

# FNR ANNUAL REPORT

*The Luxembourg National Research Fund (FNR) is the main funder of research activities in Luxembourg. The FNR invests public funds and private donations into research projects in various branches of science and the humanities, with an emphasis on selected core strategic areas. Furthermore, the FNR supports and coordinates activities to strengthen the link between science and society and to raise awareness for research. It also advises the Luxembourg government on research policy and strategy.*





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# 01 KEEPING HIGH THE STANDARDS OF EXCELLENCE IN RESEARCH

*Seeds of excellence are present, a culture of quality is emerging, impact orientation is gaining momentum and collaboration between institutions is advancing.*

Excellence and long-term socio-economic benefit. These are the two cardinal values that must guide the path of Luxembourg's public research. It is only by applying these two principles rigorously that the Luxembourg National Research Fund (FNR) can achieve its ambitious goal of establishing Luxembourg as a knowledge-based society focused on science, research and innovation, in order to contribute to the economic diversity, social well-being and the future prosperity of our country.

Within only two decades, Luxembourg's public research has already come a very long way. Seeds of excellence are present, a culture of quality is emerging, impact orientation is gaining momentum and collaboration between institutions is advancing. Finishing the high growth start-up phase that commenced at the turn of the millennium, public research has now entered its consolidation phase, during which it will have to prove its excellence and quality in a fiercely competitive worldwide research landscape.

The role of public research is to be the driving force of the Luxembourgish research ecosystem. It has the potential to fuel others, but to achieve impact, it also needs the determination and the energy of the private sector. The Luxembourg public research ecosystem is young, attractive and dynamic, and the Belval R&I Campus, which embodies both the country's past and the future of research, is its impressive showcase. Abroad, the excellence of the ecosystem is a supplementary asset for the country, because it has an undeniably unique business card.

In 2019, the Luxembourg National Research Fund will celebrate its 20<sup>th</sup> anniversary. Since its creation back in 1999, the FNR has played an essential leading role in the

development of this vibrant research ecosystem, driving the national strategy and keeping high the standards of excellence in research and socio-economic impact.

For the upcoming four years - the current multiannual contract with the Government goes for the period 2018-2021 - the FNR has the firm intention to continue in that direction, and it will dedicate a total budget of 341 million euros to make continued progress in the realisation of its vision and mission.

To achieve this realisation, three strategic objectives have been set, articulated around six key value drivers. The FNR also wants to push forward a competitive and comprehensive culture of excellence and has therefore defined six dimensions that constitute the agency's understanding of "excellence in research". Scientific excellence will evidently remain the key criterion throughout the FNR schemes, but it will be tied to strategic considerations and a greater emphasis on the generation of economic and societal impact through research.

As unambiguously formulated in its mission, the FNR will continue to put all its efforts in setting up a sustainable world-class research system in Luxembourg that will generate societal and economic impact in key strategic areas. One further step towards that goal is the redefinition process of the national research priorities, for which the FNR has been mandated by the Ministry of Higher Education and Research, an important process that took place in 2018 and will be finished by mid-2019.

*Véronique Hoffeld, Chair of the Board*  
*Thierry Wolter, Vice-Chair of the Board*  
*Marc Schiltz, Executive Head*



1

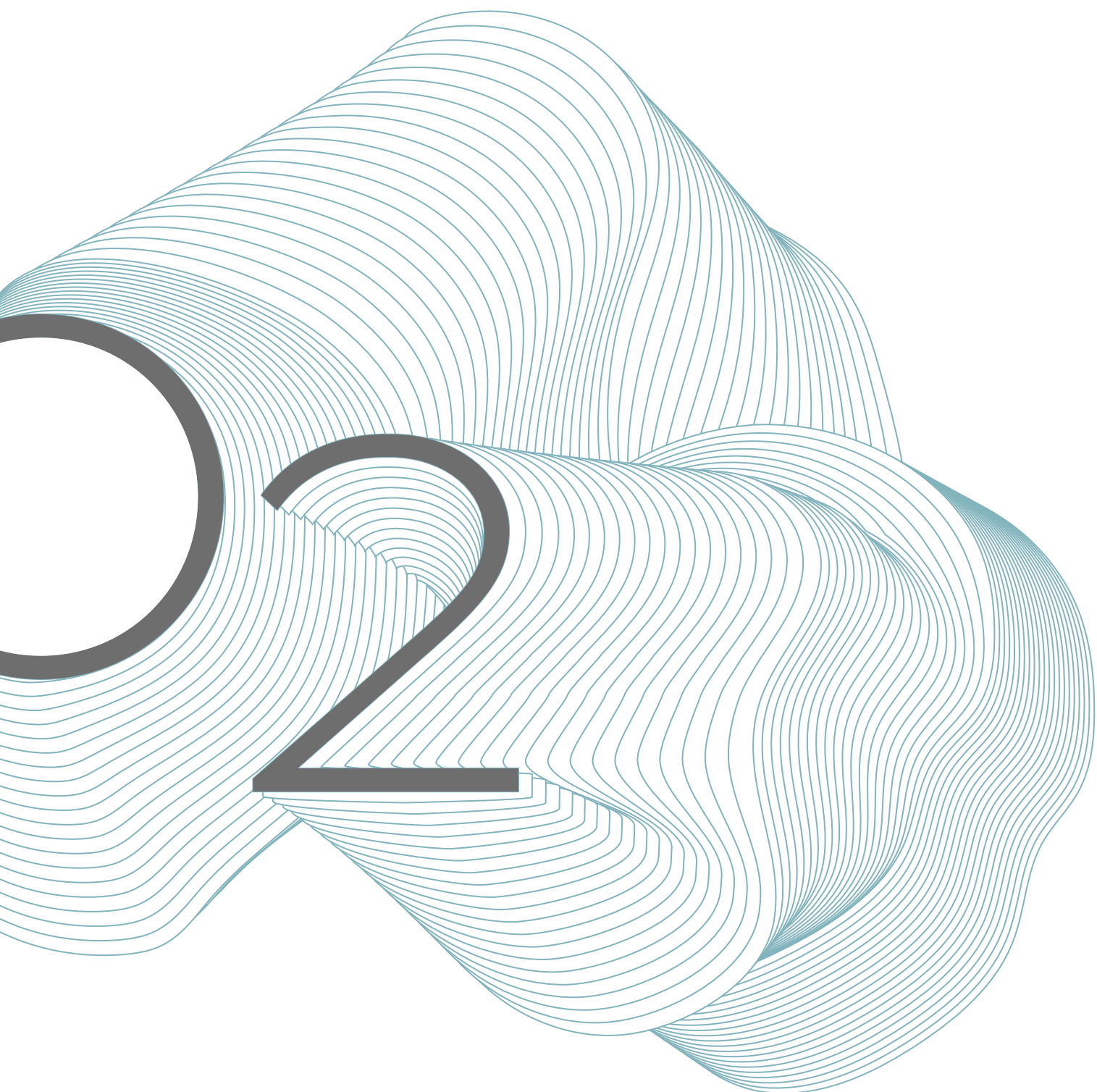


2



3

1. Véronique Hoffeld  
 2. Thierry Wolter  
 3. Marc Schiltz



# 02 OBJECTIVES, STRATEGY, POLICY

## *Luxembourg National Research Fund* *Research with impact*

### WHAT WE DO

The Luxembourg National Research Fund (FNR) is the main funder of research activities in Luxembourg. The FNR invests public funds and private donations into research projects in various branches of science and the humanities, with an emphasis on selected core strategic areas. Furthermore, the FNR supports and coordinates activities to strengthen the link between science and society and to raise public awareness for research. It also advises the Luxembourg government on research policy and strategy.

### OUR VISION

To establish Luxembourg as a leading knowledge-based society through science, research and innovation, thereby contributing to the country's economic diversification and future prosperity.

### OUR MISSION

To set up a sustainable world-class research system in Luxembourg that will generate societal and economic impact in key strategic areas.

### OUR STRATEGIC PRIORITIES

The FNR aims to be a driving force for Luxembourg's innovation capabilities and focuses on the three following strategic objectives to foster research with impact:

- **Attaining scientific leadership in key areas**  
By setting the highest quality standards, the FNR contributes to establishing international research excellence in Luxembourg. By attracting and training the most talented scientists, the FNR helps to build critical mass in key research areas, thereby supporting economic development and societal progress.
- **Turning public research into a competitive advantage for Luxembourg**  
The FNR supports the advancement of Luxembourg's knowledge-based economy by supporting industry-informed research, by reinforcing co-operation between public research and innovative industries and by facilitating the commercial exploitation of research results.

- **Anchoring Science and Research in Society**

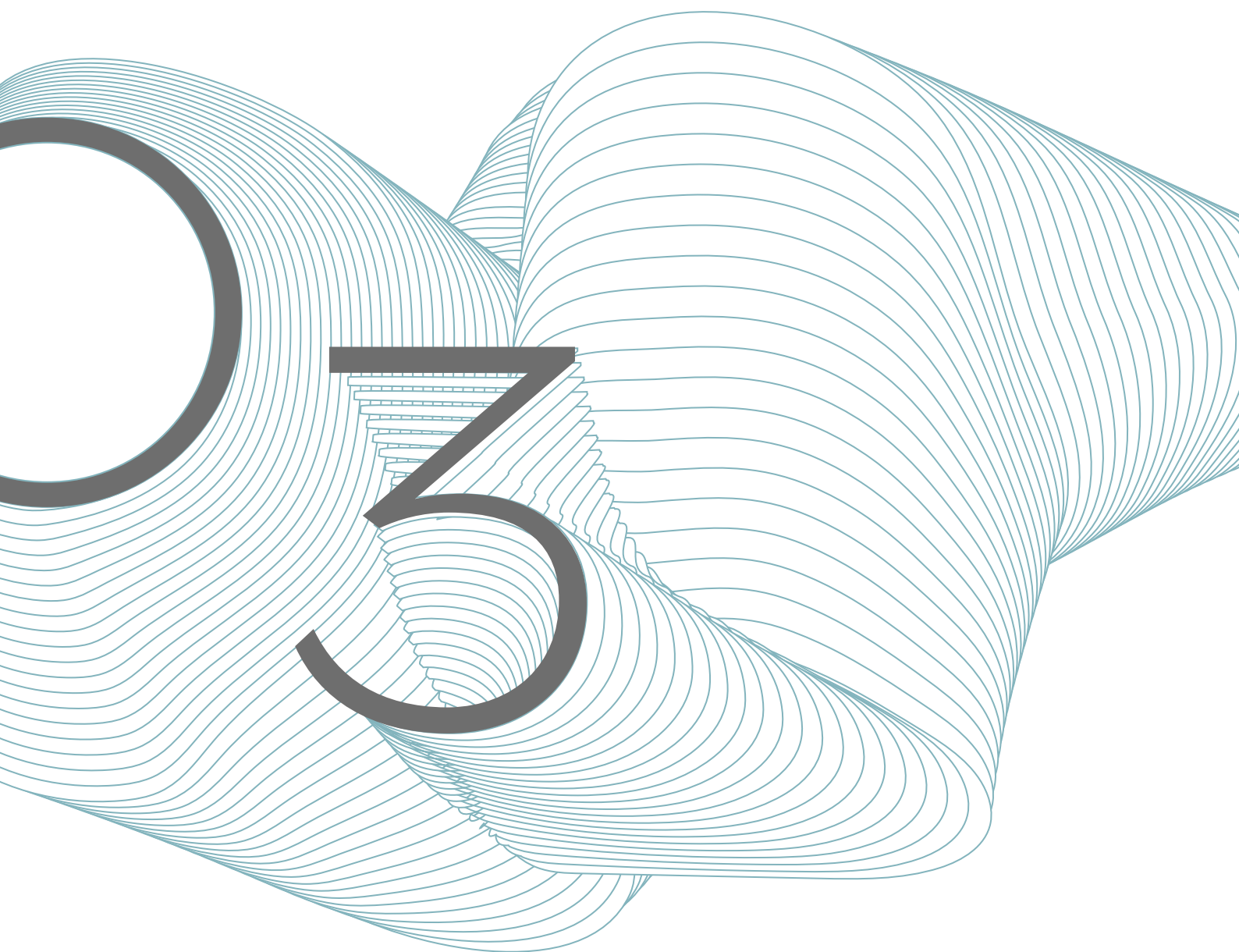
The FNR promotes the active involvement of researchers and scientists in addressing current and future societal challenges. To ensure that research is established sustainably in the public consciousness as an important pillar of Luxembourg's knowledge society, the FNR supports an active exchange between scientists and the public at large.

### HOW WE WORK

Our most highly valued criteria are excellence and quality in research. In order to identify the most promising and most excellent projects and researchers, we systematically submit funding requests to an assessment by independent international experts. The FNR implements the "Principles of Scientific Merit Review", which embody the highest international standards of expert assessment, transparency, impartiality, confidentiality and integrity.

### OUR CORE VALUES

- **Towards researchers and research institutions**  
We implement a fair and transparent process in our decision taking and nurture an open dialogue with the scientific community.
- **Towards the government, tax-payers and donors**  
We are accountable for the usage of funds that we are entrusted with and we strive for efficiency in our operations.
- **Towards the general public**  
We care for the long-term interest of the country and consider engagement with society as a constitutive part of science.
- **Towards our collaborators**  
We aim to stimulate talent-development and competence building of our staff, who translate the FNR's vision, mission and core values into action.



## 03 SELECTION PROCESS

Through a rigorous selection process, the FNR aims to fund the most excellent and promising research. FNR's selection process is therefore based on scientific merit - the FNR adheres to the 2012 Global Research Council "Statement of principles on scientific merit review" - and applies the highest standards of transparency. So how can researchers apply for FNR funding and how are their proposals evaluated?

First, the FNR launches calls for project proposals in its different research programme. Second, a project has to be submitted to the FNR.

Then the FNR identifies the most suitable independent experts for each project and systematically submits funding proposals for evaluation to them. The names of these experts are not disclosed by the FNR so that they can provide their assessment in full confidentiality. These experts provide written reviews on the merits of the proposals, based on the following criteria:

- Scientific or technological innovativeness and excellence - feasibility of the project- expected results

Additional specific criteria might be applicable depending on the target programme.

In a next step, the FNR appoints panels of independent, high-profile scientists and experts to assess and compare the merits of all the proposals that have been submitted within a given programme or research field.

Each panel establishes a ranking for funding the most excellent and promising projects. For some FNR schemes, the panel also conducts interview sessions of candidates in addition to the written reviews. The formal decision to fund a proposal is taken by the FNR, in strict compliance with the funding recommendations issued by the expert panels.

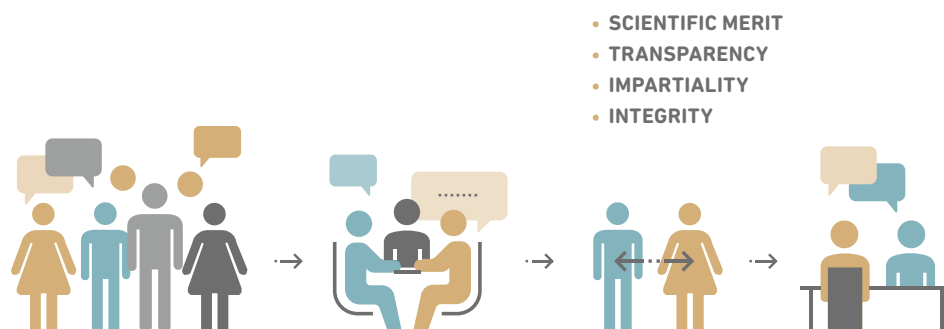
To be transparent, a complete feedback is sent to all the submitting researchers including the reviews and a feedback of the expert panel. This gives the researchers the opportunity to eventually resubmit their an improved proposal in a next call.

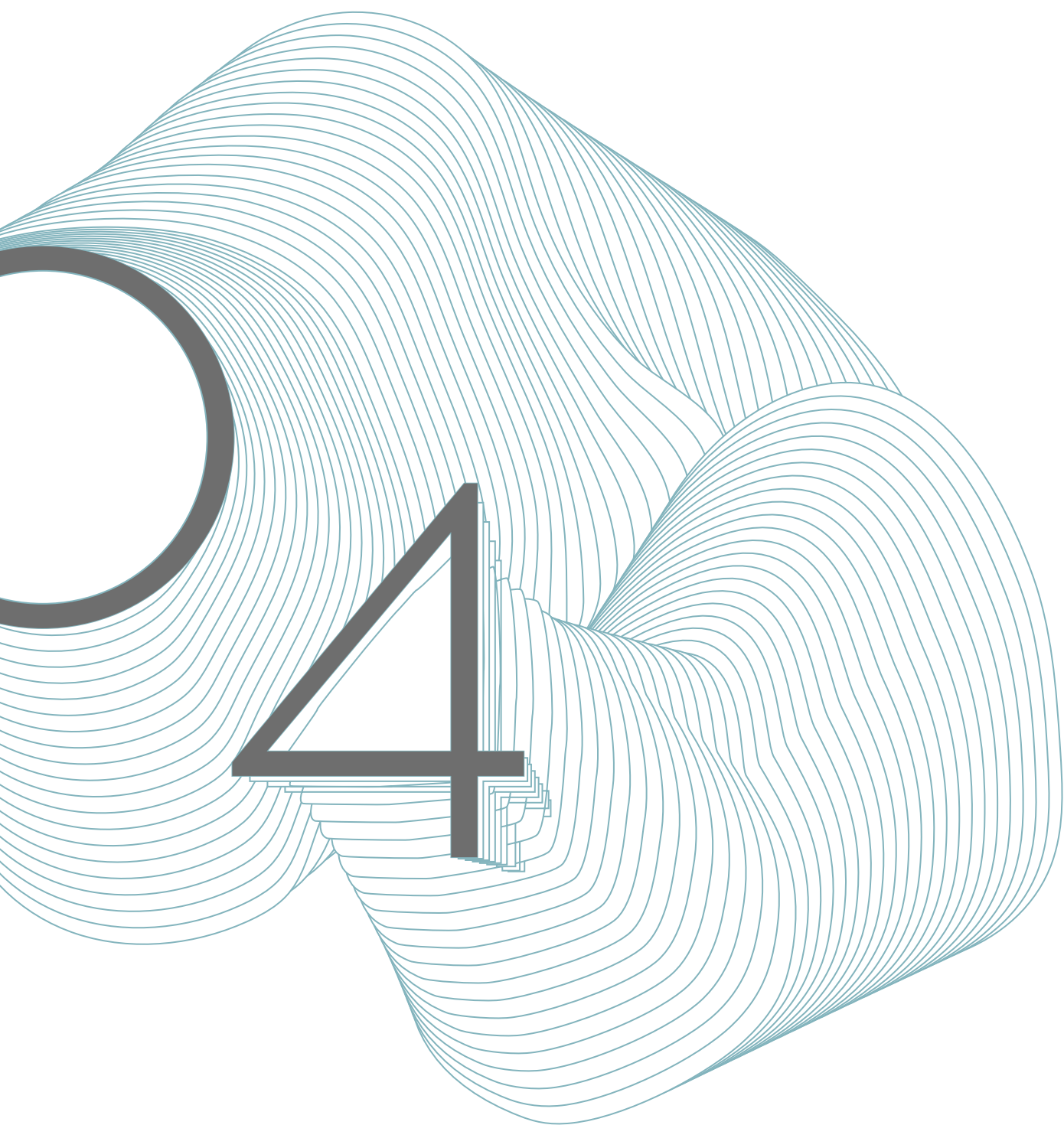
In 2017, the average success rate accross all FNR programmes was 36%.

The FNR aims to continuously evaluate and improve its assessment and selection processes to keep up with the highest international standards of transparency, impartiality and integrity. In 2015, an independent assessment of the CORE selection process was undertaken by the Evaluation Center of the University of Michigan. It concluded that "The FNR successfully (implements) what are currently considered 'best practices' in peer-review internationally" also, the FNR has also been delivered the ISO-9001 certificate that attests quality standards of the management system at FNR.

More info:

 [www.youtube.com/watch?v=E01mojHT-Ik](https://www.youtube.com/watch?v=E01mojHT-Ik)





# 04 <sup>2018</sup> MAIN FIGURES

1461

REALISED EXPERTISES



NEW INDUSTRIAL  
FELLOWSHIP  
& BRIDGES GRANTS

6,500

visitors @ Researchers' Days

72.10

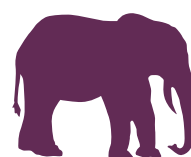
MEUR NEW COMMITTED

23

RESCOM CONFERENCES,  
WORKSHOPS & LECTURE  
SERIES FUNDED

260

FUNDED PROJECTS



36

NEW  
CORE  
PROJECTS

646

RUNNING PROJECTS



NEW ATTRACT  
FELLOWS



NEW PSP -  
PROMOTING SCIENCE  
TO THE PUBLIC PROJECTS

251

FINISHED PROJECTS

735

PROJECTS EVALUATED

24.61

MEUR COMMITTED TO  
INTERNATIONAL PROJECTS

18

INTERNATIONAL BILATERAL  
COOPERATION AGREEMENTS  
RUNNING IN 13 COUNTRIES  
WORLDWIDE IN 2018



NEW JUMP PROJECTS

59

EARLY CAREER GRANTS



# 05 FNR ACTIVITY REPORT FOR 2018

## I. MAJOR PROJECTS

Marc Hansen, Minister Delegate for Higher Education and Research, Véronique Hoffeld, Chair of the Board of the FNR, and Marc Schiltz, FNR Secretary General, officially signed the multi-annual contract between the FNR and the Government in January 2018. Within the framework of this contract, which covers the years 2018 to 2021, the budget of the FNR was set at 264.41 MEUR, an increase of 11% compared to the multi-annual contract of 2014-17. The budget allocation enables the FNR to implement its three strategic objectives, which are:

- Strengthen the foundation of public research;
- Contribute to shaping the future of Luxembourg;
- Promote innovation in strategic research management.

During the year the FNR Office worked on the "Revision of national public research priorities" project, mapping the strengths and weaknesses of the areas funded by the FNR. In collaboration with an external consultant, the FNR organised two workshops with more than 100 participants, bringing together national stakeholders and international experts. A proposal for the new priorities is being prepared and will be forwarded to the Ministry of Higher Education and Research in spring 2019.

As part of the "PRIDE" programme, an external evaluation of the implementation of the "National Quality Framework for Doctoral Training" was carried out at the University and the three public research institutions. In September, the FNR organised a round table with stakeholders based on the preliminary results. The final report of the evaluation with recommendations was finalised in early 2019.

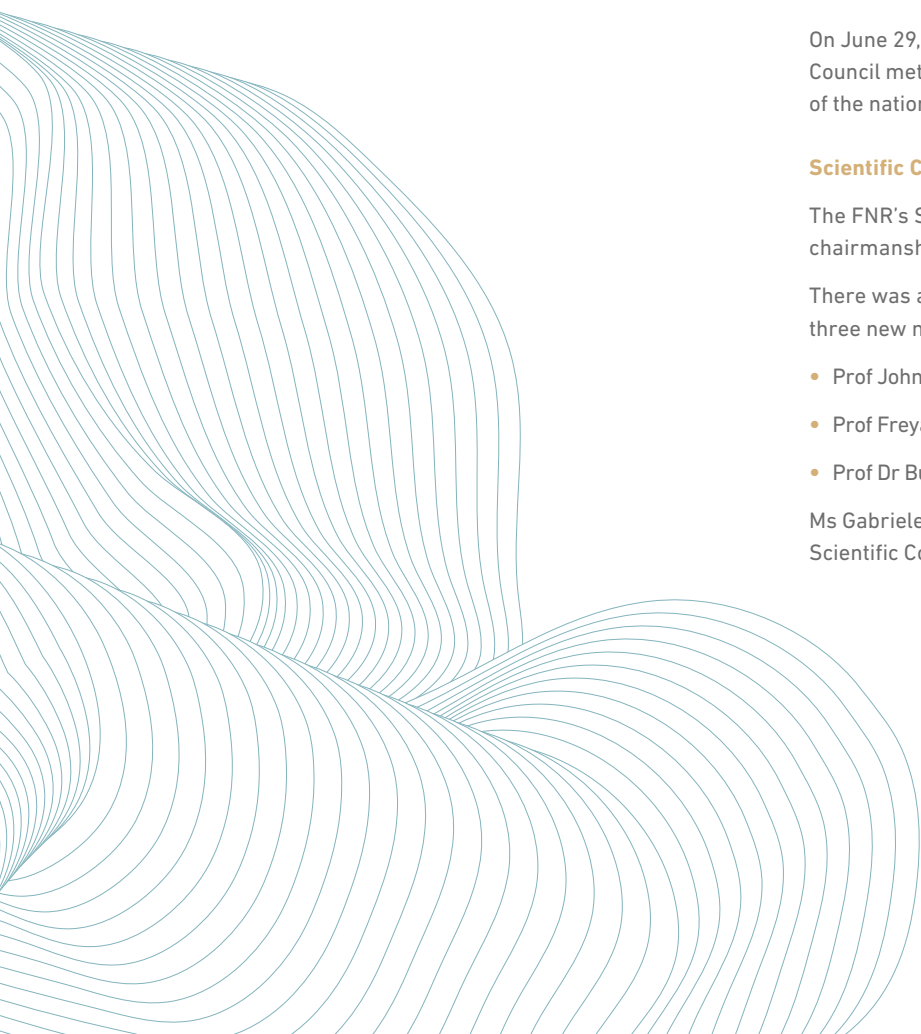
The FNR, along with ten other national research funding organisations, with the support of the European Commission (EC) and the European Research Council (ERC), has launched cOAlition S, a joint initiative to make full and immediate Open Access to research publications a reality by 2020. The initiative is promoted by Science Europe, the association of national research funding and research performing organisations in Europe. The FNR is a convinced advocate of OPEN ACCESS. Back in 2016, it introduced its new policy on Open Access

publications from FNR co-funded research as well as a new instrument to help cover the article processing fees, the FNR Open Access Fund, the first call of which was launched in January 2018.

The Luxembourg National Research Fund (FNR) has signed the DORA declaration, which consists of a set of recommendations to improve the assessment of scientific output. As a signatory of DORA, the FNR fully supports the declaration's practices in research assessment and has updated its own peer review guidelines accordingly. The FNR has always implemented a qualitative evaluation of research proposals, where a variety of research outputs are valued. In its "FNR Strategy and Action Plan 2018-21", the Office explicitly promotes a comprehensive view on Excellence in Research, articulated through six dimensions that span the full range of research outcomes, and is fully in line with the principles of the DORA declaration.

LARI – the Luxembourg Agency for Research Integrity – that was formally created in 2016 and whose committee of international experts was nominated in late 2017 – started its mission in September 2018, with the appointment of its Secretary General Katrina Bramstedt. A main pillar of LARI activities is to raise awareness for research integrity and good scientific practices in Luxembourg. It will provide its member institutions with a service facility and offer independent investigations of allegations of research misconduct.

In late spring 2018, the Leir Charitable Foundations (LCF) and the Luxembourg National Research Fund (FNR) signed an agreement on the joint funding of a bilateral research project between the University of Luxembourg and Columbia University on the topic of Parkinson's disease research. This INTER collaboration project has been favourably assessed in a scientific evaluation process. The goal of the project is to investigate mutations in a gene which increase the likelihood of getting Parkinson's Disease and how these mutations disrupt the normal attachment of important cellular machinery.



In December, the FNR organised the 6th edition of the Researchers' Days, a two days festival during which the Rockhal was transformed into a giant research lab with 31 exciting interactive workshops, and five Science Cafés, all revolving around the topic of research and science. Around 6,500 visitors – 2000 school kids on Friday and a whopping 4500 visitors on Saturday – streamed to the Rockhal to meet and exchange with Luxembourg-based researchers and scientists. Luxembourg's Prime Minister Xavier Bettel, who visited the festival on the first day, spoke of how important it is to have events such as Researchers' Days, where families can share in science activities, and he reiterated the Governments support for research over the coming five years.

## II. FNR GOVERNANCE

### Board of Directors

The Board of Directors held five meetings in 2018.

- **The Chairmanship** (Ms Véronique Hoffel, Mr Thierry Wolter and Mr Marc Schiltz) met three times during 2018.
- **The Audit and Finance Committee of the Board of Directors** (comprising Ms Andrée Billon, Ms Hjoerdis Stahl and Mr Roger Assacker) held five working sessions, four of which by written procedure.
- **The Appointments and Remuneration Committee (CNR) of the Board** (comprising Ms Véronique Hoffeld, Mr Wolter and Ms Christiane Hoffmann) met twice in 2018.

**Mr Robert Kerger**, in his capacity as government commissioner, is invited to attend committee meetings.

On June 29, the Board of Directors and the Scientific Council met to prepare the process leading to the revision of the national research priorities.

### Scientific Council

The FNR's Scientific Council met twice in 2018 under the chairmanship of Mr Yves Fromes.

There was a partial renewal of the Scientific Council, with three new members appointed:

- Prof John Scheid
- Prof Freya Baetens
- Prof Dr Burkhard Stiller

Ms Gabriele Dobenecker was appointed vice-chair of the Scientific Council.

### III. PROGRAMMES AND PRIORITY ACTIONS

The activities carried out during the year for the three strategic objectives laid down in the multi-annual contract are summarised as follows:

#### OBJECTIVE 1: Strengthening the foundations

##### CORE<sup>1</sup>

The FNR received 140 proposals, 137 of which were eligible. After assessment by independent international experts, the FNR selected 36 projects for funding, totalling EUR 21.6 million. 14 of the 45 proposals submitted were accepted as part of the CORE Junior programme. With regard to the bilateral international cooperation projects implemented in CORE, 4 of the 15 proposals for bilateral projects were selected for funding.

The five selection panels confirmed that the selection process is being implemented according to the highest international standards.

##### OPEN

The FNR received 7 proposals, all of which were eligible. After an assessment by international experts, the FNR selected 3 projects, which were given a total of EUR 1.3 million in funding.

##### INTER

The FNR assessed 205 proposals and granted funding to 25 projects (14 bilateral, 11 multilateral) for a total of EUR 10.1 million. As part of the AAL programme, 2 projects were granted funding amounting to EUR 470,000. Furthermore, the FNR evaluated 14 mobility proposals, of which 10 were selected for a total budget of EUR 642,000

As part of the new cooperation, 2 projects (with the *National Foundation for Research, Science and Technology Portugal (FCT)*) were accepted in the CORE 2018 call and a first call was launched in the Netherlands (with the *Netherlands Organization for Scientific Research (NWO)*).

Within the framework of the Fulbright programme, 2 projects were financed for MEUR 0.04.

##### RESCOM

The FNR assessed 24 proposals, 23 of which were retained for a total budget of EUR 779,000.

##### OPEN ACCESS

The FNR evaluated and selected 1 proposal for a total funding of EUR 1,500.

##### AFR

Following the introduction of the PRIDE programme, only a limited number of doctoral students continue to be funded via the individual AFR instrument. The panel of experts evaluated a total of 100 eligible proposals, of which 29 were selected for overall funding of EUR 5.2 million.

