European Commission

Research and Innovation

Securing Europe's Biotech Lead

How collaborative research drives biotech health innovation and global competitiveness

Securing Europe's Biotech Lead: How collaborative research drives biotech health innovation and global competitiveness

European Commission
Directorate-General for Research and Innovation
Directorate D — People, Health and Society
Unit D2 — Health Innovations and Ecosystems

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EUROPEAN COMMISSION

Securing Europe's Biotech Lead

How collaborative research drives biotech health innovation and global competitiveness

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2026

Directorate-General for Research and Innovation

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Foreword

Marc Lemaître
Director-General,
Directorate-General
for Research and
Innovation (DG RTD)

Health biotechnology lies at the intersection of health, competitiveness, security and resilience, strengthening Europe's capacity to protect its citizens while driving innovation, economic growth and leadership in the global biotechnology race.

As Europe's population ages and the burdens of chronic diseases continue to rise, biotechnology is transforming the way diseases are prevented, diagnosed and treated. It directly addresses the EU's two leading causes of death - cancer and cardiovascular diseases - and is becoming critical to strengthening preparedness against pandemics, infectious diseases and future health emergencies as climate change and geopolitical instability intensify health risks.

From next-generation vaccines to advanced diagnostics and targeted treatments for rare diseases, biotech innovations are rapidly expanding what medicine can achieve. Europe must create faster pathways to turn scientific breakthroughs into patient access and market solutions, mobilise sustained investment, and foster stronger collaborative innovation ecosystems.

Collaborative research, funded by Horizon Europe and its predecessor programmes, has already demonstrated its effectiveness and shown where Europe's unique added value is most apparent. By connecting universities, research organisations, startups, hospitals, industry, and other stakeholders, and by pooling expertise, resources, and cross-border collaboration, it delivers impact that no single Member State or actor could achieve alone.

This report presents evidence of this impact. Drawing on EU-funded health biotech research between 2014 and 2025, it showcases how collaborative research has generated scientific breakthroughs, strengthened innovation ecosystems, supported economic growth and delivered tangible benefits for patients and society.

At a time when Europe is seeking to reinforce its resilience, competitiveness, security and technological sovereignty, the conclusion is unequivocal: sustained, strategic support for collaborative health biotech R&D is indispensable to translating biotech potential into better healthcare and the capacity to shape the next generation of medical innovations.

Executive Summary

Europe funds health biotechnology R&I to turn scientific discovery into the medicines, vaccines and therapies people depend on, and to keep its economy competitive. This report examines a subset of projects to identify what investment under the collaborative research approach has delivered.

It analyses 154 collaborative research projects carried out during 2014-2025, funded under the Horizon 2020 (Societal Challenge 1) and Horizon Europe Cluster 1 (Health) framework programmes. Together, they represent €1.08 billion of EU investment.

The findings confirm the unique strength of EU-level collaborative research. It links expertise across borders to deliver world-class science, treatments to the clinic, and market-ready innovations.

A connected European research community

- 2,048 participations drawn from 59 countries, including 26 EU Member States.
- 332 participations from small and medium-sized enterprises (SMEs).

Science of global standing

- 8,560 publications in leading journals, including Science, The Lancet, and Nature Medicine, with the most cited receiving over 5,000 citations.
- 69 patent filings from the portfolio, 18 granted so far, with more under examination.

Treatments reaching the patients who need them most

- 172 clinical studies across 86 projects, most at the early and mid-stage trials, where funding is scarcest.
- A malaria vaccine approved by the World Health Organization (WHO) and deployed across Africa at under $3 a dose.
- A precision sepsis therapy that cut 28-day mortality by 6.1 percentage points in a Phase II trial.
- A single-infusion gene therapy for an ultra-rare liver disease, now in its pivotal trial phase.

Innovation built for the market

- All projects delivered one or more innovations.
- In the subset (53 projects, 2023–2025) assessed by the Innovation Radar, an EC tool that identifies and analyses innovations, 40.2% of innovations carry the potential to create new markets.
- 24.1% are already market-ready, above the 18.6% recorded across all Innovation Radar fields.

Impact that continues after the funding ends

- One project's discoveries grew into a company acquired for €1.025 billion.
- Successive funding support enabled Europe's first stem-cell-based clinical trial for Parkinson's disease.

With Europe launching a new Competitiveness fund under the next MFF, the evidence is clear. Sustained investment in collaborative research is the precondition for the competitiveness Europe is working to secure.

01. Health biotechnology: it matters more than ever

Health biotechnology turns scientific discovery into the medicines, vaccines and therapies that people depend on. It is one of Europe's strategic technologies, and the moment to sustain investment is now.

A strategic technology for Europe

Health biotechnology refers to the use of living organisms, biological systems, or their components to develop or improve medical treatments, diagnostic tools, and preventive healthcare solutions. The field focuses on harnessing biology to make healthcare smarter, more precise, and more effective.

Since 2023, the EU has increasingly positioned biotechnology as a critical technology for European economic security. Health biotechnology is central to the goals Europe has set for itself: competitive, healthy, resilient and sustainable economies and societies.

The **Strategic Technologies for Europe Platform (STEP)** Regulation recognises biotech as a critical technology that is essential for reducing strategic dependencies, promoting the competitiveness and sustainability of the Union's industry.

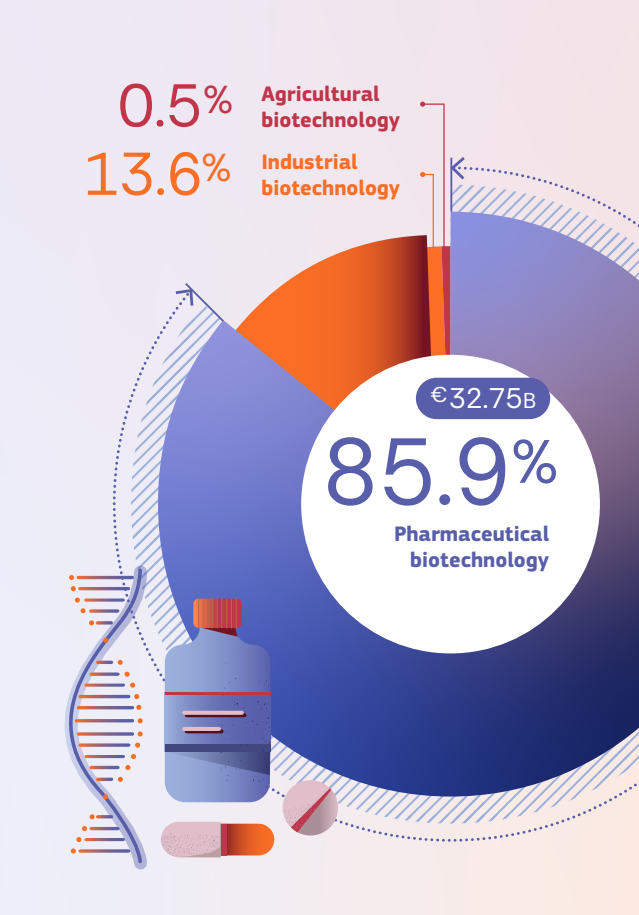
The **European Life Sciences Strategy** emphasises the strategic importance of biotechnology, underscoring that a more competitive biotech sector will offer patients timely, broader access to treatments and products, improved healthcare, and a better quality of life.

A growth engine for the European economy

Biotechnology **contributes**

€38.11B

to the European economy, amounting to around 1.58% of the EU's industrial sector. The largest share, €32.75 billion, comes from pharmaceutical biotechnology.



The sector has expanded steadily since 2008, more than twice as fast as the EU economy over the past decade, as biotechnological processes increasingly replace conventional production methods. In 2024, **95 billion euros were spent** on biological medicines sales in the EU, equal to 41% of total pharmaceutical spending.

The world biotechnology market was worth around $1.55 trillion in 2024 and is projected to reach roughly $5.71 trillion by 2034. Growth on that scale rests on investment made upstream, before a single product reaches the market.

The signal is already visible in Europe's most research-intensive firms. Every European SME in the global top 2,000 for research investment sits in the health sector, most of them in biotechnology.

Meeting Europe's greatest health challenges

Non-communicable diseases account for around 80% of the disease burden in the EU and are the leading cause of avoidable early death. Cardiovascular disease remains the single leading cause of death, responsible for roughly a third of all deaths in Europe.

