



LUXEMBOURG  
INSTITUTE  
OF HEALTH

# 2022

ANNUAL REPORT





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*Prof Ulf Nehrbass,  
Chief Executive Officer*

## MESSAGE FROM THE CEO

Dear all,

The present annual report is an opportunity to look back together on the year 2022.

When looking at the performance of an institute, a straight-forward and immediate starting point consists in impartial external evaluations.

Namely, in 2022, the Luxembourg Institute of Health was evaluated by the Swiss company Interface, and I am delighted to say that this in-depth assessment has shown that not only the output but also the strategy and the outlook of the LIH are very positive. I would therefore like to thank all those who contributed to such an encouraging outcome.

In addition, LIH operates by taking into account key performance indicators, objective measures we are given by the Ministry of Higher Education and Research to assess on how we perform. These include the number of peer-reviewed publications, their quality, as well as the funding secured, among others. Again, I am delighted to report that we have been able to meet the targets of all of our KPIs, and again, I wish to thank all of those involved in achieving our goals.

When we look at the scientific output in terms of papers published, in 2022 we hit the remarkable record of 413, of which 131 published specifically in top 10% journals. I will only mention three examples here, while you can read more about all our research breakthroughs throughout the report.

The first is by the laboratory of Dr Jérôme Paggetti and Dr Etienne Moussay. This very interesting work reveals how leukemia disarms the body's defenses through microscopic vesicles which are actually able to tune down the immune response in cancer patients. This certainly holds great translational potential.

Second, the work conducted by Prof Dirk Brenner, together with German colleagues, on mesaconic acid looks at this immune suppressant naturally synthesized by the body itself. There are multiple translational applications here too, not only during sepsis, but also in those cases in which immune reactions have to be suppressed.

And thirdly, Dr Johannes Meiser and his colleagues looked at how the metabolome regulates cellular



function and dysfunction. They showed how certain metabolomes are actually instrumental in the spread of cancer cells during metastasis.

I would also like to take the opportunity to reflect on an earlier effort. It is now widely acknowledged that the LIH has been instrumental during the COVID-19 pandemic. Indeed, the Large Scale Testing (LST) can now be looked at retrospectively and we can assess the impact that we have had. The WHO published in Nature the impact measured by excess mortality. I am extremely proud to report that the lowest excess mortality during the COVID-19 crisis in Europe was precisely here in Luxembourg. And probably not only in Europe, but across the world. Indeed, we have had about a four time lower excess mortality compared to our neighbouring country Germany, despite their similar health system. We have now arguments and clear indicators that allow us to pinpoint our success here in Luxembourg to large-scale testing and tracing. To everybody who was involved, again, a heartfelt thank you.

Looking now forward, I can say that the events of the past year have contributed to paving the way towards the translational future of the LIH.

Indeed, CLINNOVA, the flagship digital health initiative, has been approved for funding and officially kicked off in April 2023, with the support of the Ministries of Health and Higher Education & Research. This one-of-a-kind multinational effort aims to develop precision medicine across three large disease groups, namely multiple sclerosis, inflammatory bowel disease, and rheumatoid arthritis. Through this pioneering artificial intelligence (AI), data-driven endeavour, we will be working together with our colleagues from France, Switzerland and Germany to build a data-enabling environment for cross-border data sharing, standardisation, and interoperability, so as to fully unlock the potential of AI-driven precision medicine and be able to assign the right drug for the right patient at the right time. This initiative represents a big success for us and a wonderful runway into our translational future.

A final point to mention is the launch of a platform that will allow us to bring clinical trials to Luxembourg patients: the Luxembourg Clinical and Translational Research Centre (LCTR-Fuerschungsklinik Lëtzebuerg). Co-managed with the Centre Hospitalier de Luxembourg (CHL), the LCTR is the first national research infrastructure bringing together clinicians, researchers and patients, with the aim of translating research findings into tangible therapeutic and diagnostic solutions. It brings to bear all of the translational resources that the LIH has, from the clinical trial support of its Clinical and Epidemiological Investigation Center (CIEC) to the biobanking services of the IBBL, to the statistical evaluation expertise of the Competence Centre for Methodology and Statistics (CCMS). All of these resources are now being made available to the entire research and healthcare community here in Luxembourg. The LCTR Fuerschungsklinik is a launchpad that will allow us to implement scientific projects that can immediately benefit Luxembourg patients. Again, another cornerstone project of our translational future.

I would now like to take the occasion to extend my heartfelt gratitude to the staff for all the past and upcoming meaningful translational work. I would also like to thank our stakeholders, notably the Ministry of Higher Education and Research, the Ministry of Health, and the National Research Fund, for financing all of these efforts. The positive evaluations we have obtained thus far are indeed a wonderful way to show our appreciation and to ensure that these generous past and future investments in our activities will continue to bear their fruits.

Thank you,

  
Prof Ulf Nehrass  
Chief Executive Officer  




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*Dr Gregor Baertz  
President of the Board of Directors*

## MESSAGE FROM THE PRESIDENT

Dear reader,

I am delighted to introduce the 2022 annual report of the Luxembourg Institute of Health.

This edition is particularly important as it illustrates the achievements and events of a year that marked major turning points nationally and internationally.

Over the past years, when faced with the unparalleled challenge of COVID-19, the LIH had the chance to prove its worth in terms of its ability to quickly adapt and respond to the crisis in order to continue adding value. Indeed, I can say with confidence that the LIH has kept delivering on its mission to positively affect people's health. Our institute came out of the crisis stronger, more resilient and more visible than ever.

It is now firmly anchored within the national and international research landscape. It made a name for itself, and proved its value and reputation as a truly translational institute and leader in clinical research, contributing to affirming our country's standing as an international hotbed for disease management. Those following the press will have indeed noticed the Luxembourg's excellent achievements during the COVID-19 pandemic, as was reported extensively across national and international media and acknowledged in an article in the prestigious journal *Nature* in December 2022. I would like to thank again Research Luxembourg and all the LIH staff for their contribution in achieving these outstanding results.

Just when it seemed like the pandemic had started to recede and grant us some much-needed respite, the year 2022 brought with it yet another storm – the invasion of Ukraine. The ongoing conflict has caused a humanitarian, social and political crisis for the Ukrainian people and for the world in general. Research and science have not been spared, with the war's impact on international collaborations leading to lost opportunities for discoveries in medicine and science, not only in Ukraine and Russia, but worldwide too.

In this context, the LIH, in line with the coordinated action of the global scientific community, has welcomed several talented Ukrainian researchers throughout 2022, enabled by the financial support of the FNR, thus playing a part in supporting international research during these unsettling times.

One of the features of our modern times is the speed at which news travel, and possibly also the dominance of the negative compared to the positive ones. We should not however forget that the work we do on a daily basis contributes to an increased life expectancy and quality of life for thousands of people.

The question now arises as to where we are heading in the immediate future.

The Luxembourgish government, our main financial partner, continues to believe that research is a major asset to society and is keen on dedicating considerable funds to research. This certainly helps us plan for the next few years.

LIH will continue to implement its transition towards a fully translational research institute. In that sense, we are now deploying Clinnova, the official kick-off of which took place in Luxembourg in April 2023.

We are also pursuing international innovative collaborations with countries like Norway and Israel, as well as strengthening the well-established ones with our immediate neighbors, such as Germany and France.

At the national level, the collaboration with the LNS is intensifying: the LIH will contribute to the creation and hosting of a joint research department, which is a major step forward for research in Luxembourg.

LIH will also be ready to help implement Chimeric antigen receptor (CAR) T-cell therapy – an innovative cancer immunotherapy – in Luxembourg, as soon as the health authorities give the green light.

Many stakeholders in the healthcare system are questioning its sustainability for the next decade. This is mainly due to an increased workload, lack of medical and nursing resources, insufficient digitalisation and a lack of a clear and generally accepted vision on how to meet these challenges. The LIH's ambition and mission is to support the efforts of the government to build the healthcare system of tomorrow, thereby generating crucial societal benefits.

Our efforts will be supported by the continuous nurturing of our relationship of trust with our staff and the unions, with whom a new collective agreement was recently signed.

Finally, on behalf of the Board, a final word to thank the entire staff, from research to administration, for their daily commitment, and the management for its enlightened leadership and mentoring. Special thanks also go to Simone Niclou and Marc Grabowski for their work in the interest of LIH. We wish both of them a successful career at our partner, the University of Luxembourg.

Enjoy the read,



Dr Gregor Baertz  
President of the Board of Directors



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# MISSION & VISION

Our **mission** is to leverage knowledge and technology arising from research on patient derived data, with the aim of having a direct and meaningful impact on people's health.

Our **vision** is to become a leading European institute for precision medicine and precision health, transforming research excellence into tangible benefits for patients, with the long-term goal of preventing diseases.















Strengthening LIH's  
patient centric position  
through strategic  
and organisational  
developments





From left to right: Dr Gregor Baertz (president of the Board of Directors of LIH), Claude Meisch (Minister of Research), Prof Ulf Nehrbaas (CEO of the LIH)

## Signing of the multi-year agreement between research centres and the state

In January 2022, Luxembourg's Minister of Higher Education and Research, Claude Meisch, signed multi-year agreements with five institutions, the LIH, University of Luxembourg, Luxembourg Institute of Science and Technology (LIST), Luxembourg Institute of Socio-Economic Research (LISER), and the National Research Fund (FNR). The agreements covered an increase of 17.6% in state allocations to the institutions, totaling 1.70 billion euros, from 2022 to 2025.

In addition, the agreements outlined joint activities in four missions: digital technology for personalized medicine, financial technologies of the future, education and training, and climate and energy challenges. The LIH received 182.5 million euros to develop projects in areas such as "Digital Health" and "Precision Medicine."

The missions aimed to promote collaboration between public research, higher education, and society to support the country's economic and social development. The LIH set objectives to place the patient at the center of its activities, implement initiatives in cancer and inflammation-related diseases, and develop an interoperable IT system between stakeholders in the Luxembourg health sector.

The LIH is committed to the missions and expresses gratitude to the Ministry for its support.

## National Center for Translational Cancer Research (NCTCR) launch

The LIH led the coordination of a new National Center for Translational Cancer Research (NCTCR) in Luxembourg. The NCTCR is an initiative of the national Plan National Cancer-2, which aims to promote research in translational oncology with a direct impact on patients and society. In that vein, the center itself aims to stimulate translational cancer research and build bridges between scientific developments and treatment in the hospital. This will accelerate precision oncology efforts at the national scale, improve the quality of care, and expand access to cutting-edge clinical trials.