##### PEARL

No PEARL project has been formally submitted by research institutions under the 2018 call for proposals. The recruitment process for the PayPal-FNR PEARL Chair in Digital Financial Services is in progress and is expected to be completed in 2019.

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<sup>1</sup> In-depth information on the FNR's different financing instruments (CORE, OPEN, INTER, etc.) is available on the website [www.fnr.lu](http://www.fnr.lu)

### **NCER-PD - National Centre of Excellence in Parkinson Disease Research**

At its meeting in May 2018, the steering committee confirmed the very positive progress of the "NCER-PD" research competence centre. In 2019, the first phase will be completed and the proposal for the second phase will be reviewed by the committee at the beginning of the year.

### **ATTRACT**

Six candidates applied for the FNR ATTRACT program in 2018. The FNR selected two candidates, Dr Johannes Meiser ("cancer metabolism", LIH, starting investigator, MEUR 1.5), and Dr Emma Schymanski ("environmental cheminformatics", UL-LCSB, consolidating investigator, MEUR 2.0). The financial contribution finally amounts to MEUR 3.5. Sustained efforts must be made by the research institutions to achieve the target of 40% female applicants in the period 2017 - 2021.

### **PRIDE**

17 proposals had been submitted by Doctoral Training Units (DTU) by the end of 2017. After a pre-selection in January and interviews in March 2018, the FNR selected 6 PRIDE projects (Microbiome, Parkinson's, Data-driven modelling, Photovoltaics, Law, Mathematics), allocating a total of 75 doctoral positions at a cost of MEUR 14.7.

### **OBJECTIVE 2:**

**To strengthen research which generates economic and societal impact**

#### **JUMP (Proof of Concept (PoC) and Pathfinder)**

The FNR assessed 42 proposals in "Pathfinder" and granted funding to 20 projects, totalling MEUR 0.8.

The FNR assessed 10 proposals in "Proof of Concept" and granted funding to 9 projects, totalling MEUR 2.4.

A spin-off, "Databourg Systems Sarl.-S" was launched as a direct result of the PoC projects.

#### **Knowledge & Innovation Transfer Support (KITS)**

There were no program calls in 2018. The new call will be launched at the end of 2019.

#### **BRIDGES and Industrial Fellowships**

A total of 27 BRIDGES (former CORE-PPP) projects and 38 Industrial Fellowship (former AFR-PPP) project submissions were evaluated. 16 BRIDGES projects, receiving MEUR 5.2 in funding, and 24 Industrial Fellowships, receiving MEUR 4.3 in funding, were selected after evaluation.

#### **IPBG**

No applications were submitted in 2018 under the Industrial Partnership Block Grant (IPBG) programme.

#### **Public<sup>2</sup>**

There were no program calls in 2018. A new, more focused call for proposals in certain domains, will be scheduled for the end of 2019.

## PSP

PSP-Classic: the FNR evaluated 42 project proposals and granted funding to 36 projects for a total commitment of MEUR 0.9.

PSP-Flagship: the FNR evaluated 2 project proposals and granted funding to 2 projects for a total commitment of MEUR 0.7.

## Science in Society

To strengthen the exchange between researchers and society, the FNR has carried out the following actions:

Events: The FNR organised the 6th edition of Researchers' Days at the Rockhal (see "Major projects above). In addition, the FNR organised a "Science Communicator Networking Event" to bring together all the actors in scientific communication in Luxembourg, with more than 40 participants.

Media: In 2018, the FNR renewed its existing "Mr Science" media partnerships with RTL Télé Lëtzebuerg, RTL Radio and Eldorado. The science.lu website continues to mobilize and retain readers, with more than 1,850,000 page views and 970,000 unique visitors to the site since its launch, more than 22,000 fans on Facebook, more than 900,000 views on YouTube and more than 800 followers on Twitter. In 2018, the Instagram channel of science.lu was also launched.

Training: The FNR proposed 9 training courses (for researchers, teachers, educators) in the field of communication and popularization of science, including the second edition of the Science Journalism Course at the University for PhDs from Doctoral Schools.

## FNR AWARDS 2018

For the tenth consecutive year, the research and innovation community gathered in the Halle des poches à fonte in Belval to reward the country's best researchers and scientific mediators, as well as their institutions. At the 10th edition of the FNR Awards, the FNR has awarded six Excellence Awards. Endowed with €5,000 each, these prizes were awarded in the categories "Outstanding Scientific Publication", "Outstanding PhD Thesis", "Outstanding Promotion of Science to the Public" and "Outstanding Research-Driven Innovation". For the first time, all the prizes were awarded to Luxembourg teams and researchers, which demonstrates the quality of research and scientific mediation produced and carried out in Luxembourg in various fields.

## Promotion of FNR activities

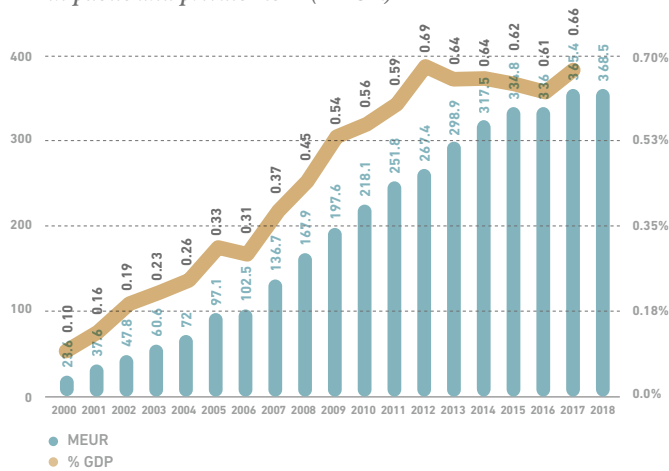
The FNR regularly communicates via its website [fnr.lu](http://fnr.lu) as well as via its digital channels (Linkedin, Twitter, Facebook and FNRInfo), to inform the scientific community and the general public about its activities, as well as results of Luxembourg research.

The FNR actively supported the project to create a common brand for Luxembourg public research, a project initiated by public research actors with the aim of promoting it.

# 06 2018 STATISTICS

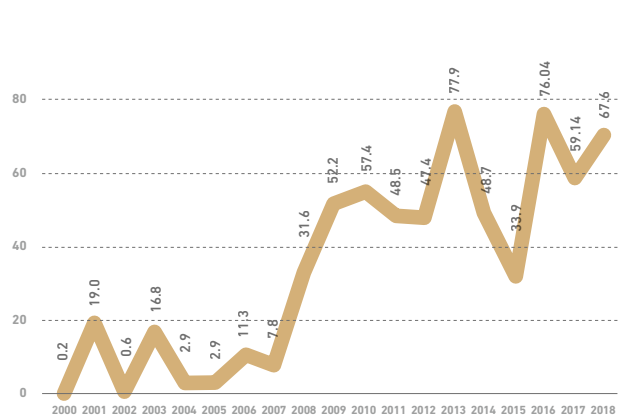
## LUXEMBOURG INVESTMENTS

Luxembourg public investments  
in public and private R&D (MEUR)



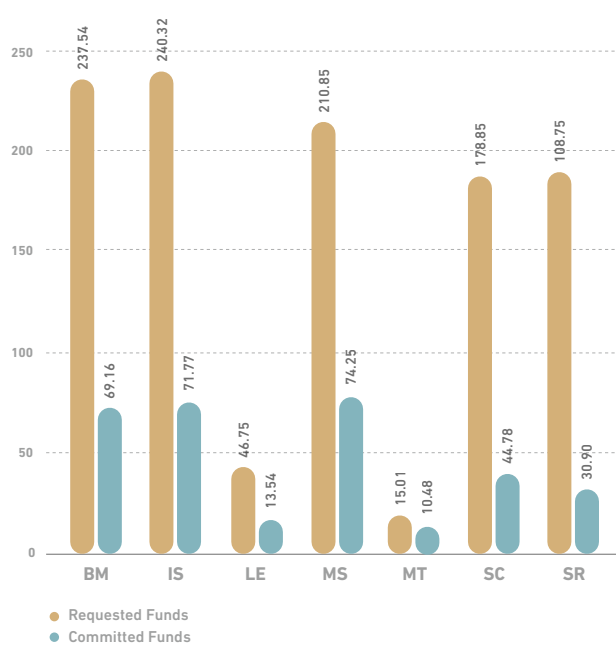
## FNR FUNDING

FNR: Annual funding commitments (MEUR)



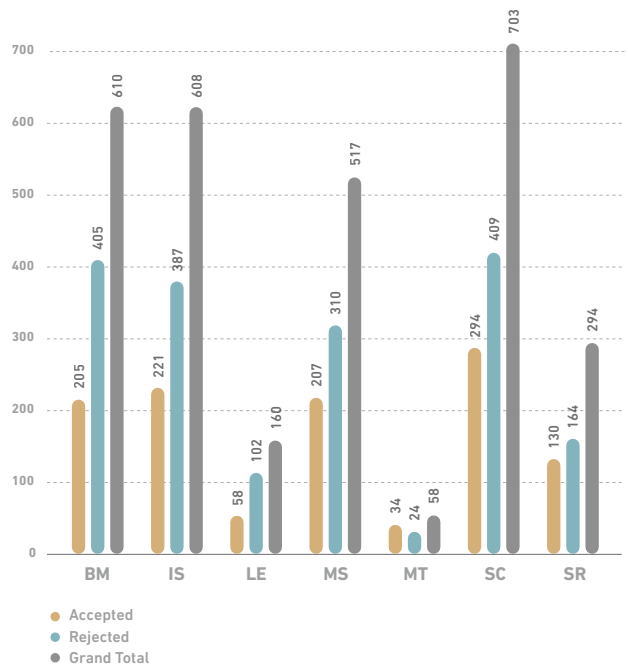
## 2014-2018 REQUESTED AND COMMITTED FUNDS

Applied funds vs. FNR committed 2018 (MEUR)



## 2014-2018 ACCEPTED VS. REJECTED PROJECTS

2950 projects submitted, 1801 rejected, 1149 accepted



## FNR NEW COMMITTED 2018

|                                       |                                                                                                 |
|---------------------------------------|-------------------------------------------------------------------------------------------------|
| <b>112 FNR-funded projects</b>        | <b>44.82 (MEUR)</b>                                                                             |
| <b>36</b> CORE Projects               |  <b>21.61</b>  |
| <b>0</b> PEARL Project                |  <b>0.00</b>   |
| <b>2</b> ATTRACT Projects             |  <b>3.50</b>   |
| <b>25</b> INTER Projects              |  <b>10.08</b>  |
| <b>9</b> JUMP (POC) Projects          |  <b>2.40</b>   |
| <b>20</b> JUMP (Pathfinder) Projects  |  <b>0.81</b>   |
| <b>0</b> KITS Projects                | <b>0.00</b>                                                                                     |
| <b>3</b> OPEN Projects                |  <b>1.30</b>   |
| <b>1</b> OPEN ACCESS Project          |  <b>0.0015</b> |
| <b>16</b> BRIDGES (CORE PPP) Projects |  <b>5.12</b>  |
| <b>0</b> IPBG Project                 | <b>0.00</b>                                                                                     |
| <b>0</b> PUBLIC2 Project              | <b>0.00</b>                                                                                     |

|                                                                       |                                                                                                 |
|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| <b>38 PSP   10 INTER MOBILITY   23 RESCOM   6 AWARDS   12 ART 3.5</b> | <b>3.19 (MEUR)</b>                                                                              |
| <b>36</b> PSP Classic                                                 |  <b>0.90</b> |
| <b>2</b> PSP Flagship                                                 |  <b>0.70</b> |
| <b>10</b> INTER-MOBILITY                                              |  <b>0.64</b> |
| <b>6</b> AWARDS                                                       | <b>0.03</b>                                                                                     |
| <b>12</b> ART 3.5                                                     | <b>0.14</b>                                                                                     |
| <b>23</b> RESCOM                                                      |  <b>0.78</b> |

|                                 |                                                                                                  |
|---------------------------------|--------------------------------------------------------------------------------------------------|
| <b>59 Early Career Grants</b>   | <b>24.09 (MEUR)</b>                                                                              |
| <b>29</b> AFR PhD Grants        |  <b>5.16</b>  |
| <b>24</b> INDUSTRIAL FELLOWSHIP | <b>3.01</b>                                                                                      |
| 15 PHD                          |                                                                                                  |
| 9 PDR                           | <b>1.24</b>                                                                                      |
| <b>0</b> AFR Bilateral          |  <b>0.00</b>  |
| <b>6</b> PRIDE                  |  <b>14.68</b> |

## FNR NEW COMMITTED 2014-2018

|                                       |                                                                                                   |
|---------------------------------------|---------------------------------------------------------------------------------------------------|
| <b>391 FNR-funded projects</b>        | <b>202.83 (MEUR)</b>                                                                              |
| <b>169</b> CORE Projects              |  <b>99.02</b>  |
| <b>4</b> PEARL Projects               |  <b>16.63</b>  |
| <b>9</b> ATTRACT Projects             |  <b>16.04</b>  |
| <b>99</b> INTER Projects              |  <b>37.77</b>  |
| <b>35</b> JUMP (POC) Projects         |  <b>9.60</b>   |
| <b>20</b> JUMP (Pathfinder) Projects  |  <b>0.81</b>   |
| <b>8</b> KITS Projects                | <b>2.57</b>                                                                                       |
| <b>10</b> OPEN Projects               |  <b>4.83</b>   |
| <b>1</b> OPEN ACCESS Project          |  <b>0.0015</b> |
| <b>32</b> BRIDGES (CORE PPP) Projects |  <b>11.87</b> |
| <b>1</b> IPBG Project                 | <b>2.68</b>                                                                                       |
| <b>3</b> PUBLIC2 Projects             | <b>1.01</b>                                                                                       |

|                                                                        |                                                                                                   |
|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| <b>225 PSP   58 INTER MOBILITY   93 RESCOM   6 AWARDS   12 ART 3.5</b> | <b>12.56 (MEUR)</b>                                                                               |
| <b>218</b> PSP Classic                                                 |  <b>3.06</b> |
| <b>7</b> PSP Flagship                                                  |  <b>2.70</b> |
| <b>58</b> INTER-MOBILITY                                               |  <b>4.36</b> |
| <b>6</b> AWARDS                                                        | <b>0.03</b>                                                                                       |
| <b>12</b> ART 3.5                                                      | <b>0.14</b>                                                                                       |
| <b>93</b> RESCOM                                                       |  <b>2.27</b> |

|                                                            |                                                                                                    |
|------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <b>367 Early Career Grants</b>                             | <b>96.68 (MEUR)</b>                                                                                |
| <b>206</b> AFR PhD Grants                                  |  <b>33.48</b> |
| <b>54</b> AFR Postdoc Grants                               |  <b>6.35</b>  |
| <b>48</b> INDUSTRIAL FELLOWSHIP (incl. former AFR PPP)     | <b>9.43</b>                                                                                        |
| <b>29</b> INDUSTRIAL FELLOWSHIP (incl. former AFR PDR PPT) | <b>3.86</b>                                                                                        |
| <b>13</b> AFR Bilateral                                    |  <b>3.69</b>  |
| <b>17</b> PRIDE                                            |  <b>39.87</b> |

## FUNDING AND PROJECTS FIGURES 2018

# 210.5

TOTAL AMOUNT REQUESTED  
IN MEUR

# 735

PROJECTS SUBMITTED IN 2018

# 72.1

NEW COMMITTED BY FNR -  
TOTAL AMOUNT IN MEUR

# 260

PROJECTS FUNDED IN 2018

# 34.25%

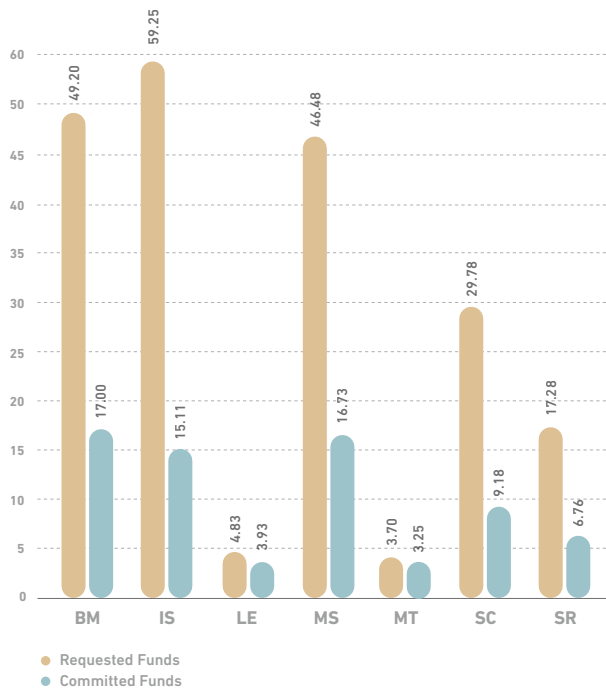
OVERALL FUNDING  
SUCCESS RATE

# 35.37%

OVERALL PROJECT SUCCESS RATE

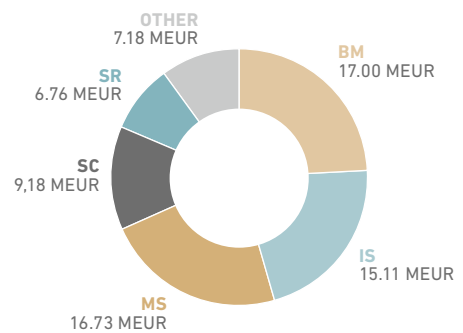
### 2018 REQUESTED AND COMMITTED FUNDS

Applied funds vs. FNR committed 2018 (MEUR\*)



\*without Awards and Art 3.5

FNR committed 2018 per domain



● MS New Functional and Intelligent Materials and Surfaces and New Sensing Applications   
● BM Biomedical Sciences/Regulation of Chronic, Degenerative and Infectious Diseases   
● SR Sustainable Resource Management in Luxembourg   
● IS Innovation in Services   
● SC Societal Challenges (LM+ID)

## PUBLIC-PRIVATE PARTERSHIPS



| BRIDGES*                       | 2008      | 2009     | 2010     | 2011     | 2012     | 2013      | 2014     | 2015     | 2016     | 2017      | 2018      | TOTAL     |
|--------------------------------|-----------|----------|----------|----------|----------|-----------|----------|----------|----------|-----------|-----------|-----------|
| National private partners      | 5         | 4        | 4        | 3        | 5        | 7         | 2        | 1        | 6        | 9         | 9         | 55        |
| International private partners | 5         | 4        | 2        | 1        | 2        | 3         | 2        | 2        | 0        | 1         | 7         | 29        |
| <b>TOTAL</b>                   | <b>10</b> | <b>8</b> | <b>6</b> | <b>4</b> | <b>7</b> | <b>10</b> | <b>4</b> | <b>3</b> | <b>6</b> | <b>10</b> | <b>16</b> | <b>84</b> |

\*BRIDGES (former CORE-PPP)

| IF*          | 2008     | 2009      | 2010     | 2011      | 2012      | 2013      | 2014      | 2015      | 2016      | 2017      | 2018      | TOTAL      |
|--------------|----------|-----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| PhD          | 1        | 12        | 1        | 10        | 13        | 9         | 7         | 9         | 9         | 15        | 15        | 101        |
| Postdoc      | 1        | 1         | 0        | 2         | 1         | 1         | 3         | 4         | 7         | 9         | 9         | 38         |
| <b>TOTAL</b> | <b>2</b> | <b>13</b> | <b>1</b> | <b>12</b> | <b>14</b> | <b>10</b> | <b>10</b> | <b>13</b> | <b>16</b> | <b>24</b> | <b>24</b> | <b>139</b> |

\*Industrial Fellowship (former AFR-PPP)

## FUNDING INSTRUMENTS 2006-2018

(Statistics of ongoing instruments)

| Launch date  | Programme title                                                              | number of submitted proposals | number of FNR funded projects | number of finished projects | committed (MEUR) |
|--------------|------------------------------------------------------------------------------|-------------------------------|-------------------------------|-----------------------------|------------------|
| 2006         | <b>ATTRACT</b> Opportunities for Outstanding Young Researchers in Luxembourg | 74                            | 18                            | 8                           | 28.10            |
| 2006         | <b>INTER</b> Promotion of International Cooperation                          | 1153                          | 184                           | 89                          | 65.12            |
| 2008         | <b>CORE</b> Multi-annual Thematic Research Programme                         | 1250                          | 372                           | 201                         | 203.43           |
| 2008         | <b>AFR</b> PhD Grants + <b>BFR-AFR</b> Transitions                           | 2046                          | 1070                          | 875                         | 119.36           |
| 2008         | <b>AFR</b> Postdoc Grants                                                    | 756                           | 346                           | 258                         | 31.49            |
| 2009         | <b>PEARL</b> Excellence Programme for Research in Luxembourg                 | 24                            | 10                            | 3                           | 43.90            |
| 2012         | <b>INTER Mobility</b> Promotion of International Scientific Exchange         | 170                           | 74                            | 50                          | 3.56             |
| 2012         | <b>RESCOM</b> Promoting Scientific outcomes                                  | 456                           | 264                           | 152                         | 7.65             |
| 2012         | <b>PSP</b> Promoting Science to the Public                                   | 378                           | 307                           | 263                         | 4.38             |
| 2012         | <b>JUMP</b> (POC) Proof of Concept                                           | 54                            | 37                            | 16                          | 11.19            |
| 2013         | <b>OPEN</b> Multi-annual Research Programme                                  | 32                            | 12                            | 0                           | 5.83             |
| 2015         | <b>KITS</b> Knowledge & Innovation Transfer                                  | 9                             | 8                             | 0                           | 2.57             |
| 2016         | <b>PRIDE</b> Research Intensive Doctoral Education                           | 86                            | 17                            | 0                           | 39.87            |
| 2016         | <b>AFR</b> Bilateral                                                         | 31                            | 13                            | 1                           | 3.69             |
| 2016         | <b>IPBG</b> Industrial Partnership Block Grant                               | 2                             | 1                             | 0                           | 2.68             |
| 2016         | <b>PSP-Flagship</b>                                                          | 13                            | 6                             | 0                           | 2.33             |
| 2016         | <b>BRIDGES</b> (CORE PPP)                                                    | 48                            | 32                            | 1                           | 11.87            |
| 2016         | <b>INDUSTRIAL FELLOWSHIP</b> (AFR PhD PPP)                                   | 86                            | 39                            | 1                           | 7.73             |
| 2016         | <b>INDUSTRIAL FELLOWSHIP</b> (AFR PDR PPP)                                   | 39                            | 25                            | 0                           | 3.40             |
| 2017         | <b>PUBLIC</b> <sup>2</sup>                                                   | 7                             | 3                             | 0                           | 1.01             |
| 2018         | <b>OPEN ACCESS</b>                                                           | 1                             | 1                             | 1                           | 0.0015           |
| 2018         | <b>FNR AWARDS</b>                                                            | 52                            | 6                             | 0                           | 0.03             |
| 2018         | <b>ART. 3.5</b>                                                              | 12                            | 12                            | 0                           | 0.14             |
| 2018         | <b>JUMP</b> (Pathfinder)                                                     | 42                            | 20                            | 10                          | 0.81             |
| <b>TOTAL</b> |                                                                              | <b>6,821</b>                  | <b>2,877</b>                  | <b>1,929</b>                | <b>596.55</b>    |



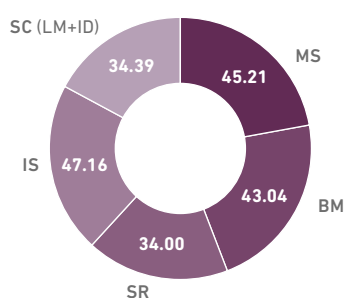
Sum of Committed Funding (in MEUR) / Domain

| DOMAIN                                                                                | 2008         | 2009         | 2010         | 2011         | 2012         | 2013         | 2014         | 2015         | 2016         | 2017         | 2018         | Total         |
|---------------------------------------------------------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|
| MS_New Functional and Intelligent Materials and Surfaces and New Sensing Applications | 3.40         | 3.40         | 4.50         | 2.90         | 2.00         | 6.90         | 3.32         | 3.92         | 4.60         | 6.17         | 4.10         | 45.21         |
| BM_Biomedical Sciences/Regulation of Chronic, Degenerative and Infectious Diseases    | 3.20         | 1.90         | 5.40         | 2.80         | 6.60         | 3.40         | 3.42         | 3.99         | 4.12         | 4.50         | 3.71         | 43.04         |
| SR_Sustainable Resource Management in Luxembourg                                      | 2.50         | 4.20         | 3.00         | 3.10         | 4.20         | 3.50         | 3.40         | 2.09         | 1.90         | 4.13         | 1.98         | 34.00         |
| IS_Innovation in Services                                                             | 2.40         | 3.30         | 2.70         | 3.80         | 3.80         | 3.80         | 3.86         | 5.69         | 3.82         | 7.11         | 6.88         | 47.16         |
| SC_Societal Challenges (LM+ID)                                                        | 2.60         | 1.40         | 3.80         | 2.90         | 4.20         | 3.10         | 2.98         | 2.10         | 3.91         | 2.47         | 4.94         | 34.39         |
| <b>TOTAL</b>                                                                          | <b>14.10</b> | <b>14.20</b> | <b>19.40</b> | <b>15.50</b> | <b>20.80</b> | <b>20.70</b> | <b>16.98</b> | <b>17.78</b> | <b>18.35</b> | <b>24.38</b> | <b>21.61</b> | <b>203.80</b> |

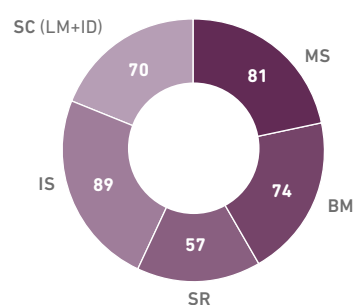
Projects by Domain

| DOMAIN                                                                                | 2008      | 2009      | 2010      | 2011      | 2012      | 2013      | 2014      | 2015      | 2016      | 2017      | 2018      | Total      |
|---------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| MS_New Functional and Intelligent Materials and Surfaces and New Sensing Applications | 7         | 8         | 8         | 5         | 4         | 10        | 7         | 7         | 8         | 10        | 7         | 81         |
| BM_Biomedical Sciences/Regulation of Chronic, Degenerative and Infectious Diseases    | 7         | 3         | 8         | 5         | 9         | 7         | 7         | 6         | 8         | 8         | 6         | 74         |
| SR_Sustainable Resource Management in Luxembourg                                      | 6         | 11        | 5         | 5         | 6         | 4         | 4         | 4         | 3         | 6         | 3         | 57         |
| IS_Innovation in Services                                                             | 8         | 10        | 6         | 7         | 8         | 6         | 8         | 10        | 6         | 11        | 9         | 89         |
| SC_Societal Challenges (LM+ID)                                                        | 6         | 4         | 9         | 6         | 9         | 5         | 4         | 4         | 7         | 5         | 11        | 70         |
| <b>TOTAL</b>                                                                          | <b>34</b> | <b>36</b> | <b>36</b> | <b>28</b> | <b>36</b> | <b>32</b> | <b>30</b> | <b>31</b> | <b>32</b> | <b>40</b> | <b>36</b> | <b>371</b> |

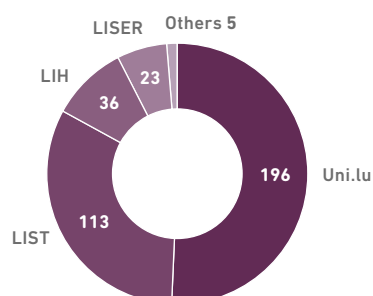
CORE: Funding by domain, between 2008 and 2018 (MEUR)



CORE: Projects by domain, between 2008 and 2018

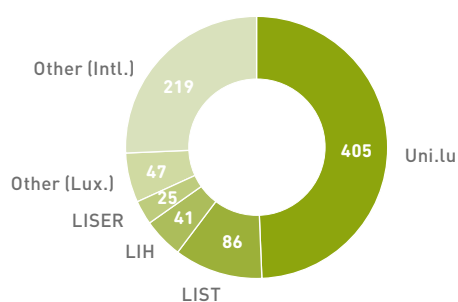


CORE: Projects by institution, between 2008 and 2018

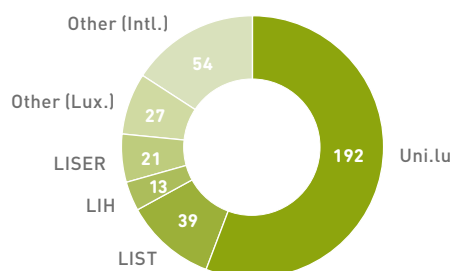


## AFR PHD & POSTDOC GRANTS

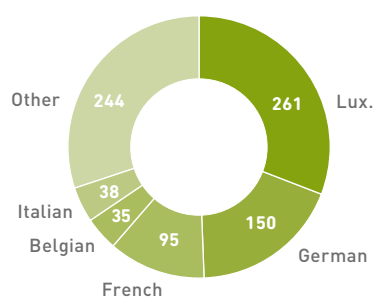
**AFR: PhD Grants per host institution (2008-2018)**



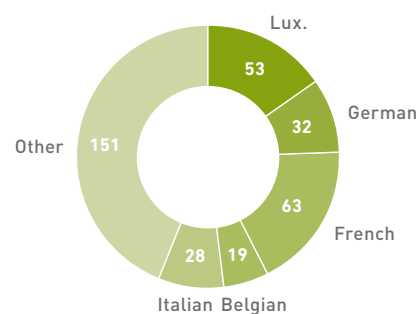
**AFR: Postdoc Grants per host institution (2008-2018)**



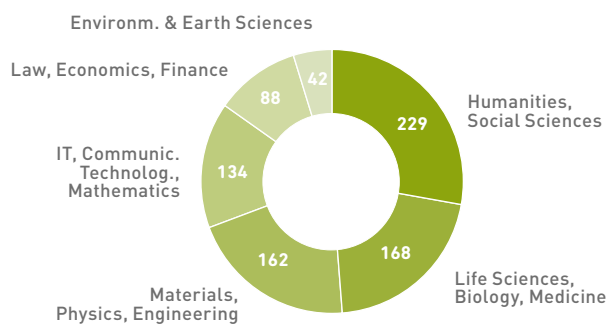
**AFR: PhD Grants by nationality (2008-2018)**



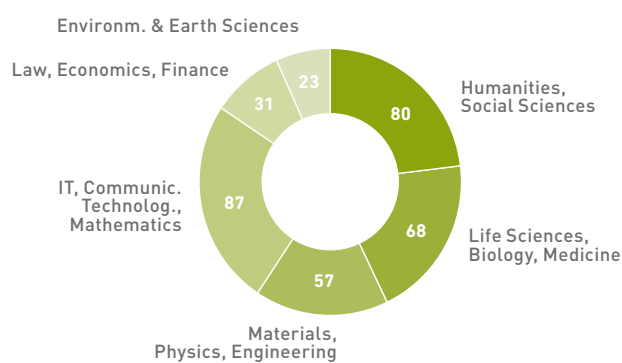
**AFR: Postdoc Grants by nationality (2008-2018)**



**AFR: PhD Grants by domain (2008-2018)**



**AFR: Postdoc Grants by domain (2008-2018)**



## WOMEN IN SCIENCE IN NUMBERS - FNR FUNDED

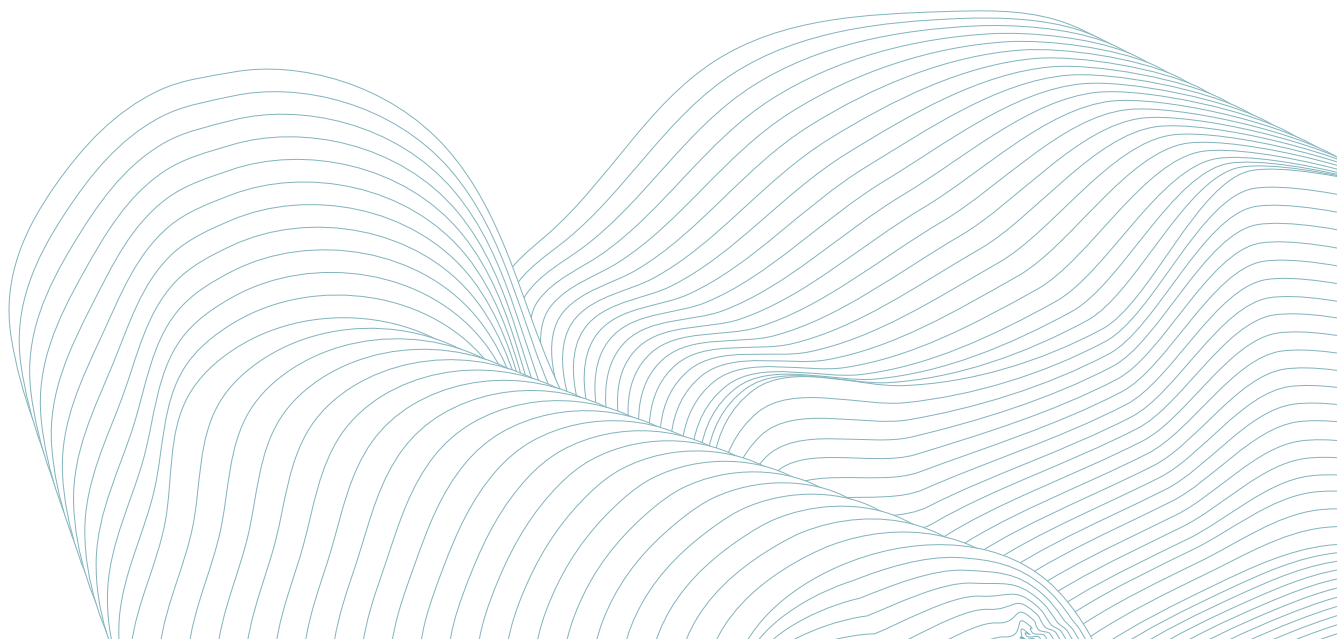
Gender balance in research is a topic frequently discussed and debated – it is a fact that nearly all countries in Europe have more men than women scientists, and it is also known that the proportion of women generally decreases the higher it goes up the career ladder.

