ANNUAL REPORT 2016

AGENCE NATIONALE DE LA RECHERCHE

ANR

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Being at the heart of competitive project-based funding for research and innovation.

Michael Matlosz
ANR PRESIDENT AND CEO

2016 WAS A SPECIAL YEAR FOR THE ANR. CAN YOU TELL US WHY?

We celebrated the agency's tenth anniversary in 2016. The ANR has changed a great deal since its creation. Dedicated to funding the Government's involvement in research and innovation, the ANR has become more professional in its assignment of competitive funding through calls for proposals while respecting the best international standards. We are grateful for the Government's confidence – in 2016 our budget significantly increased, enabling us to fund more projects and raise our selection rates.

Our anniversary celebrations have included a number of events under the banner of "10 ANR years", presenting the results of projects the agency has supported: the tenth Interdisciplinary Workshop on Global Security; the "ANR and Young Researchers" event in April attended by Thierry Mandon, Secretary of State for Higher Education and Research, and Jean-Pierre Bourguignon, President of the European Research Council; the "Research and Creation " event in July at the Avignon festival, with guest Najat Vallaud Belkacem, the Minister of Education; and the second "Digital Technology" event in November. We ended this special year by celebrating our tenth birthday on 15 December at the French Natural History Museum with Thierry Mandon, where we also signed our first contract of objectives and performance.

WHAT DOES THIS FIRST CONTRACT MEAN TO YOU?

It provides a positive roadmap for a future-focused ANR. The contract symbolises a new phase, clearly positioning our organisation as a State operator serving research and innovation. It expresses a long-term ambition shared with the Government, consolidating the ANR as the leading competitive-based research funding body in France. Five major areas have been identified to guarantee the quality and scientific excellence of our selection, promote academia-industry partnerships and international cooperation, develop impact analyses, strengthen dialogue with communities, make our operation more efficient and finally simplify our actions.

THE CONTRACT'S FIRST YEAR IN OPERATION HAS JUST COME TO AN END. WHAT CONCLUSIONS WOULD YOU DRAW?

As you will see in the pages of this annual report, 2016 was marked by the launch of several structural initiatives directly linked to the contract. In terms of the selection process, we have tried to reinforce transparency by organising a call for applications to chair scientific evaluation panels. We have also made efforts to improve information and dialogue by launching the first "ANR Tour", which enable us to go out and meet communities all over France. With the same aim of making our actions clearer, the agency has begun a review of its financial regulations. Finally, to increase the efficiency of its activities and its management, the ANR has introduced a stronger internal control system and laid the foundations for forward planning of the agency's jobs and skills.

2016 WAS ALSO VERY RICH IN TERMS OF ACTION TO SUPPORT THE INVESTMENTS FOR THE FUTURE PROGRAMMES. CAN YOU TELL US MORE?

Acting as an operator on behalf of the General Commission for Investment, which reports directly to the Prime Minister, the agency organised intermediate evaluations of projects supported through the first Investments for the Future programme. Begun in 2015, these evaluations continued in 2016 with the Initiatives of Excellence, several Technology Transfer Acceleration Companies and Energy Transition Institutes, as well as national biology and health infrastructure. In the second programme, four new calls for proposals were issued. Finally, the French President announced a third programme on 21 June 2016. We are delighted to have been appointed once again as the operator for actions under the headings of "Supporting progress in teaching and research" and "Exploiting research". Altogether, 2016 was a very successful year for the agency, with excellent prospects for 2017 and beyond in the service of French excellence in research, higher education and innovation.

283 EMPLOYEES AT 31/12/2016, OR 260 FULL-TIME EQUIVALENTS WORKED

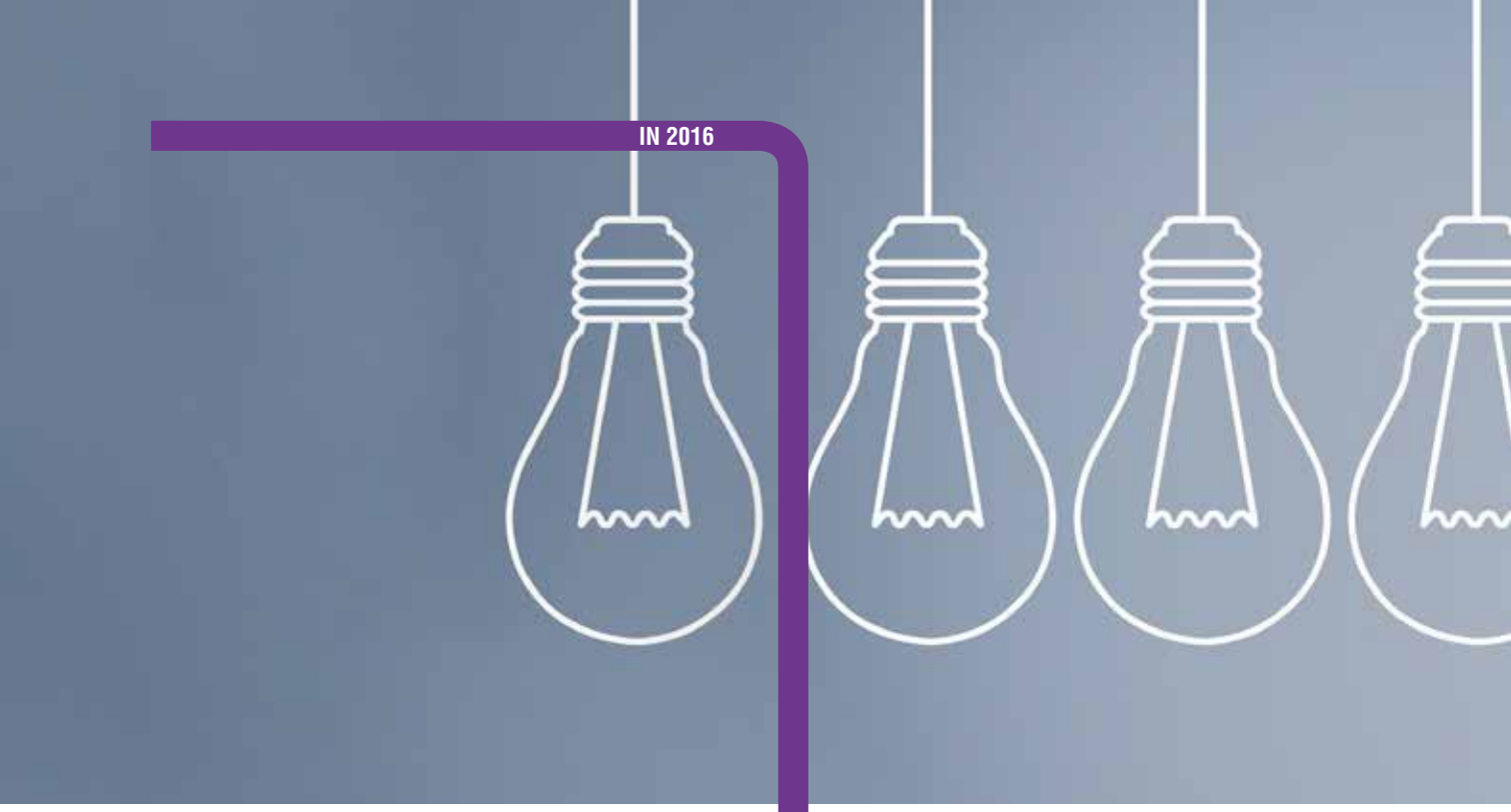
€595.9 M

FUNDING BUDGET IN 2016

OF WHICH

€457.6 M

ALLOCATED TO CALLS FOR PROPOSALS



IN 2016

OUR PROFILE

The French National Research Agency (ANR) is a public body funding scientific research and innovation and reporting to the French Research Ministry. Its role is to provide project-based funding in France.

This involves funding research projects on a competitive basis across all scientific disciplines, covering both basic and applied research. The agency stands at the heart of the French research ecosystem, working with stakeholders in both the public sphere and the private sector. The agency also works with research funding agencies in other countries and is involved in European and international research organisations (Science Europe, Global Research Council, etc.).

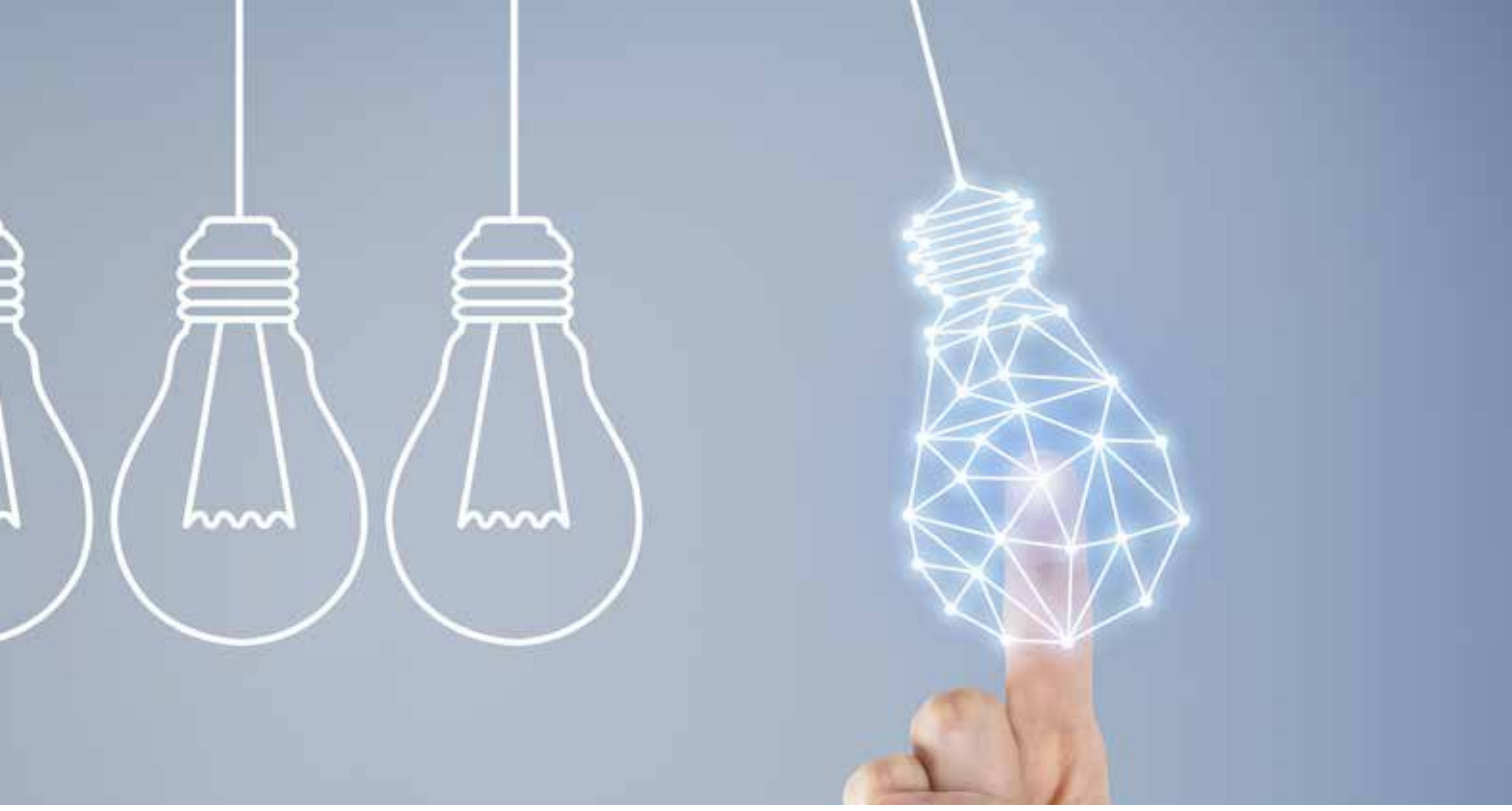
Each year, the ANR issues a Work Programme setting out its research priorities and funding instruments. This roadmap is developed in consultation with members of the research ecosystem,in accordance with France's national research strategy. The agency deploys a wide range of instruments to foster collaboration between teams, and also supports individual projects as well as European and international collaborations. Most of its funding comes through an annual generic call for proposals.

The agency also supports large-scale projects under the French government's "Investments for the Future" programmes, on behalf of the the Prime Minister's General Commission for Investment.

74% OF FUNDED PROJECTS ARE **COLLABORATIVE**

19.5% ARE **INTERNATIONAL PROJECTS** FUNDED JOINTLY WITH AGENCIES IN OTHER COUNTRIES

16% OF FUNDED PROJECTS INVOLVE JOINT RESEARCH TEAMS FROM **ACADEMIA AND BUSINESS**



SINCE 2005

≈ **15,600** PROJECTS FUNDED

≈ **€6.5 BN** ALLOCATED TO RESEARCH COMMUNITIES

A 4-YEAR ROADMAP: THE