2018
A YEAR AT THE CNRS

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THE BEST OF 2018

JANUARY

INTERNATIONAL

On 1 January, Imperial College London and the CNRS set up the **Abraham de Moivre International Joint Unit** (UMI) in mathematics, which is inaugurated in London (UK) on 15 January.

APRIL

INSIDE THE CNRS

Alain Schuhl is named Chief Scientific Officer.

MARCH

COMMUNICATION

The CNRS launches its new website on 20 March. Its updated graphics, functions and editorial concept have been designed to give the site a more modern look and to improve user experience.

MAY

ENERGY

With the construction of the Energy Hub, whose inauguration is attended by Frédérique Vidal, French Minister of Higher Education, Research and Innovation, **Amiens** (northern France) becomes an important research centre in renewable energies and energy transition.

ENVIRONMENT

Two core sampling expeditions are carried out in Russia as part of **Ice Memory**, an international programme to safeguard the historical record of the world's glaciers.

JUNE

INTERNATIONAL

The CNRS's CEMES (Centre d'Elaboration de Matériaux et d'Etudes Structurales) and Hitachi High Technologies Corporation formalise the creation of a joint laboratory, the first to unite the CNRS and a foreign company.

JULY

INSIDE THE CNRS

The Centre and its laboratories participate in the ***EuroScience Open Forum*** (ESOF), the largest interdisciplinary science and innovation gathering in Europe, and in the ***Science in the City festival.*** Both events are the first of their kind for Toulouse, the French host city, and for France.

INSIDE THE CNRS

The CNRS formalises the setting up of a subsidiary in Singapore. Called ***CNRS@CREATE,*** its mission will be to oversee French-Singaporean research projects within the Singaporean ecosystem.

SEPTEMBER

NEUROSCIENCE

The Institut NeuroMyoGène, a new laboratory dedicated to the study of healthy and pathological nervous and neuromuscular systems, **is inaugurated in Lyon (southeastern France) on 26 September.**

UNIVERSE

The first particle tracks are detected by **the prototype of DUNE, an international neutrino experiment** scheduled to start by 2026 at Fermilab, near Chicago (US). Its mission will be to shed light on the mysteries of neutrinos, the most abundant matter particles in the Universe.

INSIDE THE CNRS

Joël Moret-Bailly is named CNRS Ethics Officer.

OCTOBER

BIOLOGY

The IBMC (Institut de Biologie Moléculaire et Cellulaire) inaugurates its new extension, the **insectarium,** in Strasbourg (northeastern France) on 1 October.

INNOVATION

On 10 October, the CNRS hosts its startups at CNRSXStartup, an exceptional day of dialogue and interaction, followed by the presentation ceremony of the **seventh edition of the Innovation Medal.**

SOCIETY

A conference entitled **"Everyone Measuring, Everyone Measured – Science at the Heart of Society"** is held to mark the revision of the International System of Units.

INNOVATION

Inauguration of **the first large-sized telescope of the Cherenkov Telescope Array (CTA).** When complete, it will be the world's leading observatory for very-high energy gamma-ray astronomy.

CHEMISTRY

Inauguration of the **"2018-2019 year of chemistry, from primary school to university",** an initiative by the French Ministry of National Education, in cooperation with the Ministry of Higher Education, Research and Innovation.

NOVEMBER

INSIDE THE CNRS

Creation of the CNRS Innovation Office (DGDI).

INSIDE THE CNRS

Appointment of Rémy Mosseri as CNRS Scientific Integrity Officer.

UNIVERSE

Landing on Mars of Insight, a joint CNRS / CNES / IPGP mission co-directed by NASA, **with the SEIS seismometre,** an instrument developed by French teams, on board.

INSIDE THE CNRS

The philosopher and philologist **Barbara Cassin is awarded the CNRS Gold Medal.**

DECEMBER

PARTNERSHIP

Inauguration in Orléans (central France) of the INEM / ARTIMMUNE joint laboratory created to study the mechanisms of asthma and identify therapeutic targets.

BIOLOGY

Inauguration of the Genetics, Reproduction and Development (GReD) laboratory in Clermont-Ferrand (central France).

ENERGY

Inauguration of the Institut Photovoltaïque d'Île-de-France, near Paris, which houses a laboratory of the same name, abbreviated **IPVF.**

Antoine Petit,
CNRS Chairman and CEO

What is your assessment of your first year as CNRS Chairman and CEO?

Antoine Petit: This past year has been an opportunity for me to rediscover the CNRS, which I had left in early 2006. I had confirmation of the exceptional quality of the work conducted by the research units and by the support staff. I went around all of the regional offices, institutes and departments, and I was struck by the energy and enthusiasm of everyone I met.

At the CNRS, pluridisciplinarity is a genuine driving force. But pluridisciplinarity is of no value without high-level disciplinary research. And yet society, or the socio-economic world, does not raise disciplinary questions concerning mathematics, biology, philosophy or sociology, but rather general questions, for example about artificial intelligence or health. Addressing these issues requires contributions from various disciplines. One of the CNRS's strengths must lie specifically in its capacity to mobilise specialists from different backgrounds and facilitate collaboration.

I have also become fully aware of the CNRS's international visibility. Its brand image is exceptional – the organisation is seen as a real ambassador of French science.

Since there is no such thing as perfection, I have also noted areas in which there is room for improvement – our IT resources, for example – and in some cases a certain inertia, often typical of large-scale organisations, but that we must all strive to overcome.

In terms of recruitment, the CNRS has adopted a new multi-year employment programme that foresees the annual recruitment of 250 researchers and 310 engineers and technicians over four years. Why this choice?

A. P.: We have changed the recruitment system primarily for economic reasons and financial sustainability. But it is important to understand that permanent positions are only one part of the puzzle, albeit a crucial one. What is the point of recruiting researchers if the CNRS cannot give them the necessary resources to conduct their research and provide them with high-quality support services? That is why we have decided to increase, even though modestly, the hiring of engineers and technicians. In the same spirit, we have requested and obtained extra support for our laboratories, allocating €15 million of our working capital to their operating budgets.

The CNRS has also committed resources to recruit PhD students (200 in 2019). This provides significant scientific policy leverage that will serve three of the CNRS's priorities: international presence, pluridisciplinarity and societal issues.

You have made technology transfer a focal point of the CNRS policy, and the organisation now boasts a newly-created Innovation Office, the third administrative office alongside the Resources and Scientific Offices.

