

From Research to Impact

The WELRI's
Commitment to
Excellence

2025

Annual Report

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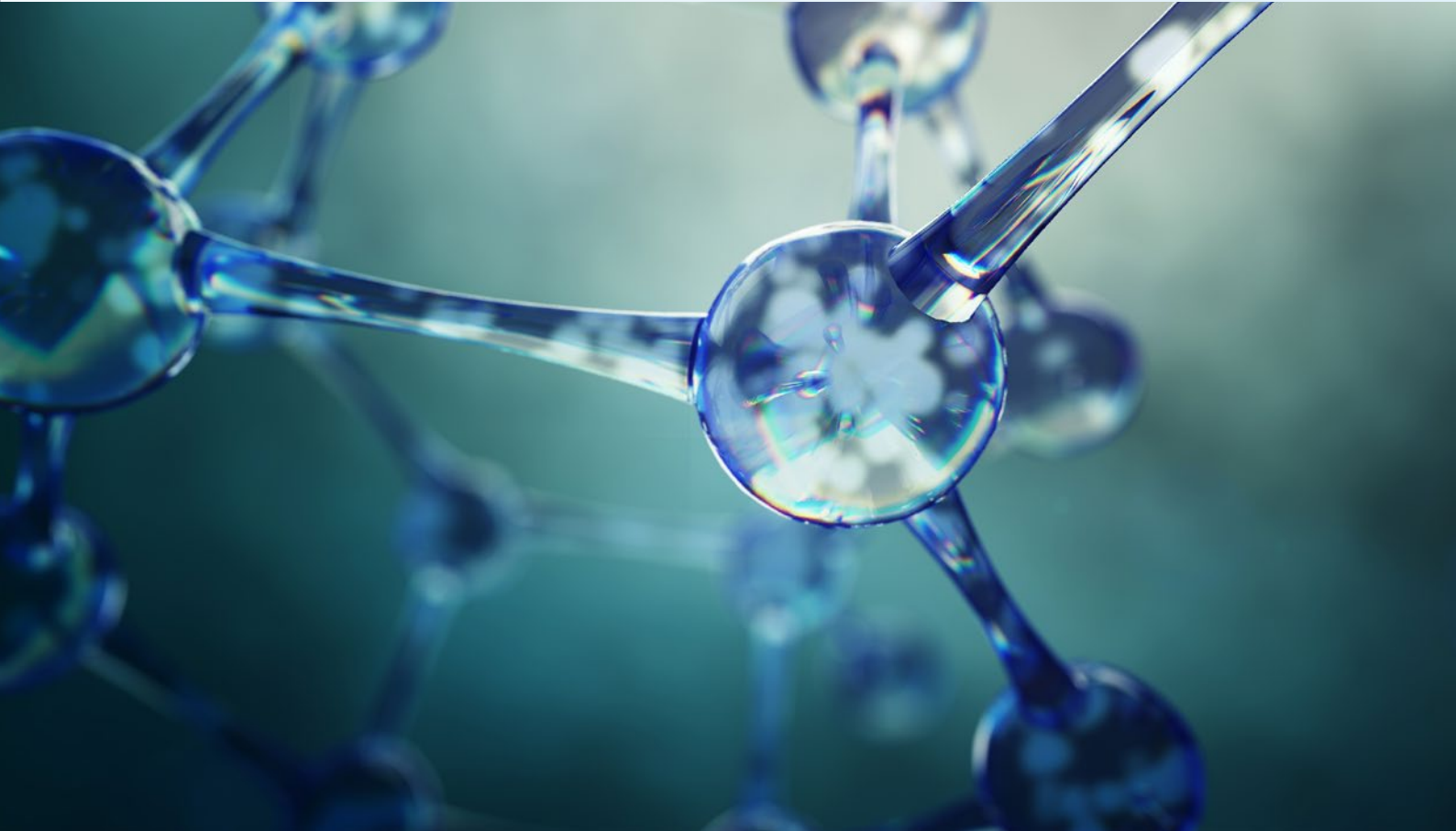
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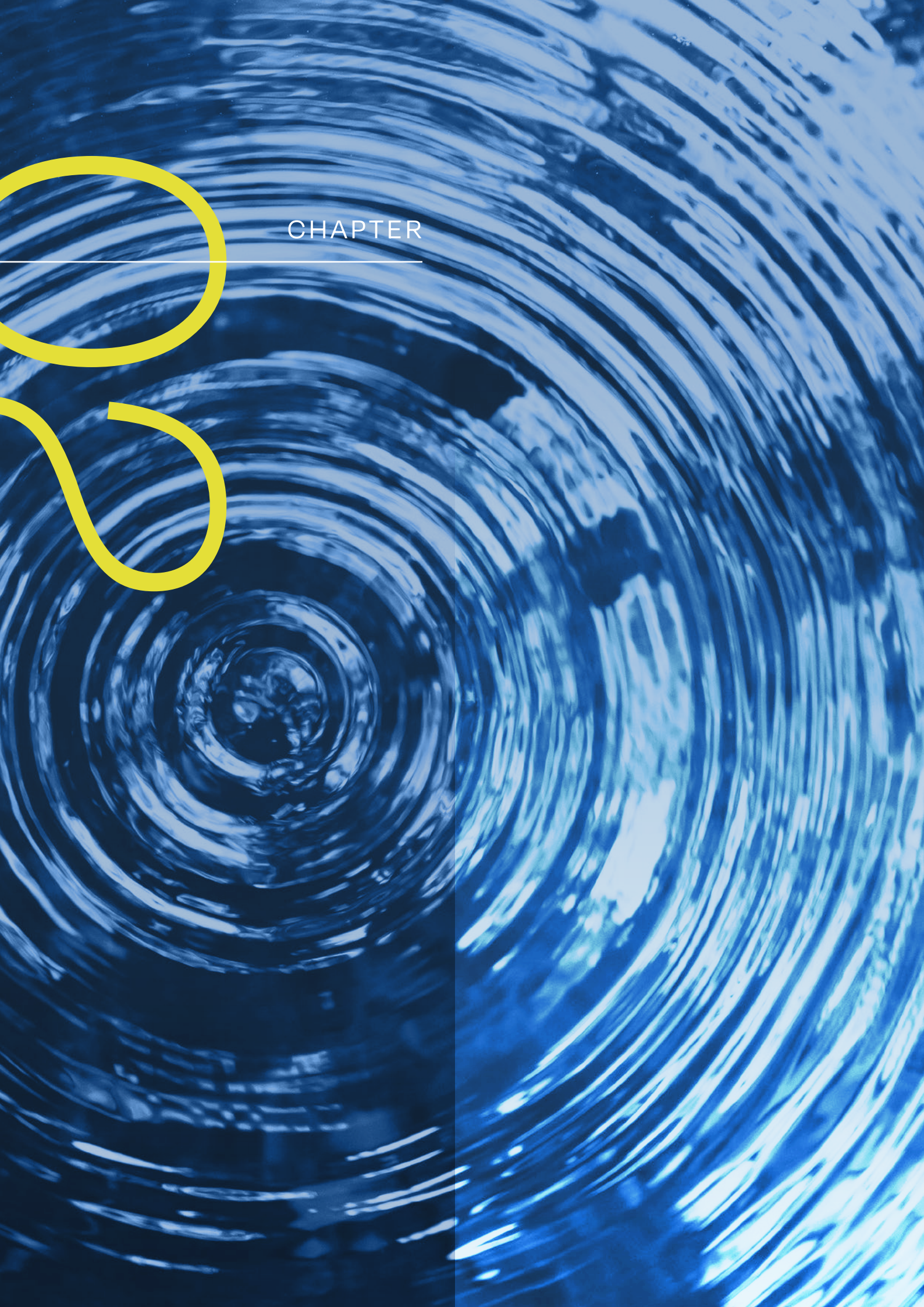
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The WEL Research Institute (WELRI), supported by the Walloon Government, invests in outstanding talent and bold ideas to deliver breakthrough discoveries with tangible impact.

At the crossroads of fundamental science and real-world application, WELRI tackles key challenges in health and the sustainable transition, two of Wallonia's strategic priorities, by translating cutting-edge science into intellectual property that drives industrial partnerships and the creation of spin-offs. Bringing together leading researchers from five Wallonia-Brussels universities through a rigorous international peer-review process, WELRI operates across two complementary departments:

- **WELBIO**, advancing life sciences for medical, pharmaceutical and veterinary biotechnology.
- **WEL-T**, developing engineering, chemistry and physics solutions to drive the sustainable transition.



CHAPTER

When growth meets purpose: five years that changed our scale and our impact

From 2020 to today

The Walloon Government's strategic vision in 2020 laid the foundations for the Institute's growth and impact today. It significantly strengthened its long-term investment in the WELRI, driven by a clear ambition: **to back talent and research excellence as engines of innovation.**

This support translated into:

- Increased funding for strategic research in life sciences (€15 million per year), leading, through the 2021 and 2023 calls, to a rise in active WELBIO programmes from 28 in 2020 to 45 in 2025.

- The replication of this model in a second strategic area (€9.75 million per year) focused on disruptive technologies for sustainable transition. This resulted, through the 2022 and 2024 calls, in the creation of the WEL-T department, supporting 26 active programmes in 2025.

Together, the support received from the Walloon region over the last five years more than doubled the Institute's scale, growing the number of Investigators from 28 to 71.

Scaling excellence

This expansion has gone hand in hand with a strengthening of scientific excellence. As the Institute reached greater critical mass, its productivity, competitiveness and international visibility increased significantly.

This progress is reflected in a marked rise in publications in high-impact journals and sustained success in highly competitive European funding programmes. Cumulative publications more than doubled, from **533** in 2020 to **1,174** in 2025. Over the same period, cumulative funding secured from European programmes, such as the ERC, Horizon

2020 and the Marie Skłodowska-Curie Actions, as well as other international grants, increased from **€31 million** to **€69 million**.

Recognition of the Institute's excellence has grown in parallel. By 2020, Investigators had secured **64** awards and distinctions, representing **€7.6 million**. By 2025, this had increased to **161** awards and **€13 million** in cumulative prize and distinction funding.

Together, these indicators reflect not only expansion in scale, but a measurable rise in quality and international visibility.

Delivering impact

Chosen for their excellence, vision and impact, Investigators at the WELRI are dedicated to transforming discoveries into real-world value. While fundamental research provides the scientific foundation, translating breakthroughs into practical solutions requires sustained effort and strong collaboration with industry to overcome challenges of scale, cost and integration. To support this process, the Institute offers a robust and flexible framework, working closely with Investigators, university Knowledge Transfer Offices and Innovation Clusters. Through regular, structured exchanges, this partnership identifies promising results, secures intellectual property, and develops pathways to commercialisation, ensuring that ground-breaking research is converted into tangible societal and economic benefits.

Spin offs

Six spin-offs have been created to date based on results generated by our historical WELBIO

department, with **4** of these launched between 2020 and 2025. All are firmly rooted in the Walloon Region, including locations such as Brussels South Charleroi, Louvain-la-Neuve and Liège.

Collectively, these companies have raised **€88 million** in cumulative funding and created **75** jobs, including **62** between 2020 and 2025, demonstrating both the economic and societal value generated by strategic research. Beyond job creation and investment, these spin-offs translate cutting-edge discoveries into innovative therapies, contributing to Wallonia's strong position as a hub for life sciences innovation.

Patent applications

Over the past five years, the WELRI's intellectual property portfolio has grown significantly. By 2020, **26** patent applications had been filed. By 2025, the total had more than doubled to **59**, including **48** active families and six granted patents.

- Within the WELBIO department, almost half of these applications relate to oncology, a field that has long been strongly represented and continues to drive innovation in health.

- The WEL-T department, launched in 2023 to advance strategic research in sustainable technologies, has already contributed 7 patent applications, highlighting the rapid emergence of this new area of research.

Technology transfer to industry

Building on the growth of its patent portfolio, the WELRI has strengthened the licensing of these technologies to industry, with cumulative gross licensing revenues rising from **€6.8 million** in 2020 to **€10 million** in 2025.

Industrial collaborations have also grown, rising from **28** cumulative projects in 2022 to **49** in 2025, representing a total of **€12.4 million** in funding for the labs. Collaboration with industry can take many forms. Some partnerships begin with expressions of interest in patents, allowing companies to assess and validate technologies before progressing to licensing agreements. Others focus on jointly maturing promising innovations with one or more industrial partners, supported by funding from the Walloon Region (SPW EER or Innovation Clusters). In other cases, collaborations arise from direct requests from industry, leading to targeted service contracts tailored to specific technological needs. In 2025 alone, 6 new collaborations were established.

