed the Twin Towers in 1974 without a safety net, relying on flawless vestibular control to maintain balance 417 metres above ground.



Astronauts in microgravity must re-learn balance when returning to Earth; some feel like they're tilting even when standing straight.

Pain (Nociception): Feeling pain on the skin, in muscles, joints, bones, and internal organs; includes empathetic pain felt for others.

Congenital insensitivity to pain (CIP) is a rare condition where people feel no pain at all. While it may sound like a superpower, many with CIP suffer repeated injuries, burns, or infections without realising.

The FDA/CE-approved *NOL® Index* non-invasively tracks physiological pain responses during surgery using a finger probe with AI algorithms, optimising anesthetic and pain care and reducing postoperative complications. NOL and similar sensors analyze heart rate, skin conductance, and peripheral temperature to provide real-time, quantifiable pain monitoring for unconscious patients.

Proprioception: Knowing where your body parts are without looking.

Ian Waterman lost all sense of proprioception from the neck down due to a viral infection damaging his sensory nerves. He can move only by looking at his limbs and thinking about each action; yet he learned to walk again through sheer visual-motor control.

Watch the video

Rehabilitation platforms like *MindMotion* and Logitech-funded VR prototypes use full-body tracking to help patients regain proprioceptive accuracy after stroke or nerve injury. Modern prosthetic limbs now integrate IMUs (inertial measurement units) that feed body position data back to the user, effectively restoring proprioceptive feedback.

Kinesthesia: Perceiving body movement.

Olympic gymnast Simone Biles' "air awareness",; the ability to know exactly where her body is in 3D space while twisting mid-air, is an elite kinesthetic skill. She can adjust her landing mid-somersault without seeing the ground.



Cats also have exceptional kinesthesia, which is why they can land on their feet from surprising heights.

3D motion capture systems (like Vicon) are used to study elite athletes' mid-air movement awareness, helping train gymnasts and divers with real-time visual feedback. Wearable accelerometer systems like *Performa Track* accurately detect spatial orientation, allowing athletes to "see" their movement patterns and correct technique mid-training.

Muscle Tension Sense: Feeling how contracted or relaxed muscles are.

Elite weightlifters can adjust grip, posture, and tension instantly to balance hundreds of kilograms; often avoiding injury by fine-tuning muscle contraction mid-lift. Yoga practitioners who master "progressive muscle relaxation" can drop their heart rate and blood pressure on command.

Wearable electromyography sensors (e.g., from Myon and Delsys) monitor real-time muscle activation levels to help in physical therapy, high-performance sports, and injury prevention.

Yoga mats with embedded pressure and tension sensors guide users in posture alignment and relaxation by reading muscle engagement patterns.

Stretch Receptors: Detecting expansion in lungs, stomach, bladder, blood vessels, and digestive tract.

Free divers rely on lung stretch receptors to judge when to surface before blackout. World record-holder Alexey Molchanov can dive over 130 metres, carefully reading internal pressure and expansion signals.

Capsules like the *PillCam* and motility monitoring devices assess stomach expansion and gut distension from the inside, enabling real-time GI tracking.

Devices such as respiratory belts with strain gauges measure lung expansion and inform ventilator settings for critical care patients.

Sense of Time (Chronoception): Awareness of passing time and internal circadian rhythm.

Professional speedcubers (Rubik's Cube solvers) can predict within milliseconds how long they've been solving without a clock; their internal chronoception is honed by repetition.

Time perception slows under stress: during accidents, people often report "everything happening in slow motion."

MRI-based studies use tasks like temporal reproduction to map the brain's "internal clock" in regions such as the cerebellum and basal ganglia, advancing treatment for Parkinson's and ADHD-related timing deficits.

Devices track light exposure, body temperature, and melatonin cycles to optimise sleep-wake schedules and treat jet lag.

Directional Awareness: Navigating space through internal mapping and dead reckoning.

Polynesian navigators can cross thousands of kilometres of open ocean without instruments, using wave patterns, stars, and subtle directional cues stored in internal mental maps.

Homing pigeons use a similar internal compass; humans may retain remnants of this magnetic navigation sense.

Controlled experiments at Caltech found measurable brainwave changes in people exposed to magnetic field shifts, suggesting latent compass abilities.

AR helmets for pilots and divers integrate real-time heading, pitch/roll, and environmental mapping, effectively enhancing natural directional senses.

Chemoreception (Internal): Detecting blood CO_2 levels, oxygen saturation, hormonal changes, immune status, pollutants, pH changes, glucose levels, and fatty acids.

