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GÁBOR SOMLYAI

Rewriting disease mechanisms through submolecular intervention

CEO, HYD LLC

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FROM THE EDITORS

Editor's note

Leaders Advancing Medical Science

Titles say little about how a leader actually works. That is why we spent this edition with Gábor Somlyai, CEO at HYD LLC.

He began researching deuterium depletion at Hungary's National Institute of Oncology when the field barely existed. The chief executive of HYD LLC on thirty-five years of science and the trials behind it.

Our cover story follows Gábor through the choices that shaped the work, from the early years to the decisions being made now, and asks what other leaders can take from them.

Also in this edition: Medicine's slowest step is not the science. Most cancer drugs that enter trials never reach patients, and the ones that do often arrive late. The UK's recent push on trial set-up shows how much of that delay sits in administration and data, which leaders can fix.

Then: Why factories are moving AI to the edge. Camera-based inspection needs answers in milliseconds, not round trips to a distant cloud region. The architecture manufacturers are settling on, and the operational problems nobody budgets for.

And: Lisa Su and the AMD turnaround playbook. In 2014 AMD was losing money and its customers' trust. A decade later it was competing at the front of the industry. The few bets, and the kept promises, behind one of tech's clearest turnarounds.

We hope you find something here worth taking into your next meeting. ■

The Editors



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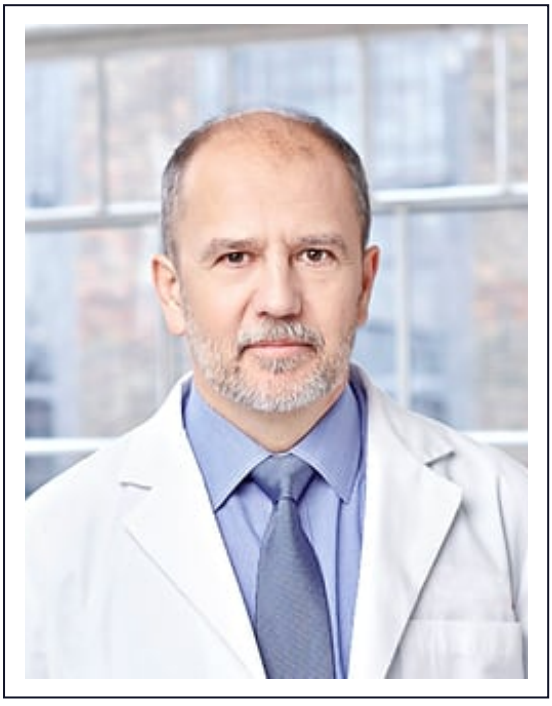

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> *Somlyai explains that after decades of cancer research, scientists have successfully mapped a highly complex molecular signalling network responsible for initiating and completing cell division.*

Gábor Somlyai

Rewriting disease mechanisms through submolecular intervention

CEO, HYD LLC

Modern medicine has mapped the genome, decoded proteins, and developed precision therapies that were once unimaginable. Yet despite these advances, chronic diseases like cancer, diabetes, and age-related conditions continue to overwhelm lives, systems, and science. They often begin quietly, deep within the cell, far beneath the reach of most current treatments. What if the key to transforming these outcomes lies even smaller than our genes? What if the real switch that controls life and death in our cells is hidden within the most basic element of all: hydrogen?

Gábor Somlyai stepped into this microscopic mystery with a question that challenged decades of biological assumptions. His pioneering research into the role of hydrogen isotopes, particularly deuterium, opened a new dimension in cellular biology.



A New Blueprint for Life and Cancer Control

Dr. Somlyai explains that after decades of cancer research, scientists have successfully mapped a highly complex molecular signalling network responsible for initiating and completing cell division. Yet two fundamental questions remained: What triggers a cell to leave its resting state and begin DNA replication? And how is this

intricate cascade of events precisely coordinated to produce two genetically identical daughter cells?

Dr. Somlyai's groundbreaking work introduces a paradigm-shifting idea: cell division may be governed not only by genetic and protein-level interactions, but also by a submolecular mechanism linked to the atomic composition of hydrogen in the body. Specifically, he and his team identified the ratio between two naturally occurring hydrogen isotopes—protium and the heavier deuterium- as a direct influence on cellular behavior.

His research, dating back to 1990, demonstrated that lowering deuterium concentrations below natural levels inhibits tumor growth, while elevated levels stimulate cell proliferation. Over time, the data revealed that an increased deuterium-to-hydrogen (D/H) ratio serves as a biological trigger, initiating the transition from a resting phase into DNA replication, and synchronizing the complex genetic activities that follow.

This discovery not only redefines how scientists understand cancer growth but also opens the door to entirely new therapeutic possibilities, ones that operate at a level below conventional genetic or molecular intervention.

Overcoming Scientific Hurdles When Dr. Somlyai began his research career in this field at the National Institute of Oncology in Hungary, the concept of deuterium depletion was virtually unexplored. One of his first scientific hurdles was to produce deuterium-depleted water (DDW), which he managed through water electrolysis, conducted in his own garage.

The next challenge was to measure deuterium levels with the necessary accuracy. For this, Dr. Somlyai collaborated with chemists Gábor Jancsó and György Jákli from the Central Research Institute for Physics, who possessed a reliable measurement technique.

The early experiments with DDW yielded remarkable anticancer effects. However, Dr. Somlyai and his team exercised scientific caution, repeating experiments for over a year to eliminate any possibility of error. Confident in the consistency of the findings, Dr. Somlyai reached out to other research institutions and universities to replicate and explore the effects of changing the D/H ratio in various biological systems.