Bridge Fund

Intellectual property generated by strategic research is not always immediately ready for industrial transfer. The Bridge Fund, managed by the WELRI, provides targeted support to increase the technological maturity of promising research results and enhance their likelihood of successful transfer to industry.

By 2020, 5 Bridge Fund projects had been awarded, with a total budget of **€615,000**. By 2025, this had grown to 11 projects with a cumulative budget of **€1,403,000**, including **2** projects awarded in 2025 totalling **€200,000** and specifically aimed at advancing breakthrough technologies towards the market.

These investments have delivered tangible results, strengthening patent applications, confirming industry interest in emerging technologies, and increasing their attractiveness to investors, ultimately supporting the creation of spin-offs and accelerating the translation of research into real-world impact.

Together, these figures demonstrate not only the Institute's growth in scale but also its increasing capacity to transform scientific breakthroughs into tangible societal and economic benefits, from pioneering therapies to innovative industrial technologies.



Innovation

Cumulative
number
of patent
applications

2020

26

2025

59

2020

Growth in scale

Active Investigators

28

2020

71

2025



Scientific impact

Cumulative number of publications

533

2020

1174

2025



Cumulative EU funding

€ 31
Mio

2020

€ 69
Mio

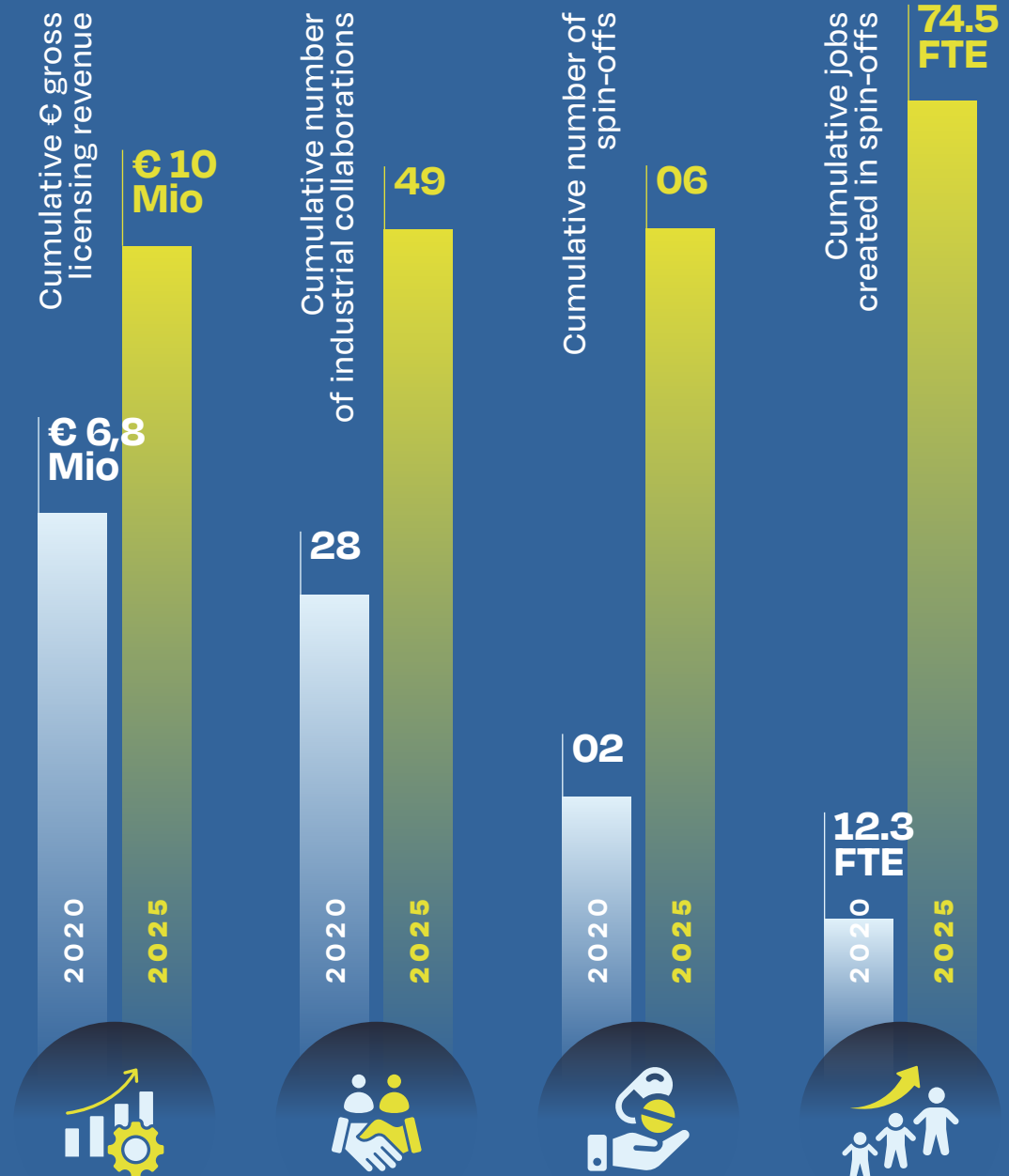
2025



Five years that changed our
scale and our impact

→ 2025

Economic impact



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CHAPTER



Highlights of 2025

News from our spin-offs

Santero Therapeutics' breakthrough against superbugs

Amid the growing challenge of antimicrobial resistance (AMR), particularly antibiotic resistance, Santero Therapeutics unveiled a major discovery at the 9th AMR Conference in Basel in February 2025.

Santero Therapeutics, a spin-off co-founded in 2021 by Cédric Govaerts and Abel Garcia-Pino (both Investigators at WELRI-ULB) was established to develop antibiotics with novel modes of action targeting highly resistant pathogens.

The company has identified several highly promising molecules during the "hit-to-lead" phase. Two of these, when administered intravenously, reduced bloodstream infection in a mouse model of septicemia by a factor of 100. In vitro studies further showed that the same molecules effectively eliminated both lambda bacteria and strains exhibiting high levels of antibiotic resistance, demonstrating their potential to transform the fight against AMR. Building on this success, Santero Therapeutics has launched a new €10 million fundraising round to support the next critical stage, lead optimisation, an essential step before advancing to human trials. Since its creation, the company has already raised €10.5 million from private and public investors.



Neuvasq advances preclinical research in ophthalmology

Neuvasq, a spin-off founded in 2021 by Benoît Vanhollenbeke (WELRI-ULB) was established to develop innovative therapeutic antibodies to restore neurovascular barriers. The company presented new preclinical data at Euretina, Europe's leading ophthalmology congress, held in Paris in September 2025.

For the first time, Neuvasq disclosed results confirming that its lead drug candidate, NVQ401 – a bispecific antibody activating the Wnt/ β -catenin signalling pathway – can reverse disease phenotypes across multiple animal models of retinopathy. Notably, NVQ401 reduced both neovascularisation and avascularisation in the Oxygen-Induced Retinopathy (OIR) model, a widely used benchmark for developing therapies for diabetic macular oedema and wet age-related macular degeneration. The results pave the way for clinical development, bringing Neuvasq one step closer to delivering new therapies that restore neurovascular function in patients.

From breakthroughs to real-world impact

Anti-GARP immunotherapy against solid tumours: Clinical development in progress

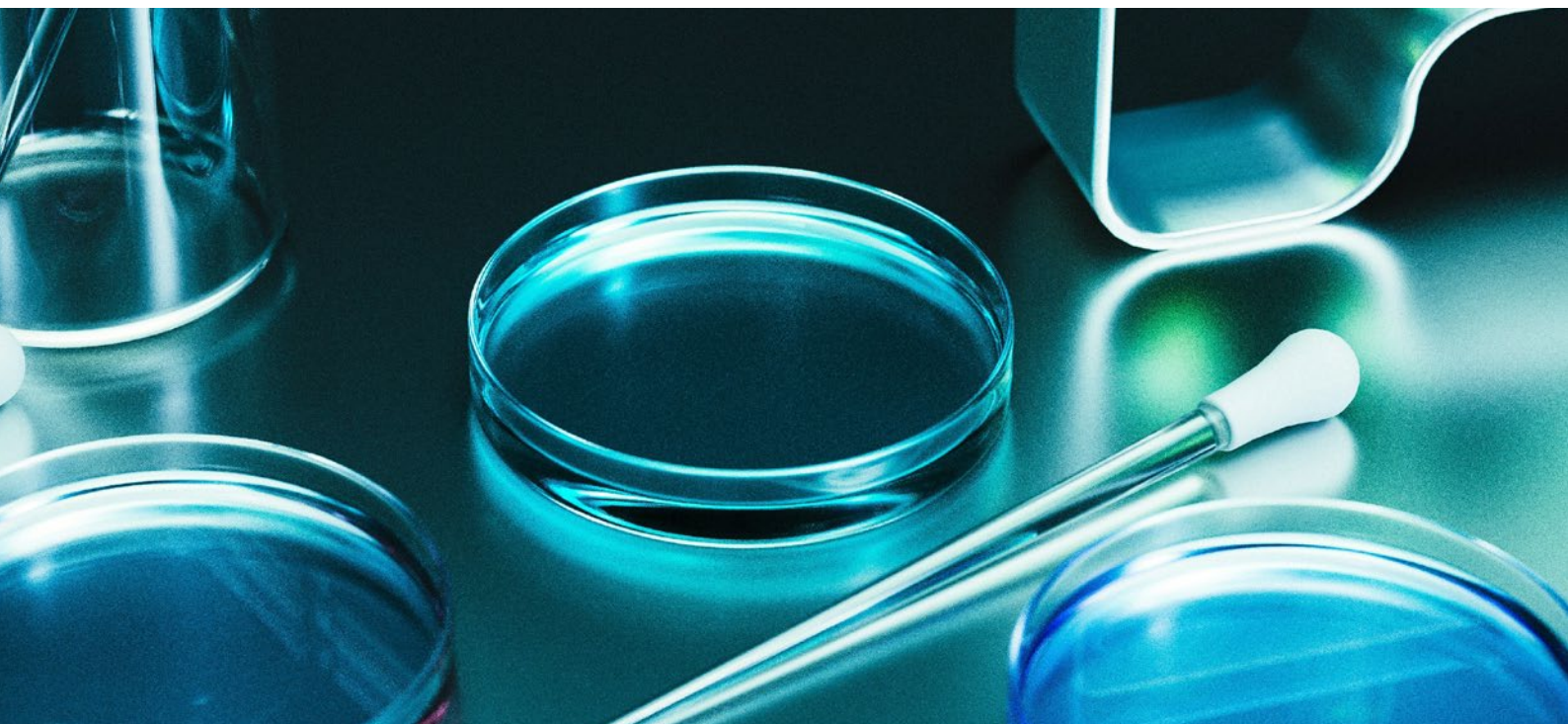
In 2025, the Phase 1 clinical study evaluating ABBV-151 (livmoniplimab) in combination with budigalimab (ABBV-181, anti-PD1) in patients with advanced or metastatic solid tumours completed recruitment. The programme continues to progress steadily through clinical development.

ABBV-151 is an antibody designed to block GARP and reactivate the patient's own immune system against tumours. This innovative strategy originates from the pioneering research of Pierre Coulie and Sophie Lucas (WELRI-UCLouvain), who identified GARP as a critical regulator of tumour-induced immune suppression. The antibody was co-developed in collaboration with argenx and partnered with AbbVie in 2016 for clinical development. It advanced to Phase 2 in solid tumours in 2023. The completion of patient recruitment in 2025 for the evaluation of ABBV-151 in combination with anti-PD-1 therapy marks a further significant milestone in its clinical development.

Walloon innovation at the heart of new vaccine deal to save Asian eels

China is the world's largest producer of farmed eels, a sector currently threatened by Anguillid herpesvirus type 1 (AngHV-1). Alain Vanderplasschen's laboratory (WELRI-ULiège) has developed a live attenuated recombinant vaccine against AngHV-1, which can be administered by immersion in rearing tanks, enabling simple and effective mass vaccination.

In August 2025, a licensing agreement was signed with Ningbo SanSheng Biological Technology, a leading company in China's animal health sector, for the production and distribution of this vaccine across Asia, where demand is high. This builds on a previous agreement signed in 2020 between ULiège and the same company for a vaccine against Koi Herpesvirus (KHV), which affects common carp and koi varieties.



Supporting technological maturation

Building impactful solutions

In 2025, the Governing Board approved two Bridge Fund projects totalling €200,000, aimed at advancing breakthrough technologies towards the market.

- One project focuses on market analysis to narrow down promising fields of application for a new generation of non-isocyanate polyurethane (NIPU) foams using CO₂ as a raw material. This patented technology offers a unique, scalable industrial alternative to conventional PUs.
- The second project aims to strengthen the regulatory and physico-chemical profile of a patented molecule designed for the broad-spectrum prevention of respiratory infections.