Some mountaineers can detect their own drop in oxygen levels at high altitudes before measurable symptoms appear; a lifesaving early warning for hypoxia.

Osmoreception: Monitoring hydration and salt balance.

Elite endurance athletes monitor hydration instinctively. Some can predict electrolyte loss mid-race and adjust fluid intake before cramping starts. Your body can sense sodium imbalance well before blood tests show it.

Hunger Sense: Recognising the need for food, including specific nutrients, minerals, or vitamins.

Pregnant women often report sudden cravings for specific foods, sometimes linked to nutrient needs like calcium or iron. Ice cravings can be a symptom of iron-deficiency anaemia; the hunger sense sometimes signals deficiencies in unusual ways.

Nausea Sense: Sensing conditions that trigger vomiting.

Astronauts in space can experience "space adaptation syndrome", sudden nausea when the inner ear's motion sense and the eyes disagree on orientation. Morning sickness may have evolved to protect embryos from potentially harmful foods.

Suffocation Sense: Detecting CO_2 build-up to trigger breathing reflex.

Free divers train to suppress the intense urge to breathe triggered by CO_2 buildup, but ignoring it too long can cause shallow-water blackout.

Urge-to-Excrete Sense: Feeling bladder or bowel fullness.

Ultra-marathon runners have to manage bladder and bowel urges over 100+ km races, often suppressing or strategically timing relief to maintain pace. This sense can be tricked, for example, anxiety can cause a "false" need to urinate.

Energy/Metabolic Sensing: Detecting cellular energy (ATP) levels to regulate fatigue and alertness.

Tour de France cyclists report being able to "feel" when their glycogen stores are running low before measurable fatigue sets in.

Microbiome-Gut-Brain Sense: Picking up gut microbe activity that affects mood, appetite, and behaviour.

Some people notice mood shifts a day after antibiotics; linked to temporary gut microbiome disruption.

Environmental Microclimate Awareness: Noticing subtle changes in temperature, humidity, and airflow.

Aboriginal trackers in Australia can detect subtle shifts in air temperature, wind, and humidity to predict weather changes. Farmers often use this sense to "smell" rain before it arrives.

Environmental Pollutant/Air Quality Sensing: Subconsciously detecting smoke, smog, or harmful chemicals.

9/11 first responders reported detecting toxic air before formal air quality warnings, via taste, throat irritation, and smell. Some people can detect ozone before thunderstorms.

Social Perception Sense: Reading micro-expressions, tone of voice, and behavioural cues to sense presence or emotional state.

Poker champion Daniel Negreanu reads micro-expressions and subtle breathing changes to predict opponents' moves. Dogs also excel at this, they can pick up your emotional state before you say a word.

Attention/Consciousness Modulation: Shifting awareness or mental focus in response to sensory input.

Meditation masters in Tibetan traditions can shift awareness between pain, body sensations, and pure mental focus at will. This skill is used by elite snipers to maintain calm focus under extreme stress.

Precognition: Claimed ability to perceive future events.

Some stock traders claim they "just know" when markets will move, but research often finds it's unconscious pattern recognition, not supernatural foresight. A few lab studies claim participants respond to stimuli milliseconds before they occur, a finding that is both controversial and intriguing.

Retrocognition (Postcognition): Claimed ability to perceive past events.

Psychics claim to "see" past events at crime scenes. In most verified cases, however, details can often be traced to prior exposure or inference. The CIA once tested "postcognition" in remote viewing experiments during the Cold War.

Clairvoyance: Claimed ability to see distant or hidden events/locations.

Remote viewers like Ingo Swann claimed to describe locations they had never visited, in some cases with surprising accuracy.

Claircognizance: Claimed "clear knowing" without reasoning.

Some inventors describe "knowing" solutions instantly without working through the steps, often after long immersion in a problem.

Psychometry: Claimed ability to read an object's history by touch.

Mediums claim to read the history of objects by touch, such as holding a watch and describing its owner's life.

Clairaudience: Claimed ability to hear non-physical voices or sounds.

Some claim to hear guidance or warnings internally; one New York woman avoided a subway accident after "hearing" a voice telling her to step back.

Clairsentience: Claimed ability to feel energies or presences.

Rescue workers sometimes report "feeling" a trapped person's location before finding them. This overlaps with strong empathy and environmental awareness.

Clairgustance: Claimed ability to psychically taste something.

Mediums claim to taste specific foods linked to spirits during readings. Taste hallucinations can occur with seizures in the temporal lobe.