A. P.: Transferring the results of our basic research is an integral part of the CNRS's missions. Disruptive innovations, which are essential for most companies, mostly originate from academic research laboratories. By helping companies innovate, the CNRS indirectly

INTERDISCIPLINARITY: A GENUINE, LIVING ASSET

promotes the development of new markets, the design of new products and the creation of new jobs, thus contributing to the country's wealth. The mission of the Innovation Office will be to strengthen our links with multinationals and SMEs, and encourage the creation of startups. In fact, we have increased the budget of the CNRS's pre-maturation programme in order to expand the portfolio of projects with innovation potential.

In 2018, you paid special attention to the CNRS's partner universities, launching a series of initiatives. What is their purpose?

A. P.: Nearly all of the CNRS research units are run jointly with universities and/or other academic institutions. Interaction between us is therefore paramount. That is the reason why we have invited leading universities to participate in strategic meetings in order to define our priorities together, whether in terms of research, human resources, technology transfer or international relations. We have also strengthened the role of the scientific directors and site referents (DSRs) to enable them to focus their efforts on operational strategy. For the sites that have no DSR, we have begun to generalise the functions of deputy scientific directors and site referents in order to facilitate exchanges between the CNRS and universities.

Very early on, you expressed the wish to be involved in questions of scientific integrity. The CNRS has now appointed a Scientific Integrity Officer, as well as an Ethics Officer acting as a whistle-blower.

A. P.: These two positions will complement the role of the CNRS ombudsperson and of the Ethics Committee. Indeed, I thought it was important to set up a more unified system, defining transparent procedures to be followed by the CNRS, which is seen as an exemplary model on these issues.

What about gender parity at the CNRS? What measures have been taken to promote the role of women?

A. P.: I have discovered that, overall, the CNRS has not been offering women careers similar to those of men. Only 8% of the highest-ranking researchers are women. This is not acceptable! It will take time to put that right, but we have already introduced a very concrete measure: we have set the goal that from now on the promotion rate for women will no longer depend on the pool of candidates, but on the potential pool, so as to prevent self-censorship. I am delighted to report that we reached that goal for all promotions in 2018. However, we must remain vigilant if we want to see this reform through to the end. We are also looking at ways of increasing the number of women unit directors, who continue to be underrepresented compared to the number of women researchers at the CNRS. To address this type of issue, we have decided this year to create the Equity and Equality Commission, tasked with proposing further concrete measures.

IMPLEMENTING A MULTI-YEAR EMPLOYMENT STRATEGY

CHRISTOPHE COUDROY
Chief Resources Officer

2018 was an eventful, crucial year for the CNRS Resources Office, in particular with the introduction of a new budgetary balance…

Christophe Coudroy: In conjunction with the French Ministry of Higher Education, Research and Innovation, Antoine Petit, the CNRS chairman and CEO, has defined a multi-year employment programme to smooth out the demographic spikes of years to come and align recruitment with the retirement rate, which amounts to 250 researchers and 310 engineers and technicians per year. This puts greater emphasis on the hiring of engineers and technicians compared with the previous policy ("300/300").
In parallel, we are making an extra effort in terms of remuneration. An additional €2.4 million has already been earmarked for engineers and technicians, and we have started to review the allowance system for researchers in preparation for discussions with the ministry.
Lastly, looking at our working capital has made it possible to identify a proportion of the funds that could be mobilised, with the approval of the supervisory authorities. This will enable us to invest in the recruitment of 300 PhD students starting in 2019, based on national priorities, and dedicate €15m to supplement funding for laboratories.

Which projects for the benefit of staff members were finalised in 2018?

C. C.: Several projects aim to improve flexibility at work and facilitate interaction with HR services.
As a result, after consulting with the trade unions, the CNRS initiated teleworking, with a first campaign launched in autumn 2018. As of the beginning of 2019, 1,900 staff members were working from home, usually one day a week.
In addition, since October 2018 the Ariane application has dematerialised some 15 straightforward HR procedures (sick leave, training registration, etc), which has been a real time-saver for CNRS personnel. This is also the case of internal competitive examinations, and of all major annual campaigns (such as recruitment, evaluation, and promotions). It is equally worth noting that offers for temporary research contracts are now published at the European level, in keeping with the European Commission HRS4R label.
Lastly, regarding the allowance system for engineers and technicians (RIFSEEP), an evaluation exercise has

ASSOCIATED DEPARTMENTS

DCIF	**Accounts and Financial Information Department**
DSFIM	**Financial Strategy, Real Estate and Modernisation Department**
DRH	**Human Resources Department**
DAJ	**Legal Affairs Department**
DSI	**Information Systems Department**
DIRSU	**Security Department**

been launched covering all positions. It focuses on engineering assistants in 2018, followed by engineers (to be completed in 2019), then technicians, technical assistants and research engineers.

How are the resources available in regional offices and laboratories evolving?

C. C.: A large-scale upgrade of our information systems has been undertaken. This has entailed transferring services to new service providers, not without difficulty, especially in respect of messaging. In parallel, work on existing resources has continued, and improvements have been made to the Webcontrat and GESLAB applications. Additional security and data protection measures have also been initiated.

OPEN SCIENCE, A REVOLUTION FOR RESEARCH

ALAIN SCHUHL
Chief Scientific Officer

What is your assessment of your first year as head of the Scientific Office?

Alain Schuhl: It was a fruitful year, both in terms of major undertakings and scientific results. The Insight lander touched down on Mars with the French-made SEIS seismometre on board, and the Tara research schooner returned from its Pacific expedition, bringing back a wealth of samples that will lead to breakthrough discoveries on the role of coral and its capacity to adapt to climate change. And the philosopher and philologist Barbara Cassin received the 2018 CNRS Gold Medal.

Open research, a concept of vital importance to the future of science, was the focus of our attention and discussions. We gave new impetus to transversal initiatives and interdisciplinarity. Another major effort for the CNRS in 2018 was the rethinking of our international strategy to make it at once more flexible, more visible and more understandable. The mechanisms for international cooperation were restructured in order to provide a genuine overview of the CNRS's operations in the world arena.

What is the Centre's position at the dawn of the open research revolution?

A. S.: The CNRS is actively involved in the deployment of the National Plan for Open Science put forward by the Ministry of Higher Education, Research and Innovation. Together with our partners in the Couperin consortium, we are negotiating with publishers, and

re-examining the existing peer-review system with the CNRS National Committee. The appointment of a new director at the Scientific and Technical Information Department will bolster our action for bibliodiversity with the introduction of alternative solutions. The Institute for Scientific and Technical Information is again assuming its role at the centre of this effort to promote the revolution that open science represents.

Interdisciplinarity is a key objective for the CNRS. What were the actions taken in this regard in 2018?

A. S.: Many interdisciplinary projects continued to gain momentum in 2018. The "Momentum" call for proposals again was a resounding success, with 20 winners out of nearly 400 applicants. We launched the 2018 edition of the "Make Our Planet Great Again" programme and welcomed its researchers upon arrival in France. The Mission for Interdisciplinarity was renamed the Mission for Transversal and Interdisciplinary Initiatives in order to keep pace with projects involving all disciplines. The CNRS also initiated the "80 Prime" call for proposals, which relies on pluridisciplinarity and teamwork among its institutes. Lastly, the research network on sport and physical activity, created in 2018, now brings together more than 140 laboratories and will enable us to spearhead some excellent research schemes.

ASSOCIATED DEPARTMENTS

DAPP	**Public Partnership Support Department**
DERCI	**European Research and International Cooperation Department**
DIST	**Scientific and Technical Information Department**
MITI	**Mission for Transversal and Interdisciplinary Initiatives**

In 2018 the CNRS pursued and endeavoured to maximise its technology transfer policy. What strategies has the organisation implemented?

Michel Mortier: The CNRS has reorganised its innovation resources. In order to bolster its technology transfer policy and reflect the importance attached to this mission, which had previously been entrusted to the Technology Transfer Department, the Centre created the CNRS Innovation Office, a third managerial office alongside the Scientific and Resources Offices, within the CNRS management. The Chief Innovation Officer now coordinates the operations of the Business Relations Department (DRE), the Legal Affairs Department, its technology transfer subsidiary CNRS Innovation, and the partnership and transfer network. We have also redefined the missions and roles of CNRS Innovation and the DRE: the latter is in charge of joint research with the corporate world, and the former handles the protection of intellectual property, technology transfer and support for startups.

Does this mean that CNRS Innovation is working more closely with the CNRS, with a clear mission entirely dedicated to startups spawned by CNRS laboratories?

M. M.: CNRS Innovation is more closely connected with the CNRS than ever. The subsidiary is an extension of our institution, which holds 70% of its shares and provides 100% of its budget. In 2018 our subsidiary launched RISE, a new support programme for deep-tech startups derived from CNRS laboratories. RISE is part of the CNRS's technology transfer

STARTUPS AT THE HEART OF THE CNRS INNOVATION POLICY

MICHEL MORTIER
Chief Innovation Officer

strategy, reflecting the organisation's commitment to increase its stake in startups built on CNRS technologies. This is a trend that gained momentum in 2018: the CNRS is now a shareholder in 29 startups. The "CNRSxStartup Day", held on 10 October, 2018, showed how much the Centre values these companies.

What about business relations and innovation partnerships?

M. M.: 2018 was a fruitful year. The pre-maturation programme was strengthened with a budget increase (from €2 million to €4.6 million) scheduled for 2019 and brought forward to 2018. Several joint research facilities were launched in 2018, bringing the total to more than 150. I should also mention the implementation of the SME plan, which enables us to build closer relationships with small and medium-sized companies, by taking action in the field with local business associations or chambers of commerce and industry. The renewal of the competitiveness clusters, whose Phase IV was launched in July 2018, gave us an opportunity to rekindle or strengthen our links with many of them. Lastly, several joint research initiatives were undertaken, especially in microelectronics, laying the groundwork for discussions on a roadmap with industry players.

ASSOCIATED INSTITUTIONS

DRE	**Business Relations Department**
CNRS Innovation	**National Technology Transfer Subsidiary**

2018 IN FIGURES

RESOURCES

A BUDGET EXCEEDING

€ 3 BILLION

More than 1,000 research units

Nearly 130 service units

More than **31,500** STAFF MEMBERS including more than 40% women

More than 11,000 researchers

More than 13,000 engineers and technicians

More than 7,000 contractual employees

Nearly 300 researchers recruited

More than 300 engineers and technicians recruited

RESEARCH

THE CNRS RANKS

2nd

In the *Nature Index* and *Scimago Institutions Rankings*

(natureindex.com; Scopus / Scimago 2017)

More than **52,000** SCIENTIFIC PUBLICATIONS

of which 60%

are co-signed with at least ONE FOREIGN LABORATORY

(Scopus / Elsevier)

COMMUNICATIONS

More than **3** MILLION PAGE VIEWS on CNRSlejournal.fr and news.cnrs.fr

More than **300** PRESS RELEASES ISSUED

Nearly 500K FOLLOWERS ON THE SOCIAL NETWORKS (Facebook, Twitter, Instagram, LinkedIn, YouTube)

Nearly **40**

INTERNATIONAL JOINT UNITS

INTERNATIONAL

More than **200**

PROJECTS FINANCED

Nearly **500**

EUROPEAN RESEARCH COUNCIL (ERC) LAUREATES

More than **150**

CNRS / INDUSTRY JOINT RESEARCH STRUCTURES

More than **20**

FRAMEWORK AGREEMENTS with major groups

INNOVATION AND PARTNERSHIPS

Some **100**

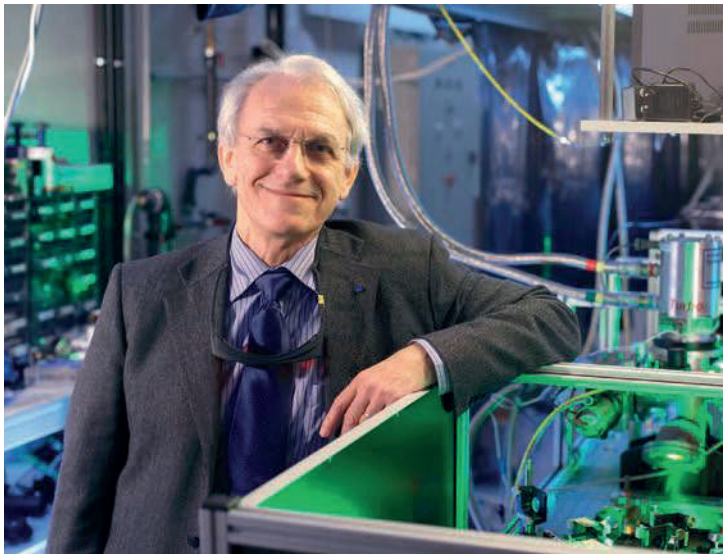
STARTUPS CREATED EACH YEAR

6th

LARGEST PATENT FILER IN FRANCE

(INPI)

Source: CNRS / DSFIM / DRH / DERCI / DIRE / DASTR / FIST SA



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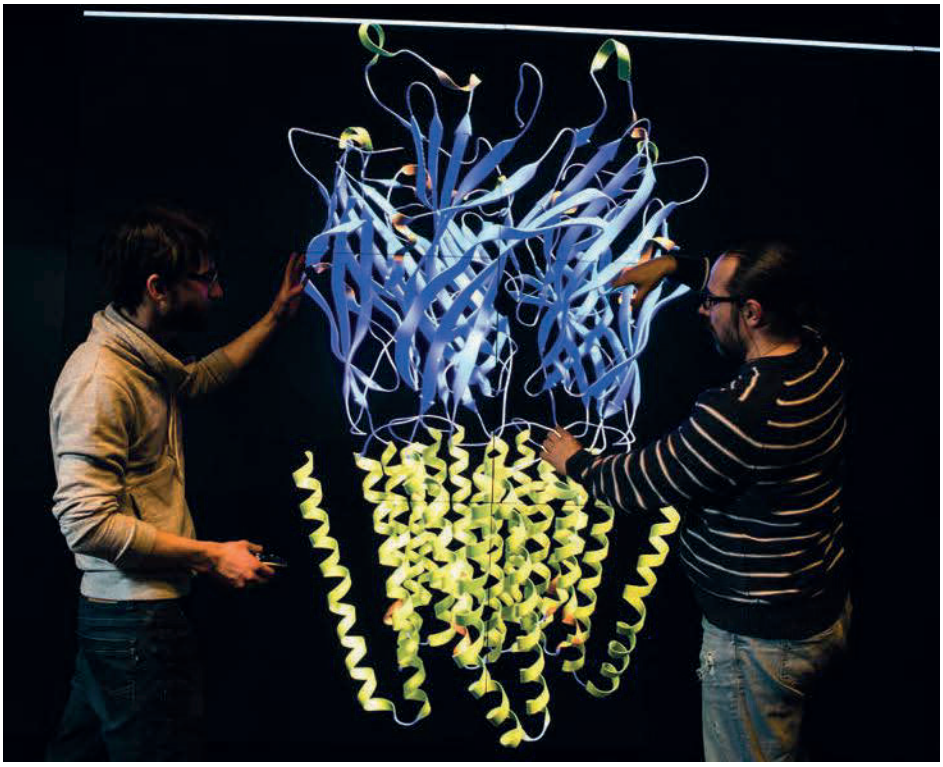
GÉRARD MOUROU, LAUREATE OF THE NOBEL PRIZE IN PHYSICS

The year 2018 was marked by the Nobel Prize in Physics being awarded to Gérard Mourou for his work, initiated in 1985, on high-power lasers, a field in which the levels of intensity and frequency now achieved pave the way for new research areas in physics and other disciplines.
Gérard Mourou, a professor and member of the Haut-Collège de l'École Polytechnique, shared the award with the Canadian researcher **Donna Strickland** for their joint development of a method for generating high-intensity, ultra-short optical pulses, and **Arthur Ashkin,** who was rewarded for designing "optical tweezers". Gérard Mourou headed the LOA (Laboratoire d'Optique Appliquée – CNRS / École Polytechnique / ENSTA ParisTech) from 2005 to 2008. He also spearheaded the Apollon laser facility at the Plateau de Saclay scientific and technological site, a major project uniting the CNRS and the École Polytechnique. With a power level of 10 petawatts, this instrument will be used to study interactions with matter at very high intensity, leading to applications in the fields of energy, biology, medicine and nuclear power.
Another highlight of the year was the inauguration of Tempos*, a unique electron microscopy platform accessible to all researchers at Paris-Saclay and aimed at advancing the exploration of the properties of nanomaterials.
These projects, like many others, are in harmony with the objectives of the INP, i.e. to shed light on the world around us by studying the mechanisms involved in observable phenomena related to matter, radiation and their interactions, eventually resulting in applications of benefit to society.

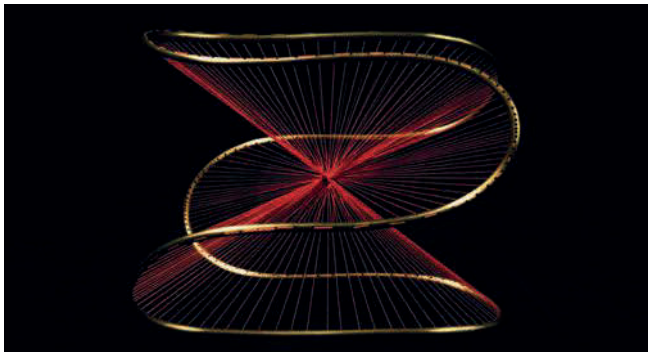
**The Tempos Equipex is sponsored by the CNRS, Université Paris-Sud, École Polytechnique and CEA, with the involvement of the R&D departments of the industrial corporations Saint-Gobain and Thales.*

AN INTEGRATIVE VISION OF BIOLOGY

Throughout 2018, the CNRS Institute of Biological Sciences (INSB) promoted an inclusive vision of biology, favouring integrated multi-scale research, from the molecule to the organism. The Institute backed major scientific projects, including LifeTime, an interdisciplinary, transnational initiative for the modelling and prediction of cell fate in space-time. Another highlight of the year was the opening of an insectarium, an extension of the Institute of Molecular and Cellular Biology, which will help combat diseases transmitted by mosquitoes.



View of the structure of an ion channel membrane protein.
© Frédérique PLAS / IBPC / CNRS Photothèque



Wire model on a brass structure showing a cubic cone of genus one.
© Cyril FRESILLON / IHP / CNRS Photothèque

A STRONG SHOWING BY FRENCH MATHEMATICIANS IN RIO

French mathematics was in the spotlight at the 2018 International Congress of Mathematicians (ICM) in Rio de Janeiro (Brazil). The CNRS National Institute of Mathematical Sciences and their Interactions (INSMI) is proud of the strong presence of French researchers among the speakers, and in particular of the Fields Medal awarded to Alessio Figalli, a CNRS researcher seconded to ETH Zurich, for his work in calculus of variations, optimal control, optimisation and partial differential equations. For the INSMI, the major events of 2018 also included the launch of the Centre Mersenne, an open-access public infrastructure for scientific publication, the creation of three Research Units in France plus a new International Joint Unit with Imperial College London (UK). Two women were appointed to take the helm of structures promoting excellence in research and the dissemination of knowledge (the Institut Henri Poincaré) and facilitating interaction with the socio-economic world (AMIES).

A pilot torus reactor in which a reference microalga is being cultured.
© Jean-Claude MOSCHETTI / GEPEA / CNRS Photothèque

AIMING FOR GREEN ENGINEERING

The Institute for Engineering and Systems Sciences (INSIS) is taking action for the development of green engineering, based on a sustainable, future-conscious research approach. Areas of investigation include the construction of environmentally-friendly buildings, the use of biosourced materials and the development of energy micro-storage solutions. No doubt some of these projects will further increase the Institute's innovation capacity: with 20 to 25 startups launched and 100 to 150 patents filed each year, the INSIS is directly involved in nearly one-third of the global innovation operations at the CNRS.

KEY FIGURES

Institute of Physics (INP)
Fundamental laws, matter and radiation

More than 2,900 tenured researchers
More than 1,600 tenured engineers and technicians
More than 700 PhD students, contractual researchers, engineers and technicians
Nearly 80 Research and Service Units, including **3** International Joint Units
Nearly 40 horizontal structures including **more than 20** Research Networks
More than 80 startups, of which **3** were created in 2018

Institute of Biological Sciences (INSB)
Elucidating the complexity and diversity of the living world

More than 6,400 tenured researchers
More than 5,400 tenured engineers and technicians
More than 1,600 PhD students, contractual researchers, engineers and technicians
More than 200 Research and Service Units, including **1** International Joint Unit
More than 30 horizontal structures, including **20** Research Networks
More than 250 startups, of which **7** were created in 2018

National Institute for Mathematical Sciences and their Interactions (INSMI)
Developing and understanding mathematical structures and models

More than 3,200 tenured researchers
More than 400 tenured engineers and technicians
More than 90 PhD students, contractual researchers, engineers and technicians
Nearly 60 Research and Service Units, including **10** International Joint Units
40 horizontal structures, including **more than 20** Research Networks

Institute for Engineering and Systems Sciences (INSIS)
Understanding today's society to develop tomorrow's technology

More than 6,200 tenured researchers
More than 2,500 tenured engineers and technicians
More than 550 PhD students, contractual researchers, engineers and technicians
More than 100 Research and Service Units, including **6** International Joint Units
More than 50 horizontal structures, including **more than 30** Research Networks
Nearly 280 startups, of which **20** were created in 2018

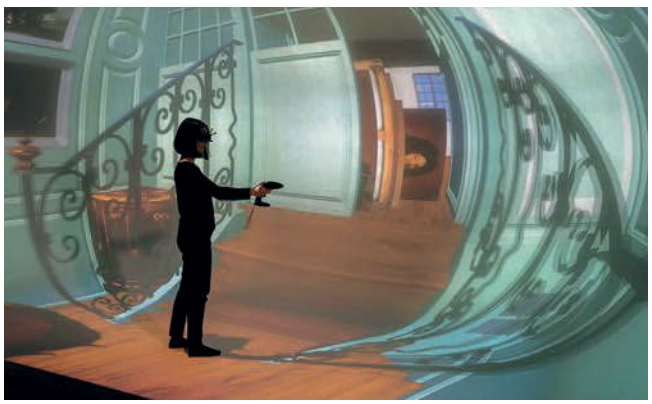
CHEMISTRY BANKS ON INNOVATION

Fractions containing fluorescent molecules in solution are placed in a rotary evaporator. The isolated fluorescent compound will then be used in *in vitro* imaging experiments.
© Frédéric MALIGNE / LCC / CNRS Photothèque

To promote exploratory research, in 2018 the CNRS Institute of Chemistry (INC) launched *Émergence*, a call for proposals targeting young researchers wishing to pursue innovative projects. The Institute has also continued to expand its international activities with the opening of 2BFuel, an International Joint Unit in Seoul, South Korea, and the Small Molecule Lab, an International Associated Laboratory in Kyoto, Japan. In the industrial sector, the IC2MP laboratory (CNRS / Université de Poitiers) became the mirror site of the E2P2L (CNRS / Solvay) in Shanghai, China. Lastly, as part of the "2018-2019: Year of Chemistry, from Primary School to University" event, the INC organised a scientific culture training day in chemistry benefiting 1,100 secondary school teachers from nearly all of France's regional education districts.

KEY FIGURES OF EUROPEAN AND INTERNATIONAL RESEARCH

More than 30 International Joint Units
Nearly 30 joint units with a French research institute abroad
Nearly 200 International Associated Laboratories
Nearly 100 International Research Networks
1,400 European research contracts
First ERC grant beneficiary
60,000 annual missions worldwide



Virtual exploration of the Notre Dame Bridge projected on the TORE (The Open Reality Experience). © Cyril FRESILLON / CREHS / CRISTAL /IRHIS /LARHRA / LISIC / CHROMELIGHT STUDIO / SCV / IRDIVE / CNRS Photothèque

DIGITAL TECHNOLOGY PUTS PEOPLE FIRST

For 2018, the Institute for Information Sciences and their Interactions (INS2I) based its action on the "Human-computer interaction" operational theme, chosen to emphasise the crucial importance of integrating human factors into the development of digital systems, from the design stage to industrial applications. The Institute also participated in a nationwide consultation on artificial intelligence, contributing its expertise in the field.

A CHECK-UP OF THE WORLD'S CORAL REEFS

Coral of the genus Fungia, south coast of Tutuila Island, American Samoa.
© Stéphane BUJAN / EPOC / CNRS Photothèque

With its conceptual maturity and ever-greater predictive capacities, scientific ecology makes it possible to qualify and quantify the characteristics of our past and future living environment based on the constraints, real or imagined, that will be imposed by human activity and environmental change. This meta-science is indispensable for understanding how ecosystems function and formulating strategies to adapt to global change and reduce the impact of human societies on the biosphere over long time scales. The Institute of Ecology and Environment (INEE) translates this vision into concrete research work, such as the TARA Pacific project, a two-year expedition in which the INEE is a partner: having ended in October 2018, it collected more than 36,000 coral samples from the Pacific Ocean. This new scientific adventure is now providing the first assessment of the health of the world's coral reefs. Also in 2018, new discoveries of human remains in the Philippines have enabled INEE researchers to study human singularity and universality, with a focus on the definition of modernity in prehistory.

KEY FIGURES

Institute of Chemistry (INC)

Promoting and coordinating research, from the atom to the material

More than 4,900 tenured researchers
More than 2,700 tenured engineers and technicians
990 PhD students, contractual researchers, engineers and technicians
Nearly 150 Research and Service Units, including **5** International Joint Units
Nearly 60 horizontal structures, including **almost 30** Research Networks
More than 160 startups, of which **10** were created in 2018

Institute for Information Sciences and their Interactions (INS2I)

A player in the digital revolution

More than 4,400 tenured researchers
More than 900 tenured engineers and technicians
More than 400 PhD students, contractual researchers, engineers and technicians
Nearly 50 Research and Service Units, including **4** International Joint Units
Nearly 20 horizontal structures, including **more than 10** Research Networks
Nearly 80 startups, of which **10** were created in 2018

Institute of Ecology and Environment (INEE)

Understanding the biosphere to take action

More than 2,800 tenured researchers
More than 1,600 tenured engineers and technicians
Nearly 500 PhD students, contractual researchers, engineers and technicians
Nearly 80 Research and Service Units, including **1** International Joint Unit
Nearly 30 horizontal structures, including **nearly 20** Research Networks
More than 30 startups, of which **3** were created in 2018

KEY FIGURES OF PARTNERSHIPS WITH INDUSTRY

More than 20 framework agreements
Including **1** with Michelin in 2018
and 1 letter agreement
with ArianeGroup
Nearly 80 pre-maturation projects,
of which **25** in 2018
More than 150 joint laboratories
with industry, of which **35** in 2018
Strategic partnership with
France Brevets
1,500 training sessions delivered by
the CNRS industry training institute
More than 5,800 patent families
Including **more than 750** patents filed
in 2018

INTERDISCIPLINARITY REACHES NEW HEIGHTS

The contribution of the CNRS Institute for Humanities and Social Sciences (INSHS) towards designing a seminar in 2018 entitled "Everyone Measuring, Everyone Measured – Science at the Heart of Society" and its participation in the nationwide consultation on artificial intelligence testify to its commitment to interdisciplinary cooperation. Other key actions for the year included promoting the internationalisation of the humanities and social sciences in cooperation with units abroad and the European scientific community, advancing open research, and preparing for the 2019 opening of the Campus Condorcet – of which the CNRS is a founding member – dedicated to the social sciences and their interactions with other disciplines. In parallel, the Institute continues to play a pivotal role in scientific fields such as archaeology, anthropology and classical studies. It also helps organise and structure research on topics that cover several fields of expertise, often interdisciplinary and with a strong social component, including healthcare, education, artificial intelligence and the social sciences, area studies, genre-based approaches and digital humanities, as well as quantitative approaches and data formalisation.

THE ENIGMA OF ANTIMATTER

After the Big Bang, matter and antimatter annihilated each other. Yet an infinitesimal difference enabled one particle in a billion to remain, and there was light. What was that difference? To answer that question, the National Institute of Nuclear and Particle Physics (IN2P3) focused on two fields of investigation in 2018: neutrinos and b quarks. With the aim of shedding light on the properties of neutrinos and antineutrinos, the Institute joined the DUNE[1] experiment in the US, pursued the deployment of the KM3NeT[2] underwater infrastructure off the coast of Toulon (southeastern France), and stepped up its participation in the JUNO[3] experiment in China. In parallel, the IN2P3 joined Belle II, an experiment at the KEK laboratory near Tokyo (Japan) to carry out high-precision measurements with b quarks. Belle II and the SuperKEKB accelerator are on the verge of becoming the world's first Super Factory for B mesons ("b" meaning particles made up of so-called "beauty quarks"), capable of collecting 50 times more data than the first Belle project. In addition, new results obtained using the CERN's Large Hadron Collider (LHC) particle accelerator have revealed deviations from the standard model, which could correspond to a violation of lepton quantum numbers.

1. Deep Underground Neutrino Experiment.
2. Cubic Kilometre Neutrino Telescope.
3. Jiangmen Underground Neutrino Observatory.

Cherenkov light sensors in the KM3NeT/ORCA neutrino telescope currently under development in the Mediterranean.
© Nicolas BAKER / CPPM / CNRS Photothèque

The *Pupil Labs* eye-tracking system, tested here in front of Mathieu Le Nain's painting 'Le Reniement de Saint Pierre' (The Denial of St Peter). © Claire-Lise HAVET / Musée du Louvre-Lens / IKONIKAT / CNRS Photothèque

Concordia Station, Dome C, Antarctica.
© Pascal ROBERT / OTELo / CNRS Photothèque

ANTICIPATING THE FUTURE

After taking over as director of the National Institute for Earth Sciences and Astronomy (INSU) in May 2018, Nicolas Arnaud launched a nationwide prospective study, in conjunction with the OSU network of observatories, on transversal challenges in the Earth sciences and astronomy. Several research infrastructures, which serve as a pillar for the Institute's operations, have been integrated into the 2018 national research infrastructure roadmap, such as Système Terre (DataTerra) a facility aimed at establishing a single data portal for the Terre research system and the SKA project, of which France is now a special member. At the European level, the eLTER research facility for the holistic study of ecosystems was integrated into the ESFRI roadmap. Still in the field of research infrastructures, 2018 was marked by the signing of the founding by-laws of the European Plate Observing System (EPOS) and the commissioning of Antenna 10 of the IRAM project NOEMA, the most powerful millimetric radio telescope in the northern hemisphere.

KEY FIGURES

Institute for Humanities and Social Sciences (INSHS)

Humans in society: describing, analysing, understanding

More than 9,300 tenured researchers
More than 2,500 tenured engineers and technicians
Nearly 500 PhD students, contractual researchers, engineers and technicians
Nearly 300 Research and Service Units, including **3** International Joint Units
More than 20 horizontal structures, including **nearly 10** Research Networks
More than 40 startups

National Institute of Nuclear and Particle Physics (IN2P3)

Probing the two infinities

Nearly 900 tenured researchers
More than 1,400 tenured engineers and technicians
More than 380 PhD students, contractual researchers, engineers and technicians
More than 20 Research and Service Units
6 Research Networks
More than 15 startups

National Institute for Earth Sciences and Astronomy (INSU)

From the centre of the Earth to the confines of the Universe

More than 3,100 tenured researchers
Nearly 3,000 tenured engineers and technicians
More than 780 PhD students, contractual researchers, engineers and technicians
Nearly 100 Research and Service Units, including **3** International Joint Units
6 horizontal structures, including **4** Research Networks
35 startups, of which **1** was created in 2018

© F. PLAS / CNRS Photothèque

The Gold Medal goes to BARBARA CASSIN

The 2018 CNRS Gold Medal, France's highest scientific distinction, was awarded to the philosopher and philologist Barbara Cassin, CNRS senior researcher emeritus and a member of the Académie Française.

The medal was given in recognition of a body of work focusing on the power of words and language and of translation as a means of "dealing with" cultural differences, constantly correlating contemporary issues and in-depth research on ancient Greek texts. Barbara Cassin's work represents an exceptional contribution to the research on the philosophy of language, from both a historical and a practical perspective. It is that of a committed researcher, in particular as regards multilingualism.

INNOVATION MEDALS

Valérie Castellani specialises in developmental biology at the INMG[1]. She conducts basic research aimed at elucidating the cellular and molecular mechanisms underlying the generation of neurons in embryos, their migration and the establishment of neural circuits through axon guidance. Her work enabled the development of various experimental approaches that she then applied to the field of paediatric cancer. Valérie Castellani's career, including her founding of the startup Oncofactory, illustrates the importance of basic research for the development of groundbreaking innovations.

A pioneer in the development of additive processes for the creation of ceramic products, **Thierry Chartier** is a researcher in ceramic processes and materials at the IRCER[2]. His investigations, focusing on the generation of "organised" ceramic structures at different scales (from the size of the particle to that of the object), have led to the development of production processes that are now attracting keen interest worldwide. Thierry Chartier's research has resulted in the founding of two startups, 3DCeram and Ceradrop, each now employing some 20 people.

Daniel Le Berre, a researcher and professor at the Lens Computer Science Research Lab (CRIL)[3], is the founding father of Sat4j, a free software launched in 2004 and used by millions of people around the world. He works in the field of artificial intelligence, with a particular interest in the development and evaluation of algorithms for inference and decision-making. Conceived from its inception as a free software that can easily be reused in other software, Sat4j became part of ObjectWeb – a consortium, now called OW2, that promotes the development of free middleware programs – in 2005, and has since become one of its leading applications.

1. Institut NeuroMyoGène (CNRS / INSERM / Université Claude Bernard Lyon 1).
2. Institut de Recherche sur les Céramiques (CNRS / Université de Limoges).
3. CNRS / Université d'Artois.

Valérie Castellani
© F. PLAS / INMG / CNRS Photothèque

Thierry Chartier
© F. PLAS / IRCER / CNRS Photothèque

Daniel le Berre
© F. PLAS / CRIL / CNRS Photothèque

The French Academy of Sciences

The laureates of the 2018 Academy of Sciences awards included 30 CNRS researchers.

ERC

59 CNRS researchers received European Research Council (ERC) grants in 2018.

i-Lab

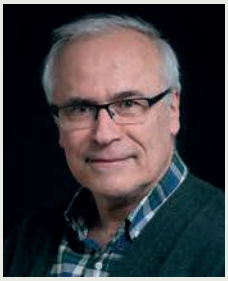
The national i-Lab competition, which provides assistance for innovative technology startup companies, announced its winners on 5 July, 2018. Of the 64 selected projects, 30 were directly linked to the CNRS, including 11 Grand Prix awards.

Étoiles de l'Europe

The 2018 Étoiles de l'Europe (Stars of Europe) awards honoured 3 CNRS researchers.

L'Oreal-UNESCO

20 CNRS researchers were among the winners of the L'Oreal-UNESCO grants For Women in Science in France, awarded by the L'Oreal Foundation.



Christophe Midler
© École polytechnique / Philippe Lavialle

INNOVATION

Christophe Midler, a CNRS senior researcher at the Management Research Centre (CRG) of the Interdisciplinary Institute for Innovation (i3)[1], has been named a member of the National Academy of Technologies of France. This distinction comes in recognition of his research over the past several years on the subject of innovation, at the interface between the academic and professional worlds.

1. CNRS / École Polytechnique / Mines ParisTech / Telecom ParisTech.

Francis Albarède
© DR

PLANET AND UNIVERSE

The 2018 Nemmers Prize in Earth Sciences was presented to **Francis Albarède,** professor emeritus at the ENS Lyon. He was rewarded for his body of work and his fundamental applications of geochemistry to the Earth sciences.

Jean-Paul Laumond
© Collège de France / P. Imbert

Étienne Ghys
© Simon CASSANAS / Academy of Sciences

ENGINEERING AND DIGITAL TECHNOLOGY

Jean-Paul Laumond, a world-renowned researcher, has been elected to the French Academy of Sciences. His work has been crucial in the development of motion planning in robotics. His scientific approach has enabled him to make significant contributions in this field, by implementing techniques derived from various disciplines (graph theory, computational geometry, automation, randomised algorithms and the neurosciences). **Étienne Ghys**, a CNRS senior researcher at the Unit of Pure and Applied Mathematics (UMPA)[1] has been elected permanent secretary of the French Academy of Sciences.

1. CNRS / ENS Lyon.

Paolo Samorì
© C. FRÉSILLON / CNRS Photothèque

MATERIALS AND PARTICLES

The European Academy of Sciences has awarded the Blaise Pascal Medal in materials science to **Paolo Samorì** in recognition of his exceptional contribution to the development of functional nanomaterials and nanodevices offering new electronic, optical and detection capabilities.

THE CNRS BUDGET IMPLEMENTED IN 2018

The pursuit of the research activities conducted by CNRS-associated laboratories and the implementation of the institution's scientific policy are reflected in its budget, as summarised below.

RESOURCES

2018 CNRS resources breakdown

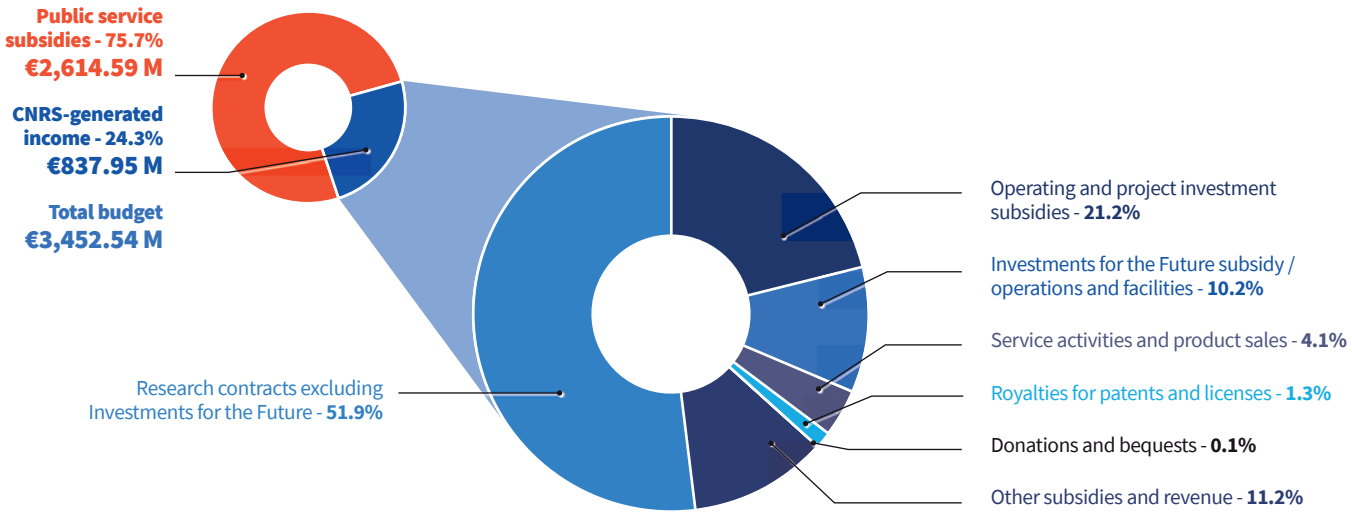


FIGURE 1 Source: BFC data – processed by the CNRS / DCIF-DSFIM

CNRS research contracts in 2018

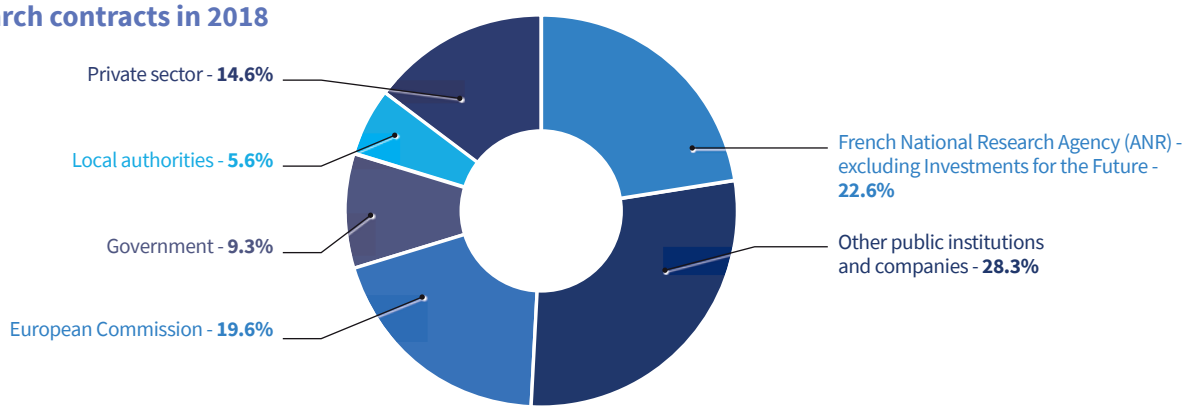


FIGURE 2 Source: BFC data – processed by the CNRS / DCIF-DSFIM

EXPENDITURE

Expenditure by cost centre

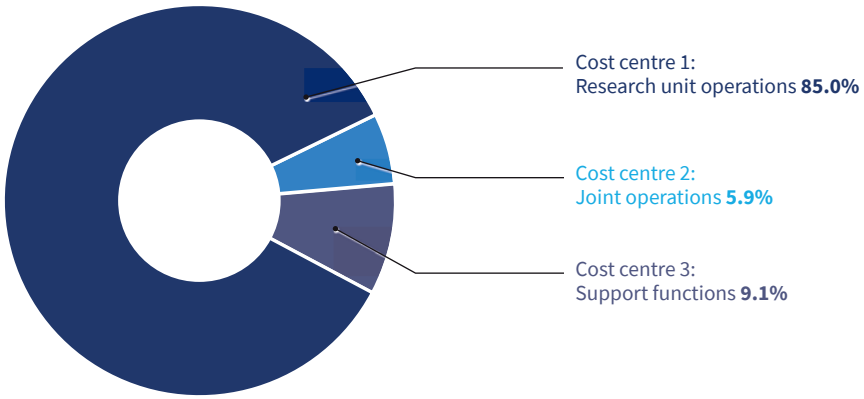


FIGURE 3 Source: BFC data – processed by the CNRS / DCIF-DSFIM

Expenditure by category

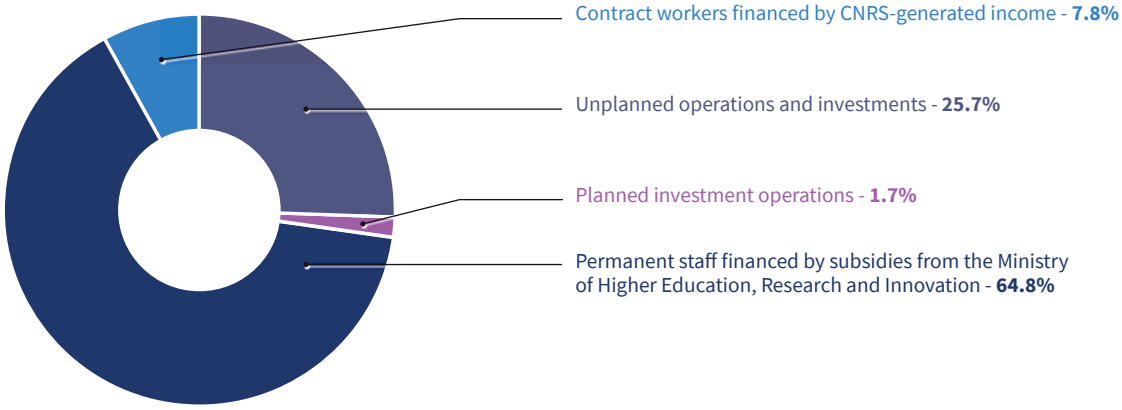


FIGURE 4 Source: BFC data - processed by the CNRS / DCIF-DSFIM

Expenditure by line item

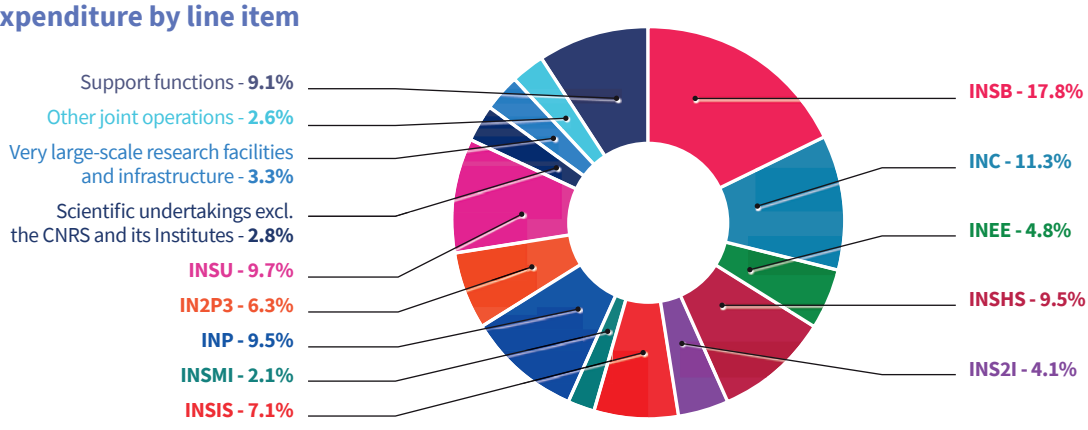


FIGURE 5 Source: BFC data – processed by the CNRS / DCIF-DSFIM

Interlocked cubic, hexagonal and needle-shaped crystals of calcium carbonate ($CaCO_3$). The image was produced using a scanning electron microscope at 3000x magnification. It was reprocessed and colourised with artificial colours.
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