AI to accelerate discovery to impact

In 2025, two Bridge Fund projects delivered significant results, leveraging artificial intelligence (AI) as a research tool to accelerate the translation of academic discoveries into tangible patient benefits. Approved in 2024 by the Governing

Board, these projects form part of WELRI's broader commitment to integrating advanced methodologies that support innovation in drug discovery.

- The first project addresses a neurological disorder, in which researchers identified a novel mechanism of action. Using AI to analyse extensive omics data, and with the support of a specialised provider, the team completed in two months an analysis that would typically take two to three years, applying industrial criteria designed to strengthen confidence in the putative therapeutic targets from the outset. This approach reduced an initial list of 5,000 genes to 21 promising targets, which are now being tested in the laboratory.
- The second project focuses on a promising target for cardiovascular disease, backed by years of experimental and translational research. Here, researchers combined in silico screening, AI and medicinal chemistry to rapidly screen several million molecules. Within a few months, around ten of the top in silico predictions were confirmed in the laboratory using a patented functional assay, advancing the development of new therapeutic options.

Generating intellectual property

In 2025, 9 new patent applications were filed across WELBIO and WEL-T programmes:

- Within WELBIO, 6 applications were submitted to further protect a patented molecule for the broad-spectrum prevention of respiratory infections, to safeguard a functional assay for drug discovery, to cover a new therapeutic modality for a rare blood cancer, and to protect a method to differentiate stem cells into insulin-secreting β -cell islets.
- Within WEL-T, 3 patent applications were filed to protect a sugar-based route to chiral molecules used in fine chemicals, a spiking method to convert low-power electrical signals into high-power mechanical motion, and a network communication protocol for energy-efficient connected devices.

Together, these filings reflect the breadth of innovation across health and sustainable technologies and strengthen the Institute's intellectual property portfolio.

Highlighting WELRI impact to Minister-President Dolimont

On 1 July 2025, the WELRI had the honour of welcoming Minister-President Dolimont to GSK to highlight the tangible impact of strategic research on both health and the sustainable transition. During the visit, Investigators showcased a selection of programmes that have generated Walloon spin-offs, led to patent filings, and advanced a therapeutic antibody now in Phase 2 clinical trials, clear evidence of how scientific breakthroughs can be translated into real-world innovation.

Hosting the meeting at GSK, a founding partner of the WELRI alongside UCB, reinforced the pivotal role of industry in supporting strategic research as a vital bridge between fundamental and applied science, fuelling the innovation pipeline.

The event further highlighted the importance of a strong partnership between research, policy, and industry. By fostering these connections, the WELRI ensures that scientific breakthroughs are not only pursued in the lab but also transformed into tangible solutions that create economic and social impact.

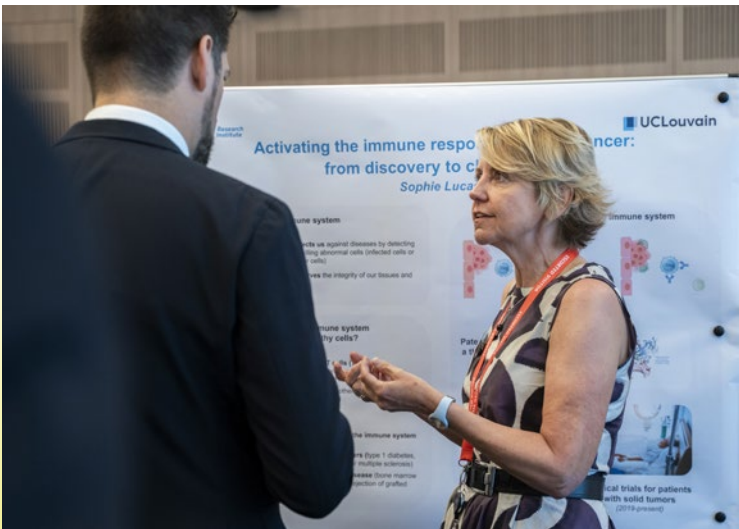


Renewed commitment by the Walloon government

In October 2025, the Walloon Government renewed its long-term support for strategic research, committing approximately €15 million per year. This funding not only ensures the continuity of WELRI's high-impact programmes but also enabled the launch of the WELBIO 2025 call, providing a fresh wave of support for ambitious new research initiatives.

By backing strategic research, the Walloon Government provides Investigators with the resources to pursue ambitious research programmes and strengthens the innovation pipeline translating breakthrough discoveries into tangible societal and economic benefits.







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Scientific excellence

WELRI Investigators are selected through a competitive international peer-review process, based on ambitious four-year research programmes. Annual calls for proposals alternate between the WELBIO and WEL-T funding instruments and their organisation is entrusted to the FNRS.

Through these funding instruments, the Walloon Region provides long-term, flexible funding that empowers Investigators to pursue bold, high-impact research and achieve major scientific breakthroughs. These programmes form the backbone of each laboratory and can evolve to seize new scientific opportunities and address unmet needs.

Two funding tracks support excellence at every career stage:

- Advanced Investigators: established leaders with a strong record of scientific achievement.
- Starting Investigators: emerging leaders building independent teams and launching ground-breaking research.

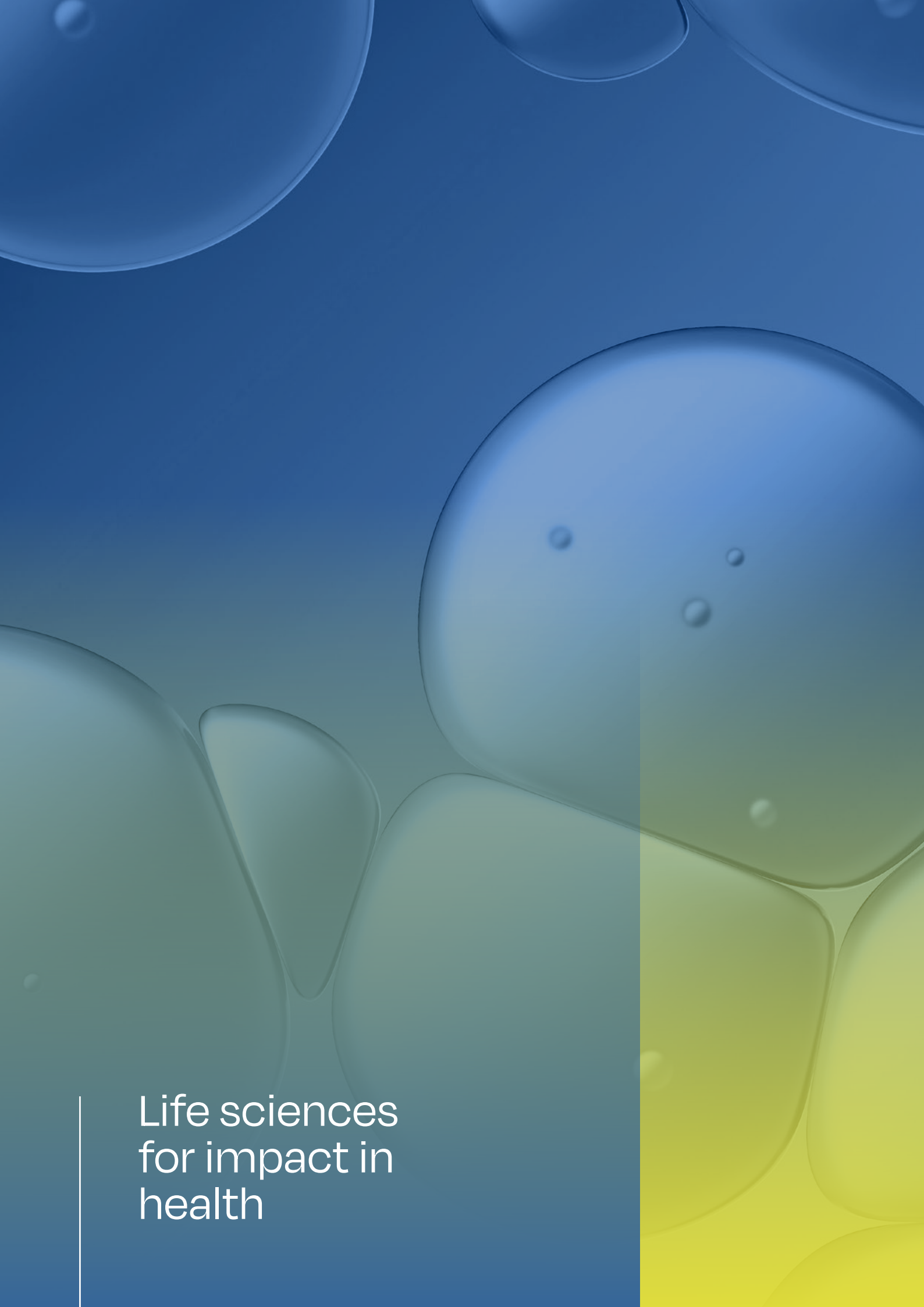
The cutting-edge research led by WELRI Investigators and their teams is internationally recognised, with ground-breaking results published in leading scientific journals. Built on years of sustained research effort, these advances underpin success in highly competitive European and international funding programmes and are further

recognised through numerous prestigious scientific awards.

In 2025:

- 170 articles were published, with around one-third appearing in prestigious journals such as Nature, Nature Communications, Circulation, Cell Metabolism, and the Journal of the American Chemical Society.
- The Investigators secured around €36 million in European and international grants, including from the European Research Council (ERC) and other European funding initiatives such as Horizon 2020 and the Marie Skłodowska-Curie Actions.
- The excellence of the work led by the Investigators and their teams has been recognised with 21 major national and international awards.

Here is a selection of scientific highlights to illustrate the internationally recognised ground-breaking work being carried out by Investigators at the WELRI in various fields of life sciences and technology.



Life sciences
for impact in
health

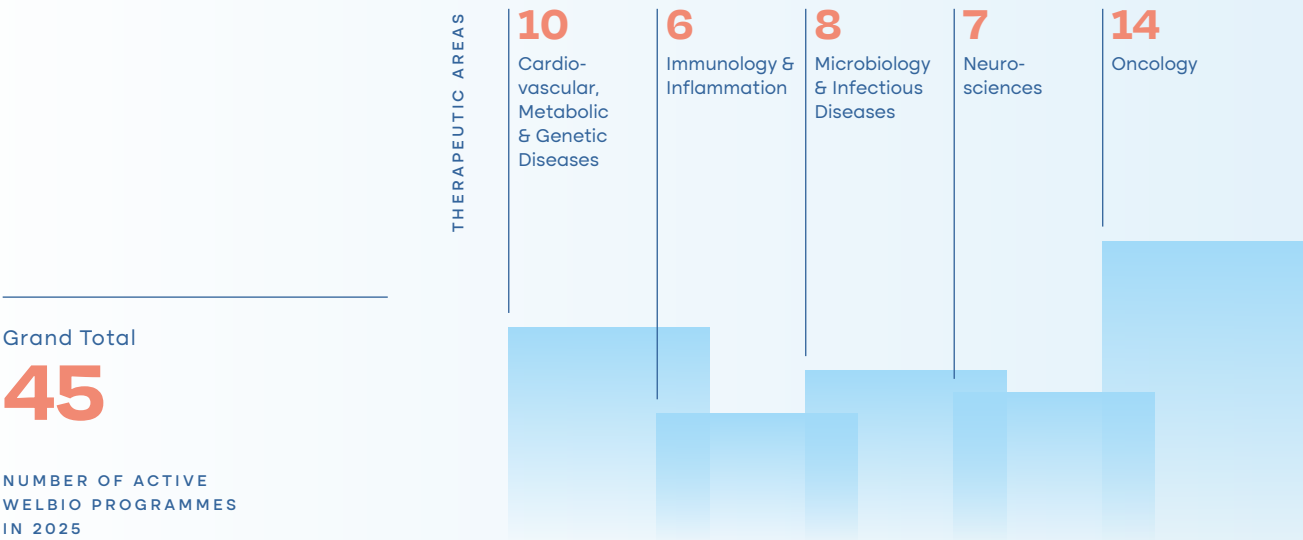
WELRI

WELRI
WELRI

The WELBIO department

In 2025, the 45 active WELBIO programmes addressed major societal challenges across 5 key domains: oncology, cardiovascular, metabolic & genetic diseases, immunology & inflammation, neurosciences, and microbiology & infectious diseases.

Number of active WELBIO programmes in 2025



By 2025, the WELRI had supported 110 WELBIO programmes. Historically, oncology accounted for around a third to a half of the portfolio, but the most recent call marked a shift: oncology represented 23%, while microbiology and infectious diseases became the largest domain, at 32%.