Clairsalience: Claimed ability to psychically smell something.

Some claim to smell a deceased loved one's perfume or cigarette smoke as a "sign." Scent memory is one of the most emotionally powerful triggers.

Telekinesis (Psychokinesis): Claimed ability to move or influence objects mentally.

Nina Kulagina, a Soviet woman, was filmed apparently moving objects without touching them.

Electromagnetic Field (EMF) Awareness: Sensing subtle effects of electromagnetic fields.

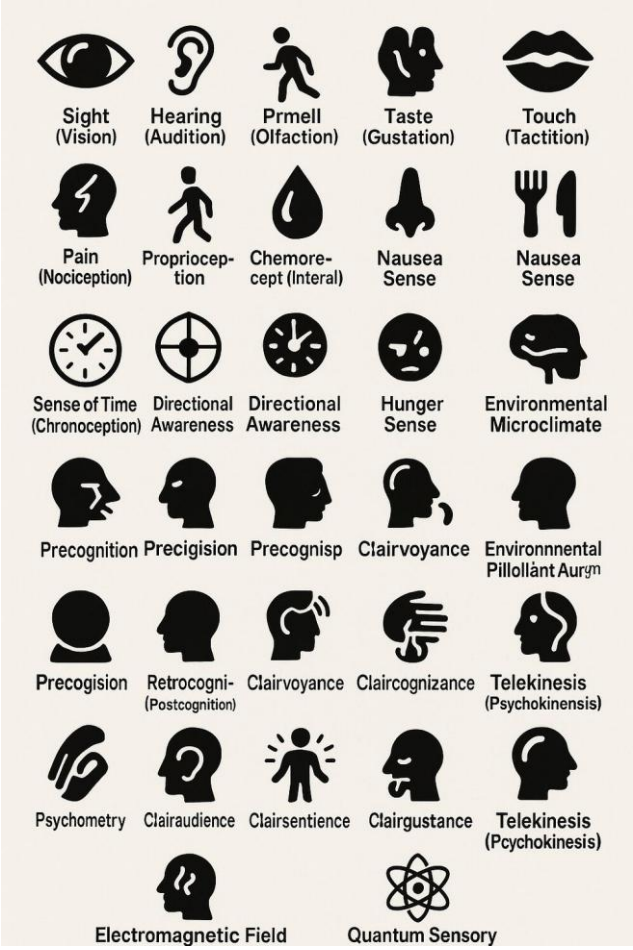
Some people with "electromagnetic hypersensitivity" report headaches or sensations near Wi-Fi routers, studies remain inconclusive.

Quantum Sensory Effects: Theorised influence of quantum events on perception or cognition.

The idea that quantum entanglement could influence human perception remains theoretical, but some researchers explore quantum effects in bird navigation and photosynthesis.

The question is, how many of your senses are truly open?

#Mindfulness #SelfAwareness #HumanPotential #AllTheSenses #TrustYourSenses


Sight (Vision)
Hearing (Audition)
Prmell (Olfaction)
Taste (Gustation)
Touch (Tactition)
Pain (Nociception)
Proprioceptive-tion
Chemore-cept (Interal)
Nausea Sense
Nausea Sense
Sense of Time (Chronoception)
Directional Awareness
Directional Awareness
Hunger Sense
Environmental Microclimate
Precognition
Precigision
Precognisp
Clairvoyance
Environnnental Pillollant Aurgn
Precogision
Retrocogni- (Postcognition)
Clairvoyance
Claircognizance
Telekinesis (Psychokinensis)
Psychometry
Clairaudience
Clairsentience
Clairgustance
Telekinesis (Pcychokinesis)
Electromagnetic Field
Quantum Sensory

THE HEALTHTECH HERALD

Stunning Study: Scientists Reversed Liver Aging with Young Gut Bacteria, Youthful Gut Microbiome May Help Slow Aging and Cancer

By Dr Sukh Rashpal Sandhu | First published 11 May 2026

New research shows that restoring youthful gut bacteria could reverse liver aging and stop liver cancer before it starts. Here is what the science actually says.



Your Gut May Hold the Key to a Younger Liver and a Lower Cancer Risk

The Discovery That Started With the Heart

Scientists at the University of Texas Medical Branch were not looking for a liver breakthrough. They were studying whether changing gut bacteria could improve heart health in aging mice.

The heart results were good. But when they looked at the liver tissue, something remarkable jumped out. Older mice that had received their own preserved younger gut bacteria showed almost no signs of the liver damage that normally comes with age.