The results were consistent: across multiple models, reducing deuterium levels significantly impacted cell behavior and confirmed the isotope's regulatory role in physiological processes. This collaborative effort helped establish a solid scientific foundation for what would grow into a revolutionary approach to cancer treatment.

Thirty-five Years of Defying Convention and Defining the Future Since the early 1990s, HYD LLC has remained a global pioneer in deuterium depletion research and application. Dr. Somlyai credits the company's longevity to its willingness to challenge conventional scientific thinking, along with a relentless commitment to innovation.

In 1999, HYD LLC made history by registering Vetera-DDW-25, the first deuterium-depleted, water-based anticancer drug for veterinary use. That same year, the company launched Preventa, the world's first commercially available deuterium-depleted drinking water. These products served both as a proof of concept and a means of funding continued research and drug development.

Dr. Somlyai believes the company's continued leadership is partly due to the natural inertia of scientific systems. While the broader field still focuses on molecule-centered mechanisms, HYD has taken a bold step toward the submolecular level, representing a fundamental shift in perspective. Such shifts are rarely quick, but Dr. Somlyai has remained confident in the long-term value of this direction.

Today, that confidence is being validated. More researchers around the world are joining the field, and a growing number of manufacturers are now producing DDW. This momentum is driving the scientific community toward broader acceptance and application of deuterium depletion in medicine.

With over thirty-five years of accumulated research and clinical experience, HYD LLC continues to lead the field. But for Dr. Somlyai, leadership does not mean exclusivity. His book, Deuterium Depletion – A New Way in Curing Cancer and Preserving Health, was written to share key discoveries and practical knowledge with the wider public. It serves both as a reflection of his life's work and a forward-looking blueprint for the future of cancer treatment and preventive health.

Rewriting the Rules of Cell Division

Dr. Somlyai explains that modern anticancer drug development has gone through two major phases. Initially, the focus was on discovering compounds that could effectively kill cancer cells while minimizing harm to healthy tissue. Chemotherapy emerged as a powerful tool in this phase, improving survival rates but often at

the cost of severe toxicity.

Later, a shift occurred with the discovery of molecular mechanisms that regulate cell division. This led to the development of targeted therapies, aimed at specific molecules within cell signaling pathways. While more refined, these therapies still operate at the molecular level. As a result, cancer incidence and mortality continue to rise, indicating that a deeper, more fundamental shift in approach is needed.

The breakthrough in Dr. Somlyai's work comes from focusing on the submolecular level. Specifically, he highlights the role of the hydrogen–deuterium (D/H) isotope ratio in influencing the behavior of cells. Unlike traditional therapies that target single molecules or pathways, modifying the D/H ratio affects the entire network of genes and proteins that regulate cell division. Depleting deuterium from cells enables a simultaneous impact across all signaling pathways, offering a more comprehensive way to influence cell behavior. This approach has shown effectiveness across all tumor types, although sensitivity can vary.

A Natural and Safer Pathway

Dr. Somlyai contrasts deuterium depletion with conventional cancer treatments that rely on synthetic drugs, which often come with significant toxic side effects. In his view, the most straightforward way to reduce deuterium levels in the body is by substituting regular water with deuterium-depleted water, known as DDW.

This method does not involve introducing foreign chemicals into the body. Instead, it works by lowering the natural level of deuterium in biological systems. Over the past thirty years, thousands of patients have undergone deuterium depletion. Toxicological studies, both preclinical and clinical, have confirmed the safety of DDW at concentrations ranging from 20 to 125 parts per million. No harmful effects have been detected.

He also refers to the experience with a veterinary anticancer product containing DDW, developed and registered by HYD LLC in 1999. The product has demonstrated a strong safety profile, further reinforcing the potential of DDW-based treatments as a safe, non-toxic, and highly effective option for cancer therapy.

A Vision Beyond Patents

Discussing the challenges of intellectual property, Dr. Somlyai notes that HYD LLC held strong patent protections for more than twenty years. However, those original patents have now expired, and the scientific knowledge has entered the public domain. Still, he sees this not as a setback but as an opportunity. With current knowledge, new and patentable products can be developed. HYD LLC fully intends to pursue these opportunities, knowing that exclusive rights are often a deciding factor for investors.

At the same time, Dr. Somlyai voices concern that the pharmaceutical industry places too much emphasis on exclusivity. The growing global burden of cancer calls for solutions that prioritize health over monopolies. He finds it puzzling that faster, more affordable therapies are not the leading priority, especially when they could alleviate economic strain on healthcare systems.

> *Somlyai and his team exercised scientific caution, repeating experiments for over a year to eliminate any possibility of error.*

HYD LLC is currently seeking financial investment and strategic partners to bring a cancer drug to market, even in the absence of active patents. With adequate funding, the company can advance research and apply for new patents, offering the protection that pharmaceutical investors typically expect. Yet, Dr. Somlyai's ultimate goal remains clear: to accelerate the fight against cancer through bold science and collaborative progress.

A Rising Tide of Academic Collaboration

Dr. Somlyai highlights a significant development in the global recognition of deuterium depletion as a promising area of scientific research. The European Research

Executive Agency (REA) of the European Commission recently awarded a grant of €763,600 to the Aqua-Synapse research program, launched in January 2023. This initiative explores the effects of deuterium-depleted water (DDW) on brain function and neuronal activity, with a particular focus on its potential relevance to depression, metabolic disorders, obesity, and aging.

HYD Cancer Research and Drug Development LLC. is an active member of this European consortium. The group includes leading academic institutions such as Lusófona University and the Institute of Molecular Medicine in Lisbon, the University Hospital of Würzburg, and the University of Oxford. According to Dr. Somlyai, such collaborations are not only accelerating scientific understanding but are also establishing credibility and validation for DDW research on a global scale.