Oncology

Oncology focuses on understanding the possible causes of various types of cancer, with the aim of discovering new treatments, enhancing diagnosis, and improving patient outcomes.

Investigators

Advanced

BLANPAIN Cédric - ULB

Uncovering and pharmacological targeting the mechanisms regulating key tumour states

CHARIOT Alain - ULiège

Translational reprogramming through tRNA modifications in health and diseases

CLOSE Pierre - ULiège

tRNA epitranscriptomics: a new vulnerability in cancer

CONSTANTINESCU Stefan - UCLouvain

Calreticulin and TpoR in Myeloid cancer

FERON Olivier - UCLouvain

Tumour acidosis: a new lens to study drug-tolerant persister cancer cells and associated ferroptosis sensitivity

MARINI Anna Maria - ULB

Mep-Amt-Rh transport proteins: control of membrane permeability to ammonium and proliferation

SONVEAUX Pierre - UCLouvain

Understanding the metabolic control of brain-specific cancer metastasis

VAN DEN EYNDE Benoît - UCLouvain

Discovery of new immuno-oncology targets

Starting

BINDELS Laure - UCLouvain

Harnessing bacterial amino acid metabolites to tackle muscle wasting in cancer

CORBET Cyril - UCLouvain

Towards metabolic targeting of the minimal residual disease in head and neck cancers

EHX Grégory - ULiège

Immunoeradication of persister cells in AML

PASTUSHENKO Ievgeniia - ULB

Uncovering the role of H3K36 and H3K4 methyltransferases in cancer

RAPINO Francesca - ULiège

Translating into cancer: tRNA actors role in cancer stem cells establishment

VAN GASTEL Nick - UCLouvain

Defining the metabolic drivers of clonal haematopoiesis through integrative single cell profiling

Representative publications

REPROGRAMMING TOWARDS LIPID METABOLISM IN EGFR-RESISTANT CANCER CELLS

Head and neck squamous cell carcinoma (HNSCC) is the sixth most common cancer worldwide, with anti-EGFR therapies such as cetuximab representing the standard treatment for advanced cases. However, clinical responses are often short-lived due to the development of drug resistance. Because no clear genetic alterations have been linked to acquired resistance to cetuximab, the team of **Cyril Corbet** addressed the issue from a metabolic perspective. The researchers found that cetuximab-resistant cancer cells altered their metabolism to favour exogenous fatty acid uptake, driven by PPAR α , while glucose metabolism remained unchanged. Blocking the PPAR α -dependent metabolic pathway in mouse models with tumour xenografts restored the sensitivity of cancer cells to cetuximab. In HNSCC patient data, this metabolic shift was linked to poorer responses to anti-EGFR therapy and worse survival. These findings support the potential of selective PPAR α antagonists, currently in clinical trials, as a therapeutic strategy.

Van den Bossche et al (2025) Nature Communications

THE ROLE OF IMMUNE SIGNALS IN STARTING PROSTATE CANCER

Prostate cancer is one of the most common cancers in men and a major cause of mortality. Despite its prevalence, the early mechanisms of its development remain poorly understood. The team led by **Cédric Blanpain** demonstrated that the cellular reprogramming processes driving prostate cancer vary across different regions of the gland. This reprogramming is accompanied by the activation of innate immune signalling pathways. By blocking these inflammatory signals, the researchers were able to prevent both cellular reprogramming and tumour initiation. Notably, the reprogramming markers identified in mouse models are associated with aggressive forms of prostate cancer in humans. These findings reveal a fundamental link between immune signalling and early prostate cancer development, opening the way for new therapeutic approaches.

Jiang et al (2025) Nature Cancer

**EXPANDING
TREATMENT
HORIZONS FOR
A RARE BLOOD
CANCER**

The JAK2 V617F mutation is a major cause of myeloproliferative neoplasms, a group of rare blood cancers. This mutation constantly activates growth signals, especially through the TpoR receptor, which is important for blood stem cell function. However, the specific contribution of TpoR to disease development remained unclear. To address this, the group of **Stefan Constantinescu** created a mouse model expressing JAK2 V617F under its natural promoter, in a setting where the TpoR gene is completely knocked out. They found that while some disease features still emerged – like elevated blood counts – the mutant stem cells lost their long-term advantage without TpoR. This clarified which effects of JAK2 V617F are TpoR-dependent and opened new avenues for therapeutic strategies beyond targeting TpoR alone.

Papadopoulos et al (2025) Blood

**STARD7: A
MITOCHONDRIAL
DRIVER OF BREAST
CANCER**

To sustain their rapid multiplication, cancer cells reprogram their metabolism, especially within mitochondria—the key energy-producing structures of the cell. One protein, STARD7, a lipid transporter crucial for mitochondrial function, has emerged as a potential player, but the precise mechanisms behind this metabolic adaptation remain poorly understood. **Alain Chariot's** team discovered that STARD7 was highly active in both hormone-sensitive and triple-negative breast cancers. When STARD7 was blocked in cultured cancer cells, it triggered a major metabolic disruption, causing a build-up of S-adenosyl-L-methionine (SAM) – a molecule that regulates genes linked to cell division. This build-up slowed cancer cell growth and interfered with key signalling pathways essential for tumour development. These findings indicate that mitochondria rely on STARD7 to support cell-cycle progression in breast cancer.

Dondajewska et al (2025) Advanced Science

Representative publications

HIDDEN CELLULAR VULNERABILITY TO LIPIDS

The prevailing paradigm holds that tumour cells exposed to an acidic environment adapt their metabolism by shifting from sugar to fatty acid utilisation. **Olivier Feron's** team has challenged this view by revealing that it is the microenvironment, rather than an intrinsic metabolic shift, that dictates fatty acid preference. The researchers demonstrated that, in acidic conditions, fatty acids became protonated and were more readily taken up by cells. The resulting overload of very long-chain fatty acids created a metabolic burden, rendering cancer cells highly dependent on peroxisomes for detoxification. Disrupting peroxisomal function selectively eliminated cancer cells in such acidic environments. This vulnerability has been confirmed in patient-derived tumour organoids and in experiments using human sera. Importantly, the same acid-driven fatty acid uptake was observed in endothelial and cardiac cells, opening the door to novel therapeutic opportunities not only in oncology but also in cardiovascular diseases.

Ibanez et al (2025) Advanced Science

Distinguished achievements



LAURE BINDELS

WELRI –
UCLouvain

In 2025, Laure Bindels received the prestigious **Galien Prize** for her work in human microbiology, carried out in collaboration with Laure Elens at UCLouvain. The researchers demonstrated that the composition of the gut microbiota directly affects the absorption of tacrolimus, a key drug used to prevent organ rejection after transplantation, partly explaining why dosage requirements vary between patients. In 2025, Laure was also awarded the **Bekales Prize** by the Royal Academy of Medicine of Belgium.



**CÉDRIC
BLANPAIN**

WELRI – ULB

Cédric Blanpain pursues research in stem cell biology and oncology to decipher the roles of cancer stem cells in the development, progression and metastasis of skin, breast and brain cancers. Cédric holds an **ERC Advanced Grant** (2020-2025) to define the different tumour states at the single-cell level using a multidisciplinary approach. Cédric was named among the **2025 Clarivate Highly Cited Researchers**. This international distinction, awarded to scientists whose work ranks among the top 1% most cited worldwide, highlights the excellence, impact and leadership of his research.



GRÉGORY EHX

WELRI – ULIÈGE

In 2025, Gregory Ehx was awarded the **Bekales Prize** by the Royal Academy of Medicine of Belgium for his work on understanding how leukaemic cells evade the immune system.



**IEVGENIIA
PASTUSHENKO**

WELRI – ULB

In 2025, Ievgeniia Pastushenko was awarded an **ERC Starting Grant** (2025-2030) to investigate common mutations in skin and bladder cancers, with the aim of better understanding their role in tumour formation and progression.



Immunology and Inflammation

Immunology and Inflammation investigates the body's immune response and the complex processes underlying inflammation, aiming to develop treatments for autoimmune and inflammatory diseases, as well as immunotherapies against cancer.

Investigators

Advanced

DEWALS Benjamin - ULiège

Deciphering the mechanisms regulating the effector functions of virtual memory T lymphocytes during helminth and viral coinfections

GEORGES Michel - ULiège

Systematic eQTL and CMap based identification of IBD predisposing genes and interacting drugs

LUCAS Sophie - UCLouvain

Focused targeting of pleiotropic cytokines TGF- β and IL-1 β in cancer and autoimmunity

MARICHAL Thomas - ULiège

Deciphering the contribution of the myeloid-epithelial crosstalk to viral-induced exacerbations of chronic airway diseases (asthma or COPD)

VERMIJLEN David - ULB

The third way of immune protection in human: development and function of $\gamma\delta$ T cells in early life

Starting

MACHIELS Bénédicte - ULiège

Pneumovirus infections lead to lasting alterations in host immunity, promoting the development of lung cancer



Representative publications

PARASITIC INFECTION: IMMUNE ACTIVATION UNDER CONTROL

Nearly a quarter of the world's population is infected with helminths, parasitic worms that colonize the intestine. In response to the infection, the immune system produces interleukin (IL-4), which in turn stimulates virtual memory CD8⁺ T lymphocytes, white blood cells capable of reacting rapidly without prior exposure to the infection. However, the mechanisms that regulate their expansion in response to IL-4 remain poorly understood.

Recent results from the laboratory of **Benjamin Dewals** and his collaborators at the WELRI, including **Bénédicte Machiels**, **Thomas Marichal** and **David Vermijlen**, revealed that IL-4 increased the expression of the CD22 protein in mice infected with helminths. They observed that CD22 acted as a natural brake, limiting the IL-4-induced expansion of CD8⁺ T lymphocytes and thus preventing an excessive immune response during parasitic infection. Further research will be needed to explore whether this mechanism also exists in humans.

Yang et al (2025) Science Immunology

A DIALOGUE BETWEEN BLOOD VESSELS AND LUNG IMMUNE CELLS

The proper functioning of the lungs relies on a finely tuned local immune system. Among its key players are interstitial macrophages, derived from monocytes, which protect lung tissue. While their role is well established, the mechanisms underlying their specialisation had remained poorly understood.

Research by **Thomas Marichal**'s team, conducted in mice, revealed that TGF- β 1, produced by pulmonary endothelial cells, is crucial for the maturation of monocytes into interstitial macrophages that help maintain lung homeostasis. The team showed that without the TGF- β receptor, monocytes fail to differentiate properly into interstitial macrophages, leading to an accumulation of immature cells around blood vessels and the emergence of early signs of lung ageing. This discovery sheds light on the crucial role of local "trophic" signals in shaping immune cells specific to each tissue, reinforcing the idea that every tissue has its own unique way of directing immune cell development.

Peng et al (2025) Science Immunology



Representative publications

IMMUNE OVERDRIVE TAMED BY ANTIBODY- DRIVEN TGF- β 1 ACTIVATION

Excessive immune responses in conditions such as graft-versus-host disease are often difficult to control with current therapies. To address this, **Sophie Lucas** and her team have developed monoclonal antibodies capable of activating latent TGF- β 1 on the surface of cells, marking a departure from existing strategies that aim to block the cytokine in cancer and fibrosis.

Structural and biochemical analyses show that antibody binding induces major conformational changes and requires cytoskeletal activity to trigger TGF- β 1 activation. In a mouse model of graft-versus-host disease, the antibodies reduced disease severity and improved survival through a mechanism dependent on regulatory T cells. The findings highlight a potential new immunotherapeutic approach for conditions driven by excessive immune responses.

Lambert et al (2025) Cell Reports



Distinguished achievements



THOMAS
MARICHAL

WELRI – ULIÈGE

Thomas Marichal focuses on research in immunological responses and diseases, with a particular emphasis on advancing our understanding of the environmental triggers of asthma and allergies. Thomas holds an **ERC Consolidator Grant** (2023-2029) to continue his research into the mechanisms of lung regeneration following respiratory infections such as Covid-19 or influenza.





Neurosciences

Neuroscience explores the intricate workings of the brain and nervous system to advance our understanding of neurological disorders, with the aim of developing treatments and diagnostic strategies for conditions such as Alzheimer's disease, Parkinson's disease and drug addiction.