The kick-off meeting of the NCTCR took place in April 2022 at the Novotel Luxembourg Kirchberg and brought together the various oncology related stakeholders, including researchers, medical doctors, and patient-support groups, to consolidate the consortium and develop ideas for the future. The initiative received seed funding from the FNR, and a call for interest was launched for stakeholders in Luxembourg wishing to contribute to the initiative. Later in the year, the NCTCR website was also inaugurated.





## Making translational medicine a reality: the LCTR-Fuerschungsklinik Lëtzebuerg opens its doors

The Luxembourg Clinical and Translational Research Centre (LCTR) is a collaboration between the Centre Hospitalier de Luxembourg and the Luxembourg Institute of Health. It aims to bring together clinicians, researchers, and patients to translate research findings into tangible solutions. In December 2022, it was inaugurated in the presence of Paulette Lenert, Minister of Health, and Claude Meisch, Minister of Higher Education and Research.

The LCTR provides a platform for technological innovation and the development of novel medical solutions to improve the prevention, diagnosis, and treatment of diseases. It is at the juncture between basic research and epidemiological and clinical research, putting the patient at the heart of its activities. The LCTR offers cutting-edge research infrastructure, medical equipment, and administrative and project management support for researchers.

LCTR patients also have the opportunity to take part in new epidemiological and translational research projects, as well as clinical trials, gaining access to novel therapies and innovative diagnostics. The LCTR aims to support the development of truly personalized therapies for a broad range of diseases, contributing to Luxembourg's research and healthcare ecosystem as an international leader in translational medicine.



From left to right: Prof Ulf Nehrbaas (CEO of the LIH), Mrs. Paulette Lenert (Minister of Health), Mr. Claude Meisch (Minister of Higher Education & Research), Dr Gregor Baertz (President of the Board of Directors of LIH), and Dr Romain Nati (CEO of the CHL)



## New department names

In January 2022, the LIH changed the names of its Department of Population Health and Department of Oncology to better reflect their strategic transversal, translational research programs.

The Department of Population Health was renamed the Department of Precision Health (DoPH) to reflect the new strategic decision of the department to increase the use of real-life data and artificial intelligence in research to design tailored preventive strategies and more personalized treatments.

The Department of Oncology was renamed the Department of Cancer Research (DoCR) to avoid confusion with the medical specialty of oncology and to better reflect the department's focus on developing tools and novel treatment options. In addition, the DoCR also moved to new premises in June 2022.

The LIH aims to become a leader in patient-based research in Luxembourg and Europe and the new names better illustrate the activities of the departments and bring the LIH to the forefront of translational biomedical research at both the national and international level.



DEPARTMENT OF  
PRECISION HEALTH  
DOPH



DEPARTMENT  
OF ONCOLOGY  
DONC



*Prof Guillaume Vogin*

## Advancing the personalisation of cancer radiotherapy treatment

In December 2021, the LIH appointed Professor Guillaume Vogin, Director of the Centre François Baclesse, as an affiliated clinician-scientist to develop a research program focused on radiotherapy-induced toxicity mechanisms.

Radiotherapy is an effective treatment applied in 50% of cancer patients but despite its positive impact on survival, 10-15% of patients experience sequelae that can affect their quality of life. This program aims to identify biomarkers that can help personalize radiotherapy treatments for each patient, increasing efficiency while at the same time limiting side effects. The research includes molecular and clinical studies that integrate quantitative imaging data with a radiomics approach into the diagnosis and follow-up of sequelae.

Prof Vogin brings expertise in particle radiotherapy, sarcoma, pediatrics, and central-nervous system malignancies, and specializes in unusual radiation toxicity or suspected radiosensitivity. He is also working with the LIH's Bioinformatics team and Translational Radiomics group, and a formal collaboration with Dr Isabelle Behm-Ansmant from the University of Lorraine was also initiated. The research program is in line with LIH's strategy to implement clinically-oriented research with a direct impact on patient care.

## A leading role to reduce Luxembourg's cancer burden

In April 2022, Dr Claudine Backes was appointed as the new Scientific Director of the National Cancer Registry (RNC) in Luxembourg. As an epidemiologist with extensive experience in cancer epidemiology and prevention, Dr Backes is using her expertise to improve the prevention and care of cancer patients in Luxembourg.

The RNC is a population-based cancer registry that collects national data on all new cancer cases diagnosed and/or treated in Luxembourg for both residents and non-residents. It also provides an unbiased picture of the population cancer burden and plays a unique role in planning and evaluating national actions against cancer. Its data also contribute to epidemiological and clinical cancer research. With its team of experts, the RNC aims to provide a complete overview and monitoring of cancer cases in Luxembourg and evaluate the effectiveness of the current cancer care offered to patients.

Dr Backes is focusing her work on cancer prevention, care, treatment management, and quality of life, benefiting cancer patients across Luxembourg and contributing to the National Cancer Plan and associated research projects.



*Dr Claudine Backes*



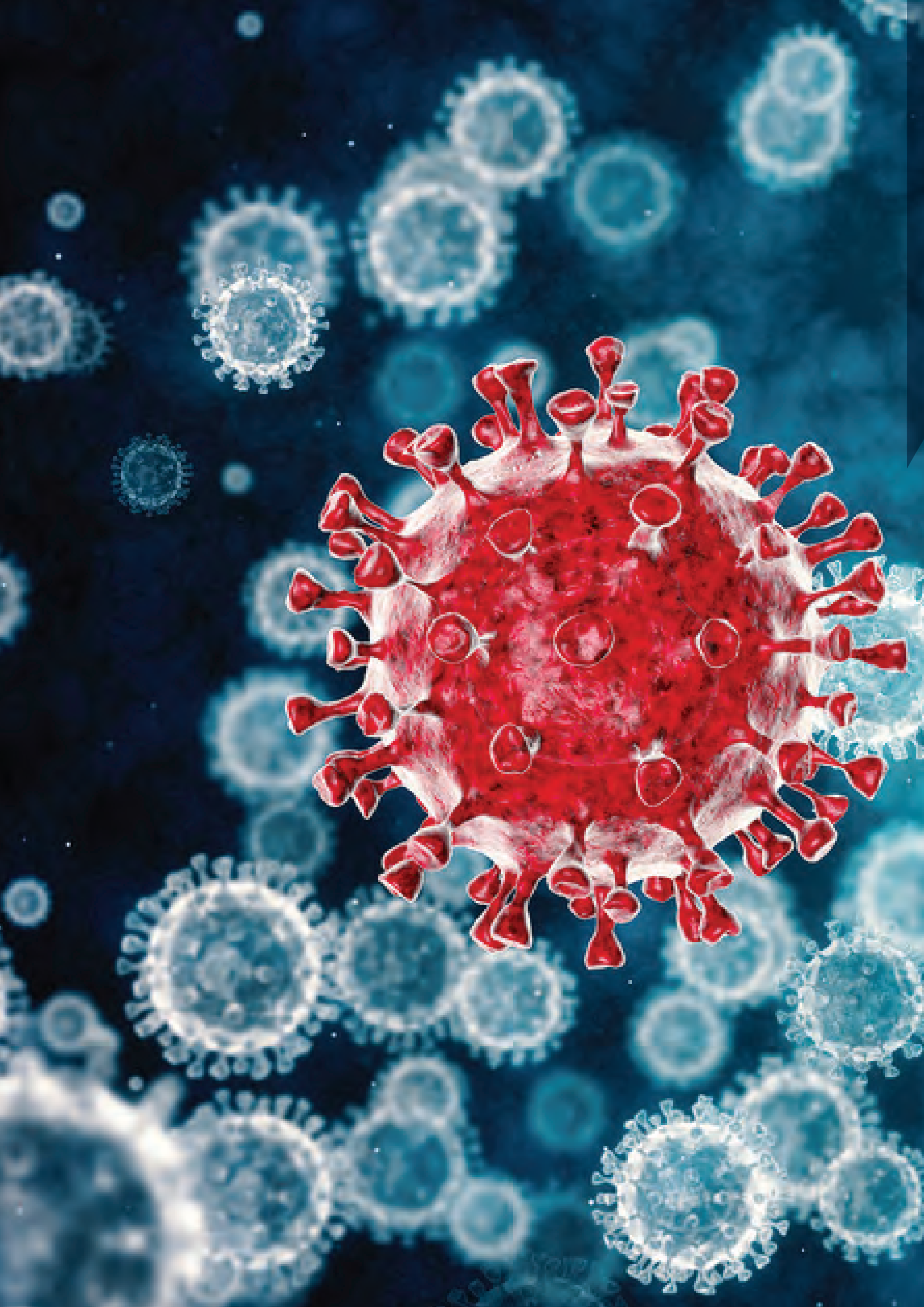
*Dr Sophie Pilleron*

## Department of Precision Health expands its cancer expertise

In July 2022, Dr Sophie Pilleron, an established researcher in cancer epidemiology at the University of Oxford, was awarded a €2M ATTRACT fellowship for her REDICO (REducing DISparities in Cancer Outcomes) project. The initiative is a 5-year participatory research programme that includes epidemiologists, clinicians, qualitative researchers, statisticians and data scientists, and it will use both quantitative and qualitative methods.

The project, which started in the beginning of 2023, has four key objectives, targeting different stages in the progression of cancer in older adults. It seeks to understand why older adults are diagnosed at a later stage in the disease than younger adults, improve the treatment decision-making process, establish more evidence-based treatment strategies for older patients with cancer, and develop a digital decision aid tool using artificial intelligence, enabling oncologists to identify older patients that would most benefit from treatment. Dr Pilleron is currently setting up her own research group at the LIH within the Department of Precision Health.







Continuing research  
efforts on COVID-19

## The Luxembourg Institute of Health and Advanced Biological Laboratories develop joint diagnostic solutions

In January 2022, the LIH and Advanced Biological Laboratories (ABL) signed a collaboration agreement to develop two in vitro diagnostic solutions to measure neutralising antibody levels and predict immune protection against COVID-19.

The LIH established a reference viral neutralisation assay that measured the activity of neutralising antibodies against different SARS-CoV-2 variants of concern, and developed a more accessible surrogate variant neutralisation test. The collaboration with ABL aimed to establish a service-based product with the reference variant neutralisation assay and to manufacture the neutralisation test for in vitro testing against different SARS-CoV-2 variants. The goal was to provide standardized and sensitive tests to assess SARS-CoV-2 immunity and to guide vaccination strategies at the personal level.

*“Such a partnership with ABL was extremely valuable for us. As part of our new strategy, we aimed to have an impact that positively affects the lives of the patients and this partnership put us in a position where we could effectively do that,”* said Ulf Nehrbass, CEO of the LIH.