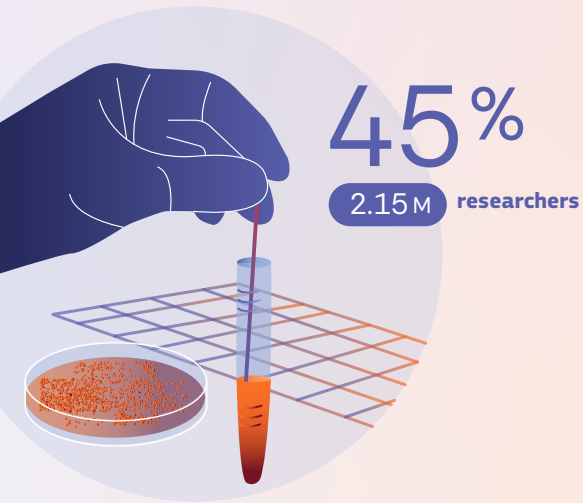
Cancer follows: around 2.7 million people were diagnosed, and 1.27 million died in the EU in 2024. An **ageing population** will intensify the situation. One in five people in the EU is aged 65 and over, and people aged 80 and over are the fastest-growing age group. Combined with declining birth rates, the balance between the younger and older generations is steadily shifting.

Other challenges are less visible but no less pressing, such as the standing threat of infectious diseases, pandemics, and rare diseases, where commercial research alone has limits.

Meeting these challenges takes research at a scale, breadth, and speed that reach beyond national borders. That is what collaborative work in health biotechnology delivers on, and the reason Europe funds it.

Turning science into innovations

The number of researchers in the EU grew by more than 45% between 2014 and 2024, reaching 2.15 million. The research base extends across Europe with expertise spanning molecular and cell biology, genetics, biochemistry, immunology, and bioinformatics, as well as clinical research know-how covering the full biotech spectrum.



No single country holds every piece a health biotech breakthrough needs. Collaborative research is the tool to turn individual exploration efforts into groundbreaking innovations.

The science is strong. The harder challenge comes next. The European Commission's life sciences strategy underscores Europe's leading role in knowledge and excellence, and proposes tenable measures to turn research into innovation—products and companies that flourish, stay and grow in Europe.

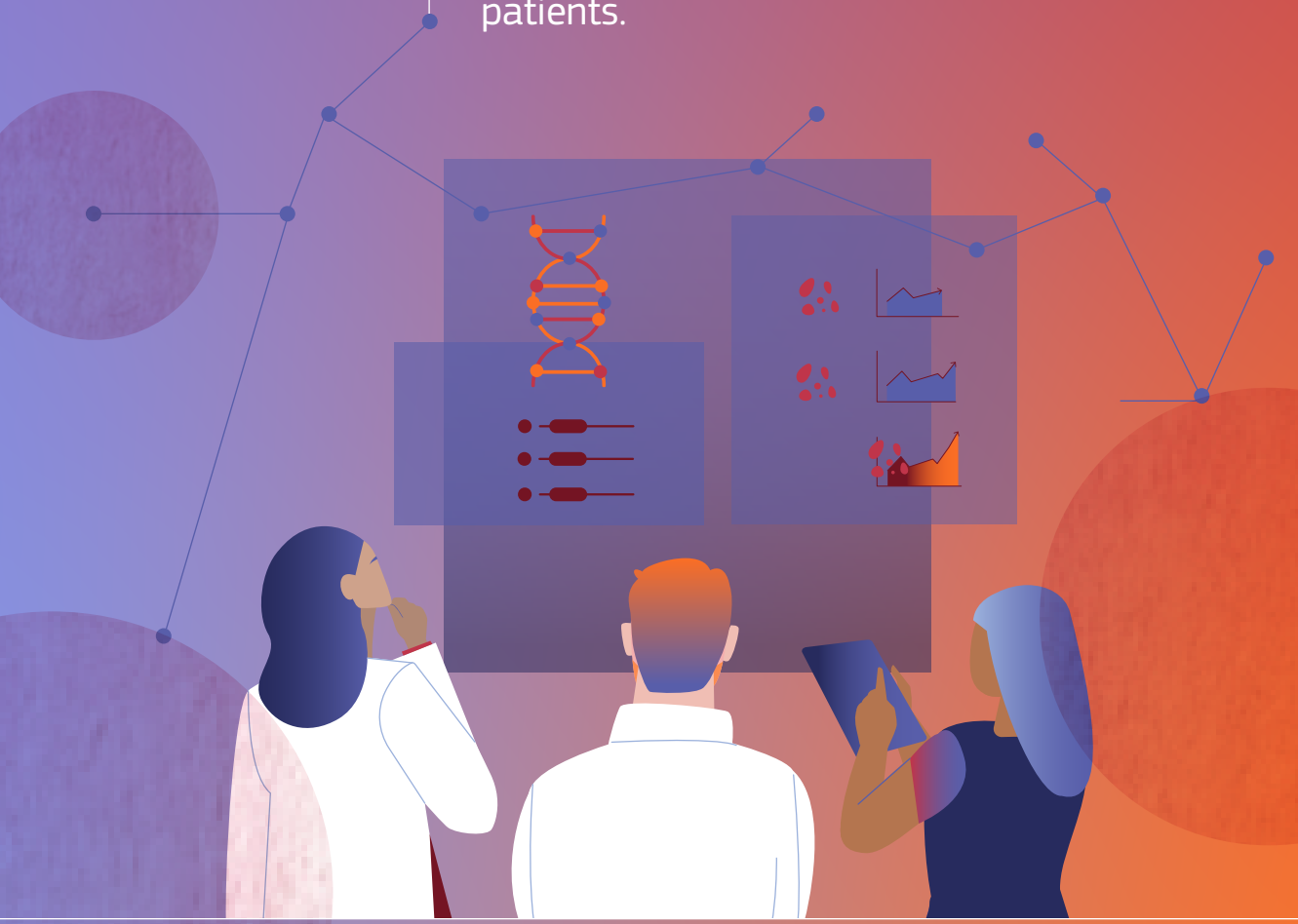
The portfolio analysed in this report is already delivering measurable outcomes: therapies advancing toward patients, innovations reaching the market, and scientific advances of global standing.

The EU is the second-largest source of biotechnology patents worldwide, holding 18% of total biotechnology patents in 2020, behind the US (39%) and ahead of China (10%).

As Europe sets its next budget priorities, the case for sustained investment in collaborative health biotech research is a clear precondition for the competitiveness Europe is now working to secure.

02. Health biotech portfolio at a glance

€1.08 billion across 154 Horizon 2020 and Horizon Europe projects has built a unique European research community that delivers knowledge, creates jobs and brings new experimental therapies to patients.

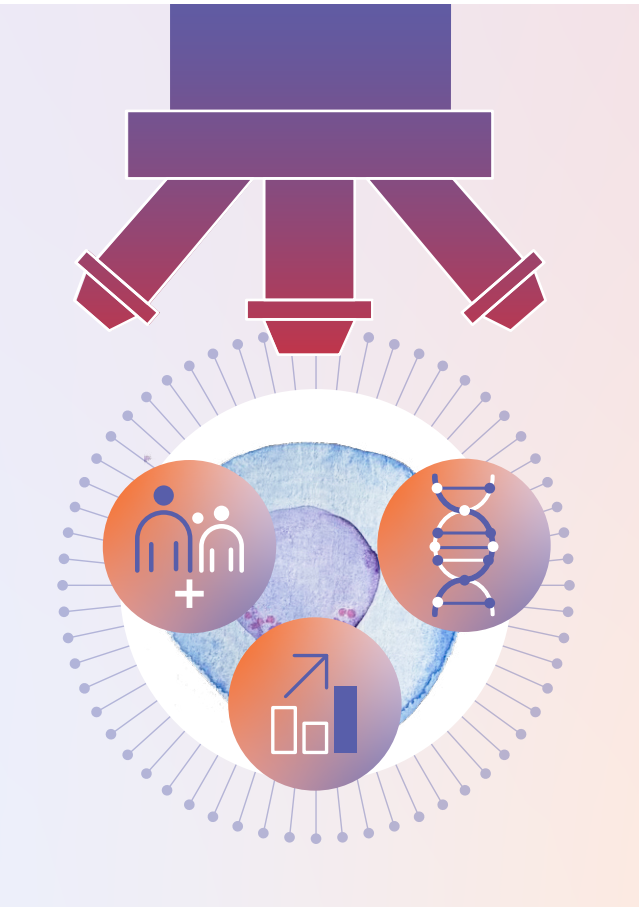


Portfolio overview

This report examines 154 collaborative research projects in health biotechnology, funded under Horizon 2020 and Horizon Europe. Each project ended by 2025 and delivered at least one innovation. Together, they account for 90% of the 171-project portfolio. That represents €1.08 billion of EU investment in biotechnology applied to human health.

The analysed projects are exploring how to keep people healthy throughout their lives: preventing, diagnosing, monitoring, treating and curing disease; building the knowledge and technologies that make this possible; and making health systems more equitable and sustainable in the process.

Health biotechnology is where much of that ambition becomes reality, in the medicines, therapies, diagnostics and vaccines it produces. Collaborative funding brings together a single European research community across disciplines, sectors and borders. It connects the laboratories where ideas are tested, the researchers who develop them, and the companies that carry them to patients.