The Luxembourg public research system employs approximately 2900 researchers (full time equivalent = FTE) , based on the statistics provided for 2015 by the Government. Around 1 in 4 researchers are female – putting Luxembourg below the EU average of 1 in 3. These statistics stem from the so-called SHE Figures from 2015 – an EU wide publication with data on female researchers' participation.

As for the FNR's funding instruments, statistics show that the success rate for retained proposals is almost identical between male and female applicants (2007 – 2018, main FNR programmes). This shows that the

evaluation procedure of the FNR does not have any significant distortions, which was also confirmed in a recent external and independent evaluation of the FNR's CORE selection procedure.

Also, there is a good gender balance in FNR's boards, with 50% female members in the governing board and 45% female members in the scientific council. The FNR expert panels are not yet as balanced (27% of 2018 panel members were female), but efforts are made to increase female participation.





OF **AFR PHD**  
GRANTS AWARDED  
TO WOMEN  
(2010-2018)



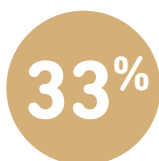
OF **AFR POSTDOC**  
GRANTS AWARDED  
TO WOMEN  
(2010-2018)



OF **INTER MOBILITY**  
RECIPIENTS  
ARE FEMALE  
(2012-2018)



OF RESEARCHERS  
ON **INTER** PROJECTS  
ARE FEMALE  
(2010-2018)



OF **INDUSTRIAL  
FELLOWSHIP**  
GRANTS AWARDED  
TO WOMEN (2016-2018)



**1797**  
SUBMITTED  
PROPOSALS **33.1%**

**760**  
RETAINED  
**33.7%**



**3633**  
SUBMITTED  
PROPOSALS **66.9%**

**1492**  
RETAINED  
**66.3%**

# 07 BALANCE SHEET AND PROFIT AND LOSS ACCOUNT

The accounts have been audited by KPMG Luxembourg, Société coopérative, Cabinet de révision agréé, and approved by the Board of Directors on March 16<sup>th</sup>, 2018. Only the original French version of the annual accounts and the audit opinion is binding. For the complete annual report (in French), please refer to [www.fnr.lu/annualreports](http://www.fnr.lu/annualreports)

## BALANCE SHEET

As at 31 December 2018 (EUR)

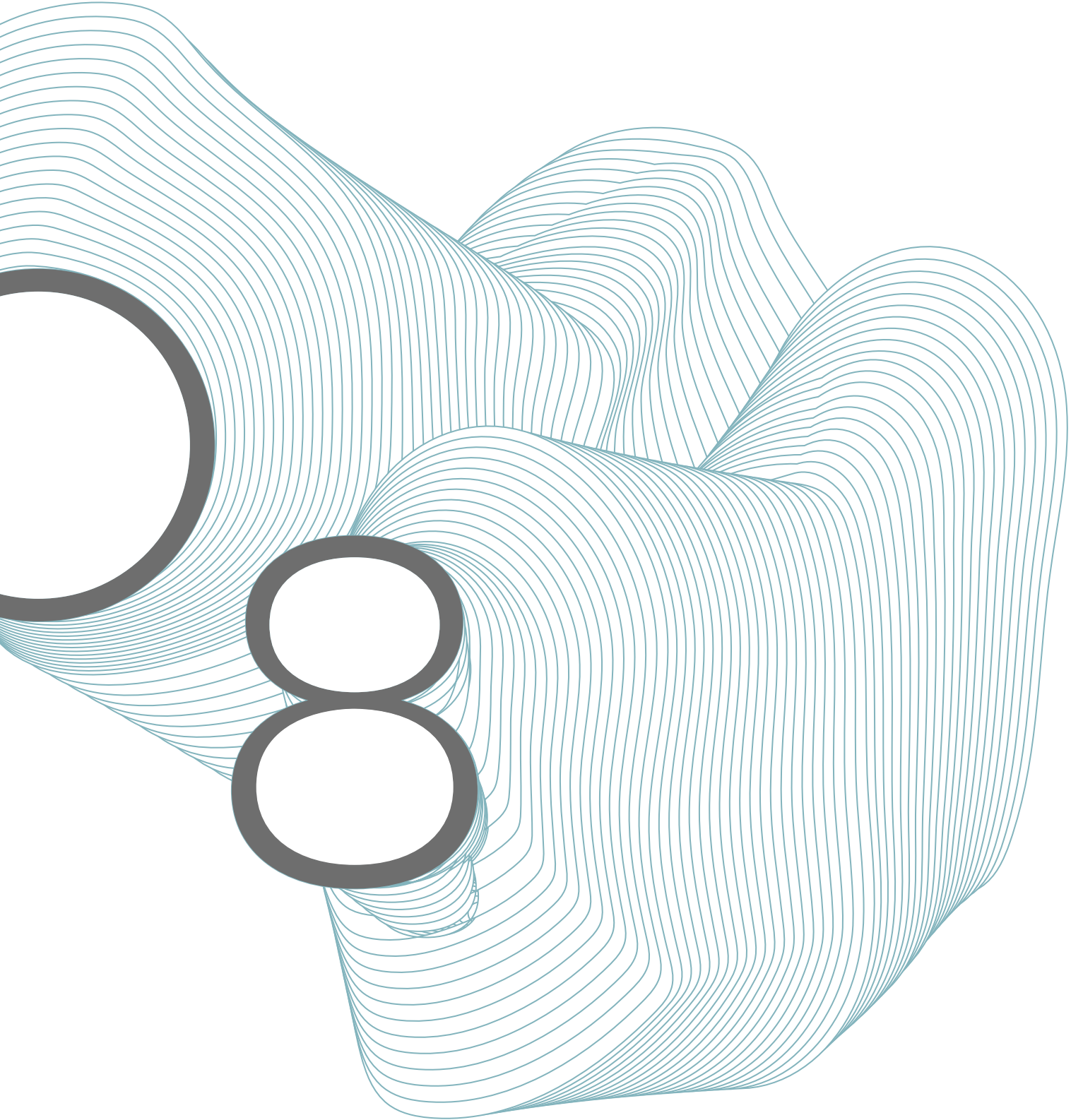
| ASSETS                                 | 2018                  |
|----------------------------------------|-----------------------|
| <b>FIXED ASSETS</b>                    |                       |
| ● Intangible fixed assets              | 0.00                  |
| ● Tangible fixed assets                | 143,824.61            |
| <b>CURRENT ASSETS</b>                  |                       |
| ● Budgetary allocations to be received | 109,095,760.61        |
| with a maturity less than 1 year       | 64,790,000.00         |
| ● Other receivables                    | 736,881.64            |
| ● Cash at bank                         | 92,738,522.46         |
| <b>DEFERRED CHARGES</b>                | 13,679.57             |
| <b>TOTAL ASSETS</b>                    | <b>202,728,668.89</b> |

| LIABILITIES                      | 2018                  |
|----------------------------------|-----------------------|
| <b>CAPITAL AND RESERVES</b>      |                       |
| ● Reserves                       | 5,220,684.10          |
| ● Result for the financial year  | 175,613.57            |
| <b>CREDITORS</b>                 |                       |
| ● Trade payables                 | 899,590.33            |
| ● Tax and social security debts  | 75,399.93             |
| ● Amounts owed to beneficiaries  | 171,999,626.07        |
| with a maturity less than 1 year | 76,267,756.84         |
| ● Other debts                    | 382,671.67            |
| <b>DEFERRED INCOME</b>           | 23,975,083.22         |
| <b>TOTAL LIABILITIES</b>         | <b>202,728,668.89</b> |

## PROFIT AND LOSS ACCOUNT

As at 31 December 2018 (EUR)

| INCOME                                    | 2018              |
|-------------------------------------------|-------------------|
| ● Budgetary allocation                    | 72,946,845.07     |
| ● Other operating income                  | 101,335.84        |
| ● Commitments made                        | (67,603,360.74)   |
| ● Operating costs (including staff costs) | (5,273,560.939)   |
| ● Value adjustments on fixed assets       | (69,857.84)       |
| ● Interest receivable and similar income  | 74,277.73         |
| ● Interest payable and similar charges    | (65.56)           |
| <b>PROFIT FOR THE FINANCIAL YEAR</b>      | <b>175,613.57</b> |



# 08 FUNDING INSTRUMENTS

## STRATEGIC OBJECTIVE 1:

To promote scientific quality and excellence in research

### CORE

CORE is a traditional programme for the funding of research projects. Proposed projects are submitted by the research institutions (bottom-up approach) and are part of the national research priorities defined by the Government (top-down approach). The projects are selected on the basis of their scientific quality.

### INTER

The objective of the INTER programme is to strengthen international cooperation and increase the impact of research activities in Luxembourg by promoting research projects which combine Luxembourg and foreign researchers. The programme is currently in three segments: (1) the international mobility programme, (2) bilateral cooperation, and (3) multi-lateral cooperation. The projects are selected on the basis of their scientific quality.

### RESCOM (Support for Research Communication)

The objective of the RESCOM instrument is to promote communication and exchange between researchers, notably by subsidising scientific events of an international scope.

### OPEN

The OPEN programme allows researchers to submit research projects whose themes are not covered by the fields of the CORE programme and therefore make it possible to identify research groups which are competitive at international level outside national priorities. The projects are selected on the basis of their scientific quality.

## STRATEGIC OBJECTIVE 2:

To strengthen research engendering an economic and societal impact

### Valorisation Programme (Proof of Concept, Knowledge & Innovation Transfer Support)

The purpose of the valorisation programme is to encourage the transfer of research results into economically viable innovations. The FNR can support feasibility studies and the realisation of prototypes and pilot systems for the purpose of projects with a high level of potential innovation. The project will be selected on the basis of the economic potential of the innovation and the proposed exploitation plan. The FNR may also support people whose expertise is needed to reflect the transfer of the results of the research into economically exploitable innovative projects.

### Industrial Fellowship

The PPP segment of the AFR programme quite specifically supports trainee researchers who carry out their research as part of a cooperation between a public research body and an industrial partner.

### BRIDGES

The PPP segment of the CORE programme supports in particular research projects carried out as part of a cooperation between a public research body and an industrial partner.

### IPBG (Industrial Partnership Block Grant)

The aim of the IPBG programme is to foster the cooperation between Luxembourg based companies active in R&D and public research institutions in Luxembourg. The IPBG awards a block allocation of PhD and/or Postdoc grants (AFR-PPP) in which Luxembourg-based industry partner(s) take the lead in arranging a research programme with a Luxembourg-based public research institution of their choice (in research relevant to FNR's strategic priority areas).

### **FNR-MECO (joint programming)**

Establish a partnership between the FNR and the Ministry of Economy with the goal of providing financial support for large, strategically important public-private projects aimed to generate the knowledge meeting future technological challenges for the partners and the country and to establish Luxembourg as an innovation hub.

### **SIS (Science in Society)**

The FNR wants to strengthen the link between sciences and society which is why it promotes scientific culture as one of its priority areas. This promotion aims to create awareness among the whole population, decision-makers and young people alike who are the citizens and researchers of the future. The objective is to create acceptance and comprehension of the role of sciences and research as creators of knowledge, innovation and to spark enthusiasm among young people about scientific careers. It is for this reason that the FNR offers platforms to assist researchers in promoting their activities, organises its own promotion activities in order to increase the visibility of sciences and research, and also provides financial support to researchers and science communicators, including teachers.

### **PSP (Promoting Science to the Public)**

The objective of the PSP-Classic programme is to strengthen the exchange between science and society. The programme co-funds projects that allow lay audiences (general public, school children, educational personnel etc.) to come into contact with science and research in an interactive way.

Projects must communicate research results or general knowledge about science and research (the career of a researcher, scientific methods, the complexity of research etc.). The choice of scientific themes is free and the funding programme is open to all disciplines. The PSP-Flagship programme aims to set up long-term science outreach activities with a sustainable and lasting impact on the promotion of science to the public in Luxembourg. The promotion of science or research needs to be placed at the centre and projects must include the active participation of the audience.

PSP-Flagship is different from PSP-Classic in the sense that it focusses on long-term projects with high impact. Similar to PSP-Classic, it is open to proposals from all scientific disciplines. Both new projects and ongoing projects are eligible for PSP-Flagship co-funding.

**STRATEGIC OBJECTIVE 3:**

**To strengthen the efficiency and durability of Luxembourg public research - To invest in human capital**

**PEARL**

The PEARL programme aims to contribute to developing a truly critical mass and international visibility of research priorities in Luxembourg both in quantitative and qualitative terms. The principal aim of PEARL is to offer a flexible and highly attractive tool to institutions so they can attract more experienced and established researchers who are recognised at international level. These parties will transfer and develop their research programmes to Luxembourg and thereby contribute to accelerating the development of national priorities.

**ATTRACT**

The ATTRACT programme aims to strengthen the excellence of Luxembourg research by attracting researchers of an excellent scientific level who are able to draw upon recognised professional experience in research. The programme offers researchers not yet established in Luxembourg the opportunity to set up their own research in a public research body in Luxembourg which is prepared to accommodate them with a jointly submitted project.

**NCER (National Centre of Excellence in Research)**

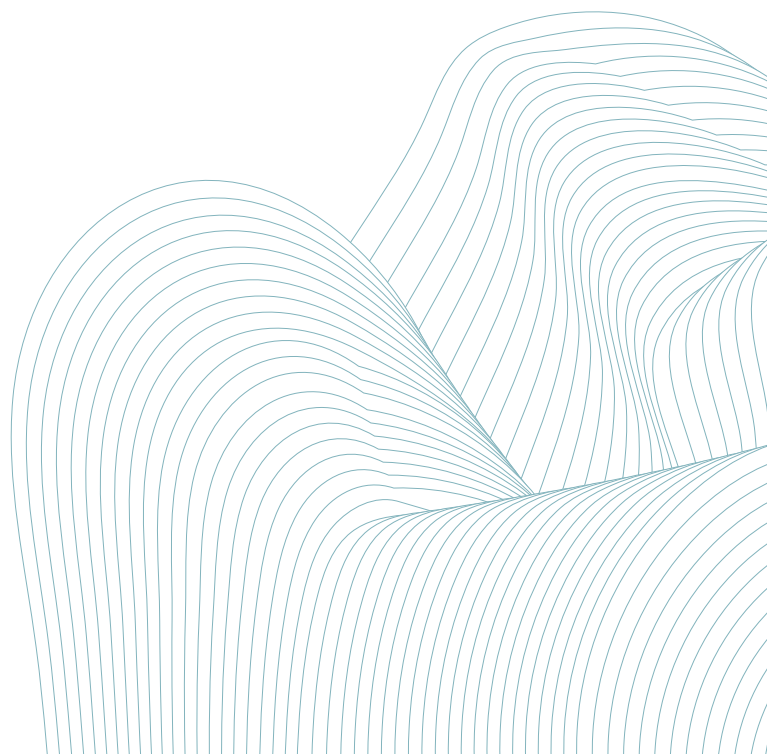
The objective of the NCER programme is to support the development of public research in areas of strategic interest in order to derive a socio-economic return in the medium to long term. It aims to strengthen cooperation between institutions and to concentrate research activities based around a common scientific and socio-economic challenge. The objective of the programme is to increase the critical mass of public research in Luxembourg and to achieve greater visibility at international level.

**AFR (Aides à la Formation-Recherche Individual)**

The AFR programme is one of the FNR's longest-running funding schemes and now serves the specific purpose of providing funding to the best researchers who are studying at doctorate levels. The AFR PhD grant scheme is divided into two sub-categories: AFR PhD in Luxembourg (AFR Incoming) and AFR PhD abroad (AFR Outgoing).

**PRIDE**

PRIDE is the FNR's new programme for funding doctoral research in Luxembourg. Under this programme, a block of PhD grants is awarded to a consortium of excellent researchers grouped around a coherent research and training programme. PRIDE is open to all domains of research and technological development. PRIDE aims at attracting excellent PhD candidates to Luxembourg and offering them a high quality interdisciplinary research training. Compared to the AFR individual grant scheme for PhDs, PRIDE provides greater advantage to institutions and PhD candidates, as institutions are able to immediately offer a full PhD grant to promising candidates, without having to undergo a separate application and selection procedure at the FNR.





## CORE 2018

| PROJECT ACRONYM | PROJECT TITLE                                                                                                                                               | PRINCIPAL INVESTIGATOR | HOST INSTITUTION | DOMAIN | FNR CONTRIBUTION IN EUR |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------|--------|-------------------------|
| ● LIGNOBENZ     | <i>New lignin-based benzoxazine polymers</i>                                                                                                                | Pierre Verge           | LIST             | MS     | 537,000.00              |
| ● REPAIR        | <i>Repairing Technology – Fixing Society? History of Maintenance and Repair in Luxembourg (1918-1990)</i>                                                   | Stefan Krebs           | UL               | SC     | 636,000.00              |
| ● BETHAB        | <i>Understanding the neurobiology of gambling addiction in the age of online betting</i>                                                                    | Damien Brevers         | UL               | BM     | 533,000.00              |
| ● Muco-IBD      | <i>Mucobiomes in the pathogenesis of inflammatory bowel disease</i>                                                                                         | Mahesh Desai           | LIH              | BM     | 678,000.00              |
| ● TRANSLA       | <i>Translanguaging Programme for Teachers Working with Language Minority Preschool Children in Luxembourg</i>                                               | Gabrijela Aleksic      | UL               | SC     | 287,000.00              |
| ● LIPOC         | <i>Lightweight Post-Quantum Cryptography for the Internet of Things</i>                                                                                     | Zhe Liu                | SnT (UL)         | IS     | 576,000.00              |
| ● RUMEXP        | <i>Testing the Random Utility Model (RUM) in migration: Evidence from Lab-in-the-field experiments</i>                                                      | Michel Beine           | UL               | SC     | 347,000.00              |
| ● TIMING        | <i>Time: too little, too late or too lone? Theoretical, empirical and experimental investigation of time choices</i>                                        | Sam Cosaert            | LISER            | SC     | 578,000.00              |
| ● STELLAR       | <i>teSting sELf-LeARning systems</i>                                                                                                                        | Yves Le Traon          | SnT (UL)         | IS     | 746,000.00              |
| ● COMBATIC      | <i>Improving T-cell and Macrophage Immune checkpoint blockades by combining autophagy inhibitors</i>                                                        | Bassam Janji           | LIH              | BM     | 426,000.00              |
| ● PainFlex      | <i>Flexibility in attention for pain over changing contexts and its impact upon poor pain outcomes: An experimental investigation and training approach</i> | Dimitri Van Ryckeghem  | UL               | BM     | 607,000.00              |
| ● GRASP         | <i>Effects of Grammatical Reflection on Spelling among multilingual pupils</i>                                                                              | Constanze Weth         | UL               | SC     | 541,000.00              |
| ● PROCEED       | <i>Exploitation of plant seed mucilage in the development of protein based xero-scaffolds embedding human gut relevant probiotic cells.</i>                 | Christos Soukoulis     | LIST             | SR     | 617,000.00              |
| ● gENESiS       | <i>Energy management system for smart sustainable buildings: planning, operation and optimal integration in the smart energy system</i>                     | Florin Capitanescu     | LIST             | SR     | 770,000.00              |
| ● FESI          | <i>Financial Strain and Economic Instability: Effects on Wellbeing and Behaviour over the Life Course</i>                                                   | Conchita D'Ambrosio    | UL               | SC     | 617,000.00              |
| ● STV           | <i>Socio-Technical Verification of Information Security and Trust in Voting Systems</i>                                                                     | Peter Y. A. Ryan       | SnT (UL)         | IS     | 661,000.00              |
| ● HyLIT         | <i>Architectural Support for Intrusion Tolerant Operating-System Kernels</i>                                                                                | Marcus Völz            | SnT (UL)         | IS     | 767,000.00              |
| ● TER_INEQ      | <i>Territorial inequality: a study of the local mechanisms implicated in long run changes in property wealth concentration</i>                              | Antoine Paccoud        | LISER            | SC     | 269,000.00              |
| ● cROSSfire 2.0 | <i>Elucidating the function of antioxidants and ROS on metabolism and inflammation in macrophages and B cells</i>                                           | Dirk Brenner           | LIH              | BM     | 615,000.00              |
| ● DANTE         | <i>Dicarboxylic Acid syNThesis Elucidation</i>                                                                                                              | Sylvain Legay          | LIST             | SR     | 595,000.00              |
| ● COReLIGHT     | <i>Colloidal Organization at interfaces Reconfigured by LIGHT-driven thermal Marangoni flows</i>                                                            | Emmanouil Anyfantakis  | UL               | MS     | 456,000.00              |
| ● DEMA          | <i>Doing Experimental Media Archaeology: Theory &amp; Practice</i>                                                                                          | Andreas Fickers        | UL               | SC     | 767,000.00              |
| ● QUTHERM       | <i>Advancing quantum thermodynamics</i>                                                                                                                     | Thomas Schmidt         | UL               | MS     | 612,000.00              |
| ● CARNAC        | <i>Carbon Nanotube sheets for Cells for liquid crystals</i>                                                                                                 | Giusy Scalia           | UL               | MS     | 467,000.00              |
| ● REFOX         | <i>Theoretical investigation and design of ultra-REactive Functional OXides</i>                                                                             | Jorge Iniguez Gonzalez | LIST             | MS     | 656,000.00              |
| ● SPRINGER      | <i>Signal Processing for Next Generation Radar</i>                                                                                                          | Bjorn Ottersten        | SnT (UL)         | IS     | 766,000.00              |

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SR Sustainable Resource Management in Luxembourg

| PROJECT ACRONYM | PROJECT TITLE                                                                                                                                                                  | PRINCIPAL INVESTIGATOR  | HOST INSTITUTION | DOMAIN | FNR CONTRIBUTION IN EUR |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------|--------|-------------------------|
| ● NAXDE         | <i>Cellular and animal models of a new paediatric neurodegenerative disorder to investigate disease mechanism, develop diagnostic tools and test small molecule treatments</i> | Carole Linster          | UL               | BM     | 849,000.00              |
| ● STAR-Sol      | <i>Semi-transparent solar cells for building-integrated photovoltaics</i>                                                                                                      | Phillip Dale            | UL               | MS     | 835,000.00              |
| ● ThreatAdapt   | <i>Adaptive Byzantine Fault and Intrusion Tolerance</i>                                                                                                                        | Paulo Esteves-Verissimo | SnT (UL)         | IS     | 875,000.00              |
| ● ALPHA1        | <i>Performance and risk characteristics of the alternative investment fund industry</i>                                                                                        | Roman Kräussl           | UL               | IS     | 890,000.00              |
| ● SOHOME        | <i>Social Housing and Homelessness</i>                                                                                                                                         | Céline Dujardin         | UL               | SC     | 88,000.00               |
| ● MEMPHIS       | <i>Multiscale 3D mapping of Hydrogen Distribution in Solids</i>                                                                                                                | Santhana Eswara         | LIST             | MS     | 535,000.00              |
| ● ONNIVA        | <i>Automatic Detection and Prevention of Deserialization Vulnerabilities</i>                                                                                                   | Alexandre Bartel        | SnT (UL)         | IS     | 631,000.00              |
| ● A-HOUSE       | <i>The Effects of Affordable Housing on Subjective Well-being</i>                                                                                                              | Magdalena Gorczynska    | LISER            | SC     | 460,000.00              |
| ● FEMPOW        | <i>Power of Consort – Power of Queen Ruling practices in composite monarchy from a gender comparative perspective (the House of Luxembourg in Europe, 1292–1442)</i>           | Anna Jagosova           | UL               | SC     | 352,000.00              |
| ● EnCaViBS      | <i>The EU NIS Directive: Enhancing Cybersecurity across Vital Business Sectors (EnCaViBS)</i>                                                                                  | Mark Cole               | SnT (UL)         | IS     | 969,000.00              |
| TOTAL           |                                                                                                                                                                                |                         |                  |        | 21,611,000.00           |

For a detailed summary of each project as well as other information, please refer to [www.fnr.lu/core](http://www.fnr.lu/core)



## BRIDGES 2018

| PROJECT ACRONYM | PROJECT TITLE                                                                                                                                    | PRINCIPAL INVESTIGATOR | HOST INSTITUTION | DOMAIN | FNR CONTRIBUTION IN EUR |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------|--------|-------------------------|
| ● FEOSbild      | <i>Fast erection of steel structures for buildings</i>                                                                                           | Markus Schaefer        | UL               | MS     | 303,294.00              |
| ● MOTASYN-PD    | <i>Modelling therapy development in Parkinson's disease based on patient-derived iPSC lines harbouring pathogenic mutations in the SNCA gene</i> | Rejko Krüger           | UL               | BM     | 399,594.00              |
| ● TESTFAST      | <i>Software testing in a fast, clever and effective way</i>                                                                                      | Yves Le Traon          | SnT (UL)         | IS     | 362,595.00              |
| ● EQUACS        | <i>Early QUALity Assurance of Critical Systems</i>                                                                                               | Mehrdad Sabetzadeh     | SnT (UL)         | IS     | 349,905.00              |
| ● SWAM          | <i>Smart Waste Collection Systems</i>                                                                                                            | Djamel Khadraoui       | LIST             | IS     | 309,702.00              |
| ● Combi-Cast    | <i>Combined approach for the spatial highly resolved, intra-day PV forecasting for smart distribution grid operation</i>                         | Daniel Koster          | LIST             | MS     | 305,534.00              |
| ● CAFFE PF      | <i>Cost-aware Active Feedback &amp; Feature Extraction for Profiling Financial Transactions</i>                                                  | Radu State             | SnT (UL)         | IS     | 372,318.00              |
| ● IMoReF        | <i>Improved Model-based Requirements for Financial Applications</i>                                                                              | Lionel Briand          | SnT (UL)         | IS     | 393,116.00              |
| ● PAX           | <i>Product Quality Improvements through Advanced Analytics</i>                                                                                   | Riad Aggoune           | LIST             | IS     | 400,000.00              |
| ● SigPep        | <i>Identification of robust signature peptides for species identification</i>                                                                    | Gunnar Dittmar         | LIH              | BM     | 193,196.00              |
| ● MeTProCC      | <i>Development and Validation of a Methodology for Thermal Prediction of the Chill-Down of Cryogenic Valves for Rocket Engines</i>               | Stephan Leyer          | UL               | MS     | 150,425.00              |
| ● PorSi3DLIB    | <i>Porous Silicon 3D Lithium-ion Battery</i>                                                                                                     | Guillaume Lamblin      | LIST             | MS     | 399,957.00              |
| ● VP4HPC        | <i>Virtual Prototyping Enhanced Through Novel High Performance Computing Technology</i>                                                          | Bernhard Peters        | UL               | MS     | 190,852.00              |
| ●               | <i>Innovative mechano-chemical process to scale up the production of stable nanocarrier dispersions for the pharmaceutical industry</i>          | Emmanuel Scolan        | LIST             | MS     | 186,635.00              |
| ● SAMIA-3D      | <i>Structural composite material for 3D Printing</i>                                                                                             | Henri Perrin           | LIST             | MS     | 399,957.00              |
| ● GASENSE       | <i>Multiplexed membranes on temperature-controlled nanowires gas sensor connected to ASIC</i>                                                    | Damien Lenoble         | LIST             | MS     | 400,000.00              |
| TOTAL           |                                                                                                                                                  |                        |                  |        | 5,117,080.00            |