## Shedding light on COVID-19: Research Luxembourg presents CoVaLux

In February 2022, Research Luxembourg unveiled the CoVaLux research programme, a comprehensive study aimed at addressing key unanswered questions related to COVID-19, specifically focused on vaccination and the long-term health impacts of the virus. The programme benefits from the close collaboration within Research Luxembourg, public research institutions and clinical partners, and relies on the expertise of national academic and healthcare players for the collection and analysis of various health and socio-economic data.

CoVaLux assesses the impacts of vaccination, vaccine efficacy, post-vaccination and breakthrough infections, as well as investigates immune responses, the emergence of new variants and clinical symptoms in cases of re-infection. The study has also revealed several aspects of Long COVID, such as the characteristics and prevalence of symptoms, the existence of risk factors, potential links to pre-existing comorbidities, and socio-economic and environmental determinants.

The programme has built on previous studies and relied on complementary data retrieved from different sources, including medico-administrative data, health and socio-economic information, and biological samples.

## The why behind mild COVID-19: Findings from all-Luxembourg study help to anticipate a personal COVID-19 health trajectory

In March 2022, researchers from the Department of Infection and Immunity identified early-stage immune responses that can differentiate mild COVID-19 patients, hospitalized COVID-19 patients, and non-infected household controls. The team used state-of-the-art deep immune profiling and systems driven data analysis, and found that a unique combination of immune responses in mild patients, including coordinated immune responses within three days following a positive PCR test, was responsible for the mild symptoms. Furthermore, the researchers found that hospitalized patients experienced an impaired frequency of innate immune cells and the expression of key functional molecules.

The study's results were published in the biomedical journal *Cell Reports Medicine* and based on the longitudinal Predi-COVID cohort, which collected data from COVID-19-positive adults in Luxembourg and followed the evolution of their symptoms.

*“Our work provides a rich data and clinical sample resource based on the unique opportunity to fully explore and understand all essential facets of the early-stage and dynamic immunological changes following recent SARS-CoV-2 infection in mild COVID-19 patients, using an unbiased, combinatorial and prospective approach,”* said Dr Markus Ollert, Director of the Department of Infection and Immunity.

## Multiple types of long COVID identified for the first time

A consortium of Luxembourg research institutions, including the Deep Digital Phenotyping unit of the DoPH, found that COVID-19 patients with more severe initial infections were more than twice as likely to experience persistent symptoms 12 months after the initial acute infection, with a significant increase in frequency and severity.

The study, published in August 2022, found that almost 60% of the 289 adult participants from the Predi-COVID cohort reported at least one symptom, with an average of six symptoms, ranging from the more commonly known fatigue and shortness of breath to less well-known symptoms like memory loss and gastrointestinal problems. A significant outcome of the study was the fact that the researchers uncovered patterns in participants' symptoms, which suggests that Long COVID is likely made up of multiple sub-categories rather than a single disease. The study also highlighted a significant impact on sleep quality due to Long COVID.

These findings can help predict outcomes, uncover more about the disease, and lead to better therapies for Long COVID. The study was coordinated by Research Luxembourg and published in *Open Forum Infectious Diseases*.





## Stay active, stop COVID-19

In April 2022, a consortium of Luxembourg research institutions led by the LIH Physical Activity, Sport and Health (PASH) research group led by Dr Laurent Malisoux published a study that found that individuals who were more physically active before contracting COVID-19 were less likely to experience severe illness and symptoms such as fatigue, dry cough, and chest pain.

The study was part of the "Predi-COVID" project, which aims to identify patient profiles that are associated with a more severe prognosis for COVID-19. The study analysed the physical activity of 452 volunteers between the ages of 31 and 51, using a questionnaire to rank each individual's physical activity on a weekly basis, which was then compared with their symptoms and disease severity.

The findings suggested that regular physical activity might be a modifiable risk factor for COVID-19 severity, including moderate illness. The success of Predi-COVID also led to the creation of CoVaLux, which focuses on vaccine efficacy and the long-term health implications of COVID-19.



## The sound of COVID-19

The Predi-COVID Cohort study, led by Dr Guy Fagherazzi of the Dept. of Precision Health, showed for the first time that vocal recordings of COVID-19 affected people could be used as a biomarker to monitor related symptoms of the disease. This technology could be a novel and non-invasive way for healthcare practitioners to remotely monitor patients and provide immediate help for those at risk.

The study, published in October 2022, obtained vocal data via Predi-COVID, a study of people who tested positive for COVID-19, where participants regularly recorded themselves with their smartphones while reading a set text and filling out a questionnaire about their symptoms and general health status. The researchers used this data to derive a vocal biomarker that accurately monitors symptomatic and asymptomatic individuals with COVID-19. This new technology could revolutionize how patients are monitored and treated, while relieving some burden from healthcare systems.

*“Such a vocal biomarker could be integrated into future telemonitoring solutions, digital devices, or in clinical practice. It offers an easily available, non-invasive tool to collect data that can be used from home,”*  
said Dr Guy Fagherazzi, leader of the study.

## LIH selected as secondary depot for COVID-19 vaccines storage

In September 2022, the LIH was selected by the Ministry of Health to host a secondary depot for freezers containing COVID-19 vaccines in a dedicated area in the Biorepository department at IBBL. For the infrastructure to be operational and fit-for-purpose by October 19th for the official inspection, several actions were implemented in a short timeframe. Namely, the electrical installation of the infrastructure was upgraded with the support of the Laboratoire National de Santé (LNS); a workflow to ensure the receipt of the vaccines and their direct storage in freezers within 20 minutes was implemented, requiring up to 6 staff members working in parallel per delivery; a project-specific operating procedure (PSOP) was developed to ensure the quality of the different activities related to the receipt, inventory, and storage of vaccines and their distribution to the Comptoir Pharmaceutique Luxembourgeois (CPL); and the first 11 freezers were installed and secured with two independent alarm systems. The first round of vaccines was thus received on October 26th, and 8 additional freezers were installed before a second delivery in November, bringing the total number of stored vaccines to 86,760.









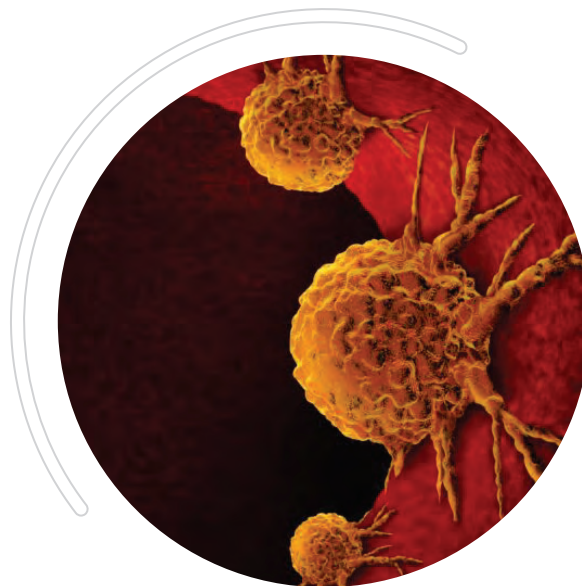
Developments  
in the fight against  
cancer

## LIH paves the way to revolutionise cancer immunotherapy through two EU funded projects

In March 2022, the EU funded two translational research projects (PreCyse and C2I) led by the Tumour Immunotherapy and Microenvironment (TIME) group of Dr Bassam Janji at the LIH in partnership with Cytovation in Norway, AC BioScience in Switzerland, and the Gustave Roussy Cancer Center in France. The aim of these projects is to assess innovative combination immunotherapies for the benefit of cancer patients.

While immunotherapy has emerged as a ground-breaking new therapy for many aggressive cancers resistant to conventional therapies, its long-term benefit has only been observed in a minority of patients thus far.

Based on scientific evidence and fuelled by the synergistic cooperation between the TIME group, Cytovation, AC Bioscience, and Gustave Roussy, the objective of PreCyse and C2I projects is to assess innovative immunotherapeutic approaches by prioritizing smart and promising combinations. The projects will pave the way towards designing a new wave of more effective and less toxic immunotherapies that could create tremendous enthusiasm in anticancer care.



## LIH led collaboration targets cancer cell metabolism to help prevent secondary tumours

A team of international cancer researchers led by Dr Johannes Meiser and his team in the Cancer Metabolism Group discovered that targeting specific metabolic pathways in cancer cells could prevent them from spreading to other parts of the body.

Metastasis is one of the most dangerous features of cancer, as cells that survive conventional therapies and migrate to other regions can form secondary tumours, which account for the majority of cancer deaths. Currently, the most commonly used drugs to treat cancer are those that target the cells ability to replicate, ideally slowing, preventing or reversing tumour growth. The researchers focused on a metabolic pathway known as one-carbon (1C) metabolism, which is spread across two main local compartments of the cell. They discovered that a specific part of 1C metabolism confers an advantage to cancer cells by supporting their motility potential. The team showed that targeting this part of the pathway inhibits tumour metastasis in a breast cancer model.

The results of the study, published in May 2022, could provide a major advantage in the fight against a wide range of cancers.

## Master hijackers: uncovering how leukaemia disarms the body's defences

Researchers in the Tumour Stroma Interactions group led by Dr Etienne Moussay and Dr Jerome Paggetti found that small extracellular vesicles (sEVs) released by tumours and their surrounding cells in mice with chronic lymphocytic leukaemia block the immune system, preventing it from destroying cancer cells.

The team discovered that the leukemic sEVs alter the body's T-cells, making them 'exhausted' and unable to trigger an immune response, thereby enabling the cancer to spread. This study is a crucial step towards understanding how cancer disarms the immune system and could provide a new avenue for the treatment of leukaemia and other cancers. Moreover, the team found that high expression of genes related to sEV biogenesis correlated with a more aggressive form of the disease and poorer prognosis and survival rates in a large cohort of patients.

These findings could lead to screening of leukaemia patients for sEV-related genes in order to understand their prognosis and determine appropriate treatment. The study was published in September 2022 in *Blood Cancer Discovery*, a journal of the American Association for Cancer Research, and selected for the January 2023 issue cover.