Inflammation was low. DNA damage was minimal. And most strikingly: not one of those mice developed liver cancer.

> *"We're learning from this work that the aging microbiome actively contributes to liver dysfunction and cancer risk rather than simply reflecting the aging process," said Dr. Qingjie Li, Associate Professor in the Division of Gastroenterology and Hepatology at UTMB, and lead researcher on the study.*

The findings were presented at Digestive Disease Week 2026, one of the world's leading gastroenterology conferences, and have since drawn widespread attention from the scientific community.

What Is the Gut Microbiome?

Before getting into the findings, it helps to understand what we are talking about.

Your gut is home to trillions of bacteria, fungi, and other microscopic organisms. Together, they form what scientists call the gut microbiome. This community plays a surprisingly large role in your health: it helps digest food, trains your immune system, regulates inflammation, influences mood through the gut-brain connection, and, as this research confirms, affects how your organs age.

In youth, this microbial community is rich and diverse. As we get older, that diversity erodes. Beneficial bacteria decline. Less helpful strains take over. Scientists used to assume this was simply a side effect of aging, a reflection of what was happening to the body. Dr. Li's research challenges that assumption directly. The aging microbiome, his team argues, does not just reflect decline. It helps cause it.

How the Study Was Designed

The researchers used a method called fecal microbiota transplantation, or FMT. In simple terms, this involves transferring gut bacteria from one individual to another through processed stool samples.

Here is the precise timeline of what they did:

Fecal samples were collected from eight mice at four months of age (the equivalent of young adulthood in mice). The samples were cryopreserved, essentially frozen for safekeeping. When the same mice reached 12 months of age (middle age in mice), the transplants began. The process continued for 10 months. Comprehensive assessments of liver tissue were conducted at 22 months, when the mice were elderly.

Critically, each mouse received its own previously stored microbiome, not bacteria from a different animal. This autologous approach eliminated the immune complications and infection risks that come with donor-based transplants. It also made the results cleaner: any benefit observed could be attributed specifically to restoring the animal's youthful microbial state.

A control group of eight aging mice received sterilised fecal material with no live bacteria. A small group of young mice provided baseline comparisons.

What the Results Showed

The outcomes were striking on multiple fronts.

No liver cancer in the treated group. None of the eight mice that received the restored microbiome developed hepatocellular carcinoma (HCC), the most common form of liver cancer. In the control group, two out of eight aging mice did develop the disease. HCC is projected to affect 22 million people globally by 2032, making it one of the most urgent cancer challenges in modern medicine. It is also notoriously difficult to detect early and treat effectively.

Reduced liver damage markers. Mice in the treated group showed significantly reduced serum liver transaminases, which are enzymes released into the blood when liver cells are damaged. Lower levels indicate a healthier liver.

Less inflammation. Key inflammatory markers, including IL-6 and fibronectin, were markedly reduced in treated mice. Chronic inflammation in the liver is a major driver of cirrhosis, fibrosis, and eventually cancer.

Improved cellular health. Telomere shortening was slowed. (Telomeres are the protective caps on chromosomes that shorten with each cell division, functioning as a biological clock of cellular aging.) Mononuclear cell infiltration, a sign of immune-driven tissue damage, also decreased. Mitochondrial function was restored.

A cancer gene was turned down. Researchers found important differences in a gene called MDM2, which acts as a negative regulator of a critical tumour-suppressor protein called p53. Think of p53 as a security system that detects and destroys damaged cells before they turn cancerous. MDM2 suppresses that system. In young mice, MDM2 was naturally low. In untreated aging mice, MDM2 was elevated, weakening their cancer defences. In the treated older mice, MDM2 levels dropped back toward those seen in young animals. The gut microbiome was, in effect, switching a cancer-promoting gene back toward a safer state.

This Is Not an Isolated Finding

The UTMB study sits within a growing body of research that paints a consistent picture: restoring a younger gut microbiome reverses biological aging in multiple organs and systems.

The brain. A 2024 study published in the journal Aging and Disease found that FMT from young, physically active donors improved cognitive function and synaptic plasticity in aged mice. The young microbiome increased short-chain fatty acids, including acetate, butyrate, and propionate, compounds that reduce inflammation in both the gut and the brain. Separate research published in January 2024 in the journal Gut Microbiota found that post-stroke transplantation of a young microbiome into aged mice significantly improved cognitive recovery, reduced brain inflammation, and increased protective immune cells.