For a detailed summary of each project as well as other information, please refer to [www.fnr.lu/bridges](http://www.fnr.lu/bridges)

| PROJECT ACRONYM    | PROJECT TITLE                                                                                                                                                                                                                                                          | PRINCIPAL INVESTIGATOR | HOST INSTITUTION       | DOMAIN | FNR CONTRIBUTION IN EUR |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------|--------|-------------------------|
| ● PD-Strat         | <i>Multi-dimensional stratification of Parkinson's disease patients for personalised interventions</i>                                                                                                                                                                 | Enrico Glaab           | UL                     | BM     | 282,000.00              |
| ● DAPAS            | <i>Deploying AAL packages at Scale</i>                                                                                                                                                                                                                                 | Viviane von Döllen     | Stiftung Hëllef Doheem | IS     | 276,000.00              |
| ● nanoPD           | <i>Development of a novel organs-on-a-chip platform for nanodrug delivery and functionality testing to treat Parkinson's disease.</i>                                                                                                                                  | Jens Schwamborn        | UL                     | MS     | 492,000.00              |
| ● PROMISE          | <i>Development of a novel microbiota-based therapy for the prevention of type 2 diabetes mellitus</i>                                                                                                                                                                  | Fay Betsou             | LIH                    | BM     | 336,000.00              |
| ● 3D Printinn      | <i>3D printable Innovative Bio Based Material for Wood Mimics</i>                                                                                                                                                                                                      | Youssef Habibi         | LIST                   | MS     | 354,000.00              |
| ● PLACOATAM        | <i>Low cost atmospheric pressure micro plasma coater instrument for its integration on a 2D and 3D additive manufacturing process of your proposal</i>                                                                                                                 | Patrick Choquet        | LIST                   | MS     | 477,000.00              |
| ● ENVALGRA         | <i>Development of a new generation of environmentally friendly, microalgal oil-based functional fluids modified with graphene family nanomaterials (GFNs)</i>                                                                                                          | Tommaso Serchi         | LIST                   | MS     | 437,000.00              |
| ● SOIL3D           | <i>Elucidating the 3D chemical and physical architecture of soil micro-structures by combining spectromicroscopic techniques and developing of novel computational approaches</i>                                                                                      | Jean-Nicolas Audinot   | LIST                   | MS     | 437,000.00              |
| ● SURCVS           | <i>Secure, Usable and Robust Cryptographic Voting Systems</i>                                                                                                                                                                                                          | Peter Y. A. Ryan       | SnT (UL)               | IS     | 858,000.00              |
| ● MoxiMulti-DoseMo | <i>Moxidectin for accelerating onchocerciasis elimination: A paediatric dose-finding study, a phase 3b trial comparing efficacy and safety of annual and biannual moxidectin or ivermectin treatment and mathematical modelling of moxidectin and ivermectin based</i> | Michel Vaillant        | LIH                    | BM     | 146,000.00              |
| ● MAMaSyn-PD       | <i>Dissecting the pathological relevance of alpha-synuclein association with Mitochondria-Associated Membranes in Parkinson's disease: A bi-national collaborative approach</i>                                                                                        | Rejko Krüger           | UL                     | BM     | 660,000.00              |
| ● FLUO-GUT         | <i>Oral exposure and gut-targeted toxicity of PFOA and its precursor 8:2 FTMO under chronic stress: when high-resolution chemical imaging bridges food toxicology</i>                                                                                                  | Jean-Nicolas Audinot   | LIST                   | BM     | 517,000.00              |
| ● GALF             | <i>Galois representations, automorphic forms and their L-functions</i>                                                                                                                                                                                                 | Gabor Wiese            | UL                     | MT     | 412,000.00              |
| ● NEGATIVE CAPACI  | <i>FNR - Fundamentals of Negative Capacitance: Towards New Low Power Electronics</i>                                                                                                                                                                                   | Jorge Iniguez Gonzalez | LIST                   | MS     | 557,000.00              |
| ● HARVESTORE       | <i>Energy harvesting and energy storage devices based on nanomaterials for autonomous sensors</i>                                                                                                                                                                      | Emmanuel Defay         | LIST                   | MS     | 529,000.00              |
| ● SATOCROSS        | <i>Support of Advanced Test Coverage Criteria for ROBust and Secure Software</i>                                                                                                                                                                                       | Michail Papadakis      | SnT (UL)               | IS     | 362,000.00              |
| ● COGNIVITRA       | <i>COGNitive VItality TRAIning at home</i>                                                                                                                                                                                                                             | Anne-Marie Schuller    | Rehazenter             | BM     | 189,000.00              |
| ● CROSS-POP        | <i>The Right-Wing Populist Discourse in European Cross-Border Areas. A comparison between Switzerland and Luxembourg</i>                                                                                                                                               | Christian Lamour       | LISER                  | SC     | 294,000.00              |
| ● DELICIOS         | <i>An Integrated Approach to Study the Delegation of Conflict-of-Interest Decisions to Autonomous Agents</i>                                                                                                                                                           | Jean Botev             | UL                     | IS     | 278,000.00              |
| ● MATIS            | <i>Making Transparent Invisible Surveillance</i>                                                                                                                                                                                                                       | Mark Cole              | UL                     | LE     | 121,000.00              |

| PROJECT ACRONYM | PROJECT TITLE                                                                                                                                                  | PRINCIPAL INVESTIGATOR | HOST INSTITUTION | DOMAIN | FNR CONTRIBUTION IN EUR |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------|--------|-------------------------|
| ● CASInO        | <i>The happy Commuter: a life-oriented Approach of commuting SatisfactIOn</i>                                                                                  | Veronique Van Acker    | LISER            | SR     | 431,000.00              |
| ● SimBa         | <i>Simulating economic and environmental impacts of dairy cattle management using Agent Based Models</i>                                                       | Antonino Marvuglia     | LIST             | SR     | 656,000.00              |
| ● CeMi          | <i>Cemeteries and Crematoria as public spaces of belonging in Europe: a study of migrant and minority cultural inclusion, exclusion and integration</i>        | Sonja Kmec             | UL               | SC     | 40,000.00               |
| ● BEST          | <i>Developing mobility-on-demand solutions for sustainable mobility-the case of Luxembourg</i>                                                                 | Thomas Gibon           | LIST             | SR     | 600,000.00              |
| ● PEVdata       | <i>Data solutions based on a basket prospective trial with pembrolizumab and vorinostat in patients with advanced and/or recurrent squamous cell carcinoma</i> | Fay Betsou             | LIH              | BM     | 335,000.00              |
| TOTAL           |                                                                                                                                                                |                        |                  |        | 10,076,000.00           |

For a detailed summary of each project as well as other information, please refer to [www.fnr.lu/inter](http://www.fnr.lu/inter)



## INTER-MOBILITY 2018

| PROJECT ACRONYM | PROJECT TITLE                                                                                                | PRINCIPAL INVESTIGATOR | HOST INSTITUTION | DOMAIN | FNR CONTRIBUTION IN EUR |
|-----------------|--------------------------------------------------------------------------------------------------------------|------------------------|------------------|--------|-------------------------|
| ● COSINUS       | <i>Collaboration with the Scripps Instiute in the US</i>                                                     | Rudi Balling           | UL               | BM     | 41,000.00               |
| ● vdW-HighPress | <i>The effect of the van der Waals forces in the relative stability of silid phases at high pressures</i>    | Alexandre Tkatchenko   | UL               | MS     | 7,000.00                |
| ● FUSGLIO       | <i>MRgFUS facilitated local treatment of brain tumors</i>                                                    | Olivier Keunen         | LIH              | BM     | 150,000.00              |
| ● EcoPol        | <i>Trade Unions and the Politics of Emissions Reductions: Shaping the Transition to a Low-Carbon Economy</i> | Adrien Thomas          | LISER            | SC     | 38,000.00               |
| ● MoBILife      | <i>Mobility, Biography, Identity, towards Quality of Life</i>                                                | Philippe Gerber        | LISER            | SC     | 79,000.00               |
| ● QOE-WiC       | <i>Visiting Professor conducting research on wireless caching</i>                                            | Symeon Chatzinotas     | UL               | IS     | 78,000.00               |
| ● RAPID-IN      | <i>Risk assessment for psyllids and whiteflies under current and future climate conditions in Luxembourg</i> | Michael Eickermann     | LIST             | SR     | 18,000.00               |
| ● EntAAI        | <i>Entrepreneurship and Applied Artificial Intelligence</i>                                                  | Denise Fletcher        | UL               | IS     | 106,000.00              |
| ● FASHION       | <i>Fintech regulatory Sandboxes from an open Innovation perspective</i>                                      | Pierre-Jean Barlatier  | LIST             | IS     | 83,000.00               |
| ● TheCoco       | <i>Thermodynamics of Computation and Communication</i>                                                       | Massimiliano Esposito  | UL               | MS     | 42,000.00               |
| TOTAL           |                                                                                                              |                        |                  |        | 642,000.00              |

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| PROJECT ACRONYM | PROJECT TITLE                                                                        | PROJECT LEADER  | HOST INSTITUTION | DOMAIN | FNR CONTRIBUTION IN EUR |
|-----------------|--------------------------------------------------------------------------------------|-----------------|------------------|--------|-------------------------|
| ● 1cFlux        | <i>Understanding and targeting the function of formate overflow in cancer</i>        | Johannes Meiser | LIH              | BM     | 1,500,000.00            |
| ● ECHIDNA       | <i>Environmental Cheminformatics to Identify Unknown Chemicals and their Effects</i> | Emma Schymanski | UL               | SR     | 2,000,000.00            |
| <b>TOTAL</b>    |                                                                                      |                 |                  |        | <b>3,500,000.00</b>     |

For a detailed summary of each project as well as other information, please refer to [www.fnr.lu/attract](http://www.fnr.lu/attract)

| ACTION       | PROJECT ACRONYM | PROJECT TITLE                                                                                                                                      | PRINCIPAL INVESTIGATOR                | HOST INSTITUTION | DOMAIN | FNR CONTRIBUTION IN EUR |
|--------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|------------------|--------|-------------------------|
| ● Pathfinder | GenoMask        | Early stage read filtering and masking of genomic information                                                                                      | Jérémie Decouchant                    | UL               | BM     | 49,970.00               |
| ● Pathfinder | NoCry           | No more Cryptographic Ransomware                                                                                                                   | Gabriele Lenzini                      | UL               | IS     | 50,000.00               |
| ● Pathfinder | HAPPY           | HAPPY: High-throughput APPROach for microfluidics-enabled lifespan determination in Yeast                                                          | Nicole Paczia                         | UL               | BM     | 39,280.00               |
| ● Pathfinder | Nutriomix       | Personalized nutrition through metabolic modeling of multi-omics data                                                                              | Ines Thiele                           | UL               | BM     | 49,870.00               |
| ● Pathfinder | PREMA 1         | PREDictive MAintenance Analysis                                                                                                                    | Jorge Meira                           | UL               | IS     | 49,980.00               |
| ● Pathfinder | Softsensors     | Software sensors for biogas plants                                                                                                                 | Khadidja Chaib Draa                   | UL               | IS     | 49,570.00               |
| ● Pathfinder | AURORA          | unpredictAble Uav swaRms fOr suRveillAnce                                                                                                          | Grégoire Danoy                        | UL               | IS     | 48,000.00               |
| ● Pathfinder | DAPROSELF       | KNIWWELINO - Pathway to Sustainable Eco-System                                                                                                     | Christian Moll                        | UL               | IS     | 49,980.00               |
| ● Pathfinder | KNIWWEL2B       | TARGETplace                                                                                                                                        | Roderick McCall                       | LIST             | IS     | 25,000.00               |
| ● Pathfinder | TARGETPlace     | Data Protection Self Assessment Method For SMEs                                                                                                    | Andra Giurgiu                         | LIST             | IS     | 43,830.00               |
| ● Pathfinder | MaGrid          | A language-neutral application for teaching and learning early mathematical skills                                                                 | Romain Martin                         | UL               | IS     | 50,000.00               |
| ● Pathfinder | CycloPD         | Developing Cyclodextrin as a small molecule compound for Parkinson's disease treatment                                                             | Jens Schwamborn                       | UL               | BM     | 26,600.00               |
| ● Pathfinder | econoRAS2       | Drugs against PDEdelta for KRAS driven cancer therapy                                                                                              | Daniel Abankwa                        | UL               | BM     | 30,000.00               |
| ● Pathfinder | LIH383          | Evaluation of LIH383 as a new neuro-pharmacological modulator                                                                                      | Andy Chevigne                         | LIH              | BM     | 30,000.00               |
| ● Pathfinder | MAISA           | Maintenance of Semantic Annotations                                                                                                                | Cédric Pruski                         | LIST             | IS     | 25,000.00               |
| ● Pathfinder | SHIM            | Smart Waterjet Head for Industry 4.0 Manufacturing                                                                                                 | Edoardo Copertaro                     | UL               | MS     | 28,000.00               |
| ● Pathfinder | MytHiC          | Multi-Hop Carpooling                                                                                                                               | Emile Simon                           | LIST             | IS     | 30,000.00               |
| ● Pathfinder | SIGMMA          | Secure, Interoperable and Global Mobile Money in sub-Saharan Africa                                                                                | Tegawendé François D'Assise Bissyandé | SnT (UL)         | IS     | 30,000.00               |
| ● Pathfinder | WoRMM           | Workplace Relocation and Mobility Management                                                                                                       | Francesco Viti                        | UL               | IS     | 49,000.00               |
| ● Pathfinder | ActPoSS         | Active Power Support for Smart Grids                                                                                                               | Patrick Kobou Ngani                   | UL               | MS     | 50,000.00               |
| ● POC        | MyoRPROG        | Prognostic gene classifier in stage II colorectal cancer                                                                                           | Elisabeth Letellier                   | UL               | BM     | 397,000.00              |
| ● POC        | VitalizeMe      | Further development, validation and commercial exploitation of an advanced alveolar in vitro model for the prediction of respiratory sensitization | Tommaso Serchi                        | LIST             | BM     | 385,000.00              |
| ● POC        | SIMMS           | Swarm Intelligent Mission systeMS                                                                                                                  | Grégoire Danoy                        | SnT (UL)         | IS     | 199,530.00              |
| ● POC        | PreMaaS         | Predictive Maintenance as a Service                                                                                                                | Jorge Augusto Meira                   | SnT (UL)         | IS     | 199,730.00              |
| ● POC        | GenoMask-PoC    | Early stage read filtering and masking of genomic information                                                                                      | Jérémie Decouchant                    | SnT (UL)         | BM     | 232,240.00              |
| ● POC        | NoCry PoC       | No More Cryptographic Ransomware, Proof of Concept                                                                                                 | Gabriele Lenzini                      | SnT (UL)         | IS     | 199,940.00              |
| ● POC        | Nutriomix (POC) | Personalized nutrition through metabolic modeling of multi-omics data                                                                              | Alberto Noronha                       | UL               | BM     | 399,950.00              |
| ● POC        | Kniw2S          | Kniwwelino to School                                                                                                                               | Valérie Maquil                        | LIST             | IS     | 193,480.00              |
| ● POC        | STARRI          | System for Training using Augmented Reality for Radiological Incidents                                                                             | Roderick McCall                       | LIST             | IS     | 197,645.00              |
| TOTAL        |                 |                                                                                                                                                    |                                       |                  |        | 3,211,595.00            |

For a detailed summary of each project as well as other information, please refer to [www.fnr.lu/jump](http://www.fnr.lu/jump)

 **OPEN 2018**

| PROJECT ACRONYM | PROJECT TITLE                                                                                  | PRINCIPAL INVESTIGATOR | HOST INSTITUTION | DOMAIN | FNR CONTRIBUTION IN EUR |
|-----------------|------------------------------------------------------------------------------------------------|------------------------|------------------|--------|-------------------------|
| ● APOGee        | <i>APproximation Of Gaussian functionals</i>                                                   | Yvan Nourdin           | UL               | MT     | 580,000.00              |
| ● RREXAM        | <i>Rational Reflection Examined</i>                                                            | Frank Hofmann          | UL               | SC     | 256,000.00              |
| ● VAPOUR        | <i>Advanced Asymmetry Tropospheric Products for Meteorology from GNSS and SAR observations</i> | Norman Teferle         | UL               | SR     | 461,000.00              |
| <b>TOTAL</b>    |                                                                                                |                        |                  |        | <b>1,297,000.00</b>     |

For a detailed summary of each project as well as other information, please refer to [www.fnr.lu/open](http://www.fnr.lu/open)

 **RESCOM 2018**

| PROJECT TITLE                                                                                                                                                          | PRINCIPAL INVESTIGATOR | HOST INSTITUTION                | DOMAIN | FNR CONTRIBUTION IN EUR |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------------------|--------|-------------------------|
| ● <i>Narrative kultureller Transformationen. Zu interkulturellen Schreibweisen in der deutschsprachigen Literatur des Gegenwart</i>                                    | Dieter Heimböckel      | UL                              | SC     | 4,000.00                |
| ● <i>Luxembourg Logic for AI Summit (LuxLogAI2018)</i>                                                                                                                 | Leon van der Torre     | SnT (UL)                        | IS     | 24,000.00               |
| ● <i>New Trends in Topological Insulators and Narrow Gap Semiconductors (NTTI/NGS) 2018</i>                                                                            | Thomas Schmidt         | UL                              | MS     | 18,000.00               |
| ● <i>4th International Parkinson's Disease Symposium</i>                                                                                                               | Rejko Krueger          | UL                              | BM     | 24,000.00               |
| ● <i>Mathematics, Science and Technology</i>                                                                                                                           | Jean-Marc Schlenker    | UL                              | MT     | 21,000.00               |
| ● <i>Current challenges for EU cross-border litigation in a changing procedural environment</i>                                                                        | Burkhard Hess          | Max Planck Institute Luxembourg | SC     | 20,000.00               |
| ● <i>IOSCO and the new international financial architecture: what role for IOSCO in the development and implementation of cross-border regulation and equivalence?</i> | Pierre-Henri Conac     | UL                              | SC     | 33,000.00               |
| ● <i>The European Union as global international actor and Investment Treaties</i>                                                                                      | Eleftheria Neframi     | UL                              | SC     | 8,000.00                |
| ● <i>Lecture Series in Translational Bioinformatics and Systems Biomedicine</i>                                                                                        | Francisco Azuaje       | LIH                             | BM     | 18,000.00               |
| ● <i>Improving Patient and Population Health through Innovative e-Health Interventions</i>                                                                             | Laetitia Huiart        | LIH                             | BM     | 24,000.00               |
| ● <i>Lecture series in CANCER RESEARCH</i>                                                                                                                             | Simone Niclou          | LIH                             | BM     | 72,000.00               |
| ● <i>Lecture Series "New Horizons: Confronting the Digital Turn in the Humanities"</i>                                                                                 | Gerben Zaagsma         | UL                              | SC     | 22,000.00               |
| ● <i>Inequality and ...? With the October Days</i>                                                                                                                     | Conchita D'Ambrosio    | UI                              | SC     | 80,000.00               |
| ● <i>SIOTOSYS Lecture Series in Microbiology: From Single Organisms to Systems Ecology and Evolution</i>                                                               | Paul Wilmes            | UL                              | BM     | 30,000.00               |
| ● <i>CREA Lunch Seminar Series 2018-2019</i>                                                                                                                           | Skerdilajda Zana       | UL                              | SC     | 84,000.00               |
| ● <i>54th European Diabetes Epidemiology Group Annual Meeting</i>                                                                                                      | Gloria Ana Aguayo      | LIH                             | BM     | 47,000.00               |
| ● <i>World Mediation Forum 10th Congress</i>                                                                                                                           | Claude Houssemand      | UL                              | SC     | 31,000.00               |
| ● <i>The 18th Meeting of the Society for Natural Immunity</i>                                                                                                          | Tatiana Michel         | LIH                             | BM     | 50,000.00               |
| ● <i>Finance Seminar of Luxembourg School of Finance (2018-2019)</i>                                                                                                   | Julien Penasse         | UL                              | SC     | 16,000.00               |
| ● <i>9th Tensions of Europe Conference</i>                                                                                                                             | Andreas Fickers        | UL                              | SC     | 35,000.00               |
| ● <i>Juvenile justice and children rights: achievements and challenges ahead</i>                                                                                       | Silvia Allegrezza      | UL                              | SC     | 14,000.00               |
| ● <i>LISER Research Seminar Series (RSS)</i>                                                                                                                           | Aline Muller           | LISER                           | SC     | 32,000.00               |
| ● <i>Lecture Series in Infection &amp; Immunity</i>                                                                                                                    | Dirk Brenner           | LIH                             | BM     | 72,000.00               |
| <b>TOTAL</b>                                                                                                                                                           |                        |                                 |        | <b>779,000.00</b>       |

For a detailed summary of each project as well as other information, please refer to [www.fnr.lu/rescom](http://www.fnr.lu/rescom)

UL University of Luxembourg

LCSB Luxembourg Centre for Systems Biomedicine

SnT Interdisciplinary Centre for Security, Reliability and Trust

LIH Luxembourg Institute of Health

LIST Luxembourg Institute of Science and Technology

LISER Luxembourg Institute of Socio-Economic Research

BM Biomedical Sciences/Regulation of Chronic, Degenerative and Infectious Diseases

IS Innovation in Services

SC Societal Challenges (LM+ID)

MS New Functional and Intelligent Materials and Surfaces and New Sensing Applications

SR Sustainable Resource Management in Luxembourg

## INDUSTRIAL FELLOWSHIP 2018

| TYPE  | NAME                       | PROJECT TITLE                                                                                                                     | PROJECT DOMAIN | HOST INSTITUTION          | COLLABORATING INST.                                                          | FNR CONTRIBUTION IN EUR |
|-------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------|------------------------------------------------------------------------------|-------------------------|
| ● PDR | Ehab Elmahallawy           | <i>Development of Innovative Syndromic Diagnostic Tools in the Management of Equine Acute Diarrhea</i>                            | BM             | Fast Track Diagnostics    | University of Liège                                                          | 137,764.00              |
| ● PDR | Carlos Espejel             | <i>Development of Standards and Tools for the Reporting and Estimation of Space Resources and Space Ore Reserves</i>              | MS             | ispace Europe SA          | University of New South Wales, UL                                            | 138,264.00              |
| ● PDR | Thomas Hartmann            | <i>Continuously Learning to Meta Learn using Ensemble and Reinforcement Learning</i>                                              | IS             | DataThings                | UL                                                                           | 136,514.00              |
| ● PDR | Marco Magri                | <i>Virtual Testing of metallic materiALS</i>                                                                                      | MS             | IMDEA Materials           | e-Xstream Engineering Sàrl                                                   | 137,264.00              |
| ● PDR | Sune Steinboern Nielsen    | <i>hyBrid bUs geoSpatial Data and Network Analysis</i>                                                                            | IS             | E-Bus Competence Center   | UL, LIST                                                                     | 136,514.00              |
| ● PDR | Anas Obeidat               | <i>Simulation of gas-dynamic, pressure surges and adiabatic compression phenomena in complex geometries of gas valves</i>         | MS             | Rotarex                   | UL                                                                           | 136,514.00              |
| ● PDR | Claudio Petucco            | <i>MULTIfunctional SILViculture environmental and economic Assessment tool</i>                                                    | SR             | LIST                      | Luxplan SA                                                                   | 136,514.00              |
| ● PDR | Sandeep Kumar              | <i>Light-matter Interaction in Infrared Active Materials</i>                                                                      | MS             | UL                        | IEE SA                                                                       | 141,572.00              |
| ● PDR | Koku Gnatuloma Nonoa       | <i>Negotiating Hyper-Diversity: Canadian and European Transcultural Theatre Aesthetics</i>                                        | SC             | UL                        | Cooperations Entreprises Socio-Culturelles                                   | 140,072.00              |
| ● PhD | Oleksii Domin              | <i>Mobile Application for Physical Activity: Development of a theory-based, personalized mHealth intervention for adolescents</i> | SC             | UL                        | Actimage Digital Intelligence Luxembourg                                     | 198,310.00              |
| ● PhD | Oltjon Kodheli             | <i>Communication Algorithms for End-to-End Satellite-IoT</i>                                                                      | IS             | UL                        | SES SA                                                                       | 198,310.00              |
| ● PhD | Raja Pandi Perumal         | <i>Development of a Decision Support System for Incorporating Risk Assessments during the System Design of Microsatellites</i>    | MS             | UL                        | LuxSpace Sàrl                                                                | 198,310.00              |
| ● PhD | Gaëtan Pradel              | <i>The HomoRphic Encryption as Applicable TechnologieS</i>                                                                        | MT             | InCert                    | Royal Holloway                                                               | 198,310.00              |
| ● PhD | Joshua Rasera              | <i>Volatile and Ice-bearing Regolith Processing, Enrichment and Recovery</i>                                                      | MS             | Imperial College London   | ispace Europe SA                                                             | 198,560.00              |
| ● PhD | Ahmad Rida                 | <i>Application Of Near Field Technology In Commercial Vehicle Tire Monitoring System</i>                                          | MS             | UL                        | Goodyear                                                                     | 198,310.00              |
| ● PhD | Ramesh Venkata-subramanian | <i>Highly Resolved Flow Simulations of Low Pressure Liquid Injection Atomization for Knowledge Driven Product Design</i>          | MS             | Delphi Technologies       | Ruhr-University Bochum                                                       | 198,310.00              |
| ● PhD | Alexandre Verlaïne         | <i>Towards Environmental Responsible Auto-Mobility Choices In Luxembourg</i>                                                      | SC             | LISER                     | LuxMobility, Delphi Technologies, KPMG, UL                                   | 198,310.00              |
| ● PhD | Steve Dias Da Cruz         | <i>Development and Evaluation of Deep Learning Methodologies for Safety Critical Sensor Applications in Automotive Industry</i>   | MT             | IEE                       | German Research Center for Artificial Intelligence (DFKI), TU Kaiserslautern | 203,146.00              |
| ● PhD | Christof Ferreira Torres   | <i>Secure Blockchain Technologies for Finance</i>                                                                                 | IS             | UL                        | BCEE                                                                         | 203,146.00              |
| ● PhD | Marvin Just                | <i>Metal Powder Flow</i>                                                                                                          | MS             | CERATIZIT Luxembourg Sàrl | UL                                                                           | 203,146.00              |
| ● PhD | Fatemeh Mashayekhi         | <i>Integration of optical fibre sensors into metallic additively manufactured structures</i>                                      | MS             | UL                        | GCL International Sàrl                                                       | 204,896.00              |
| ● PhD | Anetta Proskurovska        | <i>Applications of Blockchain Technology in Land Administration Systems</i>                                                       | SC             | LISER                     | Grosvenor Europe                                                             | 203,146.00              |
| ● PhD | François Robinet           | <i>Machine Learning for Risk Assessment in Semi-autonomous Vehicles</i>                                                           | IS             | UL                        | Foyer Assurances SA                                                          | 203,146.00              |
| ● PhD | Fa Zhu                     | <i>Efficient quality controlled plasma flow simulations directly from CAD</i>                                                     | MS             | UL                        | Sparc Industries                                                             | 203,146.00              |
| TOTAL |                            |                                                                                                                                   |                |                           |                                                                              | 4,251,494.00            |

 **AFR PhD 2018**

| FIRST NAME           | LAST NAME      | HOST INSTITUTION                         | DOMAIN | TITLE OF PROJECT                                                                                                                                         | FNR CONTRIBUTION IN EUR |
|----------------------|----------------|------------------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| ● Paolo              | Balmas         | LISER                                    | SC     | <i>China's Financial Networks in Luxembourg</i>                                                                                                          | 181,430.00              |
| ● Mehri              | Baniasadi      | UL                                       | BM     | <i>Personalised tremor control by advanced clinical Deep Brain Stimulation</i>                                                                           | 181,430.00              |
| ● Michel Pierre Paul | Breyer         | ETH Zürich                               | IS     | <i>Perception and Learning for Versatile Robotic Manipulation</i>                                                                                        | 181,430.00              |
| ● Henri              | Carême         | Université Catholique de Louvain         | SC     | <i>18th century painting in the former Duchy of Luxembourg between indigenous and immigrant tradition</i>                                                | 181,430.00              |
| ● Jean-Marc          | Ceci           | UL                                       | LE     | <i>Law with literature : freedom, testimony, responsibility</i>                                                                                          | 181,430.00              |
| ● Carla              | Courtois       | Technische Universität München (TUM)     | MS     | <i>Heterogeneous Photocatalysis: Semiconductor-Metal(Oxide) Cluster Hybrid Systems</i>                                                                   | 181,680.00              |
| ● Jordan             | De Jesus Silva | ETH Zürich                               | IS     | <i>Exploiting the Interface between High-Throughput Experimentation and Machine Learning: Towards Digitalization of Catalysis Research</i>               | 181,680.00              |
| ● Melvin             | Drent          | UL                                       | LE     | <i>Dual-Sourcing Strategies that Create Carbon Efficient Supply Chains</i>                                                                               | 181,430.00              |
| ● Ginevra            | Fabiani        | LIST                                     | SR     | <i>Space-time patterns of tree water uptake at hillslopes with contrasting climate and geology</i>                                                       | 181,680.00              |
| ● Paul               | Johanns        | Ecole Polytechnique Fédérale de Lausanne | MS     | <i>Untangling the influence of topology on the mechanics of surgical knots by tying together precision model experiments and theory</i>                  | 181,680.00              |
| ● Laurence           | Klein          | Universitat Jaume I                      | SC     | <i>Corporate Respect for the Human Rights of Indigenous Peoples: Towards Inclusive Sustainable Development</i>                                           | 181,430.00              |
| ● Praveen Kumar      | Korrai         | SnT (UL)                                 | IS     | <i>Learning-Assisted Cross-Layer Optimization of Cognitive Communication Networks</i>                                                                    | 183,180.00              |
| ● Anne               | Kremmer        | Eberhard Karls Universität Tübingen      | SC     | <i>Secular Trends in Living Conditions in Medieval/post-medieval Luxembourg City</i>                                                                     | 73,250.00               |
| ● Gabrielle          | Leterre        | UL                                       | LE     | <i>From standards of international law for outer space resources exploitation to sustainable mining</i>                                                  | 181,430.00              |
| ● Marie-Luis         | Maleska        | UL                                       | LE     | <i>Judgmental biases and mitigating effects in the audit of subsequent events</i>                                                                        | 181,430.00              |
| ● Artem              | Mal'yeyev      | UL                                       | MS     | <i>Spin structure of Mn-based rare-earth-free permanent magnets as seen by polarized magnetic small-angle neutron scattering</i>                         | 181,430.00              |
| ● Pauline            | Mencke         | UL                                       | BM     | <i>Examination of role and function of DJ-1 in Parkinson's Disease and Glioblastoma multiforme</i>                                                       | 181,680.00              |
| ● Catherine          | Meyer          | Universität Hohenheim                    | SR     | <i>Influence of Climate on Variation of Inflorescence Traits in the Neotropical Oilseed Palm <i>Acrocomia aculeata</i></i>                               | 181,430.00              |
| ● Ruta               | Müller         | UL                                       | SC     | <i>Stress effects on interoceptive learning and memory as a mechanism of somatic symptom generation</i>                                                  | 181,430.00              |
| ● Emilija            | Pashoska       | UL                                       | LE     | <i>Digital currency valuation and potential implications for the European Monetary Union</i>                                                             | 181,430.00              |
| ● Renaud             | Rwemalika      | SnT (UL)                                 | IS     | <i>Automatic generation and maintenance of functional tests in an agile environment</i>                                                                  | 181,430.00              |
| ● Arnaud             | Sauer          | UL                                       | SC     | <i>Flows, mobility and networks of the foreign workforce in the cross-border steel basin of the Minette during the inter-war period</i>                  | 181,430.00              |
| ● Sonia              | Schifano       | UL                                       | LE     | <i>Social mobility in the long run: how does it impact inequality?</i>                                                                                   | 181,680.00              |
| ● Kristopher         | Schmit         | UL                                       | BM     | <i>A combinatorial microbiome-driven mechanism for the pathogenesis of Parkinson's disease</i>                                                           | 181,430.00              |
| ● Philippe           | Sünner         | Technische Universität München (TUM)     | IS     | <i>Mathematical Analysis of Training Neural Networks</i>                                                                                                 | 181,430.00              |
| ● Marc               | Trappendreher  | University of Zurich                     | SC     | <i>Image Diffusion: Transnational Circulation of Film Images in the 'Cinema of Modernity' of the 1960s</i>                                               | 181,430.00              |
| ● Lisa               | Urban          | UL                                       | LE     | <i>Police-hacking in Cybercrime Investigations - A comparative and European analysis</i>                                                                 | 181,430.00              |
| ● Merve              | Uzunalioglu    | LISER                                    | SC     | <i>Fathers and Parental Leave in Luxembourg: The interplay between workplace characteristics and fathers' behaviour. Focus on research sector</i>        | 182,180.00              |
| ● Veronika           | Wolf           | UL                                       | MS     | <i>Energy Efficiency Optimization of Low-Grade Waste Heat Recovery via a numerical Investigation of an Organic Rankine Cycle using Supercritical CO2</i> | 181,680.00              |
| <b>TOTAL</b>         |                |                                          |        |                                                                                                                                                          | <b>5,157,540.00</b>     |