He also points to the growing number of scientific publications in the PubMed database referencing deuterium-depleted water. Since the early 1990s, this number has increased exponentially, demonstrating that universities and research institutes worldwide are becoming increasingly engaged in the exploration of this novel field.

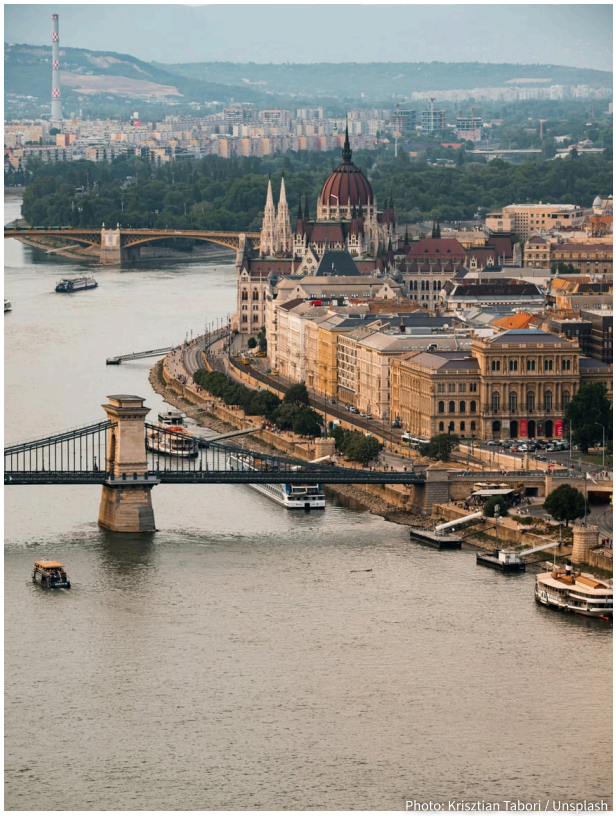


Photo: Krisztian Tabori / Unsplash

Building the Future of Oncology

When asked about industrial production, Dr. Somlyai explains that deuterium-depleted water can be produced reliably on a large scale using fractional distillation, allowing for control over deuterium content to extremely low levels. While the technology for production exists, the primary challenge has been meeting the stringent requirements of pharmaceutical-grade quality.

HYD LLC, together with its parent company HYD Pharma Inc., has overcome this challenge. They have established the world's first pharmaceutical manufacturing facility capable of producing DDW as an active pharmaceutical ingredient under Good Manufacturing Practice (GMP) standards. This milestone enables the production of DDW suitable for clinical trials and ultimately, therapeutic use. For Dr. Somlyai and his team, this achievement not only represents technological innovation but also positions Hungary at the forefront of a new generation of cancer treatment strategies.

Approaching the Threshold of Clinical Integration

Dr. Somlyai confirms that HYD LLC is ready to initiate full-scale clinical trials for deuterium-depleted drugs. All essential elements are in place. The DDW manufacturing facility is operational, the clinical protocols and dosage plans have been developed, and the team has decades of experience in both research and veterinary applications. The only remaining step is securing the necessary capital investment for human clinical development.

He emphasizes the compelling results observed even in the most resistant tumor types, where DDW treatment has extended survival times to three times longer than those achieved with conventional therapies alone. These outcomes are not isolated incidents but are grounded in years of consistent evidence.

In their most recent publication, Dr. Somlyai and his team analyzed data from 2,649 cancer patients who consumed DDW. The study concluded that incorporating deuterium-depleted water into existing oncology protocols could potentially reduce cancer-related mortality by up to 80 percent. This finding underscores the transformative potential of deuterium depletion therapy and highlights the urgent need for further clinical exploration.

Expanding Therapeutic Horizons

Dr. Somlyai recalls his initial surprise when consumer feedback revealed that deuterium-depleted water (DDW) consumption appeared to reduce blood glucose levels in a diabetic patient. This unexpected observation led HYD LLC to collaborate with researchers at Semmelweis University in Budapest. Together, they conducted several animal studies, which confirmed that the deuterium-to-hydrogen (D/H) ratio also plays a critical role in metabolic regulation.

Encouraged by these results, the team proceeded with a Phase 2 human clinical trial. The study demonstrated that deuterium depletion not only reduced fasting blood glucose levels but also improved insulin resistance in patients. These findings suggest that the benefits of DDW extend far beyond oncology.

Dr. Somlyai also highlights other independent research initiatives. Some studies have linked the deuterium content of drinking water to susceptibility to depression. Animal experiments have shown that DDW has a positive effect on long-term memory, while HYD's own investigations suggest that deuterium depletion may also contribute to anti-aging processes. These developments point to a much broader potential for DDW in preventive health and chronic disease management.

Maintaining Scientific Rigor Across Borders

As international interest in deuterium-depleted technology grows, Dr. Somlyai emphasizes that HYD LLC remains committed to the highest standards of scientific integrity and quality control. All of HYD's DDW products, protected under international trademarks, are rigorously tested by accredited laboratories. The deuterium content is measured using a validated, laser-based water isotope analyzer, providing accuracy within 1 part per million.