Metabolic health. A 2025 study from the University of Connecticut and Zhejiang University, published in the journal mSystems, found that FMT from young mice into old mice improved grip strength, reduced frailty, improved body composition, and even appeared to rejuvenate the amygdala region of the aged brain by downregulating

inflammatory pathways. The researchers described the young microbiome as triggering a form of metabolic reprogramming throughout the aging body.

Liver cancer and immunotherapy. A clinical trial currently underway (registered as NCT06643533) is investigating whether FMT can help overcome drug resistance in patients with advanced hepatocellular carcinoma being treated with chemoembolisation, lenvatinib, and immunotherapy. While this trial involves donor microbiomes rather than preserved personal samples, it reflects the field's growing conviction that the gut microbiome can influence cancer treatment outcomes, not only cancer prevention.

Why the Liver Is So Vulnerable

The liver sits at the centre of the body's chemical processing network. Everything absorbed from the gut passes through the liver via a direct pathway called the portal circulation before entering the general bloodstream. This makes the liver the primary recipient of everything the gut produces, including the compounds generated by gut bacteria.

Scientists refer to this intimate relationship as the gut-liver axis. When the gut microbiome is healthy, the signals arriving at the liver are largely protective. When the microbiome shifts toward an older, less diverse profile, the liver absorbs the consequences directly. Bacterial metabolites, inflammatory compounds, and disrupted bile acids all arrive at the liver in altered ratios, driving the chronic low-grade inflammation that, over years and decades, can progress to fibrosis, cirrhosis, and cancer.

Research published in the journal Cancer Journal (National Cancer Institute) confirms that gut microbiome composition is meaningfully linked to liver cancer risk in humans. Patients with hepatitis C-related chronic liver disease, for instance, show distinct microbiome patterns compared to healthy individuals, and those patterns have been shown in experimental models to promote tumour growth.

The UTMB study suggests the reverse may also be true. A healthier, more youthful microbiome may actively suppress that cancer-promoting environment.

What Needs to Happen Before This Helps People

It is important to be clear about where this research stands. Everything described in the UTMB study was conducted in mice. Mice age differently from humans, have different gut architectures, different immune systems, and different microbial compositions. Animal studies are an essential step in the scientific process, but they are not the finishing line.

Dr. Li was direct about this: the findings cannot currently be applied to humans. Moving toward first-in-human clinical trials will require validating the mechanisms in human biological samples, establishing safety profiles, and working out the practical questions of donor selection, dosing, and timing.

The concept of banking one's own youthful microbiome for later therapeutic use is being explored by several research groups, though it remains early-stage. Companies in the longevity and preventive medicine space have begun offering fecal banking services, though no standardised clinical protocol exists yet, and none has regulatory approval as a treatment.

What You Can Reasonably Do Now

While the technology to restore your own youthful microbiome is not yet clinically available, the research points toward concrete habits that support microbial diversity at any age.

Eat a wide variety of plant foods. Dietary diversity is the strongest and most consistent predictor of gut microbial diversity. Aim for a broad range of vegetables, fruits, legumes, whole grains, nuts, and seeds across the week, not just the same five foods repeated daily.

Include fermented foods regularly. Yoghurt, kefir, sauerkraut, kimchi, tempeh, and miso all introduce live beneficial bacteria and have been shown in clinical trials, including a 2021 Stanford study, to increase microbial diversity and reduce inflammatory markers in healthy adults.

Prioritise fibre. Fibre is the primary food source for beneficial gut bacteria. The production of short-chain fatty acids, compounds that reduce gut inflammation and support the gut lining, depends directly on fibre availability.

Limit ultra-processed foods. Diets high in refined carbohydrates, added sugars, and heavily processed ingredients consistently predict lower microbial diversity and higher systemic inflammation.

Consider the impact of antibiotics carefully. Antibiotics are life-saving when needed, but they also substantially disrupt the microbiome. Discuss their necessity with your doctor and consider probiotic support during and after antibiotic courses.

Exercise. The 2024 Aging and Disease study found that FMT from young, physically active donors produced greater cognitive benefits than FMT from young sedentary donors. Physical activity itself appears to shape a more beneficial microbial profile.

The Bigger Picture

What this body of research is slowly establishing is a new way of thinking about aging.

For most of medical history, the deterioration that comes with age has been treated as an inevitable internal process: cells wearing out, organs slowing down, DNA accumulating damage over time. The emerging microbiome science suggests a different frame. At least some of what we experience as aging is the cumulative result of what lives in our gut, and how that community changes over decades.