For a detailed summary of each project as well as other information, please refer to [www.fnr.lu/afp](http://www.fnr.lu/afp)

| DESCRIPTION                                                                                                                                                                            | DOMAIN | SOCIETE                                             | FNR CONTRIBUTION<br>IN EUR |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------|----------------------------|
| ● <i>Convention cadre "Déi Kleng Fuerscher asbl"</i> - Responsible: Gérard Wagener                                                                                                     | SC     | Déi Kleng Fuerscher asbl                            | 96,000.00                  |
| ● <i>Convention cadre "Lëtzbuerger Naturwëssenschaftsolympiad"</i> - Responsible: Jeff Kohnen                                                                                          | SC     | Olympiades Lux. des Sciences Naturelles             | 86,000.00                  |
| ● <i>Convention cadre "SUDTEC"</i> - Responsible: Nicole Schlichtenhorst                                                                                                               | SC     | Le syndicat PROSUD                                  | 86,000.00                  |
| ● <i>Convention cadre "SUDTEC"</i> - Responsible: Nicole Schlichtenhorst                                                                                                               | SC     | Le syndicat PROSUD                                  | 14,000.00                  |
| ● <i>Convention cadre "FJSL"</i> - Responsible: Sousana Eang                                                                                                                           | SC     | Fondation Jeunes Scientifiques Luxembourg           | 100,000.00                 |
| ● <i>"Energy Kids Day"</i> - Responsible: Frédéric Humbel                                                                                                                              | SC     | Parc Industriel et Ferroviaire du Fond-de-Gras asbl | 61,500.00                  |
| ● <i>"Honey Bee Wild"</i> - Responsible: Michel Wilwert                                                                                                                                | BM     | Michel Wilwert                                      | 4,000.00                   |
| ● <i>"Stage écologique à Texel"</i> - Responsible: Mike Moro                                                                                                                           | SR     | Lycée Grevenmacher                                  | 6,450.00                   |
| ● <i>"Unpuzzling Mathematics"</i> - Responsible: Hugo Parlier                                                                                                                          | MT     | Université du Luxembourg                            | 49,500.00                  |
| ● <i>"The GG goes 'round'! De GG geet ronderëm"</i> - Responsible: Carole Blond-Hanten                                                                                                 | SC     | LISER                                               | 19,500.00                  |
| ● <i>"Rock Fossils"</i> - Responsible: Ben Thuy                                                                                                                                        | SR     | Musée national d'histoire naturelle                 | 26,500.00                  |
| ● <i>"Indiana Jos - spillerisch eis Welt erfuerschen"</i> - Responsible: Jutta Meyer                                                                                                   | SC     | Anne asbl                                           | 50,000.00                  |
| ● <i>"Ökologische Exkursion - Erkundung des Lebensraums Wattenmeer"</i> - Responsible: Jacques Kremer                                                                                  | SR     | Atert Lycée Redange                                 | 6,450.00                   |
| ● <i>"Pit präsentiert: Naturwissenschaft und Technik zum Anfassen"</i> - Responsible: Gérard Wagener                                                                                   | MS     | Déi Kleng Fuerscher asbl                            | 17,0 00.00                 |
| ● <i>"Wissenschaftsreise nach Mannheim"</i> - Responsible: Frank Thillen                                                                                                               | SC     | Lycée Classique de Diekirch                         | 3,000.00                   |
| ● <i>"Projet Shell Eco Marathon"</i> - Responsible: Georges Gloesener                                                                                                                  | SR     | Lycée Technique Arts et Métiers                     | 7,000.00                   |
| ● <i>"Fuersch duer um Naturparkfest"</i> - Responsible: Laurent Spithoven                                                                                                              | SR     | Parc Naturel de l'Our                               | 15,000.00                  |
| ● <i>"12. Lëtzbuerger Naturwëssenschaftsolympiad"</i> - Responsible: Jeff Kohnen                                                                                                       | BM     | Olympiades Lux. des Sciences Naturelles             | 16,500.00                  |
| ● <i>"Studienreise: Ökologie einer Insel im Wattenmeer im Wandel der Zeit"</i> - Responsible: Iris May                                                                                 | SR     | Lycée Technique Ettelbruck                          | 6,9 00.00                  |
| ● <i>"Interdisziplinäres Projekt: Welchen Einfluss haben Ebbe und Flut auf das Leben im und am Wattenmeer, und warum ist dieses Biotop schützenswert?"</i> - Responsible: Joanne Weber | SR     | Lycée Technique Agricole                            | 3,900.00                   |
| ● <i>"Ökologisches Praktikum zum Thema Wattenmeer"</i> - Responsible: Nico Mercatoris                                                                                                  | SR     | Ecole Privée Sainte Anne                            | 1,500.00                   |
| ● <i>"Esch, Cool Science Investigations"</i> - Responsible: Gérard Wagener                                                                                                             | BM     | Lycée de garçons d'Esch                             | 24,0 00.00                 |
| ● <i>Additional funding amount in the framework of our "Contrat de parrainage 2017-2018" for a trip to Melbourne</i>                                                                   | SC     | Fondation Jeunes Scientifiques Luxembourg           | 5,000.00                   |
| ● <i>"Activités de loisir 'science et nature' destinées aux enfants et adolescents"</i> - Responsible: Patrick Delhalt                                                                 | SC     | Musée national d'histoire naturelle                 | 30,000.00                  |
| ● <i>"Cancer Research Lab"</i> - Responsible: Maiti Jacky Lommel                                                                                                                       | SC     | Fondation Recherche Cancer et Sang (RCMS)           | 15,000.00                  |
| ● <i>"Clinicity"</i> - Responsible: Elise Poillot                                                                                                                                      | SC     | Université du Luxembourg                            | 10,000.00                  |
| ● <i>"Séjour scientifique à Asnelles"</i> - Responsible: René Kramer                                                                                                                   | SC     | Parascolaires Fieldgen                              | 5,000.00                   |
| ● <i>"Réponses des cellules cérébrales suite à un stimulus pro-inflammatoire - Cibles thérapeutiques pour les maladies neurodégénératives"</i> - Responsible: Christian Gallotti       | SC     | Lycée Michel Rodange                                | 2,100.00                   |
| ● <i>"Goodyear STEM Student Challenge"</i> - Responsible: Daniela Kuhn                                                                                                                 | SC     | Goodyear S.A.                                       | 5,000.00                   |
| ● <i>"Activités relatives à l'atelier Math.en.JEANS au LCD"</i> - Responsible: Carine Bartholmé                                                                                        | SC     | Lycée Classique de Diekirch                         | 5,800.00                   |
| ● <i>"Wissenschaftsreise nach Heidelberg"</i> - Responsible: Frank Thillen                                                                                                             | SC     | Frank Thillen                                       | 3,500.00                   |
| ● <i>"EngrEdiEnts"</i> - Responsible: Nicholas Didier                                                                                                                                  | SC     | Luxembourg Science Center Groussgasmaschin          | 50,000.00                  |
| ● <i>"Future Digital Leaders"</i> - Responsible: Sergio Coronado                                                                                                                       | SC     | Luxembourg Tech School                              | 40,000.00                  |
| ● <i>"Honey Bee Wild"</i> - Responsible: Michel Wilwert                                                                                                                                | SC     | Michel Wilwert                                      | 8,000.00                   |
| ● <i>"Activités relatives à l'atelier Math.en.JEANS au NOSL"</i> - Responsible: Carine Bartholmé                                                                                       | SC     | Nordstad-Lycée                                      | 3,400.00                   |
| ● <i>"Zero Waste Outreach Activities - Think outside!"</i> - Responsible: Tanja Gibéryen                                                                                               | SC     | silu.lu - Zero Waste Lëtzebuerg asbl                | 20,000.00                  |
| ● <i>"MakerBuzz"</i> - Responsible: Eric Krier                                                                                                                                         | SC     | Make it asbl                                        | 50,000.00                  |
| <b>TOTAL</b>                                                                                                                                                                           |        |                                                     | <b>898,500.00</b>          |



## PSP FLAGSHIP 2018

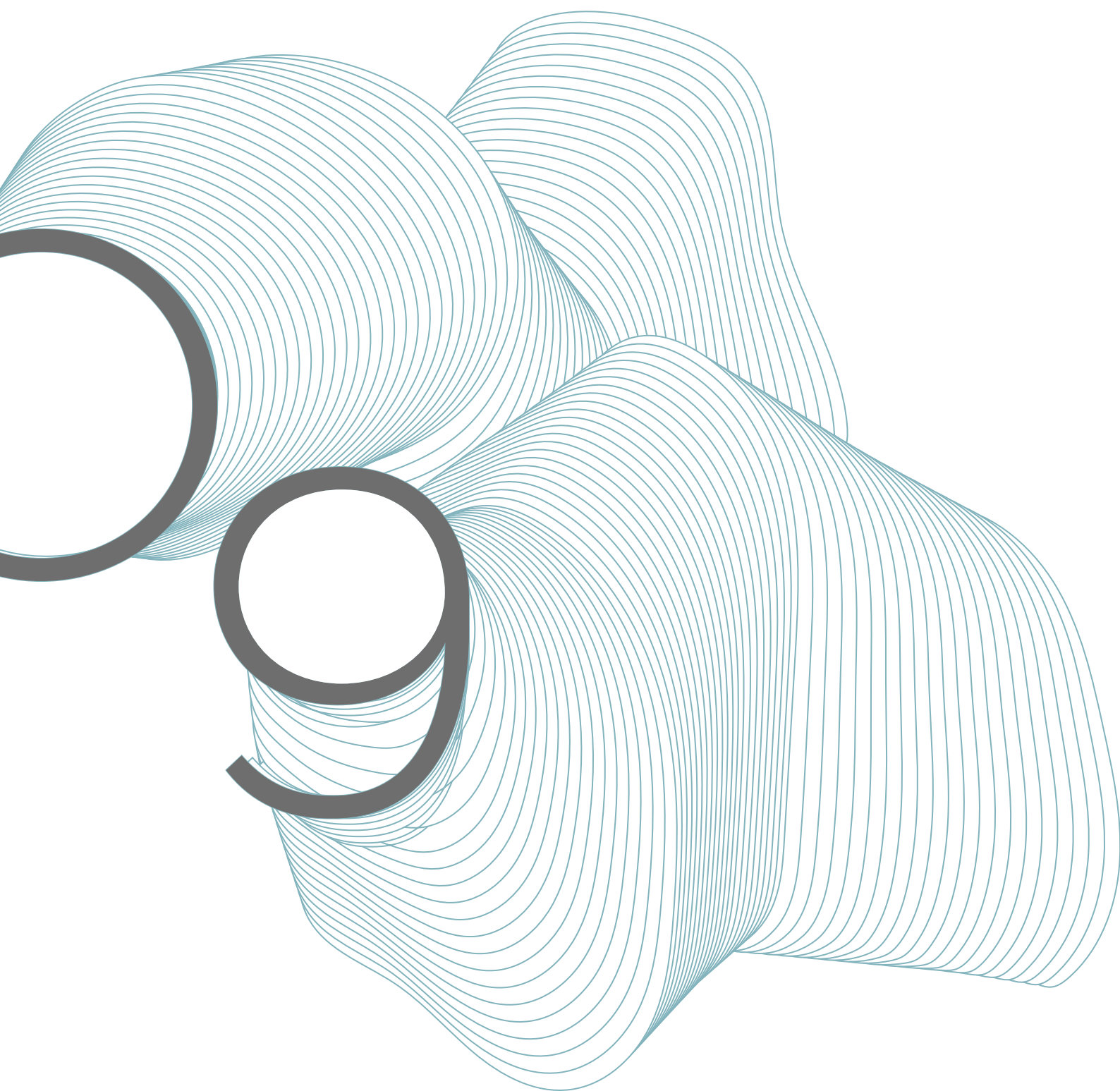
| DESCRIPTION                                                                                          | DOMAIN | SOCIETE                  | FNR CONTRIBUTION<br>IN EUR |
|------------------------------------------------------------------------------------------------------|--------|--------------------------|----------------------------|
| ● "Science Teaching to Support Children Learning Science - Sci2School" - Responsible: Christina Siry | SC     | Université du Luxembourg | 298,000.00                 |
| ● "Smart Schoul 2025: The Future Luxembourg Smart School" - Responsible: Djamila Aouada              | IS     | Université du Luxembourg | 399,000.00                 |
| <b>TOTAL</b>                                                                                         |        |                          | <b>697,000.00</b>          |

## AWARDS 2018

| NUMERO       | DOMAINE | ACTION     | SOCIETE                                      | FNR CONTRIBUTION<br>IN EUR |
|--------------|---------|------------|----------------------------------------------|----------------------------|
| ● 41102      | SR      | AWARDS-PUB | Ben Thuy                                     | 5,000.00                   |
| ● 41103      | LE      | AWARDS-PHD | Eric Schaanning                              | 5,000.00                   |
| ● 41101      | SC      | AWARDS-PSC | Luxembourg Science Center - Groussgasmachinn | 5,000.00                   |
| ● 41101      | SC      | AWARDS-PSC | Elisabeth - Anne asbl                        | 5,000.00                   |
| ● 41104      | MS      | AWARDS-RDI | Tom Wirtz                                    | 5,000.00                   |
| ● 41104      | IS      | AWARDS-RDI | Pascale Engel                                | 5,000.00                   |
| <b>TOTAL</b> |         |            |                                              | <b>30,000.00</b>           |

**UL** University of Luxembourg  
**LCSB** Luxembourg Centre for Systems Biomedicine  
**SnT** Interdisciplinary Centre for Security, Reliability and Trust  
**LIH** Luxembourg Institute of Health  
**LIST** Luxembourg Institute of Science and Technology  
**LISER** Luxembourg Institute of Socio-Economic Research

**BM** Biomedical Sciences/Regulation of Chronic, Degenerative and Infectious Diseases  
**IS** Innovation in Services  
**SC** Societal Challenges (LM+ID)  
**MS** New Functional and Intelligent Materials and Surfaces and New Sensing Applications  
**SR** Sustainable Resource Management in Luxembourg



## 09 2018 EVENTS

### *FNR 2018-21 multi-annual contract with Government signed*

In January, the 2018-21 multi-annual contract between the FNR and the Government was officially signed by Marc Hansen (Minister Delegate for Higher Education and Research), Véronique Hoffeld (Chair of the Board of the FNR) and Marc Schiltz (FNR Secretary General).

Within the framework of this multi-annual contract, which covers the years 2018 to 2021, the budget of the FNR is set at 264,41 MEUR, an increase of 11% compared to the multi-annual contract of 2014-17.

The budget allocation enables the FNR to implement its three strategic objectives, which are:

- Strengthen the foundation of public research;
- Contribute to shaping the future of Luxembourg;
- Promote innovation in public research organisation.

In total, the Luxembourg Government is investing 1.44 BEUR in research and higher education for the period 2018 to 2021. The financial means made available by the Government has thus grown by 284 MEUR, corresponding to a 25% increase compared to the period from 2014 to 2017.

[fnr.lu/fnr-2018-21-multi-annual-contract-government-signed/](https://fnr.lu/fnr-2018-21-multi-annual-contract-government-signed/)

### *FNR strategy presentation & information session*

End of March, the FNR invited the research community to an information session about FNR programmes, as well as the new FNR strategy for 2018 – 2021, in line with the new multi-annual contract recently signed with the Luxembourg Government.

[fnr.lu/fnr-strategy-presentation-information-session-presentation-available/](https://fnr.lu/fnr-strategy-presentation-information-session-presentation-available/)

**Signature**  
of the 2018-2021 multi-annual  
contract between the FNR and  
the Government.



### *FNR Open Access Fund – launch of first Call*

End of January, the FNR launched the first call for proposals for the FNR Open Access Fund. The aim of the Open Access Fund is to promote the free access to research results from FNR-(co)funded projects. The programme provides financial support to reimburse fees that may arise through the publication of peer-reviewed research results in Open Access.

The Open Access Fund supports FNR-(co)funded researchers who comply with the FNR Policy on Open Access, applicable for all FNR-(co)funded projects that received positive funding decisions after 1 January 2017.

[fnr.lu/fnr-open-access-fund-launch-first-call/](https://fnr.lu/fnr-open-access-fund-launch-first-call/)

### *Luxembourg is Innovation Leader*

Luxembourg, for the first time, ranks among the "Innovation Leaders", alongside countries like Switzerland, Sweden, The Netherlands and the United Kingdom in the European Commission's 2018 European Innovation Scoreboard. This is a huge leap for the young Luxembourgish research and innovation ecosystem, and an important recognition of the country's continuous efforts to develop a world-class R&I landscape.

Considerable progress has been made in Luxembourg by successive governments leading to a doubling of investments in research, development and innovation in the last decade. The report, published in June, states that "Attractive research systems and intellectual assets are [Luxembourg's] strongest innovation dimension".

The Luxembourg National Research Fund (FNR) has been one of the key drivers to establish Luxembourg as a leading knowledge-based society through science, research and innovation. Our unrelenting efforts to setup a world-class public research system that generates societal and economic impact in key strategic areas are bearing fruit.

[fnr.lu/luxembourg-innovation-leader/](https://fnr.lu/luxembourg-innovation-leader/)



### *Chercheurs à l'école 2018*

The FNR organised the 8th edition of Chercheurs à l'école – with more researchers and schools taking part than ever before.

The campaign has been growing, with the number of participants increasing year by year. This year, 124 researchers delivered sessions to 75 classes in a total of 28 different secondary schools across Luxembourg. In 2017, 111 researchers, 66 classes and 26 schools took part.

The aim of Chercheurs à l'école is to introduce young people to a profession that many know little about. Researchers from public institutions and private companies in Luxembourg tell their personal story: from school to university to their current job.

This enables students to gain insights into researchers' professional lives and to ask questions about research in Luxembourg. The researchers also get a platform to present their work to a young audience and receive direct feedback.

[fnr.lu/chercheurs-lecole-2018-researchers-ever-go-back-school/](https://fnr.lu/chercheurs-lecole-2018-researchers-ever-go-back-school/)

### *FNR ATTRACT Fellow in successful effort to develop 3D representation of metabolism*

An international research consortium has, with significant involvement of Luxembourg Centre for Systems Biomedicine (LCSB) scientists including FNR ATTRACT Fellow Prof Ines Thiele, developed the first computer model to include 3D in the representation of human metabolic processes. The results have just been published in the journal 'Nature Biotechnology'.

[fnr.lu/fnr-attract-fellow-successful-effort-develop-3d-representation-metabolism/](https://fnr.lu/fnr-attract-fellow-successful-effort-develop-3d-representation-metabolism/)

### *Luxembourg researchers lead study in solar cell production discovery*

In a study investigating the manufacturing process of solar cells, a team led by the group of FNR ATTRACT Fellow Dr Phillip Dale at the University of Luxembourg has discovered that 20-year old assumptions on chemical processes in the production of solar cells are in fact, inaccurate. The findings have been published in Nature Communications.

[fnr.lu/luxembourg-researchers-lead-study-solar-cell-production-discovery/](https://fnr.lu/luxembourg-researchers-lead-study-solar-cell-production-discovery/)

### *International cooperation: FNR and Leir Charitable Foundations Sign Research Agreement*

In May, the Leir Charitable Foundations (LCF) and the Luxembourg National Research Fund (FNR) signed an agreement on the joint funding of a bilateral research project between the University of Luxembourg and Columbia University on the topic of Parkinson's disease research. Subject to the favourable outcome of a scientific evaluation conducted by the FNR, the LCF and FNR intend to jointly fund the Luxembourg-based part of this research project.

[fnr.lu/international-cooperation-fnr-leir-charitable-foundations-sign-research-agreement/](https://fnr.lu/international-cooperation-fnr-leir-charitable-foundations-sign-research-agreement/)

**Signature**  
of an agreement on the  
joint funding of a bilateral  
research project between the  
University of Luxembourg and  
Columbia University.



### *Luxembourg researchers discover significant contamination of widely used lab kit*

A team led by FNR ATTRACT Fellow Prof Dr Paul Wilmes has discovered the contamination of a widely used RNA extraction kit, which could have implications for a significant number of published studies. The findings, along with how the team worked with the manufacturer to find a solution, have been published in the journal BMC Biology.

 [fnr.lu/luxembourg-researchers-discover-significant-contamination-widely-used-lab-kit/](https://fnr.lu/luxembourg-researchers-discover-significant-contamination-widely-used-lab-kit/)

### *Trends for open access to publications: Luxembourg in Top 5*

The European Commission has published data on trends for open access to publications, with Luxembourg ranking in 5th place, ahead of countries such as the United Kingdom and Germany.

The data, gathered through the analysis of Scopus data, shows the percentage of open access publications. It is presented by year, country and discipline.

 [fnr.lu/trends-for-open-access-to-publications-luxembourg-in-top-5/](https://fnr.lu/trends-for-open-access-to-publications-luxembourg-in-top-5/)

### *FNR-supported research project offers new insights into breast cancer*

A team of researchers at the Luxembourg Institute of Health (LIH), including AFR PhD Antoun Al Absi, have uncovered that breast cancer cells use a molecular shield to protect themselves against the immune system, a discovery which could help pave the way for new cancer treatment options.

 [fnr.lu/fnr-supported-research-project-offers-new-insights-into-breast-cancer/](https://fnr.lu/fnr-supported-research-project-offers-new-insights-into-breast-cancer/)

### *Political parties answer 7 R&D questions*

A few weeks prior the general elections, the Luxembourg National Research Fund (FNR) sent all political parties in Luxembourg a seven-question catalogue on research and innovation. Almost all parties contacted have answered our questions – ADR, CSV, déi gréng, déi Lénk, DP, LSAP, PiD.

Key findings:

- All the political parties agree that research and innovation play and will play a key role in the further economic and societal development of Luxembourg, and that it is important to invest money in R&D. They herewith confirm a largely spread opinion in the population (see general population opinion poll from 2017).
- Evidence-based decision making is critical, as the problems societies are facing are getting more complex. The exchange between policy makers and scientists has to be extended.
- Most parties want to strengthen the public-private partnerships and would appreciate more investments from the private sector in R&D.
- The gender balance issue further needs to be tackled, not only in research.
- R&D investments shall also be strengthened on a European level

 [fnr.lu/upcoming-general-election-political-parties-answer-7-rd-questions/](https://fnr.lu/upcoming-general-election-political-parties-answer-7-rd-questions/)

### *FNR joins cOAlition S*

In September, the FNR and 10 other national research funding organisations, with the support of the European Commission (EC) and the European Research Council (ERC), launched cOAlition S, a joint initiative to make full and immediate Open Access to research publications a reality by 2020. The initiative is promoted by Science Europe, the association of national research funding and research performing organisations in Europe.

 [fnr.lu/fnr-joins-coalition-s/](https://fnr.lu/fnr-joins-coalition-s/)

### *Johannes Meiser awarded FNR ATTRACT Fellowship*

Following the 2017/18 FNR ATTRACT Call, Dr Johannes Meiser has been awarded a 1.5 MEUR FNR ATTRACT Starting Grant to set up his own research line in the area of cancer metabolism at the Luxembourg Institute of Health (LIH).

Dr Meiser will set up his own research line in the area of cancer metabolism within the NorLux Neuro-Oncology Laboratory in LIH's Department of Oncology. Dr Meiser, who as of 1 September 2018 has taken up the position of junior group leader, will be able to study how serine metabolism contributes to malignant tumour onset and progression in the context of glioblastoma, the most frequent and aggressive form of brain cancer.

Dr Meiser's research on cancer metabolism has already led to major scientific advances. He published a significant research article in Science Advances in 2016 and in Nature Communications in 2018.

 [fnr.lu/johannes-meiser-awarded-fnr-attract-fellowship/](https://fnr.lu/johannes-meiser-awarded-fnr-attract-fellowship/)

### *MoU: A new "Space Research Program" to strengthen the Luxembourg space ecosystem*

FNR Secretary General Marc Schiltz and Deputy Prime Minister, Minister of the Economy Etienne Schneider have signed an agreement to develop a programme to support research for the commercial space industry in Luxembourg.

The "Space Research Program" will provide funding for national public research institutions and Luxembourg based companies to collaborate with each other to advance knowledge, to attract and nurture top-tier talent, and to provide sustaining contributions to the Luxembourg space industry ecosystem.

Funded projects will need to be conducting research that supports the country's space vision. Research results, new technologies and expertise will later be at the disposal of the local space and non-space industries.

 [fnr.lu/mou-a-new-space-research-program-to-strengthen-the-luxembourg-space-ecosystem/](https://fnr.lu/mou-a-new-space-research-program-to-strengthen-the-luxembourg-space-ecosystem/)

### *Japanese delegation from RIKEN-IMS visit Luxembourg*

Representatives of the renowned Japanese RIKEN Centre for Integrative Medical Sciences (RIKEN-IMS) recently visited Luxembourg to meet government representatives and the directors of the local biomedical research institutions. They presented current and future joint research projects and discussed on how to secure a long-term scientific collaboration between the two countries.

 [fnr.lu/japanese-delegation-from-riken-ims-visit-luxembourg/](https://fnr.lu/japanese-delegation-from-riken-ims-visit-luxembourg/)



### *Head of the Luxembourg Agency for Research Integrity (LARI) appointed*

Katrina Bramstedt has been appointed Secretary General of the Luxembourg Agency for Research Integrity (LARI), having taken up the position as of early September 2018.

The Luxembourg Agency for Research Integrity (LARI), created in 2016, is a joint venture between the Luxembourg National Research Fund (FNR), the University of Luxembourg (uni.lu), the Luxembourg Institute of Health (LIH), the Luxembourg Institute for Socio-Economic Research (LISER) and the Luxembourg Institute of Science and Technology (LIST). The major goal of LARI is to promote Research Integrity in Luxembourg and to ensure an independent investigation of alleged cases of research misconduct.

[fnr.lu/head-of-the-luxembourg-agency-for-research-integrity-lari-appointed/](https://fnr.lu/head-of-the-luxembourg-agency-for-research-integrity-lari-appointed/)

### *Emma Schymanski awarded FNR ATTRACT Fellowship*

Following the 2017/18 ATTRACT Call, Associate Prof. Dr. Emma Schymanski has been awarded a 2 MEUR ATTRACT Consolidator Grant for a project aiming to develop methods to identify unknown chemicals and their effects on health and disease at the Luxembourg Centre for Systems Biomedicine (LCSB) at the University of Luxembourg.

The aim of Dr Schymanski's research group and ATTRACT project 'Environmental Cheminformatics to Identify Unknown Chemicals and their Effects' (ECHIDNA) is to develop methods to identify these unknown chemicals and their effects on health and disease

The long-term aim within LCSB is to uncover causal links between environmental factors and diseases such as Parkinson's disease.

[fnr.lu/emma-schymanski-awarded-fnr-attract-fellowship/](https://fnr.lu/emma-schymanski-awarded-fnr-attract-fellowship/)

### *Researchers' Days 2018: Thousands discover science and research*

The 2018 Researchers' Days – the largest edition so far: Over two days, around 6,500 visitors of all ages streamed to the Rockhal to discover science workshops and science cafés. Xavier Bettel, Luxembourg's Prime Minister, also visited.

During two days, the Rockhal was transformed into a giant research lab with 31 exciting interactive workshops, and 5 Science Cafés, all revolving around the topic of research and science. The diverse range of workshops on offer gave visitors the chance to discover anything from an autonomous car, how plants work, drones, to topics related to health and more.

[fnr.lu/researchers-days-2018-thousands-discover-science-and-research/](https://fnr.lu/researchers-days-2018-thousands-discover-science-and-research/)

### *Luxembourg researcher receives award for AFR PhD thesis on deep brain stimulation*

Dr Andreas Husch, Postdoc at the LCSB at the University of Luxembourg, has been awarded the Best VPHi Thesis Award in In Silico Medicine with application in industrial R&D for his AFR PhD thesis, in which he presents innovative, image-based approaches to deep brain stimulation.

[fnr.lu/luxembourg-researcher-receives-award-for-afr-phd-thesis-on-deep-brain-stimulation/](https://fnr.lu/luxembourg-researcher-receives-award-for-afr-phd-thesis-on-deep-brain-stimulation/)

### *The FNR signs the DORA declaration*

As of December 2018, the Luxembourg National Research Fund (FNR) has signed the DORA declaration, which consists of a set of recommendations to improve the assessment of scientific output. As a signatory of DORA, the FNR fully supports the declaration's practices in research assessment, and has updated its own peer review guidelines accordingly.

[fnr.lu/the-fnr-signs-the-dora-declaration/](https://fnr.lu/the-fnr-signs-the-dora-declaration/)

# FNR AWARDS 2018

## *FNR awards 2018: FNR awards excellence in research, innovation and science communication*

For the 10<sup>th</sup> year running, Luxembourg's research and innovation community gathered in the Halle des poches à fonte in Belval, to reward Luxembourg's best research and science communication efforts.