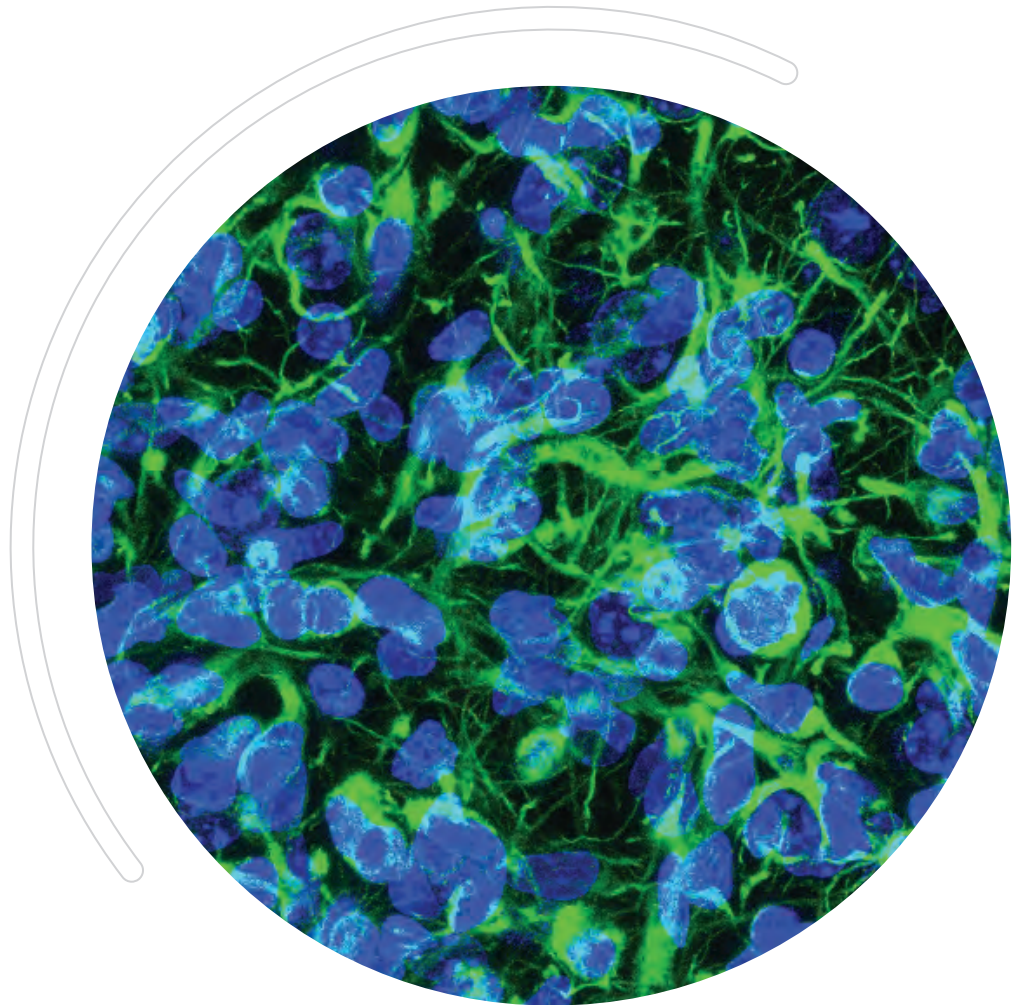
## Allergies, an ally against cancer?

A study conducted by the Neuro-Immunology group, the Allergy and Clinical Immunology group, and the NORLUX Neuro-Oncology Laboratory found that an allergic immune response in mice implanted with brain tumour cells can prevent their growth and progression, confirming epidemiological links found in patients.

The study, published in October 2022, shows how allergic inflammation can reprogram the brain's immune cells to better defend against tumours. Glioblastoma (GBM) is a highly aggressive type of cancer that occurs in the brain and is currently incurable. Despite the range of available cancer treatments, GBMs are able to evade the immune system. However, the study found that allergies cause the brain's immune cells to reprogram themselves into a more aggressive inflammatory state, combating the implanted GBM cells and preventing their growth. The study's findings will pave the way towards the advancement of new therapies targeting microglia and their ability to mobilize the immune system against GBM.







## Work by the NORLUX Neuro-Oncology lab contributes to two publications in Cell


The NORLUX Neuro-Oncology laboratory at the LIH has been collecting brain tumour samples and developing patient avatars for almost two decades, leading to a high level of scientific excellence and translational potential. Through its international collaborations, the lab's efforts have contributed to two publications in the prestigious scientific journal Cell in June and August 2022.

The first study, conducted in collaboration with the University of Heidelberg, explored the close relationship between cellular heterogeneity and glioblastoma dissemination in the brain, highlighting the interactions between glioblastoma cells and the neuronal network. The LIH team provided essential single cell transcriptomic analysis of patient-derived models to support the study findings.

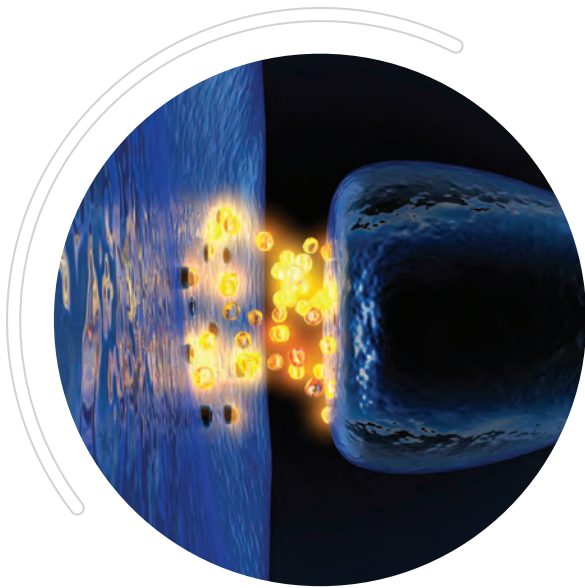
In the second study, members of the GLASS consortium, including LIH team members, identified phenotypic changes in the glioma ecosystem upon treatment and disease recurrence, highlighting distinct interactions in the surrounding microenvironment. This work was made possible by the NORLUX Neuro-Oncology laboratory providing patient tumour samples from the Luxembourg brain tumour biobank for molecular characterization.

The publications in Cell reflect the quality of these international collaborations and the importance of the NORLUX Neuro-Oncology laboratory's efforts in brain tumour research.





Unravelling the  
connections between  
the immune system  
and Parkinson's  
disease



## Forever Young: a new genetic brake for an ageing immune system

A study led by Dr Feng He of the Immune Systems Biology Group identified a surprising age-defying effect on the immune system resulting from a deficiency that usually causes Parkinson's disease.

Immunoageing refers to the fact that the immune system declines with age, making people more susceptible to many illnesses. The researchers examined a protein, DJ-1, which is deficient in early onset familial Parkinson's disease, and found that it may also play a critical role in regulating immunoageing. They discovered a reduced immunoageing process in T-cell compartments of mice with a targeted emphasis on the specific action of DJ-1, compared to normal mice of the same age. The findings revealed an unexpected link between DJ-1 deficiency and reduced immunoageing, suggesting that reducing DJ-1 from a young age could help keep the immune system young.

Further research is necessary to understand the detailed molecular mechanisms by which DJ-1 regulates immunoageing, but the findings, published in *EMBO Reports* in January 2022, offer a potent strategy to interfere with or model immunoageing for various complex and infectious diseases.

## Novel treatment aims to slow the progression of Parkinson's disease

In May 2022, the LIH and the Centre Hospitalier de Luxembourg (CHL) launched PADOVA, a clinical trial sponsored by Roche that evaluates the efficacy and safety of prasinezumab in early-stage Parkinson's disease (PD) patients.

Prasinezumab is a monoclonal antibody that targets misfolded alpha-synuclein, a protein associated with the nerve cell damage that leads to PD. The study, conducted across nine countries, recruited 575 patients between the ages of 50 and 85 with a confirmed PD diagnosis between 6 months and 3 years. Participants receive either prasinezumab or a placebo intravenously once a month for about two years, in addition to their regular medication. The study is being conducted at the CHL with the support of the LIH's Transversal Translational Medicine team and the Clinical and Epidemiological Investigation Centre.

*“From a scientific perspective, prasinezumab holds the promise of targeting the root cause of neurodegeneration in PD. This would not only give patients another treatment option – it could change their lives,”*

said Prof Rejko Krüger, Director of the Transversal Translational Medicine Unit.

## A surprising connection between immune balance, ageing and a Parkinson's disease gene

A team of researchers led by Dr Feng He at the Department of Infection and Immunity investigated the links between the loss of function of a protein called DJ-1 and the regulation of metabolic enzymes in immune cells.

While it was already known that DJ-1 mutations lead to early onset Parkinson's, there were no clear links between DJ-1 deficiency and related metabolic functions in immune cells. The study, published in Nature Metabolism in May 2022, found that DJ-1 acts as a pacemaker that regulates the functionality of a key metabolic enzyme in specialised regulatory immune cells called Treg cells. The researchers used mouse models to investigate the effect of removing DJ-1 on the enzyme fundamental to mitochondria and their energetic functionality. Without DJ-1, a lower count of Treg cells only appeared in older but not younger mice, leading to physiological dysregulation.

The study's findings may provide a new target for therapies looking to restore balance in a dysregulated immune system in many non-communicable ageing-related diseases.



## A new survey to detect risk factors for Parkinson's disease

In September 2022, the National Centre of Excellence in Research on Parkinson's Disease (NCER-PD) in Luxembourg launched an online survey in collaboration with Parkinson's research centres in Germany, Austria, and Spain, aiming to identify methods to predict the risk of developing neurodegenerative diseases.

The study is supported by the Michael J. Fox Foundation (MJFF) and is the first step toward Luxembourg joining the global MJFF initiative. The "Healthy Ageing" survey collects data on demographics, occupation, lifestyle, and medical history to calculate risk scores for Parkinson's disease. The researchers will use the data to create a European hub for the risk screening of Parkinson's. The project leverages the NCER-PD team's expertise and collaborations with several countries, enabling the development of novel prevention strategies that are urgently needed.

*“We are very excited to join this prestigious network and we can be very proud of the efforts of the NCER-PD team over the past 8 years. They put Luxembourg on the international stage among the key players in Parkinson's research,”* said Prof Rejko Krüger, NCER-PD coordinator.





January

February

March

April

May

June



# Digitalising Health

e July August September October November December



Group photo Foundation for Juvenil Diabetes of Chile

## Colive Voice secures numerous partnerships

Colive Voice, a digital health study led by the LIH Deep Digital Phenotyping group at DoPH, has collaborated with several organizations around the world in order to identify vocal biomarkers for cancer, diabetes, and other chronic diseases.

The LIH is working with the Hôpitaux Robert Schuman and its clinical research unit to advance the diagnosis, risk prediction and remote monitoring of chronic diseases through the study. The French association Les Seintinelles and the Quebec Cancer Foundation in Canada are supporting the study to identify vocal biomarkers for various cancer types. The Luxembourg foundation Think Pink, an organization aiding women affected by cancer, has also graciously supported Colive Voice financially.