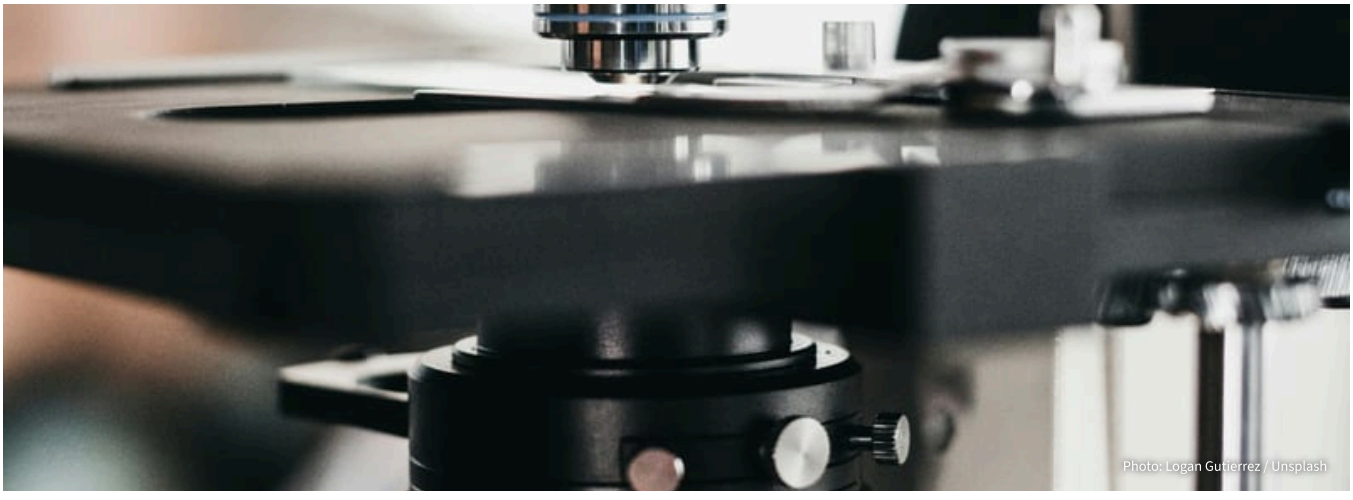
The microbiological safety of the products is confirmed in pharmaceutical-grade laboratories, and every production batch is supported by traceable quality certificates. This strict adherence to documentation and testing reflects HYD's dedication to transparency and product reliability.

Looking forward, the company is preparing for pharmaceutical-grade production. The necessary infrastructure already complies with Good Manufacturing Practice (GMP) standards. HYD LLC is actively seeking regional partners worldwide who can support local clinical trials, establish manufacturing operations, and manage regulatory approvals. For Dr. Somlyai, these collaborations are crucial to making DDW therapy widely accessible and globally impactful.

Charting a New Course in Healthcare

Dr. Somlyai believes that drug development based on deuterium depletion marks the beginning of a new era in pharmaceutical science. He sees its influence extending across multiple medical disciplines, with the potential to revolutionize the treatment of chronic conditions such as cancer and metabolic disorders.

Despite its promise, Dr. Somlyai is careful not to portray DDW as a miracle cure. He acknowledges that ongoing research is essential to further refine its effectiveness. His long-term vision is ambitious yet grounded. He envisions a future in which cancer-related mortality can be reduced to just 10 to 15 percent of current levels. For him, this is not merely an aspiration but a scientifically achievable goal that could reshape the landscape of global healthcare. ■



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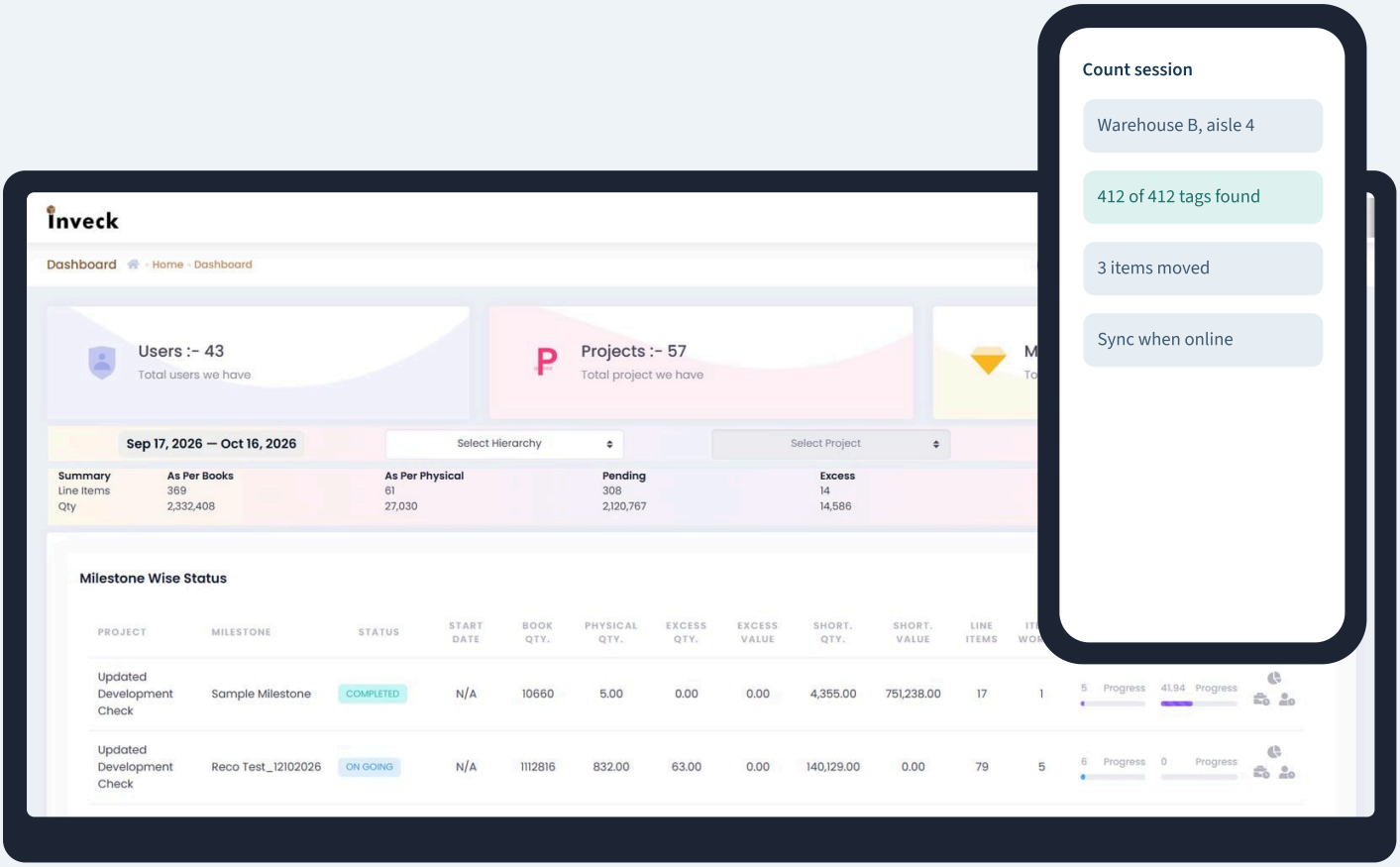