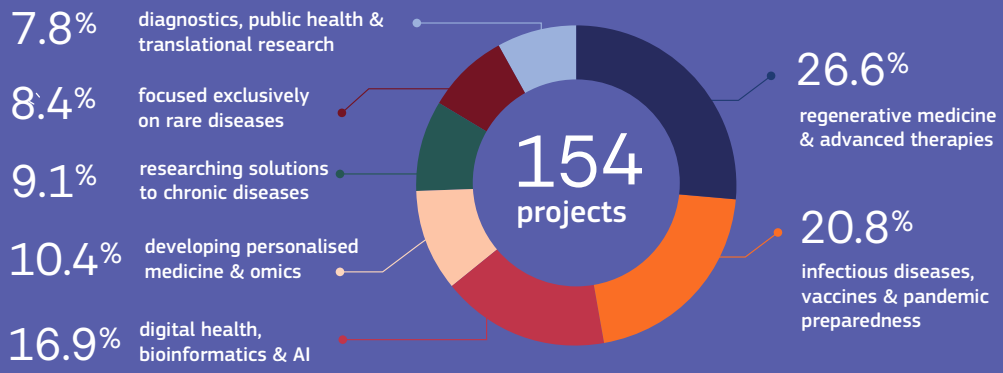
The health biotechnology portfolio: focus on innovation

154 innovative collaborative projects

€1.08B EU investment

2014 — HORIZON 2020 & HORIZON EUROPE — 2025

INNOVATION ACROSS THE HEALTH BIOTECHNOLOGY LANDSCAPE



WHICH HEALTH CHALLENGES WERE ADDRESSED?

- Cancer
- Infectious diseases
- Cardiovascular diseases
- Brain disorders
- Mental health disorders
- Diabetes
- Obesity
- Rare diseases

A research community spanning most of Europe

Behind the portfolio is a map of universities, researchers, SMEs and organisations connecting almost all of Europe. The projects draw together 2,048 participations from 59 countries. Within the Union, that includes 26 of the 27 Member States; nearly every country in the EU working inside one portfolio.

Collaborative funding puts Europe's leading researchers and innovators to work on shared projects with real impact.

Small and medium-sized enterprises (SMEs) account for

↑ 332

participations

around one in six participations, a higher one in six, a higher share than across H2020 and Horizon Europe Cluster Health projects as a whole, building industry into the research from the outset.

Technologies tackling common and rare diseases

Europe's health biotech ecosystem addresses diseases that affect the many and the few, from the earliest laboratory science to therapies entering the clinic. The work focuses on high-burden diseases that cause the most deaths, loss of good health, and economic cost. It also tackles rare diseases where patient numbers are too small to attract adequate commercial investment. Rare disease research accounts for 8.4% of the portfolio.

At its core is advanced therapy: medicine that uses gene therapy, cell therapy and tissue engineering to repair, replace, or reprogramme the body's own biology.

Another major focus is infectious disease vaccines and pandemic preparedness, the field that protects whole populations and has become invaluable in the wake of the COVID-19 pandemic.

Europe is building capability across the whole of human health, from discovery science to innovations already helping patients; collaborative research that's turning scientific advances into health impact at scale.

The portfolio also invests in technologies with the potential to shape how medicine is practised. These technologies include digital health, bioinformatics and artificial intelligence that turn the flood of biological data into earlier diagnosis and sharper treatment. They also include personalised medicine and omics, which tailor care to the individual.

A connected European research ecosystem

2,048

participations in the health biotechnology portfolio

13,30

average participations per project

26 **EU Member States**

59 **Countries**

Main beneficiaries

41% Higher or secondary education establishments

25.3% Research organisations

23.9% Private for-profit entities

332 **Small and medium-sized enterprises (SMEs) participations**

16.2% of all participations

03. A collaborative research ecosystem like no other

Europe's investment in collaborative research brings about the most innovative solutions to today's toughest challenges. As we'll see in this report, many of the projects making the greatest impact would not have come to fruition without collaboration.

The unique power of EU collaborative research

Collaborative research is how the EU funds cross-border research through its Horizon programmes. In Horizon Europe, it falls under Pillar 2, with **health as its first cluster**. Projects are built by consortia of at least three independent organisations from different countries, such as universities, companies, and patient groups, to work on a shared problem. The model breaks silos, connecting knowledge, disciplines, data and technologies to tackle unmet health needs, integrating 27 national research systems into one European Research Area.

Funding research and innovation at the EU level does what national programmes cannot. Pooling resources across countries creates a much larger budget, enabling Europe to back more ambitious, higher-risk projects.

It connects ideas, skills and facilities across borders, sectors and disciplines, producing better approaches. It assembles the critical mass needed for challenges that ignore borders, such as health crises, climate change and digital transformation.

Collaborative research in health biotechnology delivers substantial added value by bringing together complementary expertise that would be difficult to mobilise within a single institution or country. Without the support of the EU's investment, the crucial networks enabling comprehensive, cross-disciplinary research efforts would be significantly compromised, limiting the scope and impact of scientific advancement and patient outcomes.

Project coordinators across this analysed portfolio consistently emphasised the importance of multidisciplinary and cross-border collaboration in achieving scientific and translational outcomes.

What collaboration delivers

Across the projects, collaboration moves the work forward. Expertise held in one country only reaches its full potential when it connects with others. Those connections carry an idea from a single laboratory towards a therapy, a product or a new standard of care.

The groundwork beneath the breakthrough

Collaborative research rarely produces headline results the day a project finishes. Impacts travel through networks and partnerships, and the path from funding to breakthrough takes time.

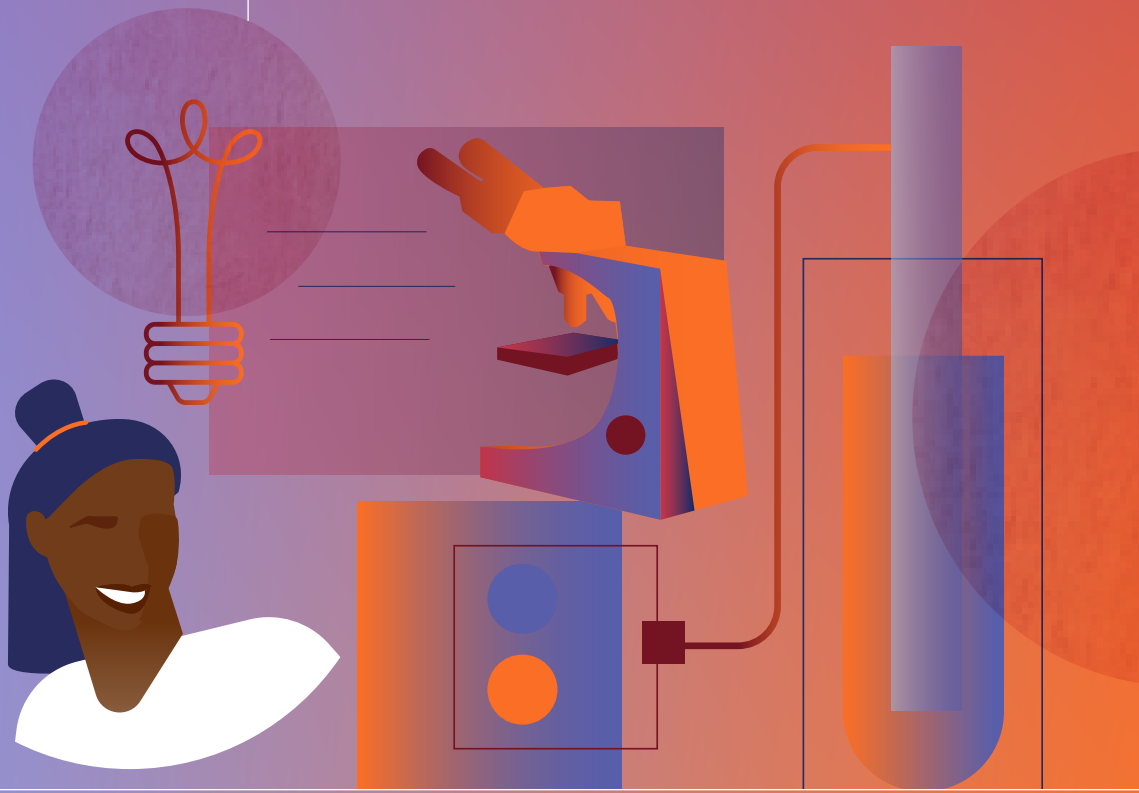
A therapy that reaches patients is assembled in stages: one partner supplies a method, another the material it depends on, and a third the model that proves it works. The finished result is visible, but the collaboration that made it possible rarely is. With timescales necessarily long—a treatment on the market today often traces back to a consortium formed a decade earlier—much of the impact surfaces only after the funded project has ended.

The chapters that follow trace this maturing impact across the portfolio: results that kept building, and kept reaching patients and markets, long after the funded work was done.

The case for sustained investment couldn't be stronger. Impact that takes years to mature needs steady funding throughout that period; research backed by successive framework programmes. That long-term commitment is what the EU provides. It follows collaborative research from discovery to innovation and lets the returns compound over time.