Investigators

Advanced

CREVECOEUR Frédéric - UCLouvain

Quantitative evaluation of movement disorders: theory and experimental validation

DE KERCHOVE D'EXAERDE Alban - ULB

Maged1 in the thalamus, a key gateway to understanding drug addiction and improving its treatment

NGUYEN Laurent - ULiège

Cell migration shapes cerebral cortex morphogenesis and function

VANHOLLEBEKE Benoît - ULB

Molecular and cellular control of brain angiogenesis and blood-brain barrier formation

Starting

BOURGUIGNON Mathieu - ULB

The state of sensorimotor cortical oscillations at hand

EL TAHRY Riem - UCLouvain

Optimisation of VNS in refractory epilepsy

HANSEEUW Bernard - UCLouvain

Beyond amyloid and tau pathology: Towards clinical trials modulating synaptic function in preclinical and symptomatic Alzheimer's disease

Representative publications

AT THE HEART OF THE DECISION- MAKING BRAIN

Every day we make countless decisions in the blink of an eye – what to eat, whether to take a risk, how to react. Behind this ease lies a complex process centred on the striatum, a key brain structure. **Alban de Kerchove d'Exaerde's** team studied decision-making in rodents, revealing three types of decision-makers – cautious, strategic, and exploratory – and uncovering how two main striatal neuron types shape choices. D1 neurons drive risk-taking, while D2 neurons modulate decisions according to individual temperament. These findings highlight distinct neuronal pathways for decision-making and offer new insights into behavioural disorders such as addiction and compulsive behaviours.

Chaves Rodriguez et al (2025) Science Advances

Distinguished achievements



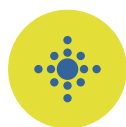
LAURENT NGUYEN
WELRI – ULIÈGE

Laurent Nguyen specialises in the molecular mechanisms underlying brain development and neurological disorders, with a focus on how neural circuitry is organised during developmental conditions. Laurent is pursuing an **ERC Synergy Grant** (2023-2028) to lead an interdisciplinary project, bringing together 4 European laboratories, to study the mechanisms underlying the mechanical folding of the cerebral cortex during embryonic development.



BENOÎT
VANHOLLEBEKE
WELRI – ULB

Benoît Vanhollebeke's research aims at better understanding the formation of the blood-brain barrier, which supplies the brain with oxygen and nutrients, but also blocks the infiltration of potentially toxic cells and compounds. Benoît holds an **ERC Consolidator Grant** (2019-2025) to study the complex regulation of the blood-brain barrier.



Cardiovascular, Metabolic & Genetic Diseases

This area investigates the underlying physiological and/or genetic factors that contribute to cardiovascular, metabolic and genetic diseases, with the aim of developing treatment and diagnostic strategies for conditions such as heart failure, diabetes, gastrointestinal diseases and cystic fibrosis.

Investigators

Advanced

BALLIGAND Jean-Luc - UCLouvain

Structural and functional characterisation of Aquaporin-1 as a "peroxiporin" in cardiovascular tissue

CANI Patrice - UCLouvain

Identifying novel gut microbes and their active compounds to tackle diseases

CNOP Miriam - ULB

Mechanisms of β cell failure and recovery to identify therapeutic targets for β cell preservation in type 2 diabetes

EVERARD Amandine - UCLouvain

Use of gut microbes to modulate host compulsive eating behaviours and host food reward and deciphering related mechanisms of interactions

GILON Patrick - UCLouvain

Study of the control of glucagon secretion and of its dysregulation in diabetes, and the search for new therapeutic targets to restore a normal regulation in diabetes

GOVAERTS Cédric - ULB

Capturing alternative conformations of CFTR with nanobodies to understand the pathogenesis of cystic fibrosis at the molecular level and to delineate new therapeutic routes

VIKKULA Miikka - UCLouvain

Treat lymphoedema: from identification of genetic causes to in vivo preclinical modelling

Starting

BELOQUI GARCIA Ana - UCLouvain

Oral delivery of biologics for the treatment of gastrointestinal diseases

FORRESTER Alison - UNamur

Identification of compounds that target ERES and anterograde trafficking, and their application in disease models of aberrant secretion

MARTIN Maud - ULB

Mechanistic understanding of microtubule function during angiogenesis

Representative publications

TREATMENT OF INFLAMMATORY BOWEL DISEASES: A FOAM TO REPLACE INJECTIONS?

Chronic inflammatory bowel diseases, such as colitis, are often treated with injectable biologics, which can be inconvenient for patients. **Ana Beloqui Garcia**'s laboratory developed a new rectal formulation capable of producing foam without the use of an external device, thanks to a reaction between potassium bicarbonate and citric acid. In two successive publications, the researchers tested, in mouse models of colitis, the combination of this foam with molecules used in the treatment of inflammatory bowel diseases, namely a glepaglutide analogue (GLP-2) and an anti-TNF- α antibody fragment. The administration of these molecules with the foam not only reduced inflammation and facilitated healing, but also allowed better retention of the drugs and optimised diffusion into deeper areas of the colon. These results indicate that this foam formulation could overcome the limitations of current injectable methods for delivering biologics to inflamed intestinal tissue.

Zhang et al (2025) Advanced Healthcare Materials

Representative publications

OBESITY AND DIABETES: THE BRAIN'S INFLUENCE ON INTESTINAL MICROBIOTA

Under normal conditions, the hypothalamus regulates appetite like a switch: it turns on when we are hungry and off when we are full. In people with type 2 diabetes, this system is disrupted, impairing the sensation of satiety and promoting obesity. To understand this dysfunction, scientists from the Hospital Clínic of Barcelona (IDIBAPS) and the University of Santiago de Compostela (Spain) enlisted the expertise of **Patrice Cani**'s research team, renowned for its knowledge of intestinal microbiota. The researchers conducted experiments on mice, using genetic techniques and a brain implant to inject appetite-related hormones (ghrelin, GLP-1, leptin). They observed that altering the activity of appetite-regulating neurons led, in just two hours, to major changes in the composition of the gut microbiota, even without any food intake. These changes, both rapid and significant, were completely unexpected. The findings demonstrate the existence of bidirectional communication within the brain–gut axis, allowing for rapid adaptation of the gut microbiota composition. However, this effect was not observed in obese and diabetic mice, suggesting a breakdown in brain–gut communication that could play a key role in the development of obesity.

Toledo et al (2025) Nature Metabolism

HOW AN OVERLOOKED RECEPTOR COULD PROTECT OUR HEART

Cardiac hypertrophic remodelling, a precursor to heart failure, remains a serious condition with limited treatment options. For several years, **Jean-Luc Balligand**'s team has studied signalling via the $\beta 3$ -adrenergic receptor in heart cells. While it is scarcely expressed in the healthy heart, its relative abundance increases in diseased hearts. Most importantly, it provides lasting protection against hypertrophy. The team's recent work revealed the precise mechanism behind this cardiac protection. In transgenic mice, activation of this receptor improved the heart's energy efficiency by enhancing glucose uptake, boosting antioxidant defences, and increasing ATP production needed to sustain cardiac contraction. This mechanism relied on the activation of the transcription factor NRF2. The same metabolic signature was also identified in human heart cells, paving the way for the repurposing of $\beta 3$ agonists, currently used in urology, to treat certain forms of heart failure, as already suggested by pilot studies.

Michel et al (2025) Circulation

DISCOVERY OF
A KEY MUTATION
IMPROVING OUR
UNDERSTANDING
OF RARE NEONATAL
DIABETES

Some infants develop diabetes before the age of six months – an early-onset form that is genetic in around 85% of cases. This is notably true for MEDS syndrome (microcephaly, epilepsy, and neonatal diabetes), a rare congenital disorder affecting both the brain and the pancreas, previously linked to two known mutations in the TMEM167A gene. A team led by **Miriam Cnop** has identified a new mutation in this gene in six children with the syndrome. Using human stem cell models and CRISPR gene editing, the researchers showed that this mutation disrupts insulin production and triggers cellular stress leading to β -cell death. These results highlight the essential role of the TMEM167A gene in pancreatic cell function and open new avenues for understanding the mechanisms underlying diabetes.

Virgilio et al (2025) The Journal of Clinical Investigation

MICROBIOTA AND
NUTRITION TO
OUTSMART THE
MECHANISMS OF
TYPE 2 DIABETE

When the diet remains too high in fat over extended periods, the protein IRAK4 – normally responsible for signalling dietary imbalance – becomes overactivated and triggers a cascade of inflammatory responses, promoting insulin resistance and, ultimately, type 2 diabetes. **Patrice Cani** and his international collaborators have identified a compound, TMA, produced by gut bacteria from choline found in certain foods, that can improve blood glucose control. Their work shows that TMA directly inhibits IRAK4, thereby reducing inflammation induced by a high-fat diet and restoring insulin sensitivity. This discovery highlights how nutrition and the microbiota can work together to generate molecules capable of combating inflammation and improving metabolic health, opening new therapeutic avenues for type 2 diabetes.

Chilloux et al (2025) Nature Metabolism

Representative publications

DATA-DRIVEN INSIGHTS TO UNLOCK NEW THERAPEUTIC OPPORTUNITIES FOR DIABETES

Type 2 diabetes is generally considered an inevitably progressive disease marked by β -cell dysfunction. Although remission can occur in some patients after dietary, surgical, or drug interventions, it is often temporary, and the underlying mechanisms remain unclear. Researchers led by **Miriam Cnop** showed that pancreatic β cells from donors with type 2 diabetes can regain function when removed from the diabetic environment and maintained under normal culture conditions for several days. By analysing gene expression during this recovery and mining public databases, they identified baricitinib as a compound capable of mimicking this functional repair programme. Baricitinib improved insulin secretion and protected β -cell function in human islets and a mouse model. As it is already approved for autoimmune diseases, it represents a promising candidate for rapid repurposing in diabetes, highlighting the potential of data-driven approaches to uncover new therapeutic strategies.

Suleiman et al (2025) Science Advances

MOLECULAR MAPPING OF GENETIC FACTORS IN DIABETES

The risk of developing type 1 or type 2 diabetes is influenced by both environmental and genetic factors. Over 1,000 genetic variants have been associated with the disease, yet their functional impact remains poorly understood. **Miriam Cnop's** team has linked over 400 genetic factors implicated in diabetes to their molecular effects in human pancreatic islets, examining gene and protein expression as well as epigenetic modifications. This detailed mapping of the mechanisms underlying diabetes was made possible by more advanced bioinformatics approaches. Freely accessible, these tools also offer potential for studying other complex diseases with a genetic component.

Piron et al (2025) Cell Genomics

Distinguished achievements



PATRICE
CANI

WELRI –
UCLOUVAIN

Patrice Cani leads research to understand the role of our intestinal bacteria in the development of various diseases, including type 2 diabetes associated with overweight and obesity, and certain cancers. For the 10th consecutive year, Patrice has been named among the **2025 Clarivate Highly Cited Researchers**. This international distinction, awarded to scientists whose work ranks among the top 1% most cited worldwide, highlights the excellence, impact and leadership of his research.



AMANDINE
EVERARD

WELRI –
UCLOUVAIN

Amandine Everard studies how our intestinal bacteria can influence our eating behaviour and the role of this gut-brain axis in eating disorders, such as binge-eating. In 2025, Amandine was doubly awarded for her innovative work at the crossroads of microbiology and neuroscience: she received the **Academy Prize for Biomedical Sciences** by the Royal Academy of Medicine of Belgium and the **2025 Endocrinology, Diabetes and Metabolism Award** from the FNRS.

Distinguished achievements



MIIKKA
VIKKULA

WELRI –
UCLOUVAIN

Miikka Vikkula was honoured with the **2025 EURORDIS Black Pearl Scientific Award** for his career, which combines scientific excellence and support for the rare disease patient community. His research transformed the understanding of inherited mutations causing conditions like primary lymphoedema and vascular anomalies and was the foundation for pioneering clinical trials to repurpose drugs for rare diseases. Miikka holds leadership roles in international rare disease organisations, such as the VASCERN Vascular Anomalies Working Group and the International Society for the Study of Vascular Anomalies (ISSVA). Furthermore, Miikka's active involvement in international conferences highlights his dedication to raising awareness of vascular anomalies on a global scale.





Microbiology & Infectious Diseases

This field investigates the mechanisms of pathogens, such as bacteria and viruses, and host responses, with a focus on the treatment of infectious diseases to improve global health outcomes.