To mark the 10th edition of the Awards, the FNR presented six prizes – each doted with 5000 EUR - to researchers and science communicators who over the past year have demonstrated outstanding efforts in areas such as science outreach, innovation and science communication. Awards were presented in the specific categories

- "Outstanding scientific publication"
- "Outstanding PhD thesis"
- "Outstanding promotion of science to the public"
- "Outstanding research-driven innovation"

For the first time, all the FNR Award winners are Luxembourgish researchers, or teams led by Luxembourg nationals – testament to the quality of the research and science communication in various domains in Luxembourg.

The awards were presented by Marc Hansen, Luxembourg's Minister Delegate for Higher Education and Research; Véronique Hoffeld, Chair of the Board of the FNR; and Marc Schiltz, Secretary General of the FNR.

In his speech, Minister Marc Hansen stressed the importance of the FNR Awards, which not only recognise the best scientists and science communication projects, but also prove that the governments continued investment in public research is bearing fruit for the good of the country.



## The 2018 FNR Award winners are:



**Eric Finn Schanning**  
Winner "Outstanding PhD Thesis"

### "Outstanding PhD Thesis"

#### *Eric Finn Schanning*

(Imperial College London)

Eric Finn Schanning developed a new mathematical model to simulate fire sales and price-mediated contagion in a financial crisis, a model that has been implemented in central bank stress tests.

The jury selected this thesis for the following reasons:

- It is an excellent combination of theoretical work and practical applications with real data.
- The originality lies in the implementation of the fire sales model by several European central banks.

Other remarkable results of the work are:

- an analysis of financial contagion based on data from 26 of the largest European banks
- Presentations at 36 university and industry conferences
- two published articles, five working papers and two in progress.



**Ben Thuy**  
Winner "Outstanding Scientific Publication"

### "Outstanding Scientific Publication"

#### *Ben Thuy*

(Musée National d'Histoire Naturelle – MNHN)

Ben Thuy's research questioned an earlier paradigm regarding the extinction of a large group of animals. It investigated the problem worldwide and in a variety of environments. The presented data are therefore much more robust than in documents and comments of other researchers.

The jury selected this publication for the following reasons:

- It is an excellent and thought-provoking article published in the top-ranked journal in its category.
- Global importance and thus high visibility for Luxembourg.
- Work by three of the world's most respected scientists in the field of Echinoderma.
- This work provides new data essential for a better understanding of the massive extinction of the late Permian - and perhaps also of the current global loss of biodiversity.





**Tom Wirtz**  
Winner "Outstanding Research-Driven Innovation"



**Pascale Engel de Abreu**  
Winner "Outstanding Research-Driven Innovation"

#### "Outstanding Research-Driven Innovation"

*Tom Wirtz, David Dowsett,  
Rachid Barrahma,  
Olivier Bouton,  
Jean-Nicolas Audinoy*

(Musée National d'Histoire Naturelle – MNHN)

Tom Wirtz and his team have developed a high-resolution analytical instrument in the nanometer range that has attracted the interest of international academic and industrial circles, including Zeiss.

The jury selected this project for the following reasons:

- It shows how early financial support for a technically complex but feasible market opportunity can be provided through the collaboration of donors, host institutions, knowledgeable customers and a dedicated team.
- It therefore has the potential to become a beacon of what can be achieved through commitment and efforts supported by Luxembourg's financing mechanisms.

#### "Outstanding Research-Driven Innovation"

*Pascale Engel de Abreu*

(University of Luxembourg)

Pascale Engel has developed an early intervention programme for Luxembourg kindergartens that supports the basic literacy of children in multilingual Luxembourg.

The jury selected this project for the following reasons:

- Very important for Luxembourg, since many pupils with a migrant background have difficulties with literacy at pre-school age.
- It is also directly relevant to support the learning of the Luxembourg language.
- The award winner has developed and tested the product according to strict standards.



**Thierry Lutgen**

Winner "Outstanding Promotion of Science to the Public"

**Guillaume Trap**

Winner "Outstanding Promotion of Science to the Public"

**Jutta Meyer**

Winner "Outstanding Promotion of Science to the Public"

**Nicolas Didier**

Winner "Outstanding Promotion of Science to the Public"

**"Outstanding Promotion of Science to the Public"*****Thierry Lutgen & Jutta Meyer***

(Elisabeth-Anne asbl)

The project "Indiana Jos" developed by Elisabeth-Anne asbl promotes science among children in day-care centres and youth centres in Luxembourg through non-formal education and interactive scientific workshops.

The jury selected this project for the following reasons:

- It is a passionate project of an organisation whose mission is not the promotion of science.
- The "Train the Trainer" approach has proved to be very effective.
- Research and discovery are now part of everyday life in the day-care centres run by Elisabeth asbl.

**"Outstanding Promotion of Science to the Public"*****Nicolas Didier & Guillaume Trap***

(Luxembourg Science Center)

With the Luxembourg Science Center, Nicolas Didier and Guillaume Trap have developed a place where the general public can gain interactive scientific experience from an early age.

The jury selected the project for the following reasons:

- Great dedication, commitment and perseverance from highly motivated employees and a transdisciplinary team.
- High visibility, high impact potential,
- The project is aimed at a non-professional audience of any age from 5 years.

**About the trophy**

As nearly the whole Luxembourgish public research is now gathered on the Belval Research and Innovation Campus, we wanted to create a new award, that ideally would link the past and the present of this site: firstly steel – which for many years in the 20<sup>th</sup> century contributed to the development and richness of Luxembourg – and secondly, the sole natural resource Luxembourg has in the 21<sup>st</sup> century – knowledge.

The result is a two-piece, 3D-printed unpolished steel trophy, assembled in

a 3D polymer plinth, the latter being poplar and maple plated.

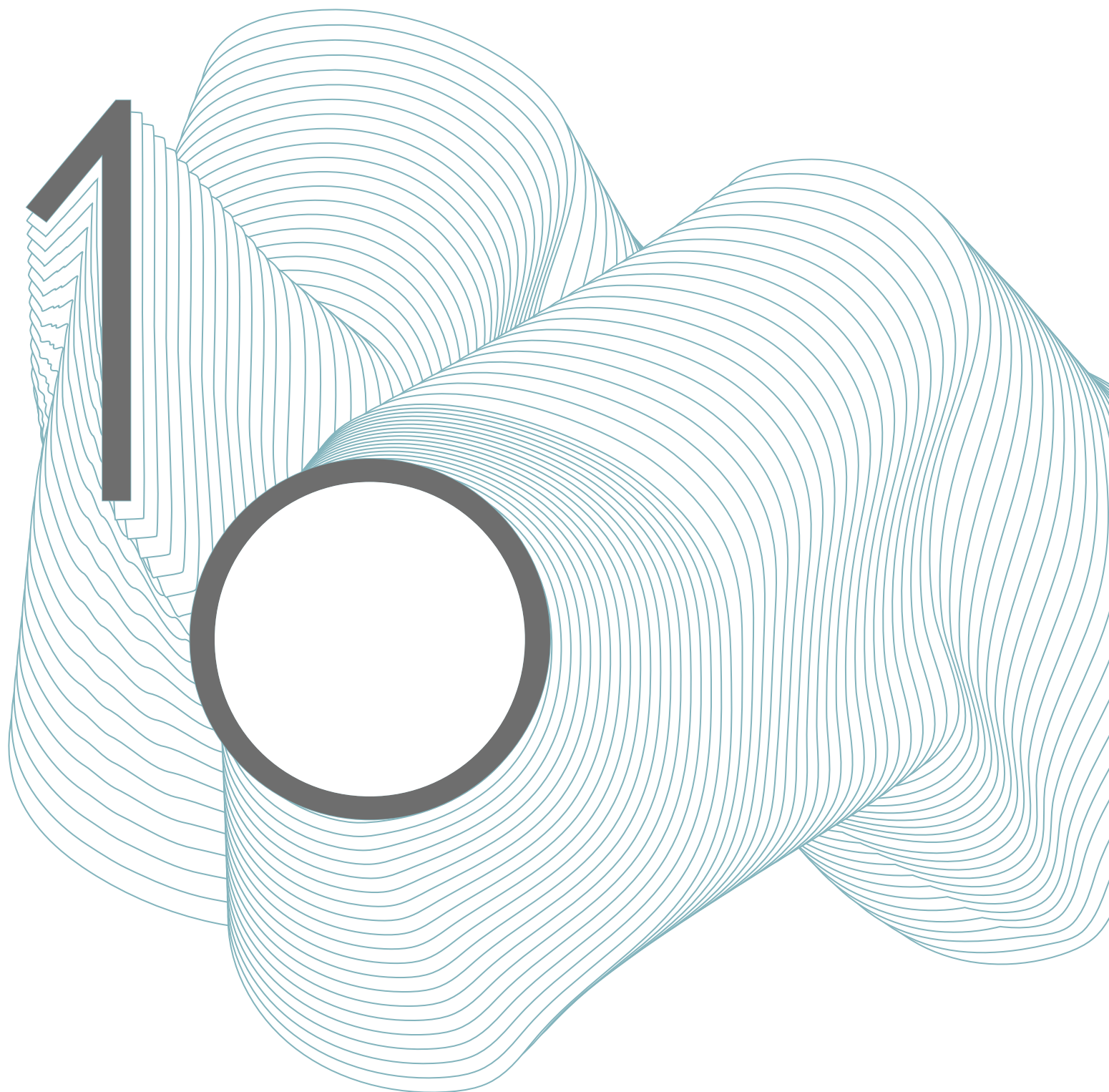
The new trophy was designed by Rodolfo Baiz, and the 3D impression of the steel elements done in Belgium. The bases were printed in Luxembourg and the whole trophy assembled at the Technoport / FabLab Luxembourg.

**Dimensions:** 84,4 x 85,8 x 287,5 mm.

**Weight:** 1,85 Kg.

All entries of the winners were presented during the award ceremony with a short video. These are available on:

 [fnr.lu/fnr-awards](https://fnr.lu/fnr-awards)



# 10 HIGHLIGHTS

**INDUSTRIAL FELLOWSHIP**  
**FNR CALL: 2017**  
**DOMAIN: SR - ENVIRONMENTAL**  
**AND EARTH SCIENCES**  
**PERIOD: 01.09.2017 to 31.08.2019**

## USING DATA FROM SPACE TO IMPROVE MARITIME SURVEILLANCE

**Splitting her time between the Luxembourg Institute of Science and Technology (LIST) and company LuxSpace as part of an Industrial Fellowship, Postdoc Ramona Pelich uses data from earth observation satellites to improve maritime surveillance and flood hazard monitoring.**

The overall goal is to develop innovative space-borne Synthetic Aperture Radar (SAR)-based vessel monitoring and route prediction methods in the domain of Maritime Surveillance (MS).

### Using data from space to monitor Earth

Ramona's primary research goals revolve around the use of Earth Observation (EO) data for the improvement of maritime surveillance and flood hazard monitoring applications. Her current research addresses challenges such as characterisation of floods in urban areas and estimating the velocity of vessels:

"I work on interpreting spatially and temporally distributed radar signatures from different parts of the world. My goal is to use this knowledge to develop innovative applications addressing societal challenges at global scale. Examples of such applications are near real-time detection of floods and vessels using data streams generated by the Copernicus mission of the European Space Agency (ESA)," Ramona explains.

Working with various types of Earth monitoring data acquired through space sensors, such as space-borne Synthetic Aperture Radar (SAR) sensors and Automatic Identification Systems (AIS) receivers. Ramona uses information processing techniques she acquired during her Engineering and PhD studies to make sense of the data.

**"This is a unique opportunity to develop new applications making use of this infrastructure and bring them to the market in close collaboration with local industry"**

Exciting times are ahead for research in Luxembourg involving space and research using space born data – and for research collaborations between industry and



**Ramona Pelich**  
Postdoc at LIST and LuxSpace

research. Ramona points out that Luxembourg in 2017 signed a collaboration agreement with the European Space Agency (ESA), with the objective to establish the Luxembourg Sentinel Collaborative Ground Segment (LUCollGS) that will allow Luxembourg privileged access to the Earth Observation Data from the ESA.

"I am among the first recipients of an Industrial Fellowship grant for a project that assesses maritime surveillance with Sentinel-1 data. My experience in carrying out research both at a Research and Technology Organization (RTO), LIST, and a private company, LuxSpace, is ideally placed in the framework of LUCollGS.

"This is a unique opportunity to develop new applications making use of this infrastructure and bring them to the market in close collaboration with local industry. I believe that such collaborations will perpetuate since both the research labs and private companies can benefit from joint projects."

Ramona explains that collaborating with an industry partner allows her to have a vision from an industrial point of view with respect to the maritime surveillance domain:

***"A concrete example of this collaboration is fact that I can validate my ship detection algorithms based on Synthetic Aperture Radar (SAR) images with Automatic Identification System (AIS) data flows provided by LuxSpace."***

***"Moreover, Luxembourg is actively involved in the maritime surveillance domain, for instance through its Commissariat aux Affaires Maritimes (CAM), which has shown an interest in my Industrial Fellowship project."***

Ramona's collaborative project with LuxSpace is progressing so well that it has already led to a new project – TransparentSea – a collaboration between LIST and LuxSpace, funded by ESA, revolving around smallscale maritime surveillance for the sustainable management of fishing.

#### **INTER-MOBILITY**

*Funding researchers based in Luxembourg for a mobility period at leading research institutions abroad, or excellent researchers from abroad to integrate in Luxembourg research teams (mobility period up to 1 year).*

**FNR CALL:** 2014

**DOMAIN:** IS - INFORMATION AND COMMUNICATION TECHNOLOGIES

**FNR COMMITTED:** 99,000 EUR

**PERIOD:** 01.05.2014 to 30.04.2018



## **WHEN COMPUTERS START UNDERSTANDING MISUNDERSTANDINGS**

Language is a means of communication, a tool, a toy. Language is objective, dreamy, misleading. Language is as diverse as the people who speak it. And now, in the middle of the digital revolution, we expect machines to be able to understand texts, capture their content and comprehend the inner logic. To enable this, it is first necessary to convert language in all its variability into a formal framework which can be processed by algorithms. A challenging task for computer scientists and logicians. And just the right task for Prof. Leon van der Torre and Prof. Beishui Liao.

Liao and van der Torre have launched a China–Luxembourg alliance to make the logic of spoken and written language, in all its uncertainties, understandable to computers: van der Torre as head of the research group Individual and Collective Reasoning (ICR) at the Faculty of Science, Technology and Communication of the University of Luxembourg; Liao as Vice-director of the Institute of Logic and Cognition at Zhejiang University. Liao has been regularly researching in Luxembourg for three years in the scope of an “Inter Mobility” project of the FNR.

The applications for machines that understand natural language are huge. For example, there are so many papers being published at any given time in all conceivable scientific disciplines – from biology to philosophy – that no human can possibly keep up anymore. Entities like the EU are forever passing new laws and regulations – from food legislation to the infamous General Data Protection Regulation. Implementing all of these into existing automated processes and computer programs is proving to be a herculean task for the people assigned the responsibility. Machine assistance is therefore sorely needed.

“What makes things difficult for us, however, is the ambiguity and complicated argumentation logic that language follows,” says Prof. Dr Leon van der Torre. In their cooperation, the two saw an opportunity to get

this problem under control. “Our teams complement each other ideally because we are approaching the topic from different perspectives,” says Liao: “In my group at Zhejiang University we had developed a series of new theories, algorithms and prototype systems for efficient computation of abstract argumentation semantics. Leon’s group works in the direction of combining logic and natural language, and has conducted fundamental research on the topic of combining uncertainty and argumentation.”

The aim of their investigations was to develop formal models for uncertain argumentation from natural language text, and this became the very topic of the Inter Mobility Grant that the FNR approved for the two researchers in 2014. “We successfully developed theory and algorithms for this purpose, which lay a good foundation for formalising uncertain arguments in natural language and for evaluating their status properly and efficiently”, Liao explains.

The teams led by Liao and van der Torres have jointly published several high-ranking papers. “The Inter Mobility Grant was a wonderful starting point for our collaboration,” Liao says: “Luxembourg is one of the world’s best research locations for computer sciences. It has an open culture and the country is ideally connected with other scientific nations.”

Accordingly, Liao and van der Torre are continuing their collaboration: Liao is still researching in Luxembourg, while van der Torre has been called as a guest professor to Zhejiang University. The “Inter Mobility” programme has thus made international mobility and networking sustainably possible.

**OPEN**

*It aims at supporting established researchers to pursue innovative research projects of high scientific quality in emerging research areas in Luxembourg. OPEN is restricted to experienced researchers with a proven track record in their respective field.*

**FNR CALL:** 2013

**DOMAIN:** LE - LAW, ECONOMICS, FINANCE

**FNR COMMITTED:** 500,000 EUR

**PERIOD:** 01.06.2014 to 31.05.2017



## THE ISSUE AT THE HEART OF CRIMINAL LAW WITHIN THE EU: ONE PROBLEM AND THREE MODELS AS A SOLUTION

**Conflict often arises whenever several states simultaneously claim legal jurisdiction for themselves. Together with research colleagues, jurist Katalin Ligeti has found a way out of this dilemma.**

*Ne bis in idem.* The Latin expression means “not twice in the same thing” and serves as a fundamental principle for all fair criminal proceedings. This means that no one shall be punished several times for the same act. Someone who has already been legally and incontestably convicted for his or her action cannot be prosecuted a second time; unless the offence is prosecuted in several countries. In which case, the offender must expect to be prosecuted and convicted several times.

Current legal practice within the EU may, in fact, lead to such a scenario. And that's not all. “In the specific context of the EU, concurrence of jurisdiction coupled with the application of the principle of European *ne bis in idem* can result in the prosecution of specific offences being barred on a ‘first come, first served’ basis if the authorities of one member state finally dispose of a case”, explains Katalin Ligeti. So, one member state may gain jurisdiction over a criminal case which another country could possibly be better suited to process and judge.

### Project-based on key knowledge gained from experience in the field

“There is as such a clear need to settle or ideally prevent situations where two or more states have concurrent jurisdiction over the same crime”, states the Professor of European and International Criminal Law at the University of Luxembourg. She added that, although a viable mechanism for criminal jurisdiction within the European framework was indispensable, there was currently no binding instrument therefor in EU law.

Katalin Ligeti has changed this situation. As part of a research project, she has sought options for a regulating mechanism based on the currently available mechanisms designed to avoid such conflicts. Co-organised by the European Law Institute and supported as part of the FNR's OPEN programme, the project is based on key knowledge gained by legal practitioners, political decision-makers and leading scientists in this field.



**Katalin Ligeti**

Professor of European and International Criminal Law at the University of Luxembourg

### Three models as building blocks for a future legislative text

Together with postdoctoral researcher Gavin Robinson, Katalin Ligeti has taken this concept a step further and developed three models: a horizontal mechanism, a vertical mechanism and an “allocation model”. “With the horizontal mechanism, conflicts of jurisdiction are solved between the national criminal justice authorities of the member states concerned”, says Katalin Ligeti. This mechanism requires only minimal harmonisation of the criminal laws at the national level and is primarily aimed at coordinating non-harmonised national criminal jurisdictions.

On the other hand, the vertical mechanism is based on supranational decisions and is therefore binding for all member states. It is applied whenever the criminal justice authorities within a state have not been coordinated. The third model is aimed at preventing conflicts arising within Europe in the first place by applying uniform regulations for allocating the exercise of criminal jurisdiction.

The three approaches propose building blocks for a future legislative text. They are not blueprints for future legislation but rather contain the most important elements of the mechanism they represent and thereby offer various implementation options to the EU legislator,” explains Katalin Ligeti.

### Comprehensive subject-related work published

“The models are the result of a broad-based, multidisciplinary research programme. The priority now is to maximise their impact. For this reason, the three models have also become part of a comprehensive subject-related work”, the professor adds.

The book *Preventing and Resolving Conflicts of Jurisdiction in EU Criminal Law*, edited by Katalin Ligeti and her colleague Gavin Robinson together with the European Law Institute and published by Oxford University Press, includes a comprehensive analysis of related topics as well as the models. It features contributions from 13 authors from various European universities and institutions. The results of the research project were also included in a discussion round held by the European Parliamentary Research Service. Therefore, *ne bis in idem* is not only a principle that applies to everyone; it is a guideline that everyone should adhere to.

#### RESCOM

*Grants for the organisation of outstanding international scientific conferences and lecture series in Luxembourg, as well as for scientific monographs.*

**FNR CALL:** 2014

**DOMAIN:** SR - ENVIRONMENTAL  
AND EARTH SCIENCES

**FNR COMMITTED:** 40,000 EUR

**PERIOD:** 03.09.2017 to 06.09.2017



**Dr Enrico Benetto**

head of the "Environmental Sustainability  
Assessment and Circularity" department  
at the Luxembourg Institute of Science and  
Technology (LIST)

## FROM SCIENCE TO INNOVATION LUXEMBOURG CITY IN THE AGE OF SUSTAINABILITY

The first days of September 2017 were full of excitement for Dr Enrico Benetto. The 8<sup>th</sup> Life Cycle Management Conference he had brought to Luxembourg City was an enormous success. More than 700 participants from 46 countries had accepted his invitation to discuss sustainability. Prominent keynote speakers like the Swiss adventurer Bertrand Piccard and the founder of Global Footprint Mathis Wackernagel inspired the audience. The most emotional moment for Benetto came quite unexpectedly when Grand Duke Henri of Luxembourg graced the hall of the European Convention Center Luxembourg (ECCL) to attend the closing event.

Benetto heads the "Environmental Sustainability Assessment and Circularity" department at the Luxembourg Institute of Science and Technology (LIST). He organised the conference together with the University of Luxembourg and ArcelorMittal. The conference was supported by the FNR, the European Investment Bank and the Luxembourg Ministry of Economic Affairs. The theme of the three-day event was "Designing sustainable technologies, products and policies: from science to innovation".

Benetto says: "Putting a figure on every single step from raw material extraction to disposal, and then asking what is the bottom line for people, for the environment and the economy: that is the idea behind Life Cycle Management." He and his colleagues are developing various tools and concepts for this purpose. In order to make products or technologies more sustainable, one should know all the points where it makes the most sense to start.

### The entire lifecycle is important

"Life Cycle Management is beneficial to the industry. It allows you to assess the impact of your products on the environment," the scientist explains. It is crucial to look at the complete picture – from production to recycling. That is the only way to prevent optimisations at the front from tearing at the back. "Life Cycle Management is also important for political decision-makers," Benetto continues: "It enables them to see the connections, to understand the overall benefit of a technology or product, and to know when and how to intervene." A third

aspect, he emphasises, is that "Life Cycle Management is furthermore helpful to consumers. It makes them aware of the role they play, and how they affect the sustainability of our economy by using or indeed not using technologies."

Benetto's prime example is electromobility. Analysis of the life cycle starts at the very beginning with locating, sourcing and refining the raw materials that go into manufacturing a battery, continues in the pathway from primary products to the finished battery, and carries on throughout the battery's entire service life all the way up to its upcycling, recycling or disposal. Where the energy comes from to charge the batteries is also taken into consideration. Whether from Germany or Norway, using grey fossil-based electricity or green hydroelectric power: all of these factors influence the outcome of the analysis.

Life Cycle Management is of course not limited to electromobility. It can be adapted to all different industries and sectors to help in making decisions, for example in the hydrogen industry or in renaturing urban areas, in agriculture or in the chemicals industry. Moreover, the goal in each case is to give decision-makers a means at hand to compare different options and ultimately select the best ones.

### Relation to the "real" world

Benetto was still a PhD student when the first Life Cycle Management Conference was held in 2001. Ever since he has been following the series of events attentively. Then, in 2013 at a conference in Göteborg, came the enticing question of whether he might want to organise the event for 2017. An opportunity that Benetto couldn't possibly pass up.

"It was an excellent occasion to raise awareness of our work, of all that we had done over the past ten years. The conference also fits in perfectly with the strategy we are pursuing at LIST. Purely scientific events often have no connection to the real world and to the actual users. The Life Cycle Management conference, however, connects research with industry and politics. A combination that comes first at LIST."

**PSP Classic**

*PSP-Classic – PSP-Classic and PSP-Flagship programmes provide researchers with funding for their own science outreach activities.*

**FNR CALL:** 2018

**DOMAIN:** SR – ENVIRONMENTAL AND EARTH SCIENCES

**FNR COMMITTED:** 26,500 EUR

**PERIOD:** 07.06.2018 to 19.11.2018



## SCIENCE MEETS ROCK'N'ROLL: WHAT HAPPENS WHEN A PALAEOLOGIST HAS A PENCHANT FOR EXTREME METAL MUSIC...

**Thanks to a unique exhibition at Luxembourg's Natural History Museum, palaeontologist Ben Thuy has enriched both the music scene and the world of science.**

There are two models of the '*Melusinaster alissawhitegluzae*' basket star: one can be found at the National History Museum (MNHN), while the other takes pride of place in the studio of its eponym, Alissa White-Gluz. The latter – singer of the Swedish extreme metal band 'Arch Enemy' – was presented with the basket star replica during a concert at the Rockhal.

The person who chose the name and handed over the replica was palaeontologist Ben Thuy – all in the name of a really extraordinary project. Last year, the MNHN researcher organised an exhibition entitled 'Rock Fossils' together with his colleague and fellow palaeontologist Lea Numberger-Thuy, thereby building a bridge between two worlds that at first sight appear to have little in common, i.e. palaeontology and rock music. So how do the two go together?

### Revealing a connection that has long been present in the underground

"Both share a passion for the obscure and hidden" explains Ben Thuy. "And both notoriously tend to cross boundaries." The researcher already proved the latter with the very idea of the exhibition funded by the FNR's 'PSP Classic programme'. In addition to the presentation, the varied programme of ancillary events included interactive debates, workshops, concerts by bands such as Arch Enemy and expeditions to explore the origin of rock fossils.

In doing so, the Natural History Museum researcher revealed a connection that has long been present in the underground. Ben Thuy is by no means the only palaeontologist with a pronounced passion for rock and metal music, as can be seen by the number of rock bands or musicians who have lent their names to fossils.



**Ben Thuy**

Palaeontologist at the National History Museum (MNHN)

### Fossil remains are a scientific sensation

In addition to the '*Melusinaster alissawhitegluzae*', the Luxembourg palaeontologist also named another fossil after Arch Enemy, i.e. the '*Melusinaster arcusnimus*'. This is another basket star species which, like the other fossil, also belongs to the Gorgonocephalidae family.

Ben Thuy and his colleague Sabine Stöhr from the Swedish Natural History Museum analysed the tiny fossil remains that had been discovered in Germany and Luxembourg and discovered that the creatures in question were a kind of transitional form between Gorgonocephalidae and "normal" basket stars – a scientific sensation!

According to the researchers, the fact that many extinct species have been named after rock stars is living proof that there is passion behind science. To a certain extent, music offers a source of inspiration, and this was certainly the case for Ben Thuy. He listened to and drew inspiration from the Swedish band's music while carrying out his research on the fossils, and one thing led to another.

### A source of enrichment for science

"It's a real honour", declares the singer. "The fact that such an important discovery was made while the palaeontologist was listening to our music is something quite special. Combining art and science in this way is impressive", affirms Alissa White-Gluz. The vocalist not only expressed her delight about this extraordinary link between palaeontology and metal music in front of approximately 1,000 fans at the Rockhal concert when the replica was handed over, she also shared it with her 800,000 Facebook followers.

"We had no idea that the musicians and fans would respond so enthusiastically", says Ben Thuy. He is convinced that actions such as these are a source of enrichment for science. Reaching such a broad audience with such tiny fossils is something many of his colleagues can only dream of. And with the chance to appear on stage with one of his favourite bands as well – what more could a palaeontologist who loves metal music possibly wish for?

**IPBG**

*The aim of the Industrial Partnership Block Grant (IPBG) programme is to foster the cooperation between Luxembourg based companies active in R&D and public research institutions in Luxembourg.*

**FNR CALL: 2016**

**DOMAIN: MS – NEW FUNCTIONAL AND INTELLIGENT MATERIALS AND SURFACES**

**FNR COMMITTED: 2,684,000 EUR**

**PERIOD: 01.01.2017 to 31.12.2022**

## JOINING FORCES TO CREATE THE TIRES OF THE FUTURE

**Corporate researchers and independent scientists are working closely and successfully together in a six-year program.**

Many drivers pay little attention to the tires on their car. But wrongly so: these inconspicuous black rubber rings are packed with all kinds of high technology and are the culmination of decades of elaborate materials research. No two tire models are alike. The material and structural requirements for your car's "boots" differ not only between summer and winter, but also from one vehicle type to another. A sports car needs a different kind of tires from a compact car, for example, and a minibus has different needs from an SUV. Another challenge for tire developers has arrived with electric cars, whose massive onboard batteries make them substantially heavier than comparable models with petrol or diesel engines but also provide a different kind of acceleration.

In order to overcome the challenges in future tire technology, experts from the American company Goodyear and researchers from the Luxembourg Institute of Science and Technology (LIST) have joined forces in a strategic partnership. "This is a marvellous concept, which brings enormous benefits to both sides," says Daniel Schmidt, lead scientist at LIST and coordinator of the "Materials Research for the Tire Technology of Tomorrow" programmer. Goodyear is one of the world's leading tire manufacturers and operates a research and development centre in Colmar-Berg, Luxembourg, which employs more than 1000 scientists and engineers. The researchers at LIST, in Esch-sur-Alzette some 50 kilometres away, can build on many years of comprehensive experience in the analysis of chemical and physical properties of materials that are also crucial in the production of tires.

### The material matrix makes all the difference

The focus for the development of new tires is on a handful of properties that are critical for safety and driving behaviour: the tires' rolling resistance, wet and dry grip, road noise, energy consumption, braking behaviour and wear. All of these characteristics, some of which even oppose each other, depend on one thing above all else: the right material mixture in the tire rubber. A huge range of ingredients may be used to build a modern tire – mixed according to different formulas to meet different requirements. As LIST researcher Schmidt sums it up: "Not all rubbers are equal." The polymers making up the basic structure of the synthetic tire material are complemented with "fillers" – in most cases based on silica or carbon – that help to give tire rubber its special characteristics. "Then there are the so-called additives: substances that, among other things, facilitate the mixing of the material components, prevent ageing, improve grip, etc," Schmidt explains.

To the layperson this might seem like modern alchemy but, for the scientists and engineers, it is materials research in its finest. "It is crucial that we understand in as much detail as possible how the substances are chemically structured, how they mutually influence one another and what ultimately happens in the complex mixtures they form," Schmidt says. "This knowledge allows us to produce bespoke materials for the tires of the future."

### Four focal points of the research teams

The researchers of Goodyear and LIST have been working hand-in-hand since 2017 with this purpose in mind. The program behind this collaboration, which the Luxembourg National Research Fund (FNR) is funding over a period of six years, is divided into four sub-programs. These reflect the four most important areas of materials research for tire technology.



In the first, the researchers are concentrating on fillers developed to enhance the mechanical properties of tire rubber or to reduce its weight, for example. The second is polymer chemistry – the molecular design and production of synthetic macromolecules perfectly suited to specific tire applications. The third sub-program is researching the effects of additives that are only added in small amounts to the polymers but are crucial for processing and final properties. “Finally, the fourth sub-program has an overarching character, focusing on novel investigative methods for materials characterisation and testing,” says program coordinator Daniel Schmidt.