If the microbiome is a driver of aging rather than merely a passenger, it becomes a target for intervention. Not a magic fix, and not an immortality treatment, but a meaningful lever that influences inflammation, cancer gene expression, organ function, brain health, and metabolic resilience, all at once.

The UTMB study is one data point in a larger and rapidly developing story. Dr. Li's team hopes to move toward human trials. Other groups are pursuing parallel questions in cognition, metabolic health, and cancer treatment. The picture is filling in with genuine scientific momentum.

The remarkable thing may be this: the key to a younger liver, a sharper brain, and a more resilient body as we age might not be a drug waiting to be synthesised. It might be a community of microorganisms that we are only now learning to understand, protect, and restore.

Sources and references

Qingjie Li, PhD. Presentation: "Restoration of a youthful gut microbiome reduced liver aging and suppressed tumorigenesis in older mice." Digestive Disease Week 2026, May 2, 2026. University of Texas Medical Branch, Division of Gastroenterology and Hepatology.

Xie J, Kim T, Liu Z, et al. "Young gut microbiota transplantation improves the metabolic health of old mice." mSystems, May 2025. DOI: 10.1128/msystems.01601-24. University of Connecticut Health Center and Zhejiang University.

Cerna C, et al. "Fecal Microbiota Transplantation from Young-Trained Donors Improves Cognitive Function in Old Mice Through Modulation of the Gut-Brain Axis." Aging and Disease, Volume 16, Number 6, December 2024. DOI: 10.14336/AD.2024.1089.

Gut-Brain Axis and Aging. Tandfonline, January 2024. DOI: 10.1080/19490976.2024.2302801.

Fecal Microbiota Transplantation in Reversing Drug Resistance in Unresectable HCC. ClinicalTrials.gov, NCT06643533.

Li D, et al. "The microbiome and liver cancer." Cancer Journal. 2023 Mar-Apr;29(2):57-60. DOI: 10.1097/PPO.0000000000000646. National Cancer Institute, NIH.

STAY CONNECTED

Follow us on LinkedIn

Enjoyed this edition? Each of these newsletters publishes new pieces on LinkedIn. Subscribe, like and share to read them first, and join the conversation in the comments.

The HealthTech Herald You are reading this newsletter

The latest breakthroughs at the intersection of health and technology.

Subscribe on LinkedIn

https://www.linkedin.com/newsletters/the-healthtech-herald-7338913774701027328/

Letters of the Heart

Real stories, timeless wisdom, and soul-deep inspiration.

Subscribe on LinkedIn

https://www.linkedin.com/newsletters/letters-of-the-heart-7329273590376210432/

The Hope Dispatch

Uplifting news, inspiring stories, and positive change from around the world.

Subscribe on LinkedIn

https://www.linkedin.com/newsletters/the-hope-dispatch-7338912777081638914/

Connecting the Dots

Where compliance, risk management, digital innovation, and bottom-line growth intersect.

Subscribe on LinkedIn

https://www.linkedin.com/newsletters/connecting-the-dots-7397392757360648192/

Truth, Translated

Plain language for a complicated world: education, geopolitics, political accountability and Big Tech.

Subscribe on LinkedIn

https://www.linkedin.com/newsletters/truth-translated-7450724196525035520/

Follow the author: Dr Sukh Rashpal Sandhu on LinkedIn

BACK PAGE

About The HealthTech Herald

The HealthTech Herald is a LinkedIn newsletter written by Dr Sukh Rashpal Sandhu. Your trusted source for the latest breakthroughs at the intersection of health and technology.

Read and subscribe

New editions continue to be published on LinkedIn. Search for The HealthTech Herald on LinkedIn to subscribe.

Disclaimer

The views in this collection are the author's own. Pieces are reproduced as first published, and facts, figures and links are current at their original publication date. Nothing in this collection is legal, financial, medical, migration or regulatory advice.

Copyright

Copyright Dr Sukh Rashpal Sandhu 2026. All rights reserved. Images are reproduced as they appeared in the original posts.

The HealthTech Herald | Dr Sukh Rashpal Sandhu | sukh@sukhsandhu.com

Masthead

Author: Dr Sukh Rashpal Sandhu

Publisher: Dr Sukh Rashpal Sandhu

Edition: 1, July 2026

Contact: sukh@sukhsandhu.com

The HealthTech Herald is published on LinkedIn by Dr Sukh Rashpal Sandhu. This edition collects the pieces in the order they were first published, with their original images.