Investigators

Advanced

ALSTEENS David - UCLouvain

Probing molecular interactions: unravelling the role of O-acetylated sialic acid in respiratory viruses

COLLET Jean-François - UCLouvain

Exploring how Gram-negative bacteria build and maintain their outer membrane, an essential structure that restricts the entry of many antibiotics

DE BOLLE Xavier - UNamur

Lipopolysaccharide O-chain biosynthesis in *Brucella abortus*: from fundamental knowledge to synthetic microbiology

GARCIA-PINO Abel - ULB

Dissecting *A. baumannii* stringent response network to target novel metabolic effectors

SMEESTERS Pierre - ULB

A host-pathogen strategy to deliver a new vaccine formulation including both conserved and variable antigens against *Streptococcus pyogenes*

VANDERPLASSCHEN Alain - ULiège

The use of herpesvirus-fish models to unravel host-pathogen-environment interactions: a new paradigm in disease mitigation for aquaculture

Starting

JURENAS Dukas - ULB

R-zymes: the peptide roles for immobilisation of therapeutic proteins or enzymes

LALOUX Géraldine - UCLouvain

Revealing the molecular arsenal of predatory bacteria

Representative publications

NEW BACTERIAL DEFENCE MECHANISM DISCOVERED

The discovery was made in *Brucella abortus*, a pathogen that causes long-lasting illness in humans and animals. **Xavier De Bolle's** team identified a new lipid transport system in *Brucella*, named Mpc, which acts as a bridge between the bacterium's two protective membranes, enabling the transfer of lipids from one layer to the other. The system is crucial for *Brucella's* survival, especially when attacked by the immune system. Without Mpc, the outer membrane's lipid balance is disrupted, leaving the bacterium more vulnerable to stress from its surroundings. Researchers also found that this system exists in many related bacteria, suggesting it plays a widespread role in microbial survival. The finding expands our understanding of how dangerous microbes adapt and could open new doors for infection-fighting strategies.

Lannoy et al (2025) The EMBO Journal

HOW BACTERIA AVOID BURSTING UNDER ATTACK

For decades, scientists believed that a single rigid layer, composed of peptidoglycan, was sufficient to protect bacteria from bursting under pressure caused by their external environment, such as antibiotics or sudden osmotic changes. **Jean-François Collet** and his team discovered that bacterial survival depends on a coordinated defence involving all three layers of their envelope: the peptidoglycan wall, the outer membrane, and the periplasm in between. Together, these layers form a pressure-balancing system that prevents the inner membrane from rupturing, thereby keeping the cell alive. As this mechanism is present in around half of all known bacteria, the discovery not only reshapes our understanding of microbial survival but could also open new avenues in the fight against antibiotic-resistant infections.

Deghelt et al (2025) Nature Microbiology

Distinguished achievements



DAVID
ALSTEENS

WELRI –
UCLouvain

David Alsteens pursues research on nano-biophysics of the cell surface machinery, focusing on interactions at the nanoscale level between biological molecules and viruses to improve our understanding of the cellular mechanisms of viral infections. David is pursuing an **ERC Consolidator Grant** (2022-2027) to bring nanotechnology to the field of virology and decipher the complex interactions between a virus and a cell.



ABEL
GARCIA-PINO

WELRI – ULB

Abel Garcia-Pino studies the mechanisms of bacterial survival under stress, antibiotic resistance and the development of new therapeutics against bacterial infections. Abel holds an **ERC Consolidator Grant** (2019-2025) to understand the role of RSH enzymes in the stress response of bacteria and to decipher their organisation and structure.



GÉRALDINE
LALOUX

WELRI –
UCLouvain

Géraldine Laloux investigates the mechanisms by which predatory bacteria attack and consume other bacteria to survive. A better understanding of these mechanisms could pave the way for new approaches to combating antibiotic-resistant bacteria. Géraldine has been awarded an **ERC Consolidator Grant** (2024-2029) to lead the VAMPIRE research project as a continuation of her research funded by an ERC Starting Grant in 2018.



DUKAS
JURĖNAS

WELRI – ULB

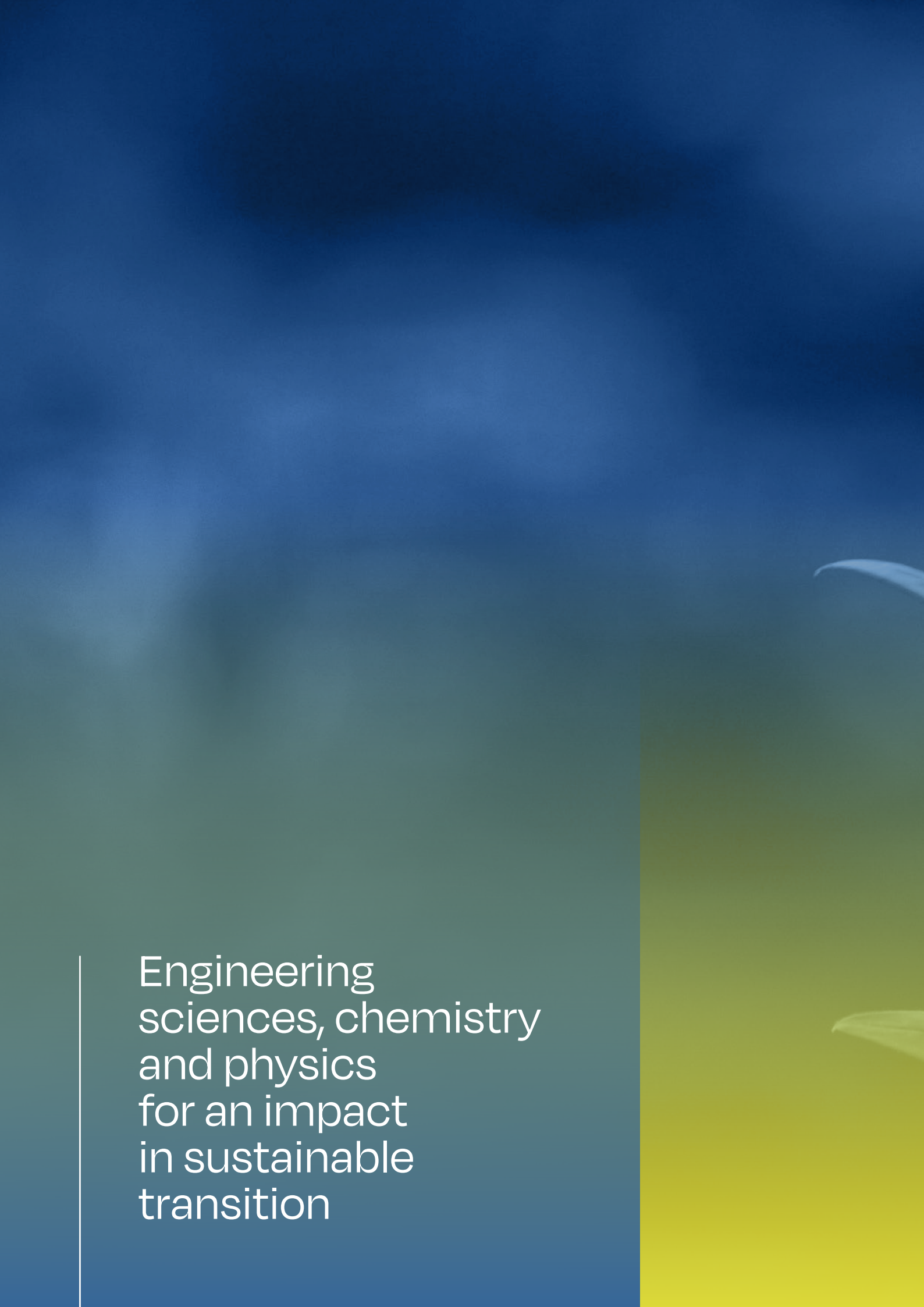
In 2025, Dukas Jurėnas was awarded an **ERC Starting Grant** (2025-2030) to explore R-bodies, giant protein structures found inside bacteria, to better understand their mechanism of action and potential role in interactions with other organisms.



XAVIER
DE BOLLE

WELRI –
UNAMUR

Xavier De Bolle and his collaborator Eric Muraille (Université libre de Bruxelles) were awarded the 2025 **GSK Vaccines Prize** by the Royal Academy of Medicine of Belgium for their joint work on a rational strategy for designing safer live attenuated vaccines against brucellosis. Their study opens new avenues for controlling this widespread zoonotic disease, which continues to affect many regions worldwide.



Engineering
sciences, chemistry
and physics
for an impact
in sustainable
transition



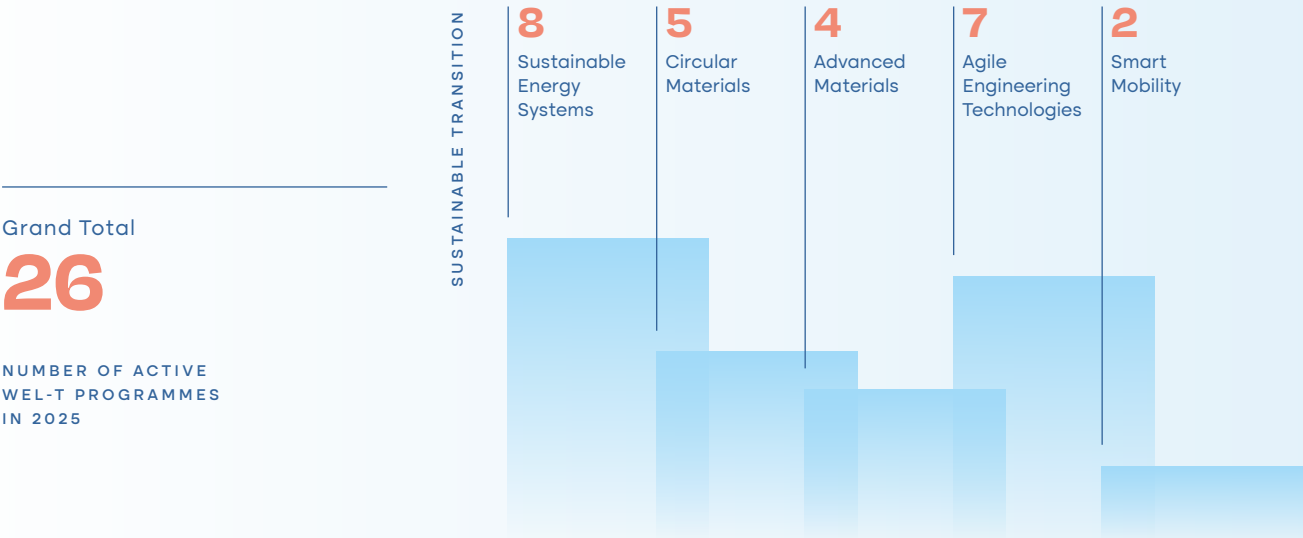
WELRI

WELRI

The WEL-T department

The WEL-T department was established in 2022 as part of a Walloon government initiative to support strategic research in engineering, chemistry and physics for the sustainable transition. The first call that year brought 14 Investigators on board, with programmes spanning sustainable energy, circular and advanced materials, and agile engineering technologies. A second call in 2024 added 12 new programmes, including a focus on smart mobility. Together, the 26 WEL-T programmes now form a strong, forward-looking portfolio driving sustainable innovation.

Number of active WEL-T programmes in 2025





Sustainable Energy Systems

Research into sustainable energy systems plays a crucial role in advancing clean and renewable energy sources, while promoting energy efficiency and environmental sustainability.

Investigators

Advanced

BONAVENTURE Olivier - UCLouvain

Sleepable and energy-efficient Internet protocols

CAUCHETEUR Christophe - UMons

Multi-parameter sensing solutions in multicore optical fibre for reliable battery monitoring

PARENTE Alessandro - ULB

Lifelong-learning digital twins for sustainable combustion technologies

VLAD Alexandru - UCLouvain

Conjugated sulphonamide coordination polymers: advancing universal divalent cation storage to high-energy calcium-metal battery technology

Starting

CAUDRON Corentin - ULB

Towards 4D monitoring of geothermal operations in 4D using passive-based seismic approaches

DE PAEPE Ward - UMons

Moist air energy carrier for waste heat recovery

GEHRING Pascal - UCLouvain

Low-dimensional transverse thermoelectric materials for sustainable spot cooling and energy harvesting

TROIAN-GAUTIER Ludovic - UCLouvain

Fe(II/III) photosensitizers for dye-sensitized photoelectrochemical cells (DSPECs) applications

Representative publications

IRON- AND ANTHRACENE-BASED PHOTSENSITISER: AN IDEAL COMBINATION TO OPTIMISE ENERGY EFFICIENCY

Iron-based photosensitizers hold great promise for photochemical applications, but their efficiency is limited by the short lifetime of their excited state and low reaction yields. To address these challenges, **Ludovic Troian-Gautier** and his team combined an iron complex with an energy acceptor, 9-phenyl-anthracene. This innovation increased the excited-state lifetime to 11.5 microseconds, an improvement of three orders of magnitude, thereby significantly boosting the efficiency of both energy and electron transfer reactions. A breakthrough with this new combination is the ability to generate singlet oxygen ($^1\text{O}_2$) using an iron-based photosensitiser, a process that was previously severely limited. Furthermore, this molecule greatly enhanced the efficiency of electron transfer reactions with acceptors such as methyl viologen, increasing the cage escape yield from 4.5% to 42%. While the energy transfer efficiency to 9-phenyl-anthracene remains modest (around 10%), this approach opens the door to sustainable alternatives to rare-metal-based photosensitisers.