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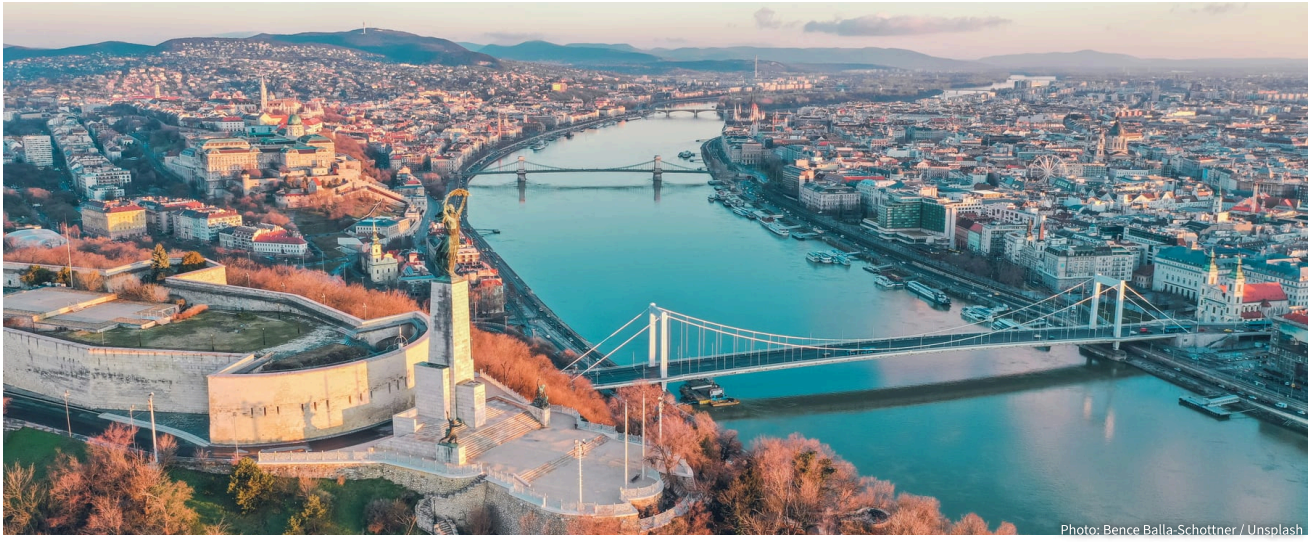
Medicine's slowest step is not the science

Most cancer drugs that enter trials never reach patients, and the ones that do often arrive late. The UK's recent push on trial set-up shows how much of that delay sits in administration and data, which leaders can fix.



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Cancer is growing faster than health systems are adapting to it. The International Agency for Research on Cancer estimated 20 million new cases and 9.7 million deaths in 2022, and projects more than 35 million new cases in 2050, a 77 per cent increase. About one in five people will develop cancer in their lifetime, yet a WHO survey of 115 countries found that only 39 per cent covered the basics of cancer management in their financed core health services.

Against that, the route from laboratory to patient remains long and uncertain. The useful question for leaders in health systems, research funding and life sciences is which parts of that route are genuinely scientific, and which are simply slow.

Why so many promising drugs fail

Scientific risk is real and large. A study by MIT researchers, drawing on more than 400,000 trial records covering over 21,000 compounds, found that nearly 14 per cent of drugs entering clinical trials eventually won approval from the US Food and Drug Administration. For cancer the rate was the lowest of any area, at 3.4 per cent, although the annual figure had risen to 8.3 per cent in 2015.

The same research found that trials using biomarkers to select patients tend to be more successful than those that do not. That is the core

of translational medicine: matching a therapy to the patients whose biology suggests it will work.

It also means that progress depends on data held mostly inside hospitals rather than laboratories, in pathology results, genomic tests and patient records. Whoever can find the right patients quickly, with their consent, shortens the path for every therapy that follows.

The delay that is not scientific

The less discussed problem is how long trials take to start and to fill. In 2023 an independent review for the UK government, led by Lord O'Shaughnessy, found that the number of patients recruited to commercial studies supported by the National Institute for Health and Care Research had dropped by 44 per cent between 2017-18 and 2021-22, from around 50,000 a year to around 28,000.

Set-up was slow as well. The median time from application to first dose in 2020 was 247 days in the UK, against 155 in the United States, 182 in Australia and 197 in Spain. The review concluded that set-up and approval processes in the UK were slow and bureaucratic compared with other countries.