04. What the portfolio delivered

From the laboratory to the clinic to the market. Collaborative research turns EU funding into world-class science, new patents and methods, treatments that reach patients, and market-ready innovation.



4.1. World-class science, patents and technologies

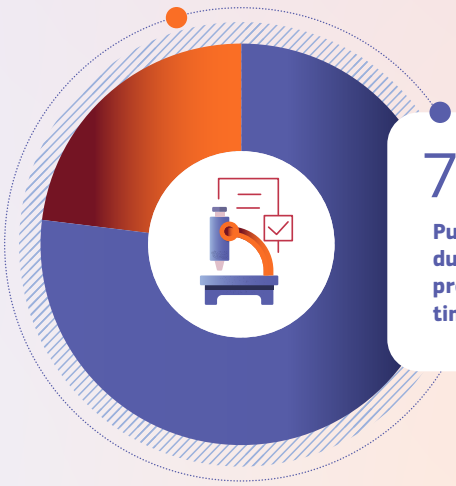
Europe's collaborative research produces science of global standing: published in the world's top journals, protected by a growing body of patents, and yielding new methods other labs can adopt.

Papers in the world's leading journals

The analysed health biotech projects have so far generated

8,560 Publications

23% **Published after the project completed**



77% **Published during the project timelines**

Project publications featured in several world-leading scientific and medical journals. The most highly cited papers appeared in journals including ***Science*, *The Lancet*, *Nature Medicine*, *Nature Genetics*, and several *Nature Reviews journals*.** These journals are among the most selective and influential within the global biomedical research landscape, reflecting the scientific excellence, international visibility, and research quality of the funded projects.

The high citation counts further demonstrate their significance and influence within the research community. Many publications exceeded 2,000 citations, while the most cited papers received more than 5,000 citations, indicating substantial uptake and recognition by the global scientific community.

Research worth patenting

Across the portfolio, 31 of the 154 innovative projects filed at least one patent application, resulting in 69 patent filings.

One such filing came from **RBDCOV**, a Spanish-led project that developed the COVID-19 vaccine BIMERVAX and tested it in 350 children and in vulnerable groups. The project also strengthened manufacturing and developed new formulations for emerging variants. HIPRA, the company that coordinated the project, filed patent applications on it and holds the BIMERVAX trademark.

Patenting is harder in biotechnology than in any other field: the European Patent Office grants fewer than 30% of biotech applications, against almost half across all technologies. The portfolio already matches that benchmark, with more still under examination.

Of the 69 filings, as of April 2026

↑ 18 **patents**

have been granted for innovations delivered through EU-funded health biotech research; 15 during the projects and 3 since. We expect more to be granted as embargoes lift and examinations conclude.

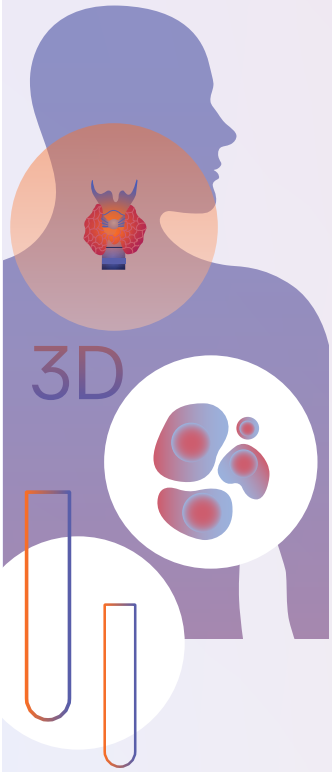
Cutting-edge technologies

Alongside publications and patents, the portfolio advances the technologies that enable new science: 3D tissue models, organoid platforms, and bioprinting methods that replace older laboratory tools.

SCREENED's bioprinted thyroid models, which detect harmful chemicals at far lower concentrations than conventional tests, show this technological advancement in action.

IMPACT IN ACTION

SCREENED: A novel way to test chemicals for harm

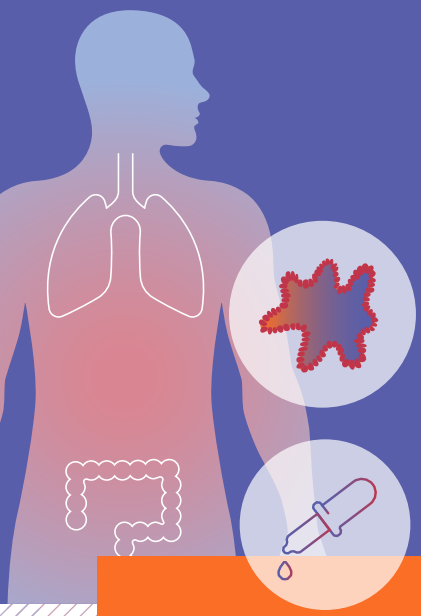


Many everyday chemicals are suspected of interfering with the thyroid, the gland that controls the body's metabolism. But proving it is hard. Human thyroid tissue for testing is scarce, and standard flat cell cultures are a poor stand-in for a living gland.

SCREENED, coordinated by Maastricht University, developed a better way to test. The project built 3D models of the thyroid, including a bioprinted version that more closely mimics the functioning of real thyroid glands than current testing models. Tested against a battery of chemicals, these models detected harmful effects at far lower concentrations than conventional methods. The project also designed a system capable of running more than 50 tests at once, providing throughput for 3D cell culture systems that are otherwise difficult to scale up for screening. One project partner has filed a patent application.

The project team hopes that this more sensitive, more human-relevant way to screen chemicals is one that other laboratories, regulators and companies can adopt, and that it becomes a step towards replacing animal testing with models built from human cells.

The project was part of a EURION cluster of 8 projects (with a total funding of 50 million euro) **dedicated to improving the identification of endocrine disruptors**.



IN THE SPOTLIGHT

HIT-CF: Personalised treatment for CF patients

HIT-CF aims to help the roughly 10% of the Cystic Fibrosis community with a rare genetic variant.

Coordinator:
Kors van der Ent, UMC Utrecht

Duration:
2018 ⟶ 2025

+500
patients represented in the organoid collection

Personalised organoid screening developed

Spin-off created to advance a promising treatment

Lab response shown to predict clinical response

Cystic fibrosis is a hereditary disease that can cause severe respiratory and digestive problems. Highly effective therapies already exist for common variants, but solutions have been lacking for rarer ones.

The HIT-CF project team developed a new screening method built on organoids: miniature 3D organ models grown in the lab from stem cells. An innovative and effective way to study disease, test drugs, and advance personalised medicine.

> We have a good biomarker to preselect patients with ultra-rare genetic variants for treatment.

Novel methods, promising results

The novel method involved taking patient biopsies, culturing them in the lab, and then testing different compounds on the organoids to see what worked. Project coordinator, Kors van der Ent from UMC Utrecht in the Netherlands, described each organoid as a "lookalike" for the individual patient.

Organoids were formed using stem cells collected from over 500 patients from across Europe with ultra-rare variants. The team worked with several pharmaceutical companies to develop and test compounds. If the organoid was responsive, the team believed there was a good chance the patient would respond too.

A promising compound was identified, leading to the spin-off of a pharmaceutical company, Fair Therapeutics, to conduct clinical trials. The trials compared patients likely to respond well, identified in the lab, with a randomly selected group of patients. The results showed a clear relationship between lab and clinical results. Patients whose organoids responded well to the compound in the lab also responded well in the trial. The clinical trials also showed promise that new drugs could be effective.

Collaboration makes it possible

CF Europe, an umbrella organisation representing patients, was an important member of the consortium and provided input at all stages of the project.

And with discussions ongoing with regulatory bodies such as the European Medicines Agency (EMA), the team hopes to secure approval to screen patients with ultra-rare variants of the disease early and prescribe medication based on lab results, impacting lives sooner.

> We aim to move forward with cheaper, effective treatments.
>
> **Kors van der Ent, Project coordinator, UMC Utrecht**

4.2. Where the research reaches patients

EU funding carries treatments through the riskiest clinical stages to the patients who need them most. Among the results: a malaria vaccine now in use, a sepsis therapy that lowered mortality, and a single-infusion gene therapy now in its pivotal trial phase.

The EU-funded projects in the portfolio develop innovative biotechnological solutions targeting various disease areas, especially those with high burdens and unmet medical needs. By refining diagnostic and treatment methods, collaborative research aims to improve patient outcomes and bolster public health resilience.

It is a societal ambition linked to Europe's key goals: life-science innovation that leads to better health at all ages, cleaner and more resilient environments, and strong, future-ready economies.

It is driven by strong contributions to biotech research, where the consortia foster cross-border collaboration to generate novel intellectual property, impactful publications, and ongoing research. By connecting academic excellence with industry expertise, these projects boost Europe's translational research and accelerate the path from discovery to application.