Glaser et al (2025) Journal of the American Chemical Society

NANOMETRE-SCALE COOLING OF ELECTRONIC CHIPS

Conventional thermoelectric technologies lose efficiency at the nanometre scale, posing a major challenge for cooling miniaturised electronic chips. To address this, **Pascal Gehring's** team harnessed the topological properties of the magnetic Weyl semimetal Co_2MnGa . By structuring the material at micro- and nanometre scales, they observed an unusually high Ettingshausen effect at room temperature, further enhanced by a longitudinal Peltier effect induced by nanoribbons. These findings highlight the potential of magnetic Weyl semimetals as hybrid thermoelectric systems, capable of combining efficient cooling with the direct utilisation of their topological properties at the nanoscale.

Razeghi et al (2025) ACS Nano

Distinguished achievements



ALESSANDRO
PARENTE

WELRI – ULB

Alessandro Parente's research aims at developing digital twins, integrating theory, experiments, simulations and machine learning, to help reduce the carbon impact of industrial combustion systems. In 2024, Alessandro was awarded an **ERC 'Proof of Concept' Grant** (2024-2026) to explore the innovative potential of the results generated from his ERC Starting Grant.



LUDOVIC
TROIAN-GAUTIER

WELRI – UCLouvain

Special story

A Belgian quantum sensor heads to the International Space Station

A diamond-based quantum sensor, developed through the OSCAR-BLINQ project - a Belgian collaboration between UHasselt, UCLouvain, and the Royal Belgian Institute for Space Aeronomy - will be sent to the International Space Station (ISS) in 2026. The sensor will accompany Belgian European Space Agency (ESA) astronaut Raphaël Liégeois to conduct astrochemical

research in microgravity, focusing on how light-sensitive molecules behave in space.

Ludovic Troian-Gautier's team will play a key role, synthesising photosensitive materials and studying their reactivity using advanced spectroscopic techniques. Data collected by the sensor will be transmitted to Earth in real time for analysis.

This mission has significant implications for long-term space exploration, particularly in understanding the effects of the space environment on living organisms. Scheduled for launch in summer 2026, the project highlights Belgian scientific collaboration and underscores the growing role of quantum technologies in space research.



Circular Materials

Circular materials are designed to enable the complete recycling of resources and to support novel synthesis strategies that are free from toxic precursors or by-products, allowing the regeneration of raw materials.

Investigators

Advanced

DETREMBLEUR Christophe - ULiège

Cascade exotherms to stimulate self-foaming of isocyanate-free polyurethane formulations at ambient temperature

EVANO Gwilherm - ULB

Catalytic deoxygenative functionalisation reactions for the synthesis of alkanes, alkenes and arenes

JONAS Alain - UCLouvain

Topographical design of the surface of textile fabrics and materials for improved functional properties: amphiphobicity, antibacterial and antifungal properties, cell culture and on-demand harvesting

RAQUEZ Jean-Marie - UMONS

Continuous solid-state modification of plastic waste via upcycling approach

SIMAR Aude - UCLouvain

Recycling healable aluminium waste by circular solid-state additive manufacturing



Representative publications

RECYCLING NIPU FOAMS INTO HIGH- PERFORMANCE ADHESIVES

Non-isocyanate polyurethane foams (NIPUFs) offer a safer and more environmentally friendly alternative to traditional isocyanate-based foams, which are known for their toxicity. However, their recycling remains challenging due to the harsh conditions required for their reprocessing, limiting their reuse. To overcome this limitation, **Christophe Detrembleur** and his team developed self-foaming NIPUFs incorporating dynamic cystamine-based disulphide bonds. This modification allows the foams to be reprocessed at mild temperatures (from 90°C), without catalysts or side reactions, thanks to a synergistic effect with hydroplasticisation (the addition of water, which softens the material). The process enables these foams to be transformed into high-performance adhesive films that are reusable and heat-activated. These adhesives work effectively on a wide range of substrates (steel, glass, nylon fabrics) and exhibit performance comparable to or exceeding that of commercial glues (Super Glue, hot melts, thermosets).

Lechuga-Islas et al (2025) Chemical Engineering Journal

MULTIFUNCTIONAL NIPU FILMS WITH INTRINSIC FLUORESCENCE

Conventional humidity sensors are complex, costly, and unable to monitor how polymers change when exposed to water. To address this, **Christophe Detrembleur** and his team developed non-isocyanate polyhydroxyurethane (NIPU) films with intrinsic fluorescence arising from clusteroluminescence, removing the need for any added fluorophores. Their light intensity decreases linearly with relative humidity, directly reflecting polymer softening. This work demonstrates the potential of NIPU films as stable, additive-free bifunctional sensors.

Mahapatra et al (2025) Advanced Functional Materials

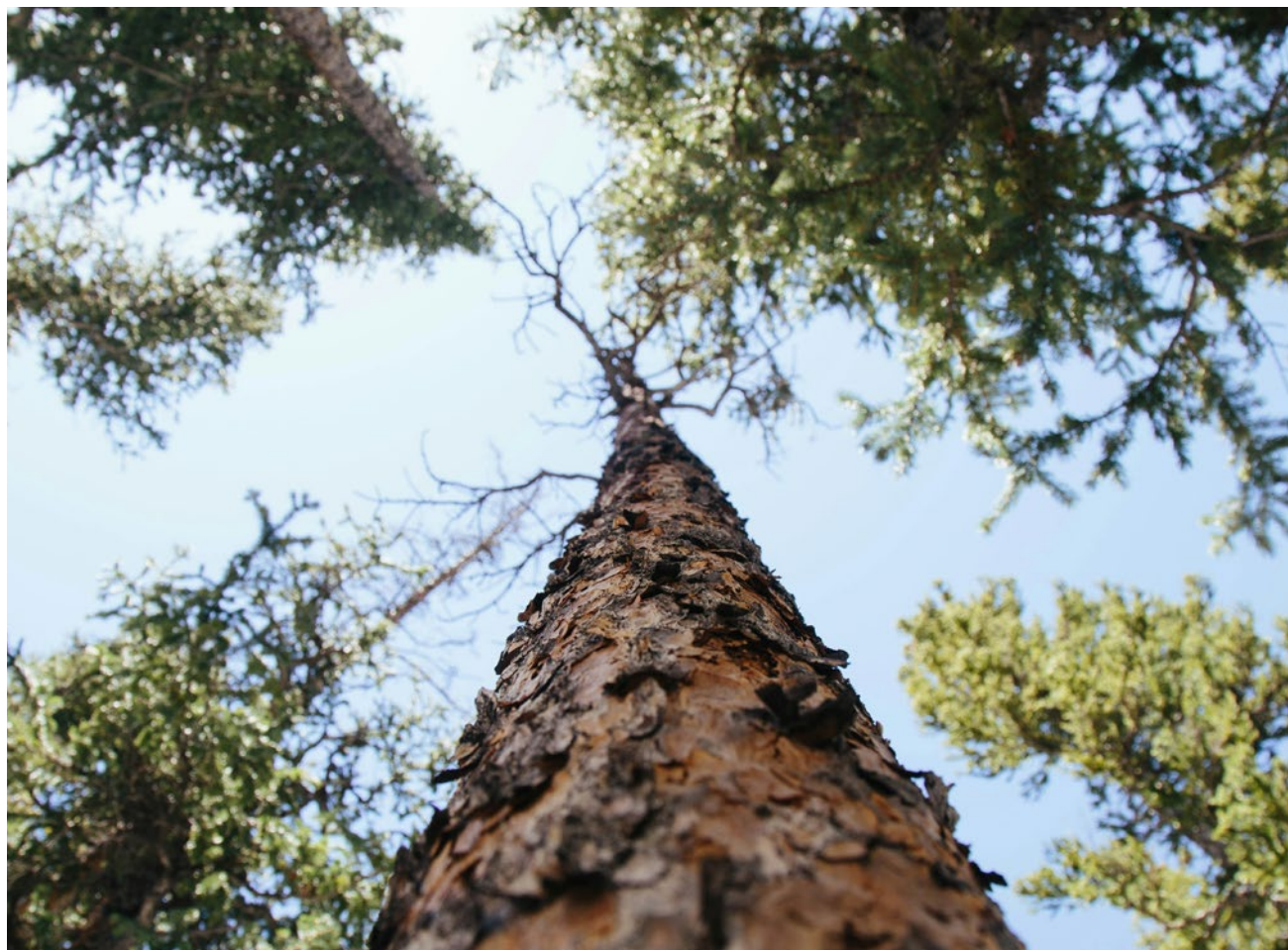
Distinguished achievements



**GWILHERM
EVANO**

WELRI – ULB

Gwilherm Evano received the **2025 Springer Heterocyclic Chemistry Award** at the 30th European Conference on Heterocycles in Chemistry in Budapest, recognising his major contributions to heterocyclic chemistry. His work has advanced a core field of organic chemistry with wide-ranging applications in pharmaceuticals and materials science. He is also a recipient of the **Grammaticakis–Neuman Award** from the French Académie des sciences.





Advanced Materials

Thanks to their unique properties and superior performance, advanced materials can replace traditional materials and help protect the environment.

Investigators

Advanced

LAURENT Sophie - UMons

Metal-complex iron oxide nanoparticles for optimised radiotherapy and imaging with MPI

PARDOEN Thomas - UCLouvain

Novel nanolaminate coatings and ultra-miniaturised test instrumentation for extreme nuclear environments

RIGNANESE Gian-Marco - UCLouvain

Towards a materials informatics active-learning platform to design new electrocatalysts

Starting

PONCÉ Samuel - UCLouvain

Computationally-driven improvements in lead-free halide perovskite photovoltaics

Representative publications

THE SUPERPOWERS OF NANOLAMINATE COATINGS

Thomas Pardoën and colleagues designed an innovative coating with remarkable mechanical properties: a nanolaminate of alternating layers of amorphous alumina (Al_2O_3) around 100 nm thick with even thinner layers of aluminium. This material, produced by physical deposition, is based on the ductility of amorphous Al_2O_3 at thicknesses of less than 100 nm. To create a thicker useful coating, these thin layers have been stacked with aluminium, which provides robust interfaces with the alumina while offering energy dissipation and crack-arresting capabilities. The result is a thin coating (thinner than a micrometre) offering the best combination of strength (hardness), ductility (ability to deform without breaking) and toughness (resistance to cracking in the presence of defects). In addition, this material benefits from alumina's excellent corrosion resistance. The main challenge of this research was to determine precisely the intrinsic properties of this coating and its individual layers, and then to link them to the physical mechanisms explaining this exceptional performance. To do this, the team used UCLouvain's patented nanomechanical on-chip testing approach. Several applications are envisaged, particularly in technologies exposed to harsh environments, combining corrosion, erosion, wear and mechanical shocks.

Baral et al (2025) Nature Communications

MORE RELIABLE SIMULATIONS TO BETTER DESIGN THE MATERIALS OF TOMORROW

Scientific research faces reproducibility challenges, and computational materials physics is no exception: the increasing complexity of software makes independent verification of results difficult. Subtle effects related to electron-phonon interactions, which play a crucial role in electronic properties, remain poorly explored and rarely validated systematically. To address this, **Samuel Poncé** and his collaborators compared several reference codes (ABINIT, Quantum ESPRESSO, EPW, and the Zacharias & Giustino method) and three computational approaches, applied to diamond and boron arsenide. Their work corrected bugs, improved documentation, and tested the robustness of the methods, revealing the importance of often-overlooked effects such as the momentum dependence of the Debye-Waller term. This unprecedented cross-software and cross-method study highlights both strengths and limitations, reinforces confidence in materials design calculations, and underscores the need for systematic verification in computational research.

Poncé et al (2025) npj Computational Materials

Distinguished achievements



THOMAS
PARDOËN

WELRI – UCLouvain

Thomas Pardoën focuses on understanding and improving the durability and strength of materials used in the aerospace, energy, and electronics industries, with a strong emphasis on innovation in materials design and testing methodologies. Thomas is pursuing an **ERC Advanced Grant** (2023-2028) to study the strength and toughness of materials, with the aim of improving their performance.



GIAN-MARCO
RIGNANESE

WELRI – UCLouvain

Gian-Marco Rignanese and his collaborators are laureates of an **ERC Synergy Grant** (2025-2030). The GEMPROMISE project combines modelling, process chemistry and generative AI to create innovative materials and predict their synthesis conditions, with the aim of accelerating their development.



Agile and Safe Production Methods

Research to increase efficiency, reduce waste and identify areas for sustainable innovation across a range of manufacturing processes.