Additionally, the LIH has collaborated with the Diabète Lab and Type 1 Running Team association in France, along with the Juvenile Diabetes Foundation of Chile, to recruit participants with diabetes and identify vocal biomarkers for the disease. These vocal biomarkers could lead to the development of voice technologies for telemedicine, remote monitoring of patients between clinical visits, and evaluation of the efficacy of drugs in clinical trials. By improving the identification and management of chronic diseases, such as diabetes and cancer, Colive Voice hopes to improve the quality of life of millions of patients worldwide.

## Driving the future of health technology

Luxembourg's Ministry of the Economy, the Luxembourg National Research Fund (FNR), and Luxinnovation jointly launched a call for proposals in April 2021 to stimulate collaborative R&D projects in health technologies using digital tools and data analysis. One year later, four projects led by the LIH were selected for funding. These aim to develop innovative devices or digital health solutions that address autism, chronic respiratory diseases, Long-COVID, and orthopaedic conditions.

The projects are:

- > **QTrobot**, a therapeutic device for in-home therapy of children with autism, under Dr Manon Gantenbein of the Clinical & Epidemiological Investigation Centre.
- > **Care4Asthma**, a non-invasive and personalised solution for asthma diagnosis and care, under Dr Christiane Hilger of the Molecular and Translational Allergology Group.
- > **GAITORING**, a digital health solution that monitors gait patterns and physical activity in patients with orthopaedic conditions, under Dr Laurent Malisoux of the Physical Activity, Sport & Health Group.
- > **DigiCog**, a novel digital device that quickly evaluates cognitive function using eye movements and explores the long-term impacts of COVID-19 on cognition, under Dr Magali Perquin of the Neuroimaging Group.

They are funded by a total budget of 6.10 million €, with co-financing from the Ministry of the Economy and the FNR covering 75% of the total amount.

## Digital patient monitoring takes first steps

The LIH and the Centre Hospitalier de Luxembourg have partnered with Luxembourg technology firm IEE to launch the GAITORING project, which aims to develop wearable digital technology that allows care providers to remotely monitor their patients when performing regular daily activities. The technology will help healthcare professionals improve patient care and avoid the long-term consequences of orthopaedic conditions such as arthritis.

The project involves the development and validation of a remote monitoring system called WalkinSense, which includes pressure-sensitive insoles developed by IEE, linked with inertial measurement units that detect patient motion, and analysis software to interpret the data. The gait and load data is transmitted to a smart device via Bluetooth and uploaded to the cloud.

The project aims to refine the technology with feedback from patients and clinicians to create a practical system with maximum real-world impact. The study began in June 2022 and will last until November 2024.







A person with blonde hair in a bun, wearing a white lab coat, is seen from behind, working at a desk. The desk has a laptop and two large monitors displaying data. The scene is overlaid with a large, semi-transparent blue circle. The text 'Understanding immunity and allergies' is written in white on the left side of the blue circle.

# Understanding immunity and allergies



## To B or not to B: Insights into the regulation of anti-viral immunity

B cells play a vital role in our immune response by producing antibodies against viruses and bacteria. Marginal zone B cells (MZB) and follicular B cells (FoB) are two different types of B cells, with MZB cells responding to blood-borne pathogens as the first line of defence, and FoB cells producing antibodies against protein antigens.

A new study conducted by the Experimental & Molecular Immunology lab led by Prof Dirk Brenner, and published in the renowned journal *Nature Communications*, sought to understand the metabolic differences between these two types of B cells. Researchers altered the production of glutathione, an antioxidant, in each cell type, and observed the resulting changes. The study found that inhibiting glutathione production in MZB cells had a significant impact on cell development and maintenance, while FoB cells adapted by reprogramming their metabolic pathways. However, this adaptation led to an accumulation of defective mitochondria in FoB cells, making them less effective at producing antibodies against viruses. The study's findings provides insight into the unique metabolic regulation of different types of B cells and offers the potential for targeted treatments for infectious diseases.

## Mesaconic acid: Effective against an overactive immune system

Scientists from the Braunschweig Integrated Centre of Systems Biology led by Prof Karsten Hiller, in collaboration with Prof Dirk Brenner's team at the LIH, have discovered a potential new drug candidate. The research was funded by a binational grant from the FNR.

The team found that mesaconic acid, a naturally occurring substance in the body, has anti-inflammatory effects similar to itaconic acid, which fights bacteria and inflammation. Mesaconic acid is derived from itaconic acid, which was discovered by the same research team in 2013. However, unlike itaconic acid, mesaconic acid does not block the enzyme succinate dehydrogenase, which is a central player in cell metabolism and cellular respiration. The researchers found that mesaconic acid could help restore an overactive immune system to its normal state. This property makes it a promising drug candidate for treating septic shock and autoimmune diseases such as psoriasis and inflammatory bowel disease.

The results were published in the leading journal *Nature Metabolism* and further research is currently underway to explore the metabolic processes underlying this exciting development.







## Getting to the guts of autoimmune diseases

Researchers led by Prof Mahesh Desai of the Dept. of Infection and Immunity and Prof Hiroshi Ohno of the RIKEN Centre for Integrative Medical Sciences in Japan analysed the potential causal relationships between extra-intestinal autoimmune diseases (ADs), such as multiple sclerosis, and the gut microbiome.

Their study, published in *Nature Reviews Immunology* in May 2022, indicates that therapies targeting gut flora may be the key to treating ADs. By identifying a range of potential links between the microbiome and immune diseases, the researchers were able to devise interventions that could directly benefit patients, from faecal transplants to the use of tapeworms, with the aim of modulating the body's immune response by manipulating the gut microbiome.

The researchers used next-generation sequencing techniques to identify changes in the gut microbiome of patients with extra-intestinal ADs, as compared to healthy individuals, in order to find out how changes in the microbiome's composition could relate to the alarming rise in ADs. They found potentially important links between certain microbial populations within the gut, and the levels and locations of key immune cells in the body linked to inflammation.

## LIH-made compound leads to discovery on how drug targets work

A study led by the University of Wisconsin in collaboration with the LIH used LIH383, a proprietary molecule developed by the LIH, to target G protein-coupled receptors (GPCRs) and gain insights into their regulation.

GPCRs, found on the surface of cells, are targets for over a third of marketed drugs and are responsible for regulating functions such as sight, taste, smell, blood pressure, heart rate, digestion, and the immune system. The study found how some GPCRs selectively recruit  $\beta$ -arrestins, proteins that can block or regulate their activity, to control signalling pathways independently.

Using nuclear magnetic resonance and the LIH's NanoLux platform, the researchers found how ACKR3, a GPCR that exclusively binds to  $\beta$ -arrestins, can adopt a conformation to selectively bind them and regulate functional cellular responses. The findings not only provide a more detailed understanding of GPCR function but also how they can be regulated by small compounds.

LIH383 itself was originally developed for pain relief and can bind specifically to ACKR3, potentially leading to the development of new drugs for pain and depression.



## LIH scientists bring pioneering insights on poorly understood meat allergy

A team of researchers led by Dr Christiane Hilger, group leader of the Molecular and Translational Allergology Group, discovered that  $\alpha$ -Gal syndrome, a potentially life-threatening allergic reaction to red meat, can be triggered by the  $\alpha$ -Gal sugar molecule irrespective of its carrier molecule. They found that the abundance of the sugar and the stability of its carrier were the key factors.

The syndrome is thought to stem from tick bites that transmit  $\alpha$ -Gal, leading to the development of an allergy towards red meat. The team identified that meat proteins carrying  $\alpha$ -Gal are a more potent trigger of an allergic reaction than meat lipids. The gastric and intestinal digestion of meat proteins were simulated, indicating that  $\alpha$ -Gal carrying proteins survive gastric digestion and remain stable long enough to cause delayed reactions upon absorption in the intestine.

These findings bring a new dimension to the understanding of carbohydrate allergenicity, which is currently not well understood. The discovery may help develop appropriate diagnostic tests and treatment for  $\alpha$ -Gal syndrome. The study was published in the *Journal of Allergy and Clinical Immunology* in April 2022 and was funded by the FNR and Deutsche Forschungsgemeinschaft.



## Peanut allergies: Mapping real-time allergic responses

In a study led by Dr Annette Kuehn and Prof Markus Ollert, in collaboration with Dr Morel-Codreanu of the National Allergology-Immunology Unit at the Centre Hospitalier de Luxembourg, researchers investigated for the first time the real-time immune response of children with peanut allergies.

The aim of the study was to identify biological markers in children that could help clinicians to assess how and under which circumstances a child might react, with future implications for better treatments and prevention strategies. The researchers found that it was possible to discriminate between those with or without an allergic response based on the immune signatures in their blood. The team also identified groups of children that tolerated higher or lower doses of peanuts before developing an allergic response, based on variations in the number of their white blood cells and other key immune cells. The results could serve as a powerful diagnostic approach for clinicians, reducing the need for laborious and costly medical approaches, which may be hazardous to health.

Recently, food allergies have developed into an important public health issue. Thus, many patients will benefit from innovative strategies, such the one developed in this study.





Awards and  
nominations  
recognising LH  
research  
excellence



## The FNR Awards Prof Rejko Krüger

At the 14th edition of the Luxembourg National Research Fund (FNR) Awards in October 2022, Prof Rejko Krüger, Director of the Transversal Translational Medicine (TTM) unit at the LIH, and Dr Ibrahim Boussaad of the Luxembourg Centre for Systems Biomedicine, were presented the award for “Outstanding Scientific Achievement” for their proof-of-concept demonstration of precision medicine in the field of neurodegenerative disease.

Precision medicine is already somewhat established in diseases like cancer, but not so much when it comes to neurodegenerative diseases. The awarded project from the TTM focused on patients suffering from a rare familial form of Parkinson’s disease with a specific genetic defect. Prof Krüger and his team were able to identify a new potential target therapy for them and, for the first time, they managed to develop one that treats the cause of the disease instead of just the symptoms.



From left to right: Prof Rejko Krüger and Dr Ibrahim Boussaad



From left to right: Prof Gerard Scacchi, member, Dr Brice Appenzeller and Prof Jean-Dominique de Kerwin, President of ALS

## LIH scientist appointed member of the Académie Lorraine des Sciences

In March 2022, Dr Brice Appenzeller, Group Leader of the Human Biomonitoring Research Unit at the LIH Department of Precision Health and Associate Professor at the University of Luxembourg, was appointed a member of the Académie Lorraine des Sciences.

Founded in 1828 in Strasbourg, the Académie Lorraine des Sciences is a scientific academy that is composed of a maximum of 50 members, usually academics or researchers, which are sub-divided into scientific disciplines according to their expertise.

*“The scientific world has a reputation for being inaccessible and hard to understand, but it doesn’t have to be this way. I hope that this new appointment will give me more tools to show the world the extraordinary things that can only be revealed with scientific disciplines, to make science accessible to the many instead of the few. Only then will the public experience the excitement of a new discovery,”* commented Dr Appenzeller.