The LIST researcher emphasises in particular the close and intensive collaboration of the teams from the manufacturing company and the independent research institute. “This collaboration is profitable for both sides,” Schmidt points out. The program creates a basis for making faster advancements in developing new materials and concepts for tire technology than would be possible without the mutual support and integration of the teams. It has around two dozen projects in total, each led by researchers from both Goodyear and LIST. A number of young scientists – doctoral students and postdoctoral researchers – are additionally driving the research forward.

#### **Valuable new findings**

At regular meetings, the project teams share information about their work, discuss plans and present their current findings. These are already highly visible. With improved computer models, the researchers have gained valuable insights into how the reinforced structure of a tire reacts to external forces – a starting point for optimising tire design. Another team has developed new analytical tools for complex material mixtures. The researchers in one of the projects have gained a deeper insight into the behaviour of tire reinforcing cords. They have also taken a step forward in understanding the interface between the cords and the rubber in order to improve its durability.

*The LIST researcher emphasises in particular the close and intensive collaboration of the teams from the manufacturing company and the independent research institute. “This collaboration is profitable for both sides,” Schmidt points out. The program creates a basis for making faster advancements in developing new materials and concepts for tire technology than would be possible without the mutual support and integration of the teams.*

The collaboration is running at full speed on computers and in laboratories. As things stand, Daniel Schmidt does not imagine that this should end following the official termination of the program in December 2022. “We have too many exciting ideas that we still want to put into action together,” he says. “We can build on promising results – and can rely on highly motivated teams at Goodyear and LIST.” The LIST scientist predicts: “Several of our young researchers will likely go on to work at Goodyear in the future – and that will further strengthen the bond between the two partners.” Schmidt is therefore convinced: “This cooperation provides us with a model for success and promises excellent long-term prospects.”

#### ATTRACT

*Funding to attract outstanding researchers (between 2 and 8 years after their PhD) with high potential in strategic research areas in order to set up a research group in Luxembourg.*

**FNR CALL:** 2014

**DOMAIN:** BM - LIFE SCIENCES, BIOLOGY AND MEDICINE

**FNR COMMITTED:** 1,990,000 EUR

**PERIOD:** 01.03.2015 to 29.02.2020



## THE IMMUNE SYSTEM: A DELICATE BALANCE

**The immune system enables the body to fight off illness – but if it works too little, or too much, this can lead to anything from inflammation, to autoimmunity to cancer. At the Luxembourg Institute of Health (LIH), FNR ATTRACT Fellow Prof Dr Dirk Brenner works on understanding the functionality that underlies a healthy immune system.**

“On a very basic level, the immune system works in two different states: one is the activated state, and one the immune quiescent state,” explains Dirk Brenner, who set up the ‘Experimental and Molecular Immunology Group’ at the LIH in the framework of his FNR ATTRACT Fellowship, which brought him to Luxembourg in 2015, adding:

*“There is a delicate balance between these two states, which is crucial for healthy body function.”*

Prof Dr Brenner explains what happens if this balance is not right: “If one or the other is not levelled out, it results in disease development. For example, if the immune system is too unresponsive, this can lead to the inability to fight infection, and it can also support the development of cancer.

“On the other hand, if the immune system is too reactive, this can lead autoimmune diseases, such as multiple sclerosis or the development of allergies.”

Together with his group members - an international team of PhD candidates, Postdocs, and technicians – Prof Dr Brenner investigates the molecular mechanisms that are involved in keeping this balance and therefore play a role in maintaining healthy body functions.

### Discovery with therapeutic implications

The team has, for example, been able to show that the metabolite tripeptide glutathione acts as an antioxidant essential for the metabolic reprogramming of immune cells. Prof Brenner’s team used conditional knockout mice, which lack the catalytic subunit of the enzyme glutamate cysteine ligase (GclC), to block glutathione production in T cells. In the absence of glutathione, important metabolic regulators and signalling pathways can no longer be activated.

As a result, the gene-deficient mice are protected from autoimmunity, but have a weaker antiviral immune response. The team’s research suggests that modulation of glutathione levels in the cell could have therapeutic implications.

The important findings were published as a featured article in the journal *Immunity* in 2017. It currently counts as one of the highest ranked articles ever published by a Luxembourgish group. In recognition of the discoveries of Prof Brenner and his group, Prof Brenner received the 2018 Science Award by the Signal Transduction Society (STS) for his outstanding work in the field of immunometabolism.



**Prof Dr Dirk Brenner**

Head of the Experimental and Molecular Immunology Group, as well as Deputy Head of Research & Strategy in the Department of Infection and Immunity at the Luxembourg Institute of Health (LIH).

### Strong team and international network crucial

Dirk Brenner's group has come far since he started creating it from scratch when he arrived in Luxembourg in 2015 after his six+ year research stay in Canada. With around ten people, Prof Brenner has built a strong team, something he stresses is hugely important: "We work together really well - and across all the projects - which is not only a great motivator, but also increases our efficiency and scientific output.

"In the end, good scientific ideas and scientific support is one thing, but you also need good people, team spirit. Basic research can be frustrating - you have all of these interesting ideas, but 90 - 95 percent of them don't work out, so you have to enjoy what you are doing to find a way to work through this frustration."

Prof Brenner also highlights that networking and international partners is a key ingredient in good science, especially for projects that are complex and require many strengths.

"Networking is the essence of research, especially if you want to do it on a high-impact level. Studies have reached such complexity that, in most cases, a single research group alone cannot do everything. That is why it is crucial to have a significant international network - you have to know whom to trust, who is your friend and who your competitor," Prof Brenner explains.

**Prof Brenner has built a strong team, something he stresses is hugely important:**

*"We work together really well - and across all the projects - which is not only a great motivator, but also increases our efficiency and scientific output."*

### Intrigued by the opportunity to build up something new

Before embarking on his ATTRACT Fellowship, Prof Dr Brenner spent time as a Postdoc in Toronto, Canada, where he worked alongside renowned scientist Prof Tak W. Mak, who discovered the T-cell receptor in 1983.

It was the FNR ATTRACT programme that brought Prof Brenner to Luxembourg - a huge change from working in an established research group. Prof Brenner explains that as what his group works on is quite new in Luxembourg, it was a lot of work to get the group going, but that this challenge was also part of what drew him to the Grand Duchy:

"I was intrigued by the perspective of Luxembourg, because I had not heard about it in terms of it being a science spot, and I was drawn to the opportunity to build up something new."

Prof Dr Dirk Brenner is Head of the Experimental and Molecular Immunology Group, as well as Deputy Head of Research & Strategy in the Department of Infection and Immunity at the Luxembourg Institute of Health (LIH). Since 2016, he is also Adjunct Professor at the University of Southern Denmark (ORCA Center).

**CORE Junior**  
**FNR CALL:** 2014

**DOMAIN:** MS - NEW FUNCTIONAL AND  
INTELLIGENT MATERIALS AND SURFACES

**FNR COMMITTED:** 351,000 EUR

**PERIOD:** 01.12.2014 to 31.03.2017



## HEADING TOWARDS A NEW KIND OF ELECTRONICS

Rarely has a scientific discovery led to a Nobel Prize as quickly as the first production of graphene. The British researchers who managed to make it in 2004 were honoured with the Nobel Prize in Physics only six years later. What is particular about this material, which consists of pure carbon, is its two-dimensional structure: the atoms in this material are arranged in a single, extremely flat layer. Electrons can only move within this 2D plane, and always feel the influence of their constraint. This leads to unusual properties that are not found in ordinary, three-dimensional crystals.

Scientists are also researching two-dimensional materials and their special characteristics at the Physics and Materials Science Research Unit of the University of Luxembourg. In 2014, the project "Modelling of carrier dynamics and ultra-fast spectroscopy in two-dimensional materials" started, which the FNR financed for a period of three years. In close collaboration with scientists at other European research institutions, the team led by Dr Alejandro Molina Sánchez took an especially close look at so-called transition metal dichalcogenides: chemical compounds of metals such as molybdenum or tungsten with elements of the carbon group such as selenium or sulphur. These 2D materials are semiconductors and, due to their specific structure, are suitable for producing optoelectronic components that can produce or capture light – in other words, they are suitable for novel solar cells.

### What happens during relaxation?

"What goes on inside these materials, and how energetically excited charge carriers behave in them, is not yet fully understood," says Alejandro Molina Sánchez. "An open question at the beginning of the project was how do electrons in the two-dimensional layer relax after excitation, meaning how do they return to their original state."

This can be studied experimentally using ultra-fast optical spectroscopy. The researchers led by Molina Sánchez have developed a model for simulating

experiments of this nature for the first time, allowing the results to be explained theoretically. The researchers not only had to contend with the extreme rapidity of the processes but also had to take numerous complicated interference effects into account – for example, those caused by material defects or by the influence of the substrate carrying the 2D material layer.

### Calculating with valleys

The researchers focused primarily on so-called valleytronics. This is a term physicists give to an analogue of spintronics, which is a kind of data processing based on a magnetic property of electrons called spin.

This spin can assume different quantum states. The same goes for special properties of certain two-dimensional crystals – and in the future, it may be possible to exploit them technically in valleytronics. The term arises from the curve shapes for the electronic energy bands in 2D semiconductors, which form two separate minima, or "valleys".

### From a vague idea to a tangible concept

Before the start of the project at the University of Luxembourg, research in this area was still in its early stages, and using valleytronics was hardly more than a vague idea for a new kind of electronics. But now, the newly developed model proves the concept could take off. "We have shown that the necessary states can be produced in 2D materials and how long they can persist," Molina Sánchez says. "With our model, it is possible to find out what chemical compounds are suitable for valleytronics."

The researchers thus have the necessary tools at hand to create novel, especially sensitive and efficient optoelectronic components. Alejandro Molina Sánchez has no doubt: two-dimensional semiconductors made of transition metal dichalcogenides will soon be even more scientifically and technologically significant than the Nobel-worthy graphene.



**Dr Alejandro Molina Sánchez**  
University of Luxembourg

**AFR PhD****FNR CALL:** 2014**DOMAIN:** MS - NEW FUNCTIONAL AND INTELLIGENT MATERIALS AND SURFACES**PERIOD:** 01.01.2014 to 31.10.2018

## UNDERSTANDING THE TRANSFORMATIONS OF ENERGY

**Energy is not generated; it is only changed. The physicist Riccardo Rao has dedicated his energy to find out more about the thermodynamic costs of these changes in biologically-inspired models.**

It is well established that the overwhelming majority of biological processes occur far from thermodynamic equilibrium. Assessing their thermodynamic cost as well as their dissipation is essential to shed light on their working principles. Beyond simple biological processes made of a few components, nonequilibrium thermodynamic descriptions for complex living organisms like cells are missing. The PhD project of Riccardo Rao was focused on setting the foundations for such descriptions by formalising thermodynamics for generic far-from-equilibrium stochastic and chemical processes.

### Understanding the energetic cost of these processes is crucial

"In brief, my research is motivated by the need to understand the mechanisms and processes underlying living organisms, and more specifically metabolism and signal transduction", says the physicist. "From a thermodynamic perspective living organisms and their constituent parts can be regarded as engines", he explains. "They burn fuels, respectively food, to carry on living or perform their function."

It's about energy: On one side, metabolism allows organisms to convert the energy from food in a form which they can use. On the other side, with signal transduction, cells use that energy to perform computation for sensing the environment, taking decisions or responding to stimuli. "I believe that understanding the energetic cost of these processes is crucial to better understand them", Rao says.

**Prof Dr Riccardo Rao**

Physicist currently working at the  
Institute for Advanced Study in Princeton



### Formalise notions from thermodynamics

Scientists from other research areas have developed mathematical descriptions which in some cases can be used to approximately describe the dynamics of these processes, for example, networks of chemical reactions for metabolism. "What I did during my PhD is to mathematically formalize notions from thermodynamics for these descriptions", explains the young researcher.

As part of his doctoral thesis at the University of Luxembourg, which was supported by the AFR programme of the FNR, Rao showed that conservation laws are crucial to formulating nonequilibrium thermodynamic descriptions of these complex systems. He worked out this description for stochastic processes and chemical reaction networks, as these are essential to model cellular processes.

### Fascination for the complexity of living organisms

Currently, the physicist is working at the Institute for Advanced Study in Princeton. "I am applying the theoretical tools that I developed to ecological systems", he says. Once again, the idea is that these systems, for example, forests or communities of bacteria in their soils, can be regarded as engines: Energy is converted from one form to another, for instance from solar energy into mass by plants, which is subsequently degraded by animals feeding on plants and so on ...

One of the goals of Rao's post-doc project is to mechanistically understand and quantify these transformations of energy. He aims to understand the principles which underlie the complexity of these transformations: "In general, I feel extremely fascinated - and astounded - by the complexity and degree of sophistication that living organisms have achieved, at all scales: from ecosystems to cells."

#### CORE

**FNR CALL:** 2012 & 2013

**DOMAIN:** SC - EDUCATION AND LEARNING

**FNR COMMITTED:** 700,000 EUR (FAMOSO-1)

817,000 EUR (FAMOSO-2)

**PERIOD:** 01.03.2013 to 29.02.2016

01.09.2014 to 31.08.2017



**Prof Karin Priem**  
Head of Public History and  
Associate Professor in History  
of Education at the University of  
Luxembourg's C<sup>2</sup>DH

## CORPORATION: FORGING A MODERN SOCIETY

**Sparked by a collection of over 2,000 images, two projects led by Prof Karin Priem from the Luxembourg Centre for Contemporary and Digital History (C<sup>2</sup>DH) reflect on the industrial heritage and societal impact of major Luxembourg-based steel and iron producing company ARBED, examining the social and educational initiatives of the company and how it helped shape Luxembourg's national and international identity in a time of industrialisation.**

Launched in 2013 and 2014 respectively, the FAMOSO projects focus on the interactions between industrialisation and cultural, economic and societal transformations in Luxembourg, and beyond.

### "I was fascinated by these images"

In 2010, the Head of Luxembourg's National Audiovisual Centre (CNA) introduced historian Karin Priem to a collection of over 2,000 photographic glass plates related to the Luxembourg steel company ARBED (United Steelworks of Burbach-Eich-Dudelange), mainly from the years 1914 - 1950. ARBED was a global player in the 20<sup>th</sup> century steel and iron industry – it has since gone through some mergers and in 2006 finally became the world's largest steel producer ArcelorMittal.

"I was fascinated by these images – spanning from the company's social and educational initiatives, to its products and the production site but also workers, engineers and industrial leaders – and they were not really known at the time – I was more or less the first researcher who was able to look at them. I wondered: why were they made?", says Prof Priem, Head of Public History and Associate Professor in History of Education at the University of Luxembourg's C<sup>2</sup>DH.

"I asked one of my team members to check in the National Library if we could find any publications about or by ARBED and we came across a booklet from the 1920s. We recognised the photographs in the booklet from the glass plates collection. Then I understood these images were made to promote ARBED, its products, its leading role within the country, also in terms of social reforms."

Raising a series of questions of why these images came to be, what was behind them, and what they were used for, Karin Priem and her team set about digging deeper into the industrial past of Luxembourg and the history of ARBED.

### Becoming a stakeholder of social reform

Over two projects, Priem and her international and interdisciplinary team explored the company's national, European and global 'philanthrocapitalist' perspectives and activities in the light of far-reaching social, cultural and economic transformations.

"In 1920s Luxembourg, there was unrest amongst workers, and the Catholic Church was not much in favour of industrialisation – ARBED had to calm down two sides, and show that they were also taking care of aspects such as the social problems and educational issues in times of industrialisation," Prof Priem explains, adding:

"Industrialists were forced to find new roles while the country was transforming socially, culturally and economically; ARBED also wanted to become a stakeholder of social, cultural and educational reform"

ARBED rolled out a range of social and educational initiatives for their workers and the workers' families: there were housing projects; hospitals; anti-tuberculosis campaigns; sanatoria and preventoria. Additionally, the children of ARBED workers were provided with education and health care initiatives in so-called open-air schools. A highly innovative vocational training school was established not only to train ARBED workers, but also to investigate how their bodies interacted with machines.

"The aim was to use the energy of the human body in the most harmonious way, so that workers would not suffer from fatigue in their future careers. ARBED was looking for an optimum human-machine interaction, the school's psycho-technological laboratory not only tested and analysed the energy and movement of the human body, but also workers' psychological dispositions. This testing was the most innovative part of the school and achieved international recognition at the time," Prof Priem explains.



### Shaping a new elite of workers

It did not end there, the ARBED vocational training initiatives also reached into the leisure time: there was a scouting group, physical exercise was offered – including a pool inside the school, a library, a music band, there was modern gymnastics – all these initiatives contributed shape the workers bodies and minds.

“The school as a whole was very much at the verge of modernity; ARBED wanted to shape a new elite of workers who would be attached to the company and would have a certain mentality and lifestyle.”

“These social initiatives often were looked at as philanthropic initiatives, but we found out that the rationale behind was to make workers more reliable by making them healthier, happier with their existence, better educated – also their children – it created a kind of community and made workers more productive.

“My team and I finally called the result of these initiatives ‘Corporation’ – there was almost no Luxembourgish family that didn’t have ties to ARBED. Indeed, ARBED was not only profoundly changing environments but also people’s private and working lives. It was a dominant if not the most important aspect of identity formation in Luxembourg – also in the long-run and with strong influence on national heritage making.”

In addition, ARBED promoted a similar so-called ‘Luxembourg model’ when the company expanded to Brazil in the early 1920s. Therefore, the company’s influence was also analysed from a transnational and global perspective.

### Industrialist wives also played a role

Prof Priem also explains that Luxembourg had an advantage: being a bit late catching up to social initiatives in times of industrialisation meant that Luxembourg could learn from its neighbours:

“Aline Mayrisch, the wife of the Director of ARBED, travelled Europe with her daughter, looking at all these social and educational initiatives and brought ideas back to Luxembourg. It was important to see that women played a crucial role in importing reform initiatives to Luxembourg.

“It was easy for these women to have this exchange in industrial circles, intellectual networks and feminist circles. They were well educated, and also eager to find new roles of their own. Luxembourg is small, so industrialists and their families (men and women) could play on different stages and combine their activities while becoming very influential. It was interesting to see how this worked in Luxembourg.”

### Photography as a technology of corporate identity formation

The main purpose of the more than two thousands of glass plates that inspired Prof Priem became clear: Now that ARBED had rolled out these initiatives, it was important to make sure people knew about them – they were a tool to shape a positive corporate image, both at home in Luxembourg and at the international level.

“Photography was the tool to mediate all of these different success stories of ARBED – the products, all the social and educational initiatives – because photography is a technology that allowed for massive dissemination and reproduction, and could be used in printed brochures, promotion campaigns, slides, films, etc. Not only in Luxembourg – industrialists were using it as a technology to convince various audiences, to impress, and to promote their cases in various ways,” Prof Priem explains.

The images and the FAMOSO projects were highlighted at a 2017 exhibition organised with the CNA, which concentrated on these glass plates as a technology to shape corporate identity. However, the project did not only highlight ARBED’s visual campaigns, but also looked at counter images that were created by workers and their associations.

An overview of the results of the FAMOSO projects will soon be published in a peer reviewed open access book edited by Karin Priem and Frederik Herman entitled *Fabricating Modern Societies: Education, Bodies and Minds in the Age of Steel* (Leiden: Brill, in print).

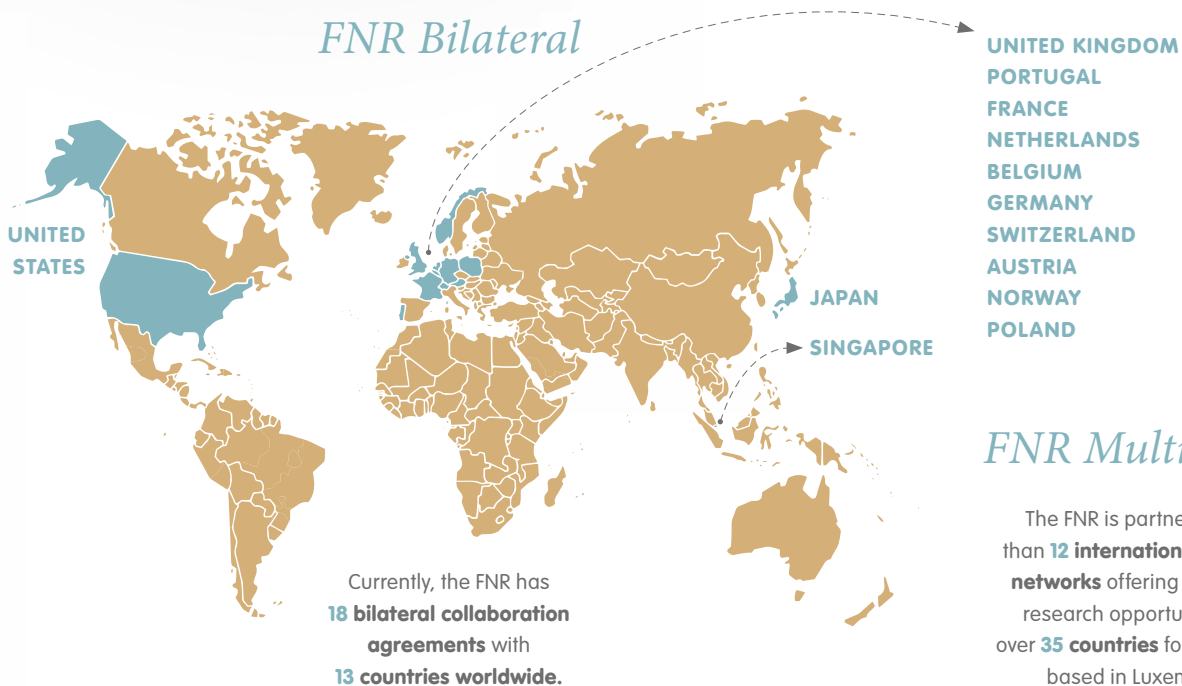
# WHY INTERNATIONAL RELATIONS?



The FNR's International Relations policy aligns with its mission to set up a **sustainable world-class research system** in Luxembourg and to increase its international visibility and recognition. A first pillar comprises **funding possibilities** for excellent **joint research projects** encouraging Luxembourg-based researchers to connect with their best peers abroad. An international competition enables for **benchmarking** with the most successful research consortia/teams. Furthermore, the collaboration allows for a **transfer of knowledge** between the involved groups. The latter is further fostered by funding of researchers' mobility as well as by the FNR's efforts in attracting established and recognised researchers to Luxembourg. The second pillar is FNR's active participation in several **international associations**, for defining **international quality standards in research funding** as well as **best practices** in research. By implementing those in Luxembourg, FNR builds-up **trust** among the worldwide research community and has become a valued partner among its peer institutions.

## INTERNATIONAL COOPERATION

The FNR maintains an increasing number of collaboration agreements that secure funding of all research partners after a single evaluation of the joint research proposal.



## Key Figures

# 80%

**1166** researchers  
(private sector)

**1968** researchers  
(public sector)  
in Luxembourg

of scientists are  
non-Luxembourgers  
(state 2016)

of research publications  
are co-authored with  
scientists abroad (2009 – 2015)

## INTERNATIONAL ASSOCIATIONS AND NETWORKING

The FNR is an active member of several international associations, bringing together research funding organisations (RFO) and research performing organisations (RPO) with the ultimate goal of **joining forces** to help **shaping the future** of (European) research. As a valued partner, the FNR is strongly involved in exchanging on and defining the **best practices in research** and **quality standards** in research funding.

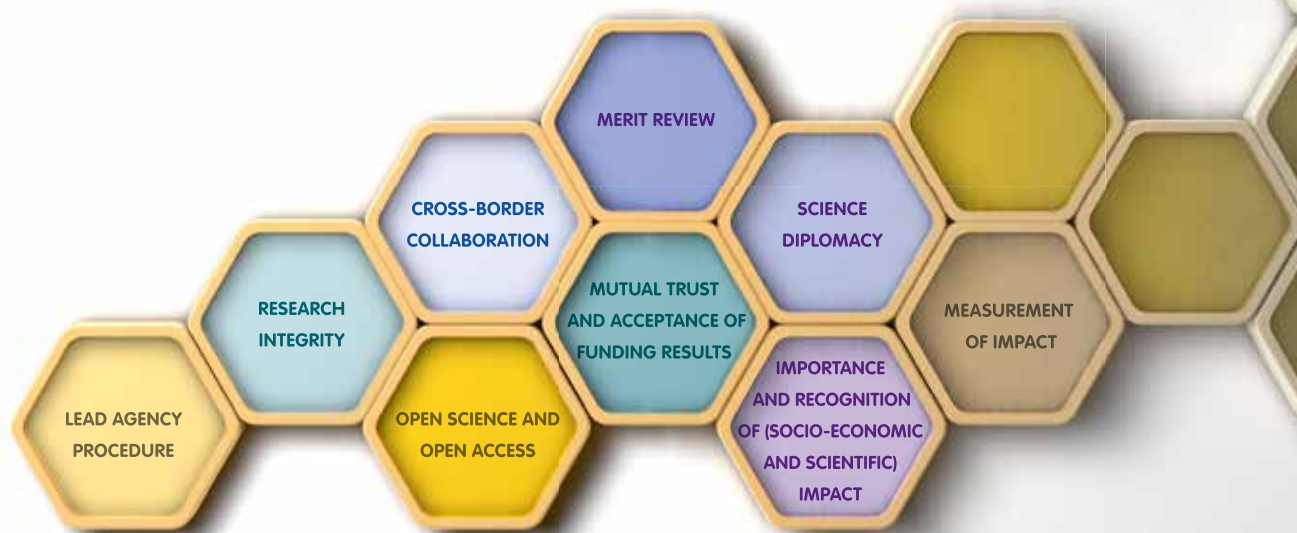
International networking among peer organisations is important to raise **visibility** for the country's research system, but also to share experiences, develop, improve and align procedures, and by thus build up mutual **trust** among the partners.

The effects of the quality standards set by international associations are not confined to the research system alone, but extend deep into society. Like its peer agencies, the FNR is fostering research with impact and is encouraging researchers to exchange with potential stakeholders (e.g. companies, citizens, ministries, politicians) and share their knowledge and findings for the benefit of society.

The FNR is a member of:



## EXAMPLES OF QUALITY STANDARDS SET BY INTERNATIONAL ASSOCIATIONS & IMPORTANT TOPICS CURRENTLY DISCUSSED



**89.48 mio €** in international projects (2014 – 2018) | representing **28,67%** of total FNR budget (2014 – 2018)

**312 mio €** committed by FNR (2014 – 2018)

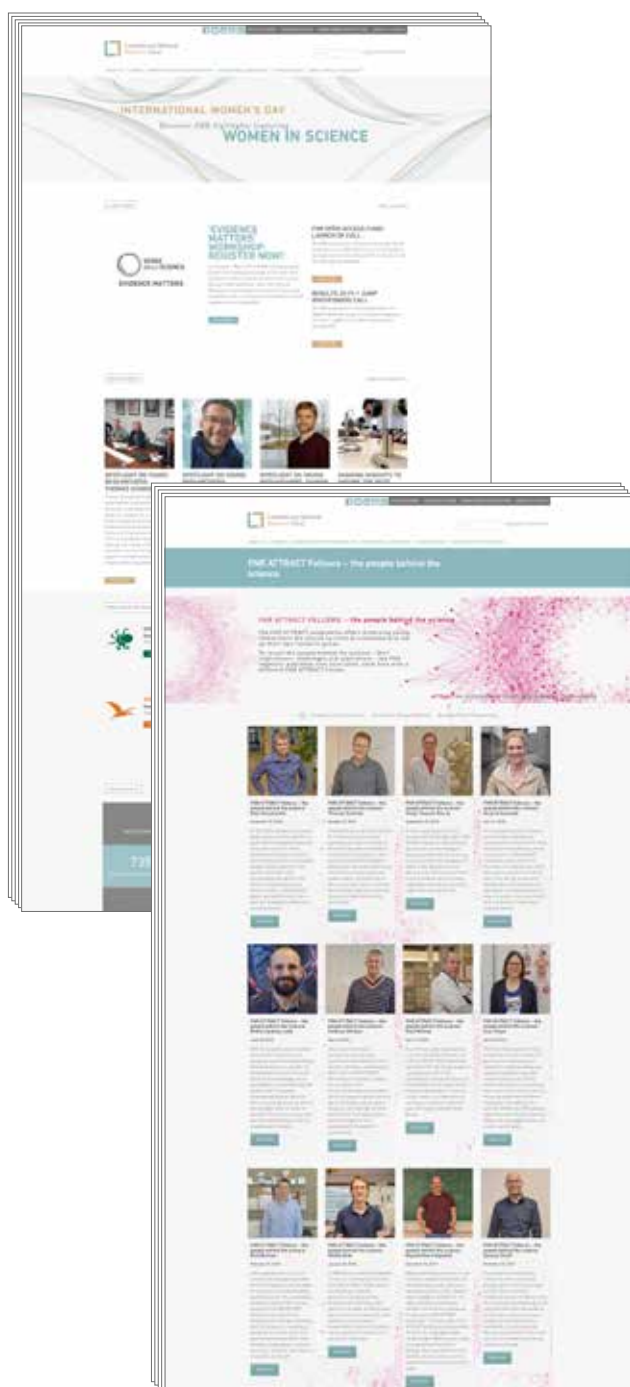
**279** international projects (2014 – 2018)

representing **24,22%** of all the FNR funded projects (2014 – 2018)

Infographic: Daniela Leitner



# 12 FNR.LU



## FNR.LU:

### more than just funding information

In addition to being a one-stop shop for all information about the FNR's activities and funding instruments, the FNR website since the 2016 re-launch also boasts a dedicated section for videos and success stories – Research with Impact: FNR Highlights. Over 150 features, interviews and stories have been published, 55 in 2018 alone. Reaching across scientific domains, nationalities and institutions, from junior to senior researchers, the FNR highlights offer glimpses into Luxembourg's research and the scientists behind it.