Very little of that was about science. The review described approvals that had historically run in sequence, costing arrangements that only around half of NHS trial sites accepted without further negotiation, and clinical staff with little time for research. In a survey it cited, 53 per cent of NHS staff respondents named lack of time as the biggest barrier.

What changed when someone was accountable

The response is instructive. The government set a target of getting commercial trials running within 150 days by March 2026. It standardised and mandated commercial contracting, funded set-up capacity in NHS organisations and, from April 2026, linked part of research funding to national delivery targets.

The numbers moved. In data to March 2026, the average set-up time for commercial interventional trials had fallen to 122 days, from 169 days a year earlier, and 99 per cent of applications received regulatory approval within target. None of this required a scientific breakthrough. It required ownership, standard paperwork and a published target.

Recruitment is the harder half. The government's April 2026 announcement itself

BY THE NUMBERS

3.4%

Share of cancer drugs in clinical trials that won FDA approval

MIT Sloan, Biostatistics study, 2018

44%

Fall in UK commercial trial recruitment, 2017-18 to 2021-22

Lord O'Shaughnessy review, GOV.UK, 2023

122 days

Average UK commercial trial set-up time, data to March 2026

Department of Health and Social Care, GOV.UK, 2026

noted that growth in the number of commercial trial participants has yet to be seen. The review pointed to where the next gains lie: only around 10 per cent of clinical research activity takes place in primary care, and about 4 per cent of GP practices recruit to commercial trials.

Where recruitment is designed in from the start, the scale can be striking. The NHS-Galleri study recruited 140,000 people in 12 months. The review recommended building patient contact on electronic health records and registries, and integrating the Be Part of Research service with the NHS App.

Lessons for health and research leaders

The lesson travels beyond the UK. Health systems that want earlier access to new treatments, and companies that want faster results, should treat trial operations as infrastructure: standard contracts, parallel approvals, research time written into clinical job plans and consented patient data that can identify eligible patients.

For technology leaders in hospitals and life sciences, the most valuable work may be the least visible: linking records, consent and registries so that eligible patients can be found in weeks rather than months.

Hospital boards can start by measuring it: how many trials the organisation runs, how long each takes to open and how many eligible patients are offered a place. Those figures belong in the same board pack as waiting times, because for a patient with few options left, a trial that opens six months late is a form of waiting list. Scientific failure is part of the work; administrative delay is a choice.

Sources: who.int; mitsloan.mit.edu; gov.uk; hra.nhs.uk. ■

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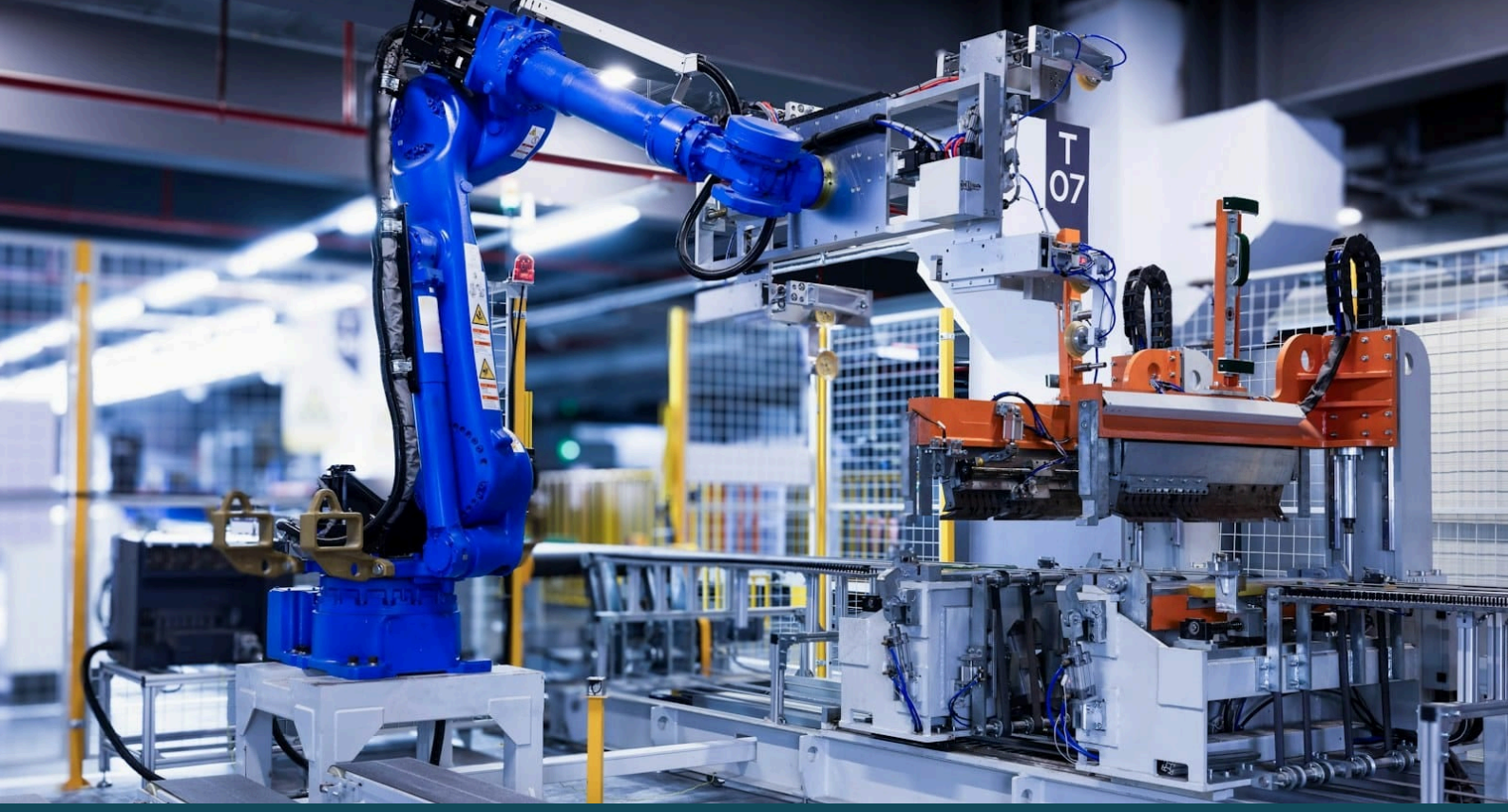