Funding treatments that reach patients with the deadliest diseases

EU funding has supported clinical studies in projects that sit at the critical clinical trial stage. The stage where scientific uncertainty is greatest, pressure to succeed is highest, and investment is scarcest. This is where collaborative European funding advances promising science.

And the results are reaching patients. OptiMalVax delivered the first high-efficacy malaria vaccine, now approved by the World Health Organization. The vaccine is being deployed across Africa at under $3 per dose. ImmunoSep cut 28-day mortality in sepsis patients by 6.1 percentage points

through treatment matched to each patient's immune profile. CureCN's gene therapy, given as a single infusion, allowed patients with an ultra-rare liver disease to stop phototherapy 16 weeks after treatment.

Advancing the riskiest stage of development

A clinical trial tests a new treatment in people to establish whether it is safe and whether it works. Drug trials run in four phases. Phase I tests safety in a small group. Phase II finds the right dose and looks for early signs of benefit. Phase III confirms the benefit in large numbers of patients. Phase IV follows the treatment once it is approved and in use.

The portfolio delivered 172 clinical studies, including both interventional and non-interventional research activities. Interventional studies comprise Phase I–IV drug clinical trials as well as non-drug studies involving medical devices and medical procedures. Multiple project teams launched 69 drug clinical trials, including 19 Phase I, 10 Phase I/II, 32 Phase II, 1 Phase II/III, 6 Phase III, and 1 Phase IV. In addition, 11 projects involved non-drug interventional studies.

There's a strong concentration of EU-funded projects in early and mid-stage clinical development, a time when access to uninterrupted funding is paramount.

88% of the identified drug clinical trials in this portfolio are between phases I and II. The predominance of Phase II trials (46%) suggests that many funded projects prioritise dose optimisation, preliminary efficacy evaluation and safety assessments in patient populations. These trials serve as a critical step in determining therapeutic potential and informing progression to confirmatory Phase III studies.

This distribution of funding for early-stage trials also indicates that EU funding plays an instrumental role in advancing high-risk translational health biotechnology innovations through the critical Phase II development stage, where scientific uncertainty, clinical attrition risk, and financing gaps are particularly pronounced. By supporting projects at this stage, EU funding helps bridge the translational gap between early scientific discovery and later-stage clinical and commercial development.

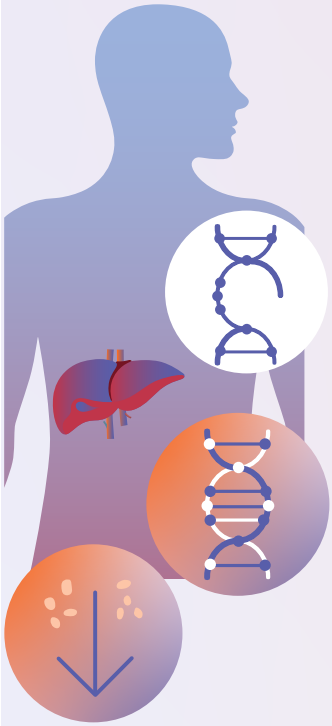
172
Clinical studies

69
Drug clinical trials

11
Projects involving non-drug interventional studies

IMPACT IN ACTION

CureCN: A gene therapy for a life-threatening liver disease

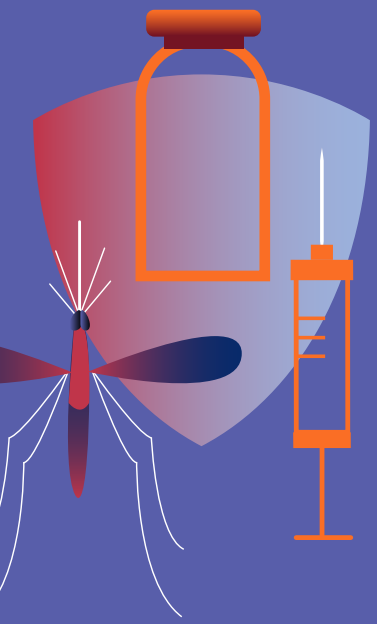


Crigler-Najjar syndrome is an ultra-rare liver disease that affects one in a million people at birth. A faulty gene leaves patients without UGT1A1, the enzyme that clears bilirubin, a toxic waste pigment. Bilirubin builds up in every body tissue and, untreated, causes irreversible brain damage and death. Treatment is burdensome and imperfect. The only definitive option, a liver transplant, carries lifelong risks.

CureCN, coordinated by Association Genethon in France, **tested a gene therapy** given as a single infusion. It uses an adeno-associated virus (AAV), a viral carrier, to deliver a functional copy of the UGT1A1 gene into liver cells.

The trial advanced cohort by cohort. The first cohorts confirmed that the therapy was safe. At the second dose level, patients' total bilirubin levels fell, and they were able to stop phototherapy 16 weeks after treatment. An independent safety board then cleared the trial into its pivotal phase, the decisive stage before approval, and the first paediatric patients were dosed.

The consortium also took on a barrier that constrains gene therapies across the field. After the vector is infused, the body builds antibodies against the viral carrier, which blocks any second dose. A separate problem affects the first dose: many people already carry immunity to AAV before treatment, and this rules out up to 60% of patients from receiving the therapy at all. It matters most for young children, whose growing livers dilute the therapy so a single dose may not hold. In preclinical models, CureCN suppressed this immune response and delivered the vector a second time. It is early evidence that AAV gene therapy could one day be repeated when a patient needs it, rather than given only once.



IN THE SPOTLIGHT

OptiMalVax: The first high-efficacy malaria vaccine

OptiMalVax developed the first high-efficacy malaria vaccine at the Jenner Institute in Oxford. It first showed high efficacy in a Phase IIa challenge trial in the UK in 2017 and was then outlicensed to the Serum Institute of India for large-scale manufacturing. At under $3 per dose, the vaccine costs a third of its nearest competitor, induces a stronger immune response, and is easier to deploy at scale.

Coordinator:
Professor Adrian Hill, Jenner Institute, University of Oxford

Duration:
2017 ⟶ 2022

78%
Efficacy in young African children

Successful Phase III trials
involving ~5,000 children

Manufactured at
< 3$
per dose, enabling large-scale access

Deployment beginning in 2024

Malaria kills about half a million people each year, mainly children, predominantly in Africa. Of the three major infectious killers, HIV, malaria and tuberculosis, none had an effective vaccine after more than 110 years of research. A malaria vaccine is exceptionally hard to design, and funding the field has had to sustain investment against decades of limited success.

> The R21/MM malaria vaccine is saving lives as we speak
>
> **Professor Adrian Hill, Project coordinator, Jenner Institute, University of Oxford**

From lab proof to lives saved

With continued funding from the European Commission and the European & Developing Countries Clinical Trials Partnership (EDCTP), OpiMalVax developed the first effective vaccine, R21/MM, targeting Plasmodium falciparum, the deadliest malaria parasite species. The vaccine can substantially reduce malaria morbidity and mortality. When deployed alongside long-acting drugs, bed nets, and insecticide spraying, it could help move towards the elimination of malaria.

The development model also represents a wider shift in collaborative research. Academics led at every stage, and African-led research teams played a major role. From 2020 to 2023, it rapidly produced and distributed the Oxford-designed Covid-19 vaccine, saving an estimated six million lives, largely in developing countries, in 2021 alone.

Two decades of EU funding

Over two decades, the European Commission, latterly with EDCTP, has been the largest single funder of the research behind R21/MM and other Oxford malaria vaccines. These international partnerships deliver lasting value.

Moreover, testing a vaccine where the need is greatest is both more efficient and more ethical, and the intellectual leadership of experienced African clinical-trial investigators was central.

Next-generation vaccines and new companies

Blood-stage and transmission-stage malaria vaccines are now in advanced clinical testing, and a new vaccine against Plasmodium vivax, a less deadly but more widespread Malaria strain, is in active development. Members of the malaria vaccine team have founded at least seven biotechnology companies. Over the next decade, the team's focus is on tools that reduce disease and death from infectious diseases in lower-income countries.

4.3. Turning research into market-ready innovation

Collaborative research does not stop at fundamental science. Every project analysed delivered at least one innovation, and many have high potential for market creation. Among those assessed by the **Innovation Radar (IR)**, 24.1% are ready for market today. That is above the 18.6% EU-wide average.