**+150**  
STORIES

**55**  
STORIES PUBLISHED  
IN 2018

## FNR ATTRACT FELLOWS

### the people behind the science

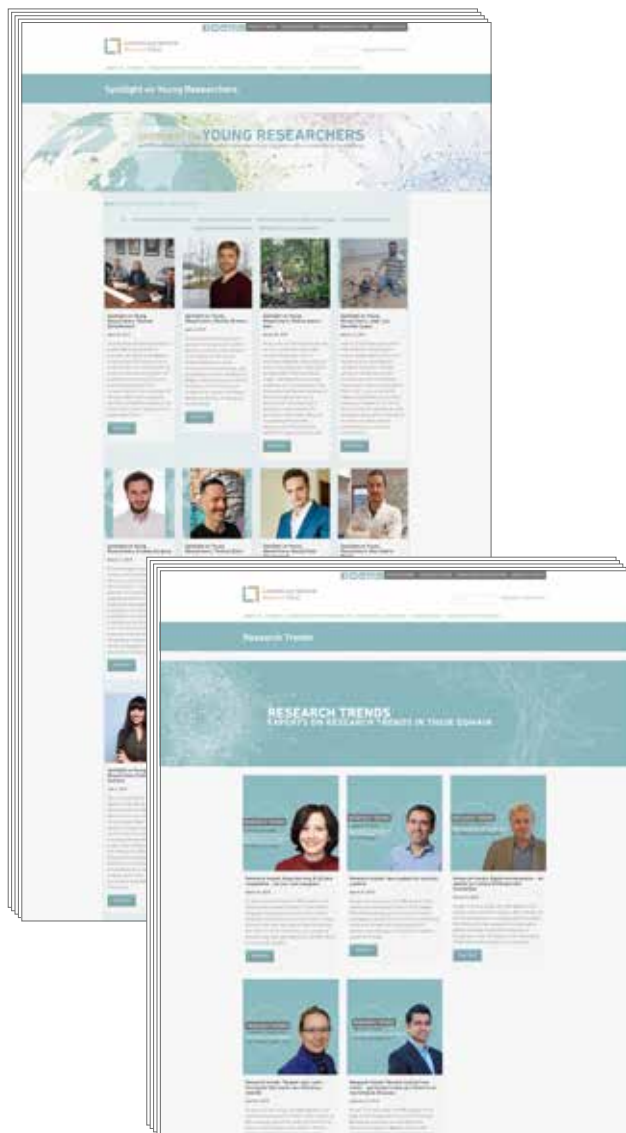
The FNR ATTRACT programme offers promising young researchers the chance to come to Luxembourg to set up their own research group.

To reveal the people behind the science – their inspirations, challenges and aspirations in this time where they transition to senior researchers and take on new responsibilities – the FNR regularly publishes new interviews, each time with a different FNR ATTRACT Fellow.

<https://www.fnr.lu/fnr-attract-fellows>

**13**  
INTERVIEWS  
PUBLISHED

**10**  
INTERVIEWS  
PUBLISHED  
IN 2018



## SPOTLIGHT ON YOUNG RESEARCHERS

Running annually since 2015/16, the Spotlight on Young Researchers initiative shines a spotlight on early-career researchers from around the globe with a connection to Luxembourg. Covering anything from whale research, over biomedical research, rivers, satellites and more, Spotlight offers a view into the hugely diverse stories of researchers who are taking the first steps on their scientist journeys, while at the same time offering these researchers a platform to gain visibility.

<https://www.fnr.lu/spotlight>

**45**  
YOUNG  
RESEARCHER  
STORIES  
PUBLISHED

**18**  
STORIES PUBLISHED  
IN 2018 EDITION

## RESEARCH TRENDS

Luxembourg boasts a range of experts in various fields. To highlight the growing scientific expertise in Luxembourg, the FNR launched the 'Research trends' series, where five experts talk about a current question facing their domain, ranging from solar energy, over digital history to artificial intelligence.

<https://www.fnr.lu/research-trends/>

**5** ARTICLES  
PUBLISHED

**75,282**

VISITORS ON FNR.LU

**275,920**

PAGEVIEWS ON FNR.LU

**1,58**

MILLION SOCIAL MEDIA  
IMPRESSIONS

**f** **2,140**  
FACEBOOK FANS

**t** **1,872**  
TWITTER FOLLOWERS

**in** **1,601**  
LINKEDIN CONNECTIONS

**YouTube** **108,000**  
VIEWS ON YOUTUBE

# 13 PhDs IN LUXEMBOURG

## DOCTORAL CANDIDATES

Coming from all over the world, the young researchers represent an undeniable force for the future of Luxembourg research, whose presence is reinforced on the international scene.

In 2018, more than 100 new doctoral candidates joined the national public institutions, the majority being affiliated with the University of Luxembourg.

The number of researchers is expected to grow steadily in the coming years, and many job opportunities are regularly offered at the different research institutions. To guarantee a quality doctoral training, the Luxembourg institutions are all implementing the “**National Quality Framework for Doctoral Training**”.

## PHD GRADUATES 2018\*

**116** UNIVERSITY OF LUXEMBOURG

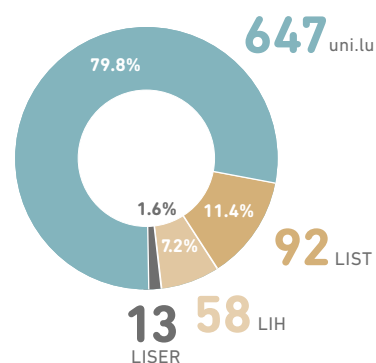
**14** LUXEMBOURG INSTITUTE OF SCIENCE & TECHNOLOGY

**13** LUXEMBOURG INSTITUTE OF HEALTH

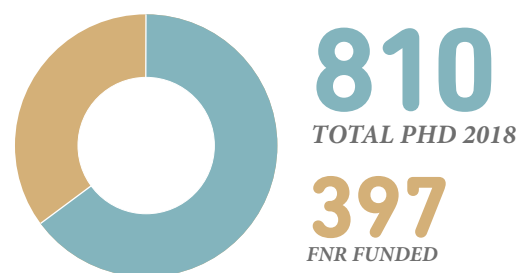
**2** LUXEMBOURG INSTITUTE OF SOCIO-ECONOMIC RESEARCH

## ONGOING & SUCCESSFULLY GRADUATED PHD 2018\*

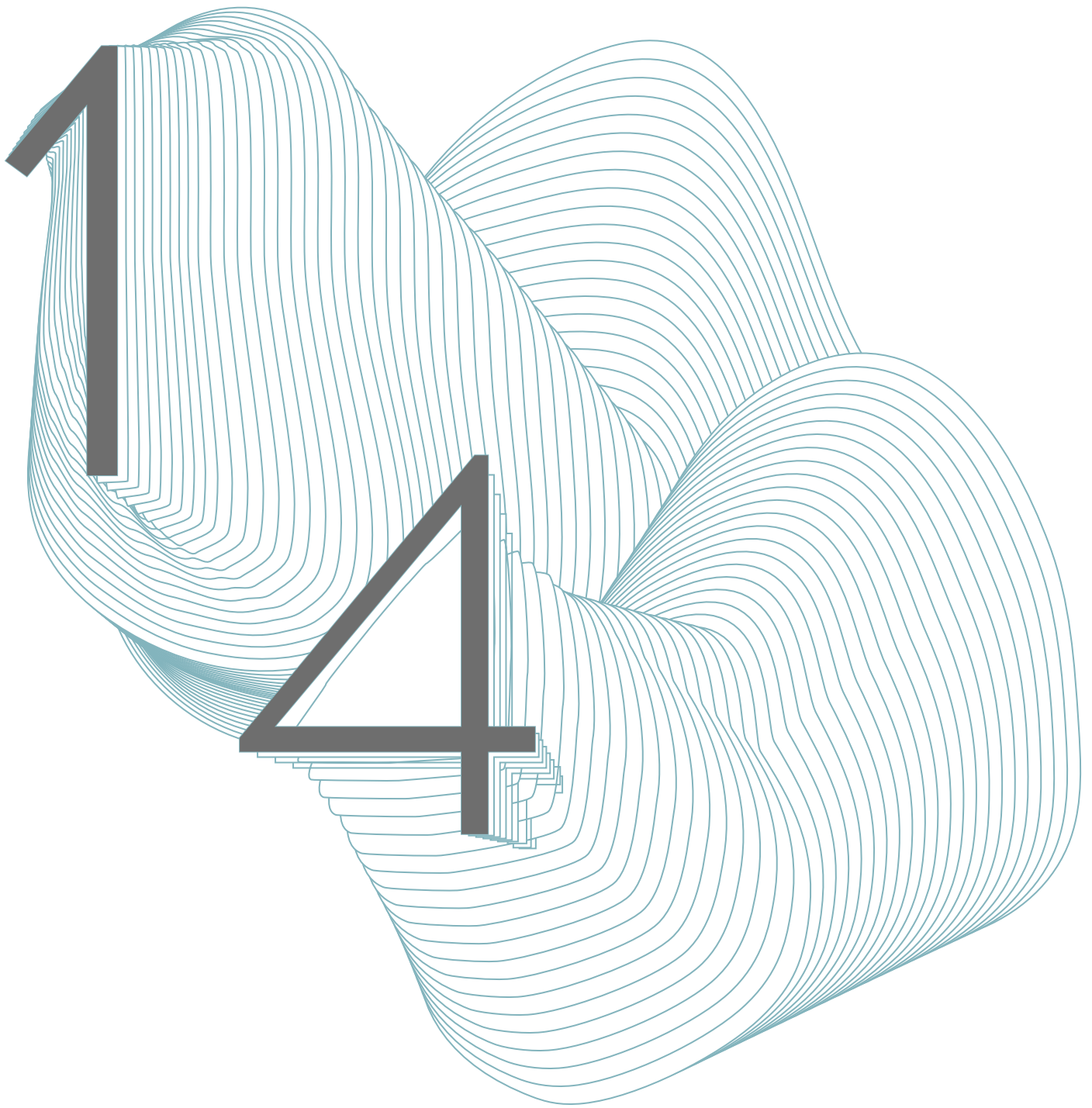
*Ongoing by host institution*



*PhDs funded 2018*



\* on 31.12.2018



# 14 SCIENCE.LU

## *What is science.lu? Luxembourg's science webpage for all!*

On **science.lu** you can find news about research in Luxembourg, DIY experiments, articles about scientific phenomena, scientific events and teaching material for primary school teachers! With our webpage and the associated social media channels (Facebook, Instagram, Twitter, Youtube), we reach thousands of people every day and offer researchers a platform to present their research to the public.

Science.lu is available in German and French, some articles are also in English or Luxembourgish.

### RELAUNCH IN 2018!

In 2018, science.lu got a major makeover. The aim was to increase the user-friendliness of the site and to modernise the look and feel. We simplified the menu, added new sections and changed the layout.

In order to promote the new site we did a spectacular street science show in Ettelbruck in September 2018!

## 323,329

VISITORS ON *science.lu*

## 521,479

PAGEVIEWS ON *science.lu*



## 22,961

FACEBOOK FANS



## 882

TWITTER FOLLOWERS



## 533

INSTAGRAM FOLLOWERS



## 307,646

VIEWS ON YOUTUBE

## 352,533

MINUTES VIEWED ON YOUTUBE



## PRESENTATION OF SOME SCIENCE.LU SECTIONS



### Research in Luxembourg

In this section we report about Luxembourgish research findings, their relevance and purpose. We portray researchers and let researchers present their work to the public. With to date over 600 articles about research in Luxembourg, this section gives a very good overview of Luxembourg's research activities.



### Experiments

Science.lu offers a collection of more than 100 simple DIY experiments for children and those of us who still enjoy trying out fun and fascinating experiments.



### Looking for participants for your study?

The column "Studententeilnehmer gesucht/Participez aux études" gives researchers a platform to display the studies for which they need the participation of volunteers (patients and healthy controls). Interested citizens are informed about ongoing studies in which they can participate.



### Ideas for science education in primary school

This new column was designed in cooperation with SCRIPT in order to support primary school teachers in making their science classes interactive. We offer a selection of experiments (with descriptions, videos and PDF downloads), engineered for in-class activities, with little cost of material. The pedagogical approach is to introduce the pupils to the scientific method (ask a question, discuss hypotheses, conduct an experiment, analyse results and come up with a conclusion).



### Mister Science

Mister Science is the ambassador for science in Luxembourg. Most people know him from the PISA show on Luxembourgish RTL Télévision. On RTL-Radio and Eldorado, he gives simple explanations to scientific phenomena. On science.lu, you can find more than 500 Mr Science articles and videos (in Luxembourgish).



### Science actors in Luxembourg

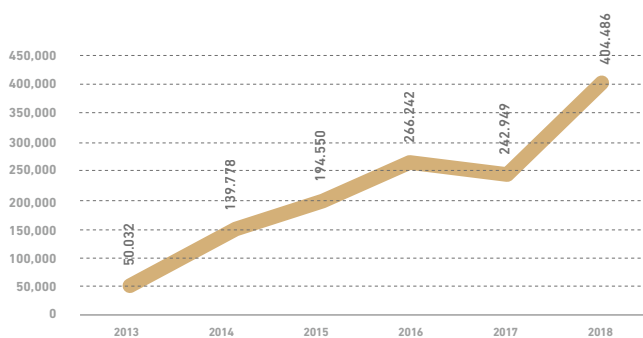
The column "Wissenschaftsakteure/ Acteurs de la Science" gives an overview over all the Luxembourg science actors, highlighting research institutions, science communication actors, research-based start-ups and companies and offers insights in their missions and activities.

## SCIENCE.LU REACHES MORE AND MORE PEOPLE

Since the launch of science.lu, the number of sessions is constantly increasing! To date we have gotten over 2 million page views, and over 130.000 people from Luxembourg visited the site. In 2018 we had an average of more than 1400 page views/day.

### SCIENCE.LU

*Evolution of sessions per year*



But science.lu is not only a webpage. Through our social media channels, we reach even more people every day. On Facebook we reached on average nearly 16.000 people per day in 2018 and on Youtube we have 311 videos that got more than 300.000 views in 2018.

## SCIENCE.LU TRAINING

For researchers that want to present their research on science.lu, the FNR regularly offers training on "how to present your research in an online article" and on "how to present your research in a video".

In 2018 we produced the second edition of "My research in 90 seconds", a format where PhD students explain their research in 90 seconds. This shooting was part of the Science Communication Course at the University, held by the FNR. Another video series about researchers from Luxembourg produced for science.lu is "Meet the Scientists".

For future training offers and video shootings check FNR Info and [science.lu](https://science.lu).



# 10 YEARS MR SCIENCE

## *Happy Birthday, Mr Science!*

*For ten years now, Mr Science has been getting his audience excited about science, informing them about relevant research and, above all, making sure they have lots of fun. What many do not know: Joseph Rodesch, the man behind the fictional character Mr Science, is an employee at the FNR and fulfils an important strategic task in the Grand Duchy: he is a mediator between science and non-scientists. This mediation has always of key importance for the FNR.*



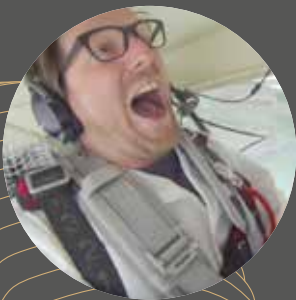
The propeller aircraft has just reached flying altitude when the pilot suddenly pushes the controls dangerously far forward. The little plane goes into a descent for a moment. But then the pilot pulls the controls tightly to his chest and applies full throttle. The plane rises into the sky and starts into a loop. What goes on behind the pilot is funny, original and informative at the same time: there sits Mr Science, surrounded by tiny action cameras that are all focused on him to record everything. In his lap, he holds a small bucket of water which, for safety reasons, is kept closed with a lid on top. **Will the water stay in the bottom of the bucket due to the centrifugal force of the loop, or will the lid get wet?**

Mr Science is aware of his stomach contents. Despite the extreme flight manoeuvre, he enthusiastically moderates the ongoing experiment they are doing as part of the show Pisa, the science magazine of RTL TV Luxembourg. Mr Science is in his element.

This and many other experiments are up on YouTube to be watched at any time (QR code takes you to the flight video). Reporting on physics, chemistry, biology and medicine as a TV star is not all that Joseph Rodesch, a chemist himself, does on behalf of the FNR. Mr Science also regularly entertains children and young adults in live shows that spark their interest in science. There are whizzes and bangs, steam and sparks, and a whole lot of astonished faces directed at the likeable man with the beard and glasses, who obviously enjoys his work so much that he can't help but convey his enthusiasm to others.

Strategically, Mr Science is an important gear in the machinery of the FNR for promoting science to the public. In addition to campaigns like the website science.lu or Researchers' Days and the targeted funding of outreach activities by the scientist himself, Mr Science fills a gap in the portfolio of well-coordinated measures. Through his work, Rodesch has also become highly familiar with the growing research landscape in Luxembourg. That makes him a trusted advisor for the journalists in Luxembourg. Furthermore, Rodesch holds training courses for teachers.

In Mr Science, one might say the FNR has a kind of “Swiss Army knife” for science communication. An investment in the toolbox of science communication aimed at closing the gap between science and the public. Joseph Rodesch is Mr Science – and Mr Science is Joseph Rodesch. Awesome!



## INTERVIEW

### *Wéi al bass Du, Mister Science?*

Ech si virun zimlech genee 10 Joer op d'Welt komm, mee ech ginn awer dacks méi al geschat.

### *Erziel ons e wéineg vun dengem Elteren.*

Meng Mamm huet beim Eldorado geschafft a mäi Papp beim FNR. Ech hunn awer och Famill bei RTL, déi u menger Erzéiung wesentlech bedeelegt waren. Ech denken, et kann een ons als glécklech Famill bezeichnen.

### *Fills Du dech mat 10 Joer eigentlech schonn erwuessen?*

Absolut! Och wann ech dacks Saache maachen, déi och Kanner extrem Spaass maachen, ass mäin eigentleche Charakter ganz eescht (laacht!)

### *Gëss Du dacks op der Strooss erkannt?*

Gewässermoossen, jo. Iwwert 80% vun de Lëtzebuerger kennen de Mister Science, mee bal kee kennt mäi richtegen Numm.

### *Wouru schaffts Du grad?*

Dierfen Zéngjäregere eigentlech schaffen? Ech denken net! Nee mee am Eescht: Mir plange grad en total verréckelt Experiment. Dat gëtt super an och e bësse geféierlech. Mir wëllen am Summer... Ah nee. Léiwer nach näischt verroden. Looss dech einfach iwwerraschen!



# 15 CARTES BLANCHES 2018

## GETTING THE NEXT GENERATION PASSIONATE ABOUT SCIENCE AND ENTREPRENEURSHIP

The science sector in Luxembourg has developed enormously over the last decades. Significant funding has been and continues to be invested in the sector, and modern infrastructure has been established. In an opinion piece, FNR Secretary General Marc Schiltz discusses how one piece of the puzzle is still missing in the quest to transform Luxembourg's knowledge economy vision into reality.

In his speech for the 100th anniversary of FEDIL, Nicolas Buck declared science and technology to be key elements in the future of industry. Technology, said the President of FEDIL, is based on knowledge and on scientific results. He added that talent is needed in order to build on and understand these results. Talent that can build bridges between science and technology. Additionally, an entrepreneurial mindset is required to implement new technologies into the economy.

I agree 100% with Nicolas Buck – the main resources needed for Luxembourg's future is a combination of entrepreneurial spirit and brainpower.

The science sector in Luxembourg has developed enormously over the last two decades. Regardless of who has been in Government, there has always been consensus that science and research both have an important role to play in the future development of Luxembourg. Constantly increasing funding that successive Governments have invested in this sector highlights this. The recently approved 4-year multiannual contracts of the public research institutions come with a 25% increase in budget – emphasising the importance of research and science in Luxembourg.

The situation in Luxembourg is in a sense unique in Europe. There is constant public investment in excellent infrastructure, which makes it possible to become

champions in individual domains. One development, which is also widely supported by Luxembourg's residents, was highlighted in a survey from 2017: 56% of respondents asserted they want more investment in research, while 60% said research raises the level of knowledge, even if it not immediately implemented.

Thus, the future looks bright in terms of establishing Luxembourg as the innovation and knowledge society we strive for. Unfortunately, there is a cloud hanging over this bright future: We are not able to get enough young people for careers in science, technology and IT.

There are likely many reasons for this: A school system that still does not fully appreciate the importance of these subjects, despite the many efforts that have been made over the last few years.

An uneven playing field, where Luxembourgish nationals are more comfortable working in the public sector than in the private sector.

There is also the fact that many young people are simply not aware that a range of careers that appear attractive today – for example in the banking and finance sector – will either be completely changed or even made obsolete by digital transformation.

If we do not succeed in getting the best of the new generation, especially women, excited about and interested in science, technology and entrepreneurship, then we will not be able to turn the vision of the knowledge economy into reality – despite the good funding and modern infrastructure in Luxembourg.

 [rtl.lu/meenung/carte-blanche/a/1132544.html](https://rtl.lu/meenung/carte-blanche/a/1132544.html)

This opinion piece was originally published as a Carte Blanche on RTL Radio

## ARTIFICIAL INTELLIGENCE (AI) – IN THE SERVICE OF MANKIND

AI has arrived in our daily lives. What can and what can AI not do? Which societal problems does AI pose? An opinion piece by FNR Secretary General Marc Schiltz.

Artificial Intelligence – a definition everyone knows by now. What is it? In a nutshell: AI is a generation of computer programmes with the ability to imitate intelligent human behaviour.

Example: Google's computer programme Alpha Go Zero has learned how to master the ancient Chinese board game Go – even defeating the human world champion. The programme has learnt how to win by playing against itself thousands of times.

In the domain of medicine, AI can already analyse scans, x-rays and other data - putting together a diagnosis for certain types of cancer that is more reliable than a diagnosis from an experienced doctor.

Not to forget virtual assistants on smartphones, the likes of Siri and Alexa, which learn to understand and talk with the user. In the future, they will learn to get to know the user even better – their wishes, habits and preferences. AI has by now reached a point where it can recognise and adapt to emotions.

So are humans, with their imperfect intelligence, running the risk of being dominated by AI? Most likely not anytime soon. While current AI programmes often do a better job than humans, they can only do so in highly specific areas: Alpha Go is a champion in the game Go, but cannot do anything else. The most extraordinary aspect about the human brain is that it can tackle such a wide range of problems.

Human intelligence can also distinguish between cause and effect – it appears AI is not yet able to do this. As Judea Pearl – who championed the probabilistic approach to artificial intelligence – said: "Today's machine learning programs can't tell whether a crowing rooster makes the sun rise, or the other way around."

AI brings with it a range of societal problems. There are jobs that will likely not exist, or not in their current form, in the future, such as chauffeurs, travel agents, accountants, but some jobs in medicine could also be affected.

There are also ethical challenges. AI is not completely transparent, as these programmes base their decisions on what they have „learned“. Who controls this? How can it be prevented that this becomes too one-sided? And in the end, how can AI be prevented from manipulating us? "Fake news" should not be followed by "Fake intelligence".

An intense exchange between science, industry, politics and society is needed in order to develop AI in a way that always puts the well-being of humans first.

 [rtl.lu/meenung/carte-blanche/a/1185286.html](https://rtl.lu/meenung/carte-blanche/a/1185286.html)

This opinion piece was originally published as a Carte Blanche on RTL Radio

## THE FUTURE OF RESEARCH IN LUXEMBOURG

Ahead of Luxembourg's general elections on 14 October 2018, it is a welcome development that research has found its way into the political party programmes. In his newest opinion piece, FNR Secretary General Marc Schiltz discusses which role the political parties envision for research in Luxembourg and what future Governments can do to further strengthen this asset of the country.

The new academic year has started, and with it has brought life back to Belval. We have also just seen the opening of a new building – the heart of all universities and previously referred to as a library: The Luxembourg Learning Centre. It is a brilliant Centre, which is much more than just a library – and it is open to everyone, student or not.

The Belval campus receives admiration and recognition from the visitors from abroad that we welcome here. There is no doubt the research destination Luxembourg is becoming another of the Grand Duchy's assets.

On 14 October 2018, Luxembourg has a general election. I of course had to take a look to see what the different election programmes have to say about research, innovation and the University. It is positive to see these topics have found their way into the election programmes – this was not the case five years ago.

It is delightful to see that there is a consensus between the political parties to continue the development of the research sector over the next years.

The parties agree that the various research institutions should work even closer together, and almost all the parties agree that the synergies between public research and the private sector should be further strengthened.

The collaboration between the two is already working well, both on the researcher and senior management level.

However, on a Governance level, we are still tied to fragmented structures, where one can wonder whether these are still adapted for the future.

For example, the University and each public research institution still has its own separate governance structure – almost half a dozen different governing boards work, separately, on developing individual parts of Luxembourg's research strategy. A counterexample to this is Switzerland, where there is one single governing board for two large universities and four research institutions with four times as many researchers as in Luxembourg.

In Luxembourg, government funding for research and innovation – in the public or private sector, as well as for start-ups – continues to be organised completely separate from one another.

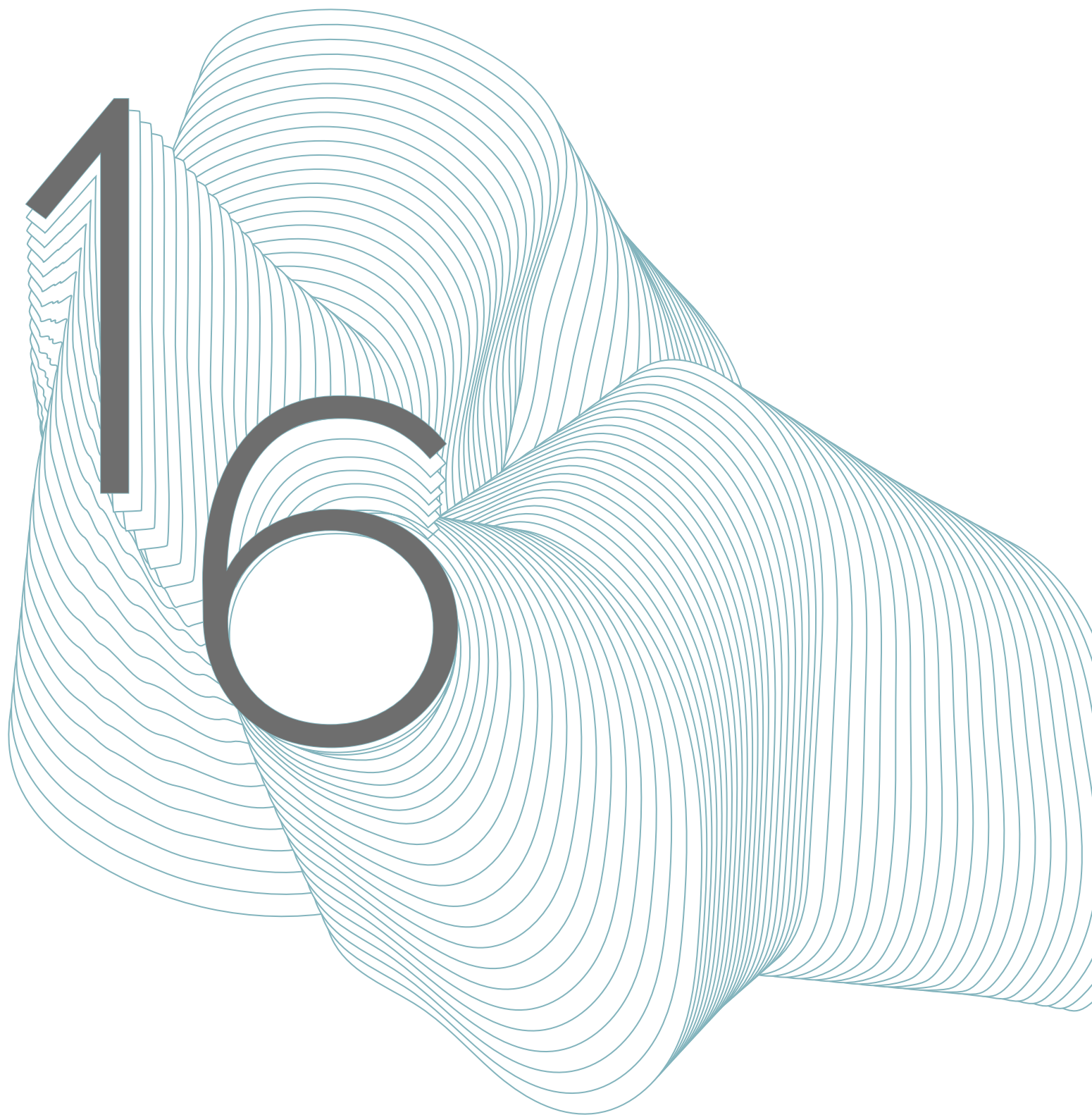
These are challenges that a future government – regardless of how it is composed – has to commit to taking on. Reflections on this can also be found in the 2016 OECD report, which unfortunately is barely talked about anymore.

Our research destination has made a name for itself on the international stage in a short amount of time – this is something to be proud of.

The future Government, independently of who it is, has the opportunity to in the long term establish our research landscape as world-class, by setting developing a new framework that makes the most of the synergies between the public and private sector.

 [rtl.lu/meenung/carte-blanche/a/1246206.html](https://rtl.lu/meenung/carte-blanche/a/1246206.html)

This opinion piece was originally published as a Carte Blanche on RTL Radio



# 16 ORGANISATION

The FNR is a public institution created by statute (Law of 31 May, 1999) and enjoys legal capacity and full administrative and financial autonomy. Our overall strategy is laid down in a four-year contract with the Luxembourg Government, which also defines our budget appropriation.

## THE BOARD

Our Board supervises the organisation and approves the overall policies and strategic priorities of the FNR. It is appointed by the government and is composed of nine independent directors active in industry, business and the civil society. The members of the Board act in full autonomy.

### Chair

*Véronique HOFFELD*, Attorney-at-law, Member of the Executive Committee and partner at Loyens & Loeff

### Vice-Chair

*Thierry WOLTER*, Member of the Executive Board and the Supervisory Board of CERATIZIT (Luxembourg)

## Members

*Andrée BILLON*, Executive Director of "Commission de Surveillance du Secteur Financier" (Luxembourg) from 2009-2016

*Edmond DIFFERDING*, Managing Director of Differding Consulting (Louvain-la-Neuve, Belgium)

*Christiane HOFFMANN*, Manager of Lilith Project (Luxembourg)

*Anouk HILGER*, Head of Project Development Renewable Energies at Enovos Luxembourg S.A.

*Richard SEDRANI*, Executive Director at the Novartis Institutes for BioMedical Research (Basel, Switzerland)

*Hjoerdis STAHL*, Director and Deputy Member of the Management Board at "Entreprise des Postes et Télécommunications Luxembourg" (Member of the Board until 09/18)

*Roger ASSAKER*, Co-founder and CEO of e-Xtream engineering

## Ex-officio (non-voting) members

*Marc SCHILTZ*, Secretary General of the FNR

*Robert KERGER*, Government Commissioner

*Yves FROMES*, Chair of the Scientific Council of the FNR



## BOARD

from left to right: Richard Sedrani, Roger Assaker, Robert Kerger (Government Commissioner), Marc Schiltz (Secretary General), Thierry Wolter (Vice-Chairman of the Board), Véronique Hoffeld (Chair of the Board), Hjoerdis Stahl, Christine Hoffmann, Edmond Differding, Andrée Billon, Yves Fromes (ex-officio member)

## THE SCIENTIFIC COUNCIL

Our Scientific Council acts as an advisory body to the FNR. Appointed by the Government, it is composed of international experts. The current Scientific Council was appointed by ministerial decree in June 2015.

### Chair

*Prof. Dr Yves FROMES,*  
Institut de Myologie, Paris (France)

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