ANALYSIS

Why factories are moving AI to the edge

Camera-based inspection needs answers in milliseconds, not round trips to a distant cloud region. The architecture manufacturers are settling on, and the operational problems nobody budgets for.

A camera above a production line photographs each part as it passes. A model decides whether the part is good. If it is not, an actuator further down the line must push it aside before it reaches packing. The time available for that decision is set by the speed of the line and the distance to the actuator, and on a fast line it is measured in milliseconds.

That constraint, more than any fashion in architecture, explains why manufacturers are running AI on the factory floor rather than in a distant cloud region. The same logic applies to machine control, where a model adjusts equipment settings in response to sensor readings and a late answer is a wrong answer.

Why the cloud is too far away

A round trip to a cloud region adds delay, and the delay varies. For dashboards that hardly matters. For a reject decision with a fixed deadline, the worst case matters more than the average, and the worst case over a wide-area network is hard to bound. Many plants also sit in industrial zones or regional towns where connectivity is less dependable than at head office, and a line cannot stop because a link has dropped.

Bandwidth is the second problem. Inspection cameras produce high-resolution images continuously, often from several angles at each station. Streaming all of it to the cloud costs money in uplink capacity and data charges, and most of those images show nothing of interest. Paying to send a photograph of a good part across a network so that a remote server can confirm it is good is poor economics.

In Asia-Pacific the shape of the industry sharpens these pressures. Manufacturers often run plants in several countries, newer facilities alongside older ones, under different telecoms conditions and, in some markets, rules or customer contracts that limit where production data may go.

A split architecture

The emerging pattern divides the work. Inference runs on the line, on an industrial computer or small server with an accelerator, close to the cameras and controllers. Training, labelling, model management and long-term storage stay in the cloud or a central data centre, where compute is elastic and data from many lines can be pooled.

Traffic between the two is selective. The edge sends back rejected images, a sample of passes, borderline cases and summary data. The centre sends down new model versions through a controlled release, with version records and the ability to roll back. If the link fails, the line keeps running on the last approved model and queues its uploads until the connection returns.

Who owns a server bolted to a line

The harder problem is ownership, because an edge device belongs to two worlds. Operational technology teams own uptime, safety and the change windows on the line. IT teams own patching, identity, monitoring and security standards. A server on a production line is both, and unless ownership is settled explicitly, it falls to whoever is on shift when the device fails.

A workable division gives IT the standards and the remote management, and gives OT authority over when changes happen. Each device needs a named owner and an entry in the asset register. Four practices follow:

- Patch without stopping the line by pairing devices, so one can be updated while the other carries the load, or by scheduling updates into planned maintenance windows.
- Test updates on a reference line or replica rig before release, then roll out to one line, then one plant, then the rest.
- Keep pre-imaged spares at each plant, specified for heat, dust and vibration, because lead times for accelerator hardware can be long.
- Define a standard kit per line: the same hardware, operating system image, camera interfaces and management agent everywhere. Variation between plants is what makes support across countries expensive.

Security on the plant network

An edge device is a bridge between the plant network and the outside world, which makes it a target. Plant networks often carry older control systems that cannot easily be patched, so the edge box must not become the way in. Place devices in their own network zone, in line with the zones-and-conduits approach of the IEC 62443 standards. Allow only outbound connections to approved endpoints, give each device its own certificate-based identity, accept only signed software and signed models, and route remote access through a single controlled point with session logging.

What to measure

Accuracy figures from a supplier's test set say little about performance on a particular line. Measure what the plant already cares about, against a baseline taken before go-live:

- Rework and scrap, to show whether defects are being caught earlier.
- False rejects: good parts discarded. They cost material directly and erode trust, and operators who stop trusting a system find ways around it.
- Escapes: defects that pass inspection and reach the next process or the customer.
- Unplanned downtime attributable to the system, including the edge hardware.
- Drift: changes in performance as lighting, materials or suppliers change.
- The time it takes to deploy a model update across every line.

Before approving the second line, ask for the false reject rate of the first, measured by the quality team rather than the supplier. ■

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Lisa Su and the AMD turnaround playbook

In 2014 AMD was losing money and its customers' trust. A decade later it was competing at the front of the industry. The few bets, and the kept promises, behind one of tech's clearest turnarounds.

When Lisa Su became chief executive of AMD in October 2014, the chipmaker was losing money, losing share to Intel in personal computers and servers, and carrying heavy debt. Within a decade it was competing at the front of the industry, including in chips for artificial intelligence. Her turnaround is one of the clearest recent examples of a leader choosing a small number of bets and executing them without drama.

An engineer's diagnosis

Su, who was born in Taiwan and earned her doctorate in electrical engineering at MIT, had spent years in semiconductor research and management at Texas Instruments, IBM and Freescale before joining AMD in 2012. Her early message to the company was about focus: fewer products, built to lead in high-performance computing, delivered on the dates promised to customers.