Investigators

Advanced

FRANCI Alessio - ULiège

Embodied Excitability: a principle for designing neuromorphic adaptive agents

GEERTS Yves - ULB

A fresh look on the polymorphism of active pharmaceutical ingredients

KERSCHEN Gaëtan - ULiège

Experimental continuation methods for nonlinear aerospace structures

LUIS ALCONERO Patricia - UCLouvain

Sustainable membranes for CO₂ capture and conversion into high-value compounds

MONBALIU Jean-Christophe - ULiège

Intelligent flow systems for advanced chemical manufacturing

PAPALEXANDRIS Miltiadis - UCLouvain

Natural convection in liquid-gas systems at high turbulence intensities and its application in spent-fuel pools

VALKENIER-VAN DIJK Hennie (Elisabeth) - ULB

Ionophores revisited: the development of supramolecular receptors for phosphate, arsenate, and sulphate as neutral ionophores for transport and potentiometric sensing applications

Representative publications

CONTINUOUS FLOW NITRATION TO SECURE ANTIBIOTIC PRODUCTION FROM BIOMASS

Nitration, one of the most hazardous reactions in chemistry due to the use of explosive nitrating agents, poses a significant challenge for the pharmaceutical industry, particularly in the production of antibiotics from biomass. To address this, **Jean-Christophe Monbaliu's** team, as part of an international consortium supported by the U.S. Food and Drug Administration (FDA), has developed an automated continuous flow platform capable of carrying out these reactions safely. This technology enables the conversion of bio-based furfural, derived from agricultural waste, into precursors of nitrofurant antibiotics, thereby eliminating the risks associated with handling hazardous substances. The system was successfully tested on four antibacterial compounds listed by the World Health Organization, all produced in under five minutes with excellent purity and high yield. Thanks to advanced automation and real-time monitoring, the production process is both safer and more sustainable.

Helwig et al (2025) Angewandte Chemie International Edition

Distinguished achievements



ALESSIO FRANCI

WELRI – ULIÈGE

Alessio Franci received the 2025 **George S. Axelby Outstanding Paper Award** from the IEEE Control Systems Society for an exceptional publication recognised for its scientific quality and impact on the control systems community. The award-winning publication, "Nonlinear Opinion Dynamics with Tunable Sensitivity", authored in collaboration with Princeton University, represents a significant advance in the study of nonlinear opinion dynamics by introducing tunable sensitivity mechanisms supported by rigorous mathematical analysis.



Smart Mobility

This field develops intelligent, sustainable transport solutions that improve safety, efficiency and environmental performance.

Investigators

Advanced

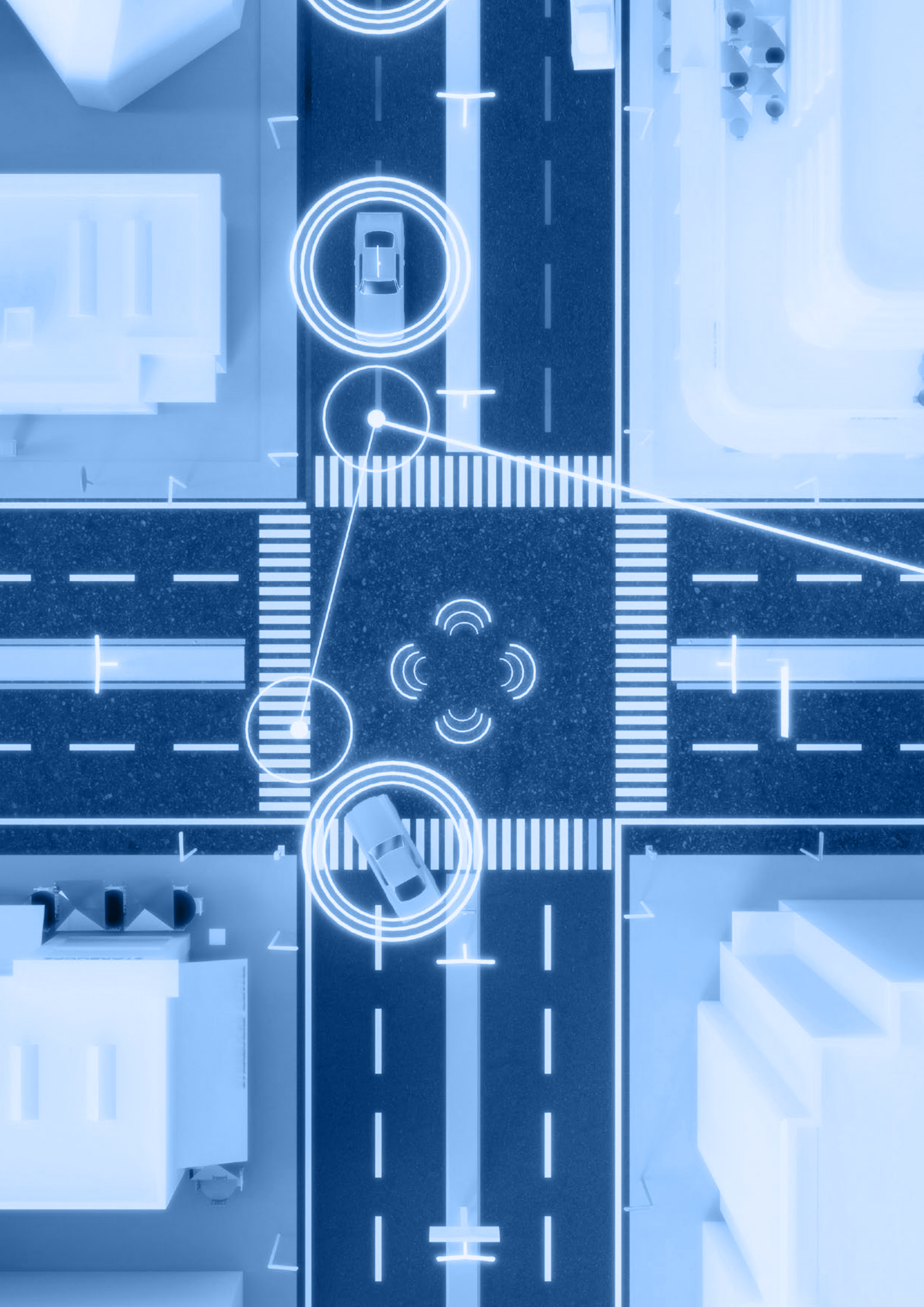
BONTEMPI Gianluca - ULB

Enhancing digital twins with scalable and interpretable AI: from physics-based modelling and simulation to adaptive learning, big data analytics and counterfactual reasoning

Starting

BIANCHIN Gianluca - UCLouvain

Green shared multi-modal transportation: a real-time optimisation approach



05

CHAPTER



Management structure & financial highlights

Institutional framework

The Institute works closely with five universities in the Wallonia-Brussels Federation: UCLouvain, ULB, ULiège, UNamur and UMONS.

The researchers of WELRI are affiliated to these universities, which reinforces the dual nature of their research commitment.

Governance

Governed by a General Assembly and a Board of Directors, the Institute's leadership includes representatives from industry, academia and Ministers of the Walloon Region, ensuring effective oversight of all key stakeholders.

Board of Directors

President: Philippe Denoël
Vice-President: Pierre Lekeux

Representatives of the Ministers of the Walloon Region

Jean-François Corbisier,
representing the Minister for the
Economy

Nathalie Leboeuf,
representing the Minister for Research

Representatives of the financial and industrial sectors

Philippe Denoël,

Head of External Vaccines R&D at GSK

Gwenaëlle De Keyser,

Head of Public Private Partnerships,
UCB BioPharma

Joëlle Van Malderen,

Senior Patent Attorney, Cirelle SA

Marc Van Den Neste,

Founder and Director, EKOSYS

Secretary General of the Fund for Scientific Research (F.R.S.-FNRS)

Véronique Halloin,

Secretary General

Representative of the Walloon Public Service

Jean-François Heuse,

Inspector General

Academic experts

Pierre Lekeux,

Emeritus Professor, ULiège

Philippe Lambin,

Emeritus Professor, UNamur

Representatives from the universities in the French Community

Jean-Christophe Renaud,

Vice-Rector Research, UCLouvain

Marius Gilbert,

Vice-Rector Research and Development,
ULB

Ruddy Wattiez,

Vice-Rector Research, UMONS



Operational unit



**VINCIANE
GAUSSIN**

**MANAGING
DIRECTOR**

Vinciane Gaussin has more than 20 years of experience in life sciences in academic, biotech and non-profit organisations. She was the Managing Director of the WELRI from 2010 to 2015 and resumed this position in March 2021, after several years at a biotech company in California. Vinciane has a degree in bioengineering, obtained her PhD in 1996 (Belgium) and did her post-doctoral work at the Baylor College of Medicine (USA).



**LAURENCE
BORGS**

**WELBIO BUSINESS
DEVELOPMENT MANAGER**

Laurence Borgs is a neurobiologist. She obtained a PhD in Biomedical and Pharmaceutical Sciences in 2009 and completed a post-doctoral fellowship in partnership with UCB Pharma. Combining scientific expertise and commercial leadership in various biotech life science companies, Laurence joined the WELRI in August 2022 as Business Development Manager for the WELBIO department.



**PERRINE
CALVEZ**

**WEL-T BUSINESS
DEVELOPMENT MANAGER**

Perrine Calvez is a chemical engineer. She obtained a PhD in materials chemistry in 2009, which led her to the global steel industry, where she held various positions: research and development, process engineer, marketing and environmental manager. In 2023, Perrine obtained an Executive Master's in Management from the Solvay Business School. Perrine joined the WELRI in October 2023 as Business Development Manager for the WEL-T department.



Management report

This report covers the 14th financial year, from 1 January 2025 to 31 December 2025.

WELRI is structured around two departments: WELBIO and WEL-T. These correspond to the strategic priorities defined by the Walloon Government within the framework of the Strategic Fundamental Research Fund (FRFS), one of the associated funds of the FNRS.

WELRI and the FRFS/FNRS work in a complementary manner to implement the mission entrusted by the Walloon region. WELRI's role is to stimulate and accelerate the translation of strategic research into societal and economic impact, while the FRFS is responsible for organising project calls in line with the strategy defined by WELRI, as well as for the financial and administrative management of research agreements under the WELBIO and WEL-T departments.

**This is reflected in
the financial flow
as follows:**

- Subsidies from the Walloon Region for strategic research within WELBIO and WEL-T are paid to the FRFS.
- The WELRI receives an annual grant (= 'WELRI amount') equal to 10% of the total subsidies from the Walloon Region, after deduction of the sums earmarked for the financing of the operating costs of the FRFS/FNRS.

Assets

Tangible fixed assets amount to €507.43 and consist of computer equipment.

Financial fixed assets amount to €7,497.00 and concern the guarantee for the rented offices in Wavre.

Receivables due within one year amounted to €29,900.00 and consisted of a 20% working capital advance on the Bridge Fund BF-2023-01 [W3.1][VG3.2]research agreement.

Cash investments amounted to €3,589,472.14 in the form of two reserves to distribute the remaining liquidity of the WELRI.

These liquid cash sums have been allocated as follows:

Operating costs (2025):

€755,248.00

Bridge fund:

€1,334,224.14

€2,089,472.14

As at 31 December 2025, a term deposit was also established in the amount of € 1,500,000.00.

A BPAID account was created to cover various small expenses and the remaining balance is €204.68.

Adjustment accounts amounted to €8,803.96 and related to charges that were to be carried forward.

Total assets amounted to:

€3,606,485.21

Liabilities

The balance at 31 December 2024, under the heading of "other allocated funds", amounted to €2,659,379.97.

The result for the fiscal year was a profit of €471,696.54.

The balance at 31 December 2025, for other allocated funds, amounted to €3,131,072.51.

Supplier debts amount to €404,491.84.

The estimated tax liability for 2025 is €898,61.

The patrimonial tax for 2025 amounts to € 11,554.01.

Provisions for holiday pay amount to €57,318.31.

Other debts amount to €129.93 and relate to an administrator's current account of €129.93.

Total liabilities amounted to:

€3,606,485.21

Result

The grant for 2025 operating costs amounted to €1,430,603.38.

Membership contributions amount to € 25.00.

Expense reimbursements amount to €525.22 and relate to an invoice paid by an employee.

Miscellaneous services and assets amounted to €128,085.43 and primarily consisted of operating costs, rent and fees.

Salaries and social contributions amounted to €499,575.70.

The estimated tax liability amounted to €818.50.

Net bank interest, after withholding tax, amounted to €21,299.80.

Financial charges amounted to €78.61.

The result for the fiscal year is a profit of:

€471,692.54

Contact

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@WEL Research Institute