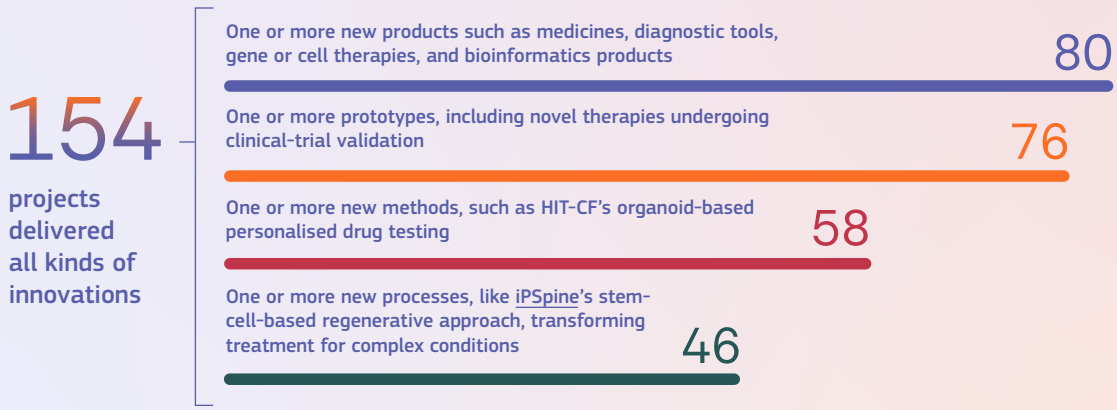
EU-funded health biotech collaborative research moves scientific discovery into societal, scientific and economic value across Europe. It also strengthens the economy by stimulating the creation of innovation-driven markets and drawing small and medium-sized enterprises (SMEs) into the value chain.

By de-risking early innovation, it supports the scaling of biotech solutions and long-term growth in the sector.

Innovation across the development path

Each project in the portfolio delivered one or more innovations. These range from treatments and diagnostics to drug-delivery systems and personalised-medicine approaches. Together, these outputs span the full journey, from early discovery to scalable clinical application.

Fig.1 What kinds of innovations did 154 projects deliver?



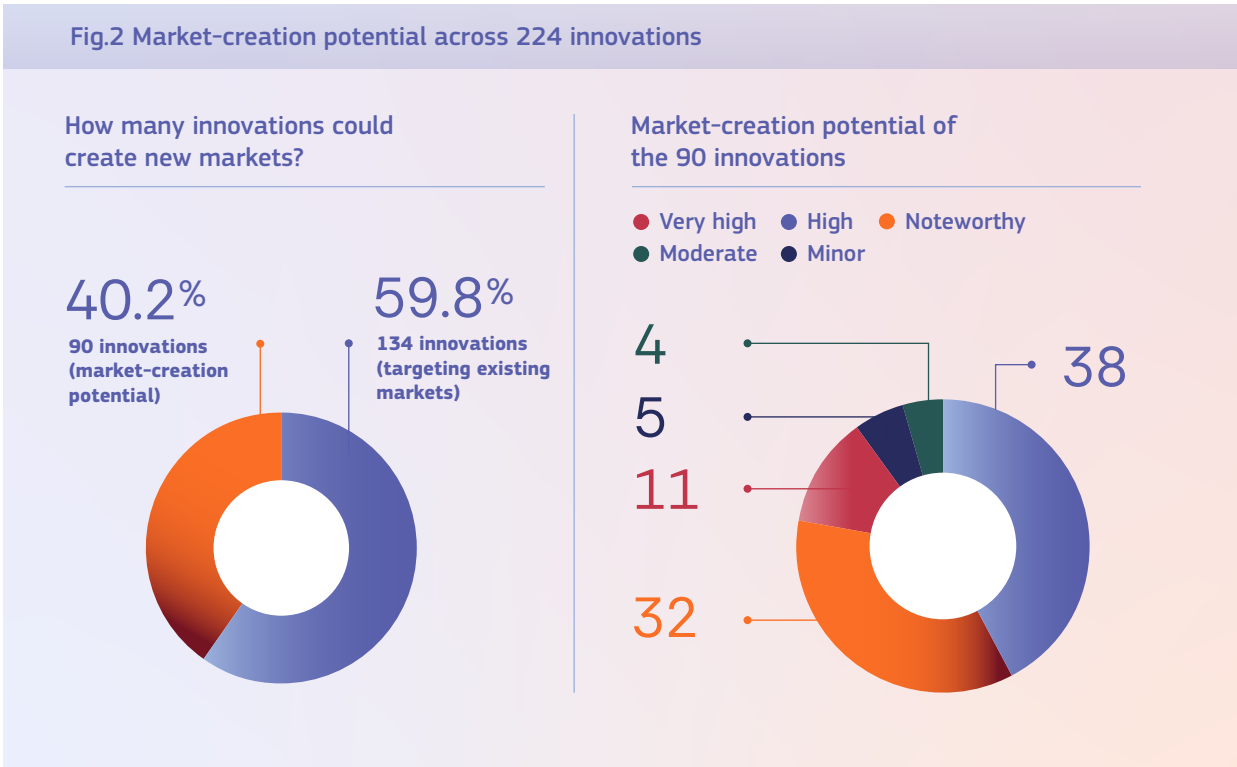
Funding innovation creates potential new markets

Since 2023, health biotech projects have been assessed with the Innovation Radar (IR), the Commission's tool for identifying high-potential innovations and innovators. The figures below cover only the 2023–2025 subset: 53 projects, €437.8 million in EU contribution, and 224 innovations. They do not cover the full portfolio.

To carry market-creation potential, an innovation must target an emerging or not-yet-existing market, have a plan for commercial exploitation, and reach a new group of customers.

On this measure, 40.2% of the 224 innovations carry market-creation potential. Of those, 54.4% show High or Very High novelty, and 90% fall in the Noteworthy to Very High band.

Fig.2 Market-creation potential across 224 innovations

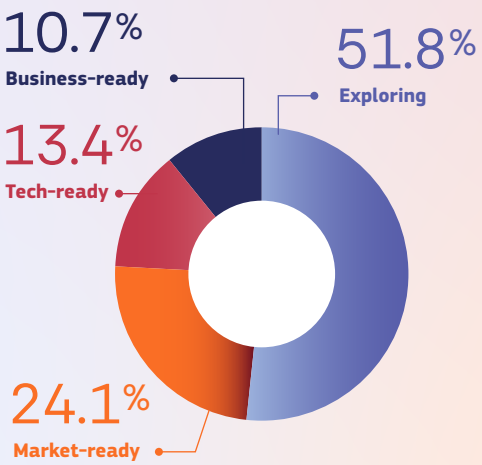


Health biotech reaches market readiness above the EU average

The Innovation Radar grades how close each innovation sits to commercial use. A market-ready innovation is one that the Radar judges technologically mature, with the consortium committed to bringing it to market.

Across the 53 health biotech projects it assessed, 24.1% of innovations are already market-ready. That share sits above the 18.6% recorded across all Innovation Radar fields. A pipeline of that kind is a near-term economic return on the collaborative research. Some innovations have already entered the market through spin-offs, follow-on funding and acquisitions. We'll discuss this further in Chapter 5.

Fig.3 How close are 224 innovations to market?



De-risking the path from lab to market for advanced therapies

Advanced cell and regenerative medicine therapies face a recognised Valley of Death: the stage where a developer must secure regulatory approval and enter the market. The barrier at this point is often manufacturing: producing a therapy at scale, to a regulated standard, and at a viable cost.

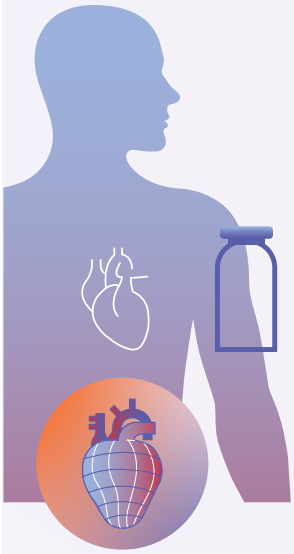
This is where promising work stalls before reaching patients. Collaborative research de-risks this stage. A consortium can build the automated, regulated manufacturing capacity needed to turn a therapy into a product. It gives small and medium-sized enterprises (SMEs) a defined role in that

value chain, funding them to help build the manufacturing and quality base on which a competitive industry depends. This strengthens competitiveness and lets biotech solutions scale.

De-risking the path from lab to market looks different in every case, as the following four projects illustrate.

IMPACT IN ACTION

SILICOFCM: A virtual-patient platform, built for adoption



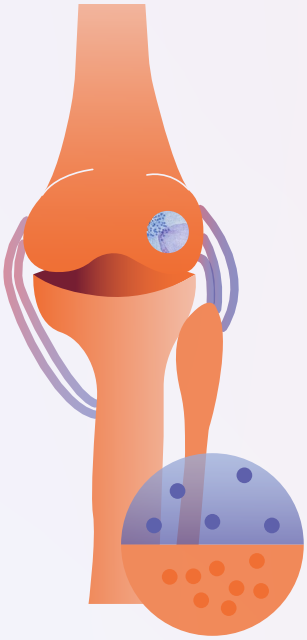
Familial cardiomyopathies are inherited diseases of the heart muscle. Hypertrophic cardiomyopathy, the most common form, affects around 1 in 500 people and is a leading cause of sudden cardiac death in the young. Developing new drugs depends on animal and clinical studies that are slow and costly.

SILICOFCM, coordinated by the Serbian SME BIOIRC, built a cloud-based platform that runs clinical trials by computer simulation. It combines a patient's genetic, molecular, imaging and clinical data into a heart model specific to that person. These models generate virtual patient populations, so a candidate drug can be tested in simulation before it reaches animals or patients.

The platform is built to be adopted. The consortium finalised an exploitation plan and a business model to commercialise it. It now focuses on aligning in silico trials with EMA and US Food and Drug Administration (FDA) pathways to increase clinical uptake.

IMPACT IN ACTION

JOINTPROMISE: Printing living joint implants to stave off arthritis



Deep osteochondral defects can trigger OA in young people, often through sports injuries or trauma. This can mean knee replacements between the ages of 40 and 50. Current synthetic implants last about 15 years, and replacing a worn one is more complex because the bone has further degenerated.

JOINTPROMISE, coordinated by KU Leuven, developed bioprinted implants that synchronise the regeneration of cartilage and the bone beneath it. To produce at scale, the consortium built an automated bioreactor and bioprinter mini factory, installed at KU Leuven, that turns single cells into organoids and bioprints them into larger implants. The platform's components were ranked tech-ready and market-ready by the Innovation Radar.

In clinical settings, these implants could regenerate subchondral bone and articular cartilage, avoid OA, and reduce the burden on healthcare providers. The robotic bioreactor-and-bioprinting platform could also produce kidney or cardiac organoids, opening different tissue implants for a range of patients.

The consortium acquired intellectual property for the osteochondral implant and its bioprinting process, and the platform has been further developed and validated since the project finalised.

IMPACT IN ACTION

AutoCRAT: Automating cell therapy to bring costs down

Stem cell therapies are the gold standard for OA, but they are expensive to develop and produce, which limits their use.

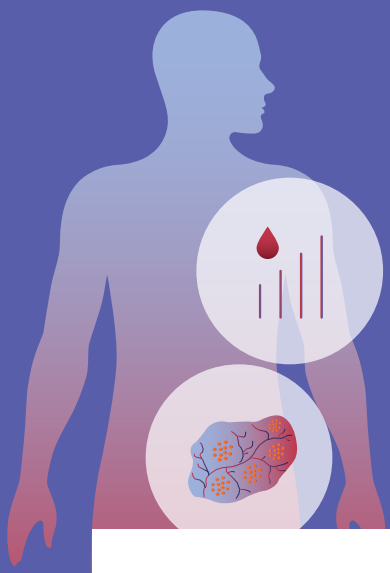
A project led by the University of Galway aimed to develop new regenerative therapies for osteoarthritis and cartilage repair. AutoCRAT developed closed, automated systems covering the full advanced therapy medicinal product (ATMP) value chain, from raw materials to cryopreservation of the final product.

The project also delivered the AutoCRAT Regenerative Medicine Factory (ARM-F), which is a closed, scalable, and regulatory-compliant system that covers cell production, extracellular vesicle production, and quality-control assays.

The closed automated approach has the potential to cut contamination risk and lower manufacturing costs, making it feasible to treat more patients. The project reached preclinical assessment of its therapies, a first step toward human clinical trials.

IN THE SPOTLIGHT

VANGUARD: A living implant to end insulin dependence



VANGUARD built a retrievable, implantable bioartificial pancreas that restores natural glucose control without donor organs. Of its four innovations, Amniogel is already market-ready and covered by a patent application.

Coordinator:
Ekaterine Berishvili, University of Geneva

Duration:
2020 ⟶ 2025

Type 1 diabetes affects over 2.2 million people in Europe and currently has no cure. Standard treatment relies on insulin therapy and continuous glucose monitoring. VANGUARD is developing a device to restore natural blood sugar control in people with type 1 diabetes. The only comparable option today is a pancreatic cell transplant, which is limited by donor shortage and the need for lifelong immunosuppression.

> The path to a functional cure for type 1 diabetes is now clearer than it has ever been.
>
> **Ekaterine Berishvili, Project coordinator, University of Geneva**

VANGUARD delivered four innovations:

- **Amniogel**: a hydrogel that keeps transplanted cells in place, protects them, and helps blood vessels grow around them.
- **Porcine islet organoids**: lab-grown clusters of insulin-producing cells from the pancreas, derived from pigs. They can work at half the usual cell dose.

- **A porcine pancreas construct:** a complete pancreas substitute built from pig cells, offering a way around the shortage of human donor tissue.
- **A human pancreas construct built with human cells, and fully removable.** That makes it safe to trial in people for the first time.

The project also creates tools others can reuse. Amniogel can carry and support other cell therapies, and its method for making lab-grown cell clusters (organoids) can be used across regenerative medicine. Two assets have clear commercial value: Amniogel as a standalone GMP biomaterial, and the bioartificial pancreas as a candidate ATMP, a regulated treatment based on cells and genes.

Nine partners in five European countries

VANGUARD brought together six research institutions, two SMEs, and the European Society for Organ Transplantation. These partnerships were essential to achieving the results within the project timeframe.

Towards clinical trials, a functional cure and beyond

The consortium plans to manufacture Amniogel to pharmaceutical standards for patient use. It will advance the human bioartificial pancreas into a first-in-human Phase I trial and build a next-generation implant that pairs Amniogel with insulin-producing cells grown from stem cells, designed to avoid immune rejection. That step would end reliance on donor tissue and on drugs that suppress immunity.

4.4. Building the European Research Area in practice

Collaborative research builds a connected European research area. An illustrative example is neurodegenerative disease stem cell research, where three successive funded consortia have enabled progress that is transforming treatments.

A laboratory distributed across Europe

Collaborative research builds durable networks that link complementary expertise across borders, sectors and disciplines. These networks are what the European Research Area is made of: a **connected environment** where knowledge, people and technology exchange freely.

A record of grants can capture the findings and deliverables, but the network that outlasts them is less visible. European investment in health biotech funds that network directly, at a scale individual countries alone cannot match.

Breakthroughs in health biotechnology depend on funding sustained across successive programmes. The **Horizon 2020 evaluation** states this plainly, with outcomes depending on sustained action across multiple framework programmes. Continuity of investment is the condition for innovations reaching patients.

The anatomy of a breakthrough: resources, resolve, and time

The impact is illustrated with European stem-cell research for neurodegenerative disease. Three successive EC-funded consortia, coordinated by the University of Milan, laid the basic-science groundwork that gave European groups leadership in the field. The effort spanned sixteen years, proving no single grant could have carried the work from first principles to the clinic.

The three consortia ran in sequence (Fig. 4). Together, they progressed along a defined trajectory, with the work beginning with protocols to differentiate human stem cells into the neurons lost in Parkinson's and other diseases, such as Huntington's.

These neurons were tested in animal models. The consortia then confirmed how the transplanted neurons performed and integrated after transplantation, and ultimately refined the cell product for clinical transplantation, including immune rejection.

For sixteen years, the consortia worked as a single, distributed laboratory, uniting scientists, industry and SMEs from several countries. Their reach extended past Europe. G-Force PD, a global initiative to coordinate Parkinson's stem-cell trials, grew out of a NeurostemcellRepair meeting in 2014. The most recent of the three grants, NSC-Reconstruct, carried this work toward the clinic.

Fig.4 European Commission funded consortia timeline - stem-cell research for neurodegenerative disease

IN THE SPOTLIGHT

NSC-Reconstruct: Making neurons the brain won't reject

NSC-Reconstruct produced replacement neurons from stem cells and engineered them to survive immune rejection. Two of its innovations are already on the market.

Coordinator:
Elena Cattaneo,
University of Milan

Duration:
2020 ⟶ 2024

Neurodegenerative diseases are the leading cause of disability in Europe, affecting one in three people, and most treatments only ease symptoms. The economic burden of neurological disorders in Europe is estimated at €368 billion a year. NSC-Reconstruct set out to repair damaged brain tissue by replacing the neurons lost in Parkinson's and Huntington's disease with new ones grown from stem cells. The obstacle is rejection: the immune system attacks transplanted cells, and grafts fail.

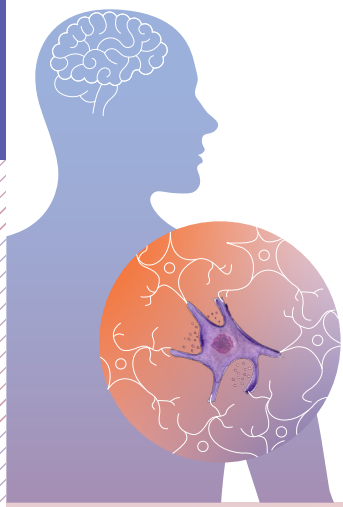
> Our hope is that neural regenerative treatments tailored to the needs of different diseases, such as Parkinson's or Huntington's disease, could one day reach millions of patients globally.
>
> **Elena Cattaneo, Project coordinator, University of Milan**

Replacing lost neurons means solving 4 problems in order:

- **Make the right cells.** New protocols turn stem cells into the three neuron types that degenerate in these diseases: midbrain dopaminergic, medium spiny and basal forebrain cholinergic neurons.
- **Know whether the graft has taken**. A stem cell line called H9-Bi-DREADD can be switched on or off using specific molecules, allowing the team to see whether transplanted cells are alive and working.

- **Stop the body rejecting them.** Hypo-immune cells are genetically modified so the immune system does not attack them, improving the chances that a graft survives.
- **Prove the cells are good enough to use.** New tools quality-control and characterise dopaminergic progenitors, the immature cells from which these therapies are built.

Two of those tools are already on the market: a reagent panel that identifies the progenitors, and an assay that checks their quality during manufacturing.



Towards first-in-human trials

The priority now is to move the most promising technologies toward the clinic. The consortium must also standardise and scale manufacturing to meet regulatory requirements for clinical-grade production. The hypo-immune cell lines and rejection tests developed in the project are expected to improve graft survival and integration. The roadmap points to first-in-human trials, where the safety and potential of these regenerative strategies can be assessed.

What sustained funding protects

In 2023, the lineage advanced to clinical trials. STEM-PD, Europe's first stem-cell-based trial for Parkinson's disease, started that year, with eight patients treated from February 2023 to October 2024. The project has now transitioned to industry, as Cellular Intelligence has agreed to acquire STEM-PD.

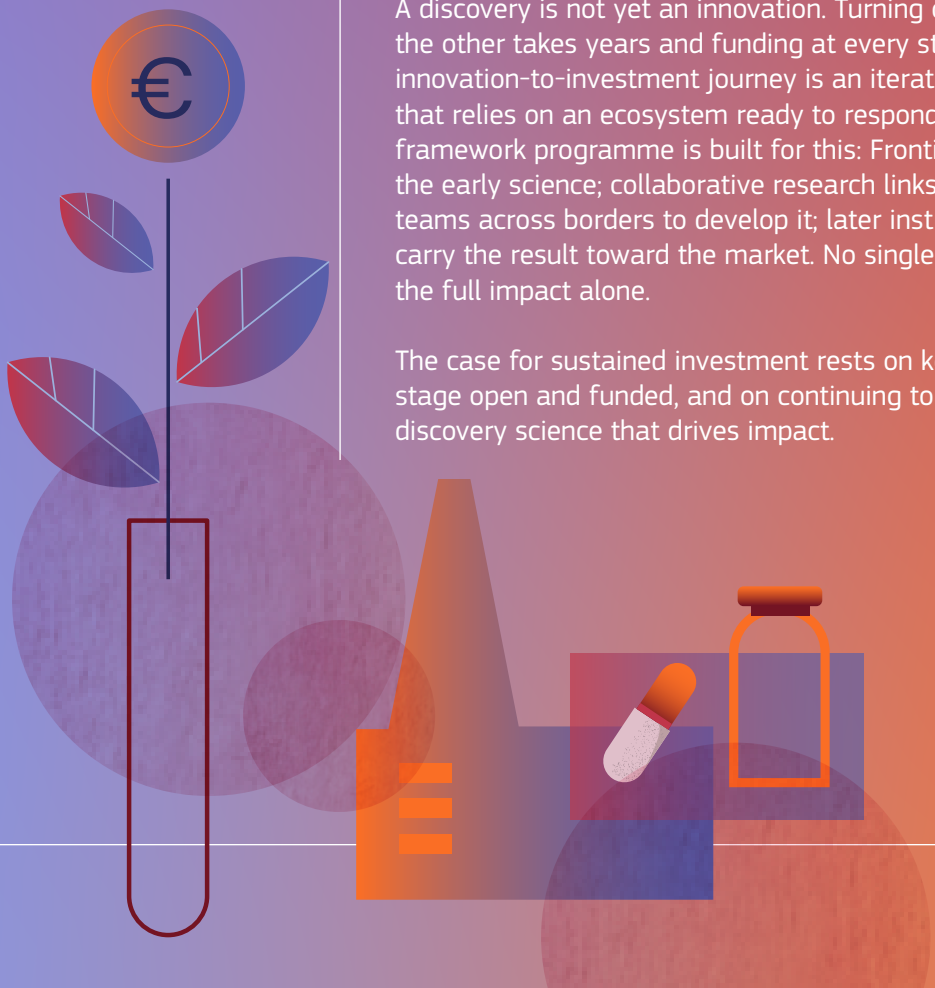
05.

Funding the whole journey

No single stage turns discovery into impact. European funding works as a continuous journey from frontier science through cross-border collaboration to the path to market. And the returns arrive often years after a project closes.

A discovery is not yet an innovation. Turning one into the other takes years and funding at every stage. The innovation-to-investment journey is an iterative one that relies on an ecosystem ready to respond. Europe's framework programme is built for this: Frontier grants fund the early science; collaborative research links complementary teams across borders to develop it; later instruments help carry the result toward the market. No single stage delivers the full impact alone.

The case for sustained investment rests on keeping every stage open and funded, and on continuing to fund the discovery science that drives impact.



From a Hannover laboratory to a billion-euro acquisition

Professor Thomas Thum's story illustrates the innovation-to-investment journey facilitated by EU R&I funding.

It began with frontier science. Between 2015 and 2021, his LONGHEART project explored how non-coding RNA molecules drive changes in the failing heart. The European Research Council (ERC) Consolidator Grant, worth nearly €1.82 million and hosted at Hannover Medical School, laid the scientific foundations for everything that followed.

The science drew investors. In 2016, Thum, by then a partner in two EU collaborative consortia on heart failure, FIBROTARGETS and HOMAGE, co-founded Cardior Pharmaceuticals, a spin-off from Hannover Medical School, with Claudia Ulbrich. The company develops therapeutics for people with heart failure and those recovering from a heart attack.

Collaborative funding then carried the work forward. In 2019, the Horizon 2020 project CardioReGenix brought a multi-partner European consortium together to advance gene-therapy approaches to heart failure. Its total budget was €14.84 million.

This collaborative stage connects a laboratory, a spin-off, and partners across Europe around a single problem when the science is ready to scale.

Public funding backed the underlying science throughout. An ERC Proof of Concept grant, MEGFIB, tested the commercial and clinical potential of the discoveries. A European Innovation Council (EIC) Transition grant, FIBREX, supports work at Hannover Medical School on RNA therapeutics to prevent heart failure, with Professor Thum in a lead scientific role.

Professor Thum's path drew on all three pillars of the framework programme: frontier science, cross-border collaboration and innovation support, each at the right moment.

Investment soon followed. In 2024, Novo Nordisk acquired Cardior in a deal valued at €1.025 billion. A company built on European public research became a major private investment in European health biotech.

06. Looking ahead: The evidence points one way

The portfolio's evidence converges on a single conclusion. Europe's lead in health biotechnology depends on sustained, collaborative investment across the whole innovation journey, and the next budget is where that case is decided.

Only Europe can build these collaborations

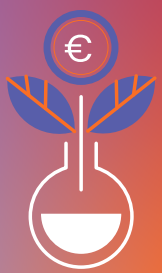
No national programme links complementary expertise across borders the way this portfolio does. Its 154 projects drew 2,048 participations from universities, research institutes, companies and hospitals across Europe and beyond. Connecting a laboratory in one country to partners in others is the part that needs European-level funding.

The portfolio is delivering

The projects analysed are already delivering innovations. They include a malaria vaccine in clinical trials, a computational heart model that supports virtual clinical trials, and the science behind Europe's first stem-cell-based clinical trial for Parkinson's disease. One project's discoveries grew into a company acquired for €1.025 billion. These are measurable outcomes, on the ground, now.

Impact keeps arriving after the funding ends

The clearest results often appear once a project has closed. A drug-repurposing consortium became a permanent, open-access platform that continues to run today. A company founded on EU-funded science attracted major private investment years later. Funding a project is funding what it sets in motion, long after the final report is filed.



The next budget decides whether this continues

Europe's competitiveness in health biotechnology rests on ensuring that every stage of this journey is funded. From discovery, collaboration, and the path to market, to sustaining it across budget cycles. The next long-term budget, the Multiannual Financial Framework (MFF) for 2028–2034, is built around this logic. A research framework programme funds discovery and collaboration; a European Competitiveness Fund carries results toward the market. The evidence in this report shows what support already delivers. The case for sustaining it could not be clearer.

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Europe funds health biotechnology to turn scientific discovery into the medicines, vaccines and therapies people depend on, and to keep its economy competitive.

This report examines what that investment has delivered. It analyses 154 collaborative research projects in health biotechnology, funded under Horizon 2020 and Horizon Europe Cluster 1 (Health) from the 2014–2021 calls, and completed by the end of 2025. Together, they represent €1.08 billion of EU investment. The overarching finding shows that EU-level collaborative research does what national funding cannot, and this portfolio is already delivering.

Research and Innovation policy

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