Three decisions that mattered

First, AMD backed a new processor design, Zen, which reached the market in 2017 in Ryzen desktop chips and EPYC server chips. Second, it built processors from smaller pieces, or chiplets, which made high-end designs cheaper to produce. Third, having already separated from its own factories, it relied on TSMC's manufacturing, which for several years was ahead of Intel's.

With the business stabilised, AMD bought the programmable-chip maker Xilinx in a deal completed in 2022 and pushed into data-centre accelerators for AI. Customers who had stopped trusting AMD's roadmap started buying again because the company kept its promises.

What other leaders can take from it

- Credibility is a product. Delivering on schedule did as much for AMD's recovery as any single chip.
- Choose where to lead, and stop elsewhere. A turnaround cannot afford to be good at everything.
- Use partners for what you cannot do best. Relying on an outside manufacturer was a strength, not a weakness, once the dependency was managed.

For a chief information officer rebuilding a function that has lost the business's trust, the AMD lesson translates directly: pick a few commitments, publish the dates and meet them. ■



Lisa Su

CHAIR AND CEO, AMD

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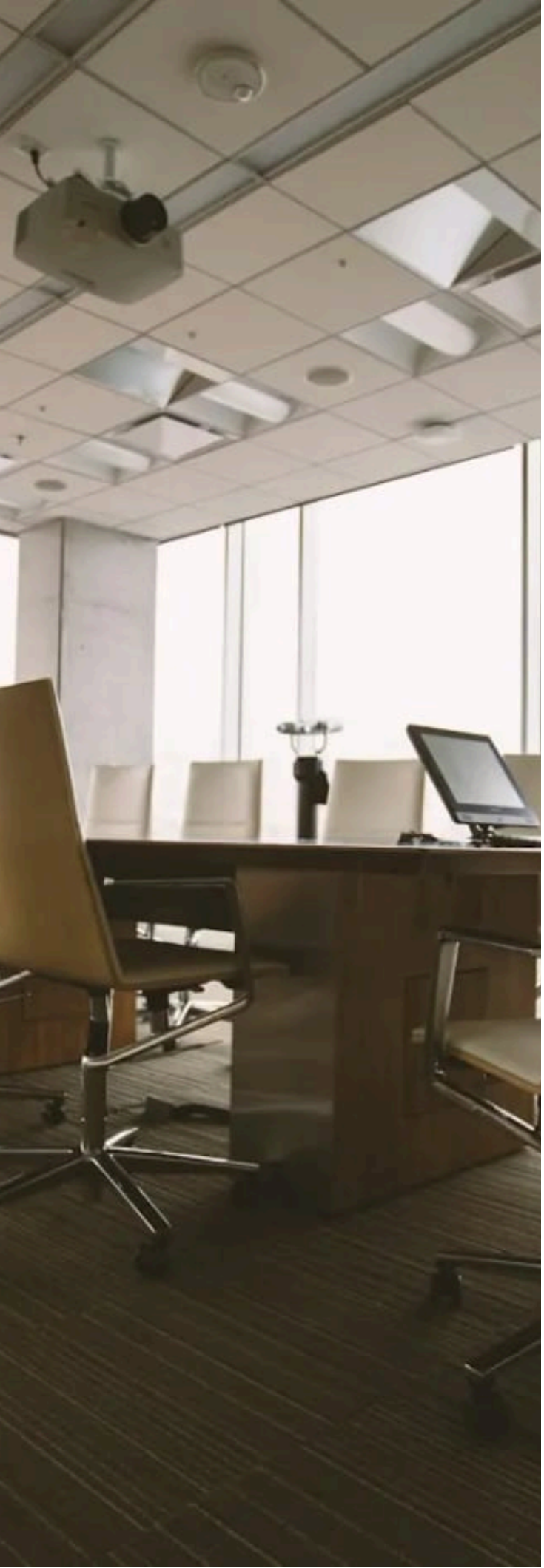

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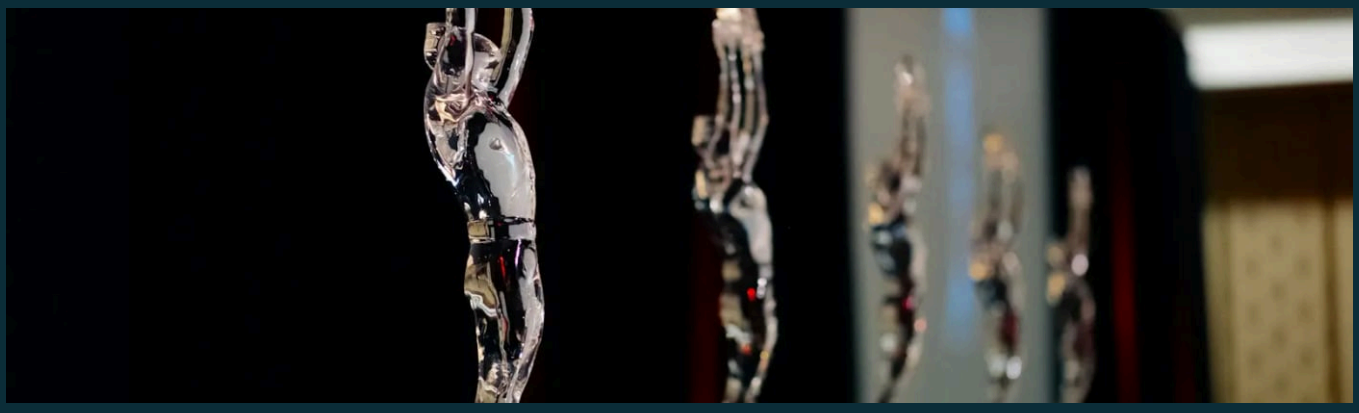

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