## LIH scientist recognised as one of the world's most highly cited researchers

For the fourth year in a row, Dr Torsten Bohn, group leader of the NutriHealth group in the Department of Precision Health, was featured in Clarivate's "Highly Cited Researchers" ranking. He is one of only five Luxembourg scientists to be recognised in the 2022 ranking.

Dr Bohn's research focuses on nutrition, with special attention to (micro-) nutrient and secondary plant bioactive metabolism, dietary patterns, inflammation and oxidative stress.



*Dr Torsten Bohn*



*Members of the WHO Collaborating Centre with Dr Judith Hübschen and Prof Markus Ollert*

## World Health Organisation nominates Luxembourg lab as an official Collaborating Centre

The World Health Organization (WHO) has designated the LIH's Department of Infection and Immunity directed by Prof Markus Ollert as a Collaborating Centre for Reference and Research on Measles and Rubella Infections.

The Centre, headed by Dr Judith Hübschen of the Clinical and Applied Virology group, is the only WHO Collaborating Centre in the world that specialises in measles and rubella. The collaboration includes monitoring genetic changes in measles virus strains to track transmission chains, developing and optimising laboratory techniques, and building capacity in measles and rubella diagnosis and surveillance. The laboratory is also the national reference laboratory for measles and rubella in Luxembourg and one of three WHO European regional reference laboratories covering another 22 countries. Its responsibilities include quality control and assessment, support and training of WHO laboratory network staff, measles and rubella virus characterisation, outbreak confirmations and investigations, and research studies.

While Luxembourg has eliminated measles and rubella, the WHO collaborates with labs worldwide to monitor cases, mutations, and vaccinations to prevent outbreaks or re-establishment of these diseases.



*Dr Guy Fagherazzi*



*Dr Claudine Backes*

## LIH scientists in the National Health Observatory

Dr Guy Fagherazzi, Director of the LIH Department of Precision Health (DoPH), has been appointed as a full member of the Luxembourg National Health Observatory (Obsanté) as an expert in patient-reported outcome measures.

Three LIH scientists have also been appointed as alternate members. They are Dr Claudine Backes, an expert in registry management, Dr Maria Ruiz-Castell, an expert in population health studies, and Dr Michel Vaillant, an expert in health statistics. The DoPH is well represented in the Obsanté thanks to its complementary expertise in public health, epidemiology, and patient-reported outcomes.

The Obsanté was created in February 2021 to help guide health decisions and policies and assess their impact by analysing data (health status, health determinants, non-monetary resources and use of the health system and of care). In other words, it generates information with the available health-related data and puts this information into perspective to identify areas for improvement. The LIH is looking forward to working closely with the Obsanté to define an evidence-based national strategy to improve the health of the Luxembourg population.



*Dr Maria Ruiz-Castell*



*Dr Michel Vaillant*





# Additional 2022 highlights

More news,  
events, awards  
and nominations



## Plooschter projet continues to support the LIH

Luxembourgish non-profit association Plooschter Projet made a generous donation of €25,000 to the Tumour Stroma Interactions Group at the Department of Cancer Research in support of leukaemia research.



## LIH launches new websites

The LIH launched a new corporate website and Research Portal to provide information to patients, clinicians, researchers, and the public. The website provides information on the LIH's research projects and news, while the Research Portal is directed towards the research community.



## Leading European magazine features LIH microbiome research

Nature Reviews Gastroenterology and Hepatology journal by Prof Mahesh Desai, head of the Ecoimmunology and Microbiome research group, attracted attention from Der Spiegel, a leading European magazine. The publication outlined how emerging personalised medicine could embrace diet-assisted microbiome engineering to remodel the microbiome towards a disease-resistant, homeostatic state.

## DII warns about measles

Dr Judith Hübschen from the Department of Infection and Immunity and co-authors published a comprehensive overview on measles in the prestigious Lancet journal, warning of a resurgence because of disrupted vaccination activities due to the COVID-19 pandemic.

## FNR Rewards LIH PhD Student

PhD student H el ene de Franco received the highly sought-after FNR Industrial Fellowship grant, which will give her the opportunity to pursue research on the individualised effect of fibre on gut microbiota in the Eco-immunology and Microbiome Group under Prof Mahesh Desai.



## Think Pink Lux continues to support the LIH

Takouhie Mgrditchian, postdoctoral researcher in the Cytoskeleton and Cancer Progression Group of the Department of Cancer Research, and Dr Cl ement Thomas, Leader of the research group, were awarded the €25,000 'Marian Aldred Award' by Think Pink Lux.



From left to right: Laurent Vanon (TPL Committee, husband of late Marian Aldred), Kathy Liebl, Takouhie Mgrditchian, and Dr Cl ement Thomas

## VIRALERT kick-off

The kick-off meeting of the FNR funded CORE project VIRALERT took place on March 16th. VIRALERT is a joint research project between the LIH and the LIST, which aims to develop environmental based epidemiological methods to detect viral epidemics early.



The interdisciplinary team of the VIRALERT project led by Leslie Ogorzaly (LIST, PI; 5th from the left) and Chantal Snoeck (LIH, co-PI; 5th from the right)

## MSCA postdoctoral fellowship for CVRU

In March, Dr Miron Sopic from the Cardiovascular Research Unit (CVRU) was awarded an MSCA Postdoctoral Fellowship. His research project aims to identify biomarkers for acute coronary syndrome diagnosis and outcome prediction, ultimately leading to novel prevention, diagnostic and treatment strategies.

## LIH runs for life

Team LIH was in action during the entire month of March to collect funds for the Relais pour la Vie. Over €1,800 was raised for the Fondation Cancer and 60 employees joined the Relais pour la Vie and walked, ran or cycled for more than 128 combined hours.



## APRIL



## NORLUX wins journal prize

The George C. Williams Prize, bestowed to the author of the most significant article published in the Evolution, Medicine and Public Health journal, was awarded to NORLUX scientist Luca Ermini for his article on why humans inherit genes that alter their risk of developing cancer.

## MAY

## Doctoral training units get funding

Two LIH doctoral training units were given a new lease on life after being retained for funding in the FNR's 2021 PRIDE Call. The CANBIO 2 and NextImmune 2 programmes will continue to train new doctoral students, generating exciting new findings.

## PhD Student Participates in ENABLE

LIH PhD student Catherine Goetzinger was part of "ENABLE", the European Network to Advance Best practices & technology on medication adherence, a European funded multi-national project that aims to find innovative solutions to help patients adhere to their recommended treatment courses.

## Luxembourg Society for Microbiology Awards the DII

At their annual conference, the Luxembourg Society for Microbiology awarded two Dept. of Infection & Immunity researchers. PhD student Eleftheria Charalambous was awarded Best Oral PhD Presentation and researcher Lisa Hefele received a Conference Achievement Award.





## LIH represents Luxembourg in Canada

LIH CEO Prof Ulf Nehrbass and Strategic Program Manager Dr Jasmin Schulz attended the multi-sectoral official trade mission to Toronto and Montreal from June 19-24 as part of the representatives for the Health and Technology sector in Luxembourg.



## NutriHealth PhD student wins prize

Nutrihealth Group PhD student Mohammed Iddir presented his thesis at the International Conference on Food Bioactives and Health in Parma, Italy and was awarded the Best Oral Presentation Award.



Mohammed Iddir

## NORLUX represented at Dutch conference

Anaïs Oudin, research engineer at the NORLUX Neuro-Oncology Laboratory, presented her team's research on tumour microenvironments at the EuroPDX conference at Egmong aan Zee in the Netherlands.



## 2021 Prestigious FNR CORE grants co-funded by Fondation Cancer

As part of a series of co-funded studies by the Fondation Cancer and the FNR's CORE programme, the LIH has seen four important cancer research projects come to light in 2021. These studies cover a wide range of cancers, investigating their spread and resistance to conventional treatments in order to generate translational results with potential patient benefits. Follow the QR codes to find out more about the different projects underway and how this funding is being used to fight cancer.



View video: HifReg



View video: 1cFlex



View video: Diomedes



View video: SYNOPODIA



## LIH presented at Vienna conference

The Tumour Stroma Interactions Group presented their research with three posters and two presentations at the European Hematology Association annual congress in Vienna, Austria.



From left to right: Elodie Viry, Giulia Pagano, Dr Jérôme Paggetti, Iria Fernandez Botana, Dr Ernesto Gargiulo, Susanne Gonder

## LIH represented at Prague congress

Four LIH scientists were elected to international scientific leadership boards and five researchers presented their research to more than 7000 participants at the Annual Congress of the European Academy of Allergy and Clinical Immunology in Prague, Czech Republic.



Dr Aurélie Poli

## LIH analyses pollutants in children’s hair

A study conducted by the Human Biomonitoring Research Unit investigated chemical pollutants in 256 children and found that out of 153 compounds, each child had a median of 61 compounds in their hair. The study also found that children were exposed to pollutants from different chemical classes, with higher exposure at younger ages and boys more exposed to pesticides than girls. Children who consumed organic diets also had lower concentrations of pollutants.

## Télévie selects LIH “chemical exposome” study for funding

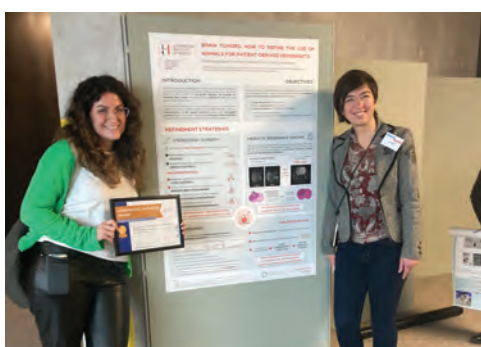
The DoPH obtained funding from the Télévie initiative to fund a doctoral candidate to work on ChemExCan, a project led by Dr Brice Appenzeller of the Biomonitoring Research Unit. The project will set up the first database of pollutant concentration values in hair from samples collected around the world. This will help understand the specificities of the chemical exposome in the local population, identify critical exposure situations, and provide information to reduce exposure, with the ultimate goal of revealing non-genetic causes of cancer and supporting preventive strategies.

## NORLUX presented at Vienna conference

The NORLUX Neuro-Oncology Laboratory team presented their research on tumour microenvironments and glioblastoma at the 2022 European Association for Neuro-Oncology conference in Vienna, Austria.

## LIH launches Precision Health book for students

On the initiative of the Association des Ingénieurs et Scientifiques du Luxembourg, the LIH, in close collaboration with the SCRIPT (Service de Coordination de la Recherche et de l’Innovation pédagogiques et technologiques), launched a book on Precision Health that was distributed to schools throughout the country. It provides a comprehensive overview of healthcare technologies and medical research and how they will evolve in the future.



Pilar Moreno Sanchez & Anais Oudin

## NORLUX shines at national 3R Symposium

The NORLUX Neuro-Oncology Laboratory team participated in the second national 3R Symposium, focused on the principles of reducing, refining, and replacing animal studies in scientific research. PhD Student Pilar Moreno Sanchez also won the poster prize.



## Researchers' Days 2022

The LIH participated in the eighth edition of the Researchers' Days at the Rockhal in Esch/Beval organised by the FNR. The event aims to promote science and research to the public via demonstrations and workshops.



## Successful ISO 9001 recertification audit

The LIH obtained a renewed ISO 9001 certificate, an international standard demonstrating the ability of the institute to meet customer and regulatory requirements. The certificate is valid until 2025, with annual follow-up audits. ISO 9001 certified departments are the Translational Medicine Operations Hub, including the Integrated Biobank of Luxembourg satellite lab at the LCTR – as well as administrative services.

## LIH receives FNR funding

Four LIH projects were awarded over € 2.9 million of funding in the FNR 2022 CORE Call. They concern a variety of topics, from cancer to nutrition to immunity and infection resistance.



## Next-level step monitoring project kicks off

NextStep-EI is developing new activity and fitness trackers, capable of detecting real life conditions when walking or running. These can help patients and athletes optimise their training to prevent injuries, mitigate the effects of osteoarthritis and instability, and aid rehabilitation. The project is coordinated by the LIH Human Motion, Orthopaedics, Sports Medicine and Digital Methods group and the University of Montreal in collaboration with the Centre Hospitalier de Luxembourg and the University of Luxembourg.

## Fondation du Pelican supports LIH PhD students

Four LIH PhD students, Mahsa Rezaei-pour, Pilar Moreno Sanchez, Alexandros Pailas, and Cyrielle Holuka were awarded the Pelican Grant from the Fondation du Pélican de Mie et Pierre Hippert-Faber, under the aegis of the Fondation de Luxembourg.



## LIH to coordinate Horizon Europe project on obesity

The HealthyW8 project aims to prevent obesity in Europe via interventions for people at vulnerable stages in life. The project received € 10 million for 5 years under the European Commission's Horizon Europe programme and regroups 21 partners coordinated by the LIH and, specifically, Dr Torsten Bohn, Leader of the NutriHealth group.



## Special feature: solidarity with Ukrainian researchers

Following the invasion of Ukraine in February 2022, the LIH has welcomed several talented Ukrainian researchers, supported by the dedicated financial commitment of the FNR, thus playing its part in aiding international research during this turbulent period.

Dr Taras Lukashiv, Associate Professor from the Yuriy Fedkovych Chernivtsi National University, is lending his expertise to the FNR CORE project “DIOMEDES”, jointly coordinated by Drs Petr Nazarov and Anna Golebiewska of the DoCR. As part of the project, Dr Lukashiv will contribute to a mathematical model that predicts the response of glioblastoma tumours to treatment. The model will incorporate dynamic changes that occur in the tumour microenvironment upon chemotherapy treatment, shedding light into the mechanisms underlying tumour resistance to drugs, enabling the prediction of patient outcomes and increasing efficacy. His initial 6 month stay, funded by the FNR since July 2022, was subsequently renewed for 6 more. Dr Lukashiv submitted his first results for publication in early December 2022 and they were published in January in the journal *Mathematics*.

In parallel, Iryna Krokmal, a master student from Kyiv Academic University, is currently working as a Laboratory Technician on the FNR CORE project “GLASS-LUX” at the NORLUX Neuro-Oncology Laboratory, coordinated by Dr Anna Golebiewska. GLASS-LUX aims to implement an innovative high-throughput Personalized Functional Profiling system to screen drugs against glioblastoma on patient-derived 3D tumour organoids. The FNR has been funding Iryna’s stay since October 2022.



Similarly, the FNR is funding the stay of Dr Olena Tsurkalenko, a physician-scientist in neurology from the Department of Neurology and Neurosurgery of Dnipro State Medical University, as a Clinical Coordinator in the Digital Medicine (dMED) group led by Prof Jochen Klucken. Dr Tsurkalenko is involved in designing and managing clinical studies and coordinating the team involved in dMED projects related to the implementation of new digital tools for the management of neurodegenerative diseases. Her initial 6 month grant was extended to 12 months. Moreover, through the FNR Inter-mobility grant 2022 – Ukraine Fast Track, a researcher from the National Technical University of Ukraine was funded for a 1-year research stay at the DoPH Cardiovascular Research Unit, led by Dr Yvan Devaux, although the current situation has not yet allowed him to travel to Luxembourg. In addition, in April 2022, the IBBL and the DoPH organised the donation and transport of blood collection kits and tubes for Ukraine, which were delivered to the “Rakiety” cancer foundation in Poland before being transported to Kyiv, Mariupol and Kharkiv.

Finally, at the DII, Nataliia Vdovichenko was hired as a research engineer to work on the identification of the potential link between early-stage pro-/anti-inflammatory markers during primary infection with SARS-CoV-2 and Long COVID symptoms in participants recruited through the FNR-funded Predi-COVID cohort. Her initial 6 month grant started June 1st 2022 and she was subsequently funded for 6 additional months.





The background of the page is a photograph of a calendar, likely a desk calendar, with a grid of dates. The calendar is partially obscured by a large, semi-transparent blue circular overlay that covers the right and bottom portions of the image. The text 'Institutional organisation and figures' is printed in white, sans-serif font within the blue overlay. The calendar itself shows dates from the 17th to the 28th, with some dates having pink or purple decorative elements. A QR code is visible on several dates, and the text '1981' is printed on some of the calendar's tabs.

Institutional  
organisation  
and figures



# GOVERNANCE

The Board of Directors is nominated by the Government and is composed of nine external members of different professional backgrounds. Its mission is to oversee the activities at LIH. It is responsible for the general organisation, for defining internal rules, for budget control, for framework contracts with partner organisations and for approving new strategies. The Board is organised into 3 sub-committees, which meet once a quarter, namely:

- > Sub-committee 1: Finance, remuneration and social benefits
- > Sub-committee 2: Research strategy
- > Sub-committee 3: Governance and risk management

The Executive Committee, composed of the Chief Executive Officer, the Chief Financial and Administrative Officer and the directors of the four research departments, is responsible for the implementation of the strategy approved by the Board of Directors and for day-to-day management of the institution. It guarantees the compliance with ethical principles, conventions and national laws.

The Coordinating Council is a consultative body composed of internal representatives of the researchers, the personal delegation and the research and innovation support personnel. It issues advisory opinions to the Board of Directors regarding research policy, development and innovation and can advise on the content of the pluriennial performance contract to be concluded with the Government.

Each research department has a Scientific Advisory Board. These boards are consultative bodies to the Board of Directors and comprise high-ranking external scientists. Their composition reflects the scientific area in which the departments are active. Their main tasks are to advise on the strategic and scientific orientations of the departments and to provide a scientific evaluation of the research units.



**BOARD OF DIRECTORS**



TRANSLATIONAL  
MEDICINE  
OPERATIONS HUB



DEPARTMENT  
OF INFECTION  
& IMMUNITY



DEPARTMENT  
OF CANCER  
RESEARCH



DEPARTMENT  
OF PRECISION  
HEALTH



**CEO LIH & IBBL**  
*Ulf Nehrass*



**RESEARCH  
DEPARTMENTS**



TRANSVERSAL  
TRANSLATIONAL  
MEDICINE



RESEARCH  
SUPPORT  
SERVICES



**CFAO**  
*Marc Grabowski*



ADMINISTRATIVE  
DEPARTMENT &  
CORE SERVICES



## KEY FACTS 2022\*

413

Publications\*\*

15.8

Mio€  
Third-party  
income

205

New agreements  
signed

5,327

Number of participant  
inclusions and follow-ups  
in collaborative research  
projects\*\*\*

268

Ongoing projects

2

Patent  
applications

15

New partnerships  
with a private  
partner

\*figures as at 31<sup>st</sup> December 2022

\*\*including peer-reviewed journal articles, books and book chapters, public health reports and doctoral theses

\*\*\*All types of visits and interactions with participants in research projects, clinical trials and clinical studies



459  
Employees

52  
Nationalities

231  
Scientists

10  
Public health  
reports

18  
PhD  
defences

3.3 million  
Total samples collected  
and aliquots created  
(IBBL)

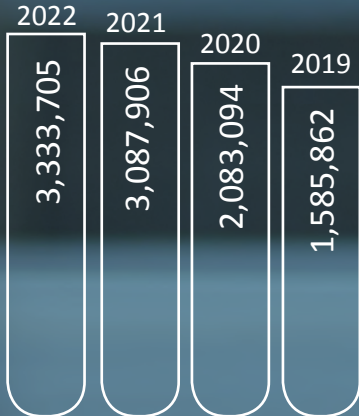
219,061  
Total samples  
distributed  
(IBBL)

896  
Mentions of LIH in  
the press (311 national and  
585 international)

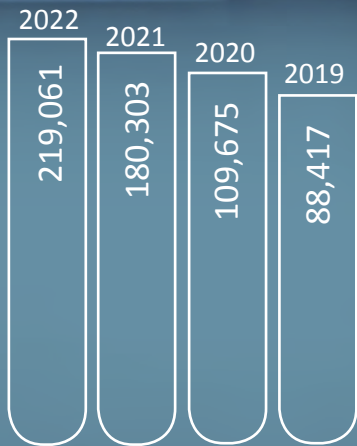


# IBBL collection statistics

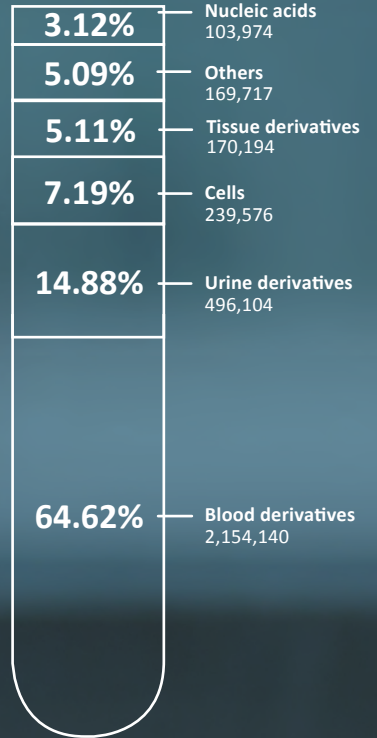
## TOTAL SAMPLES COLLECTED AND ALIQUOTS CREATED



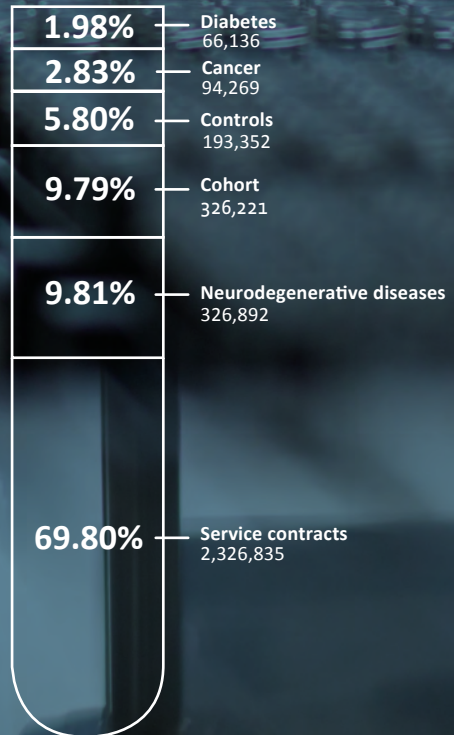
## DISTRIBUTED



## SAMPLES BY TYPE



## SAMPLES BY PROGRAMME

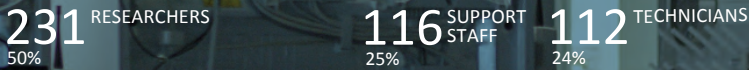




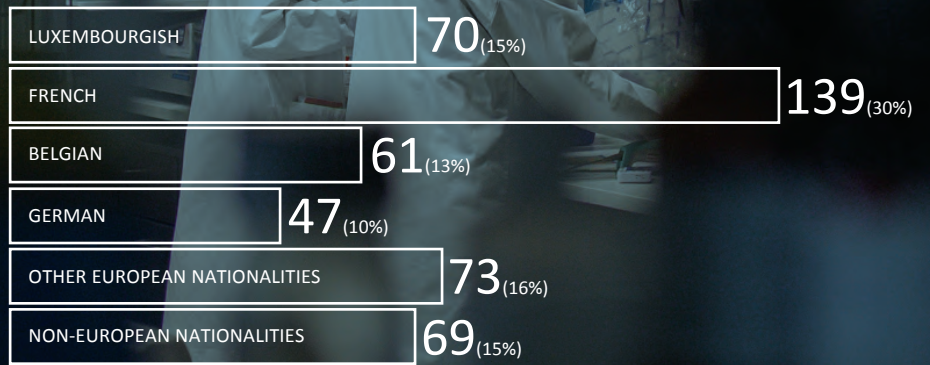
# Human Resources



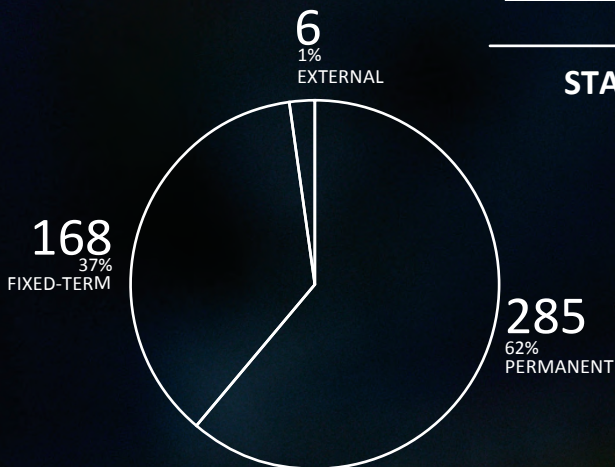
## STAFF PER DEPARTMENT



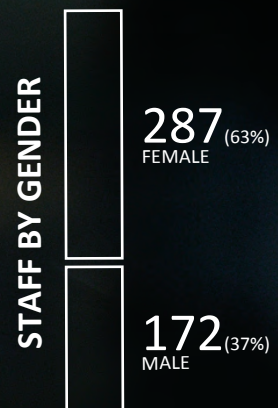
## STAFF BY FUNCTION



## STAFF BY NATIONALITY



## STAFF BY WORK CONTRACT TYPES

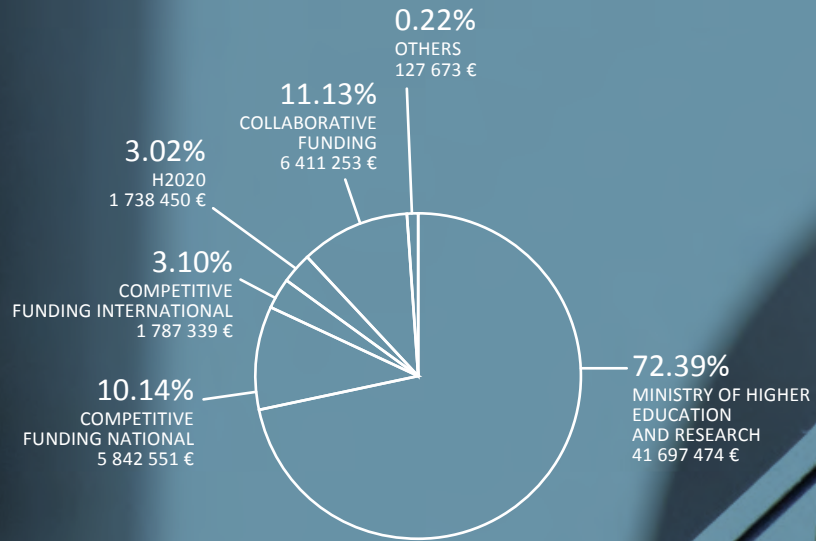


## STAFF BY GENDER



# FINANCES

## STATUTORY EXPENSES



% SOURCES OF FUNDING



% COST CATEGORIES



PROFIT AND LOSS ACCOUNT (EUR)

	2022 01.01 - 31.12.22	2021 01.01 - 31.12.21
1. Net turnover	4,592,637	4,107,400
2. Subsidies	52,691,228	49,258,295
3. Other income	80,718	111,256
4. Use of merchandise, raw materials and consumable materials	-3,343,652	-4,518,696
5. Other expenses	-14,845,556	-12,427,741
6. Staff costs		
a. Salaries and wages	-32,646,498	-29,733,606
b. Social security on salaries and wages	-4,405,454	-3,984,051
7. Value adjustment on intangible, tangible assets and financial assets	-2,295,885	-2,253,000
8. Value adjustment on current assets	0	62,214
9. Other interest receivable and similar income	94,598	2,035
10. Interest payable and similar expenses	-67,692	-80,316
<b>RESULT OF THE YEAR</b>	<b>-145,557</b>	<b>543,790</b>

ASSETS (EUR)	2022 01.01 - 31.12.22	2021 01.01 - 31.12.21
<b>FIXED ASSETS</b>		
Intangible fixed assets	590,399	478,856
Tangible fixed assets	7,606,738	5,297,426
Financial fixed assets	5,580	1,380
<b>TOTAL FIXED ASSETS</b>	<b>8,202,717</b>	<b>5,777,662</b>
<b>CURRENT ASSETS</b>		
<b>Debtors</b>		
<b>1. Trade debtors</b>	<b>4,372,731</b>	<b>2,453,151</b>
a. Becoming due and payable within one year	4,372,731	2,453,151
b. Becoming due and payable after more than one year	0	0
<b>2. Other debtors</b>	<b>771,774</b>	<b>398,327</b>
a. Becoming due and payable within one year	771,774	398,327
Cash at bank and in hand	<b>55,338,852</b>	<b>49,607,800</b>
<b>TOTAL CURRENT ASSETS</b>	<b>60,483,357</b>	<b>52,459,278</b>
<b>Prepayments</b>	<b>1,348,293</b>	<b>1,078,521</b>
<b>TOTAL ASSETS</b>	<b>70,034,367</b>	<b>59,315,461</b>



CAPITAL, RESERVES AND LIABILITIES (EUR)	2022 01.01 - 31.12.22	2021 01.01 - 31.12.21
<b>CAPITAL AND RESERVES</b>		
Financial wealth	4,099,157	4,099,157
Reserves	19,012,971	18,469,181
Profit or loss brought forward	0	0
Profit or loss for the financial year	-145,557	543,790
Capital investment subsidies	6,955,454	5,427,337
<b>TOTAL CAPITAL AND RESERVES</b>	<b>29,922,025</b>	<b>28,539,465</b>
<b>Available reserve for projects</b>	<b>28,794,677</b>	<b>23,894,807</b>
<b>Provisions for risks and charges</b>	<b>1,353,027</b>	<b>1,382,655</b>
<b>CREDITORS</b>		
<b>1. Trade creditors</b>	<b>6,487,422</b>	<b>3,259,245</b>
a. Becoming due and payable within one year	6,487,422	3,259,245
b. Becoming due and payable after more than one year	0	0
<b>2. Tax and social security debts</b>	<b>1,231,660</b>	<b>1,094,743</b>
a. Tax authorities	9,720	9,691
b. Social security authorities	1,221,940	1,085,052
<b>3. Other creditors</b>	<b>2,239,568</b>	<b>1,142,958</b>
a. Becoming due and payable within one year	2,239,568	1,142,958
<b>TOTAL AVAILABLE RESERVE FOR PROJECTS, PROVISIONS AND CREDITORS</b>	<b>40,106,354</b>	<b>30,774,408</b>
<b>Deferred income</b>	<b>5,988</b>	<b>1,588</b>
<b>TOTAL CAPITAL, RESERVES AND LIABILITIES</b>	<b>70,034,367</b>	<b>59,315,461</b>

# PUBLICATIONS

385

Scientific publications

*(including peer-reviewed  
journal articles, books  
and book chapters)*

18

Doctoral theses

10

Public Health  
reports



**130**  
Publications  
in top 10% journals

**68**  
Joint publications  
with other Luxembourg  
research institutes



Scan the QR code to access the full list\* of 2022  
LIH scientific publications!  
([researchportal.lih.lu](https://researchportal.lih.lu))

\*Please note that this list also includes 93 additional external publications of LIH authors published under non-LIH affiliations. Moreover, 2 out of the 18 theses are not currently publically listed.





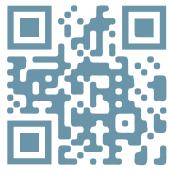


> Redaction, Design & Execution:  
Marketing & Communication LIH  
**communication@lih.lu**

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> This report is available  
for download on **www.lih.lu**

*We would like to thank everyone involved in the development of this Annual Report*



[www.lih.lu](http://www.lih.lu)



LUXEMBOURG  
INSTITUTE  
OF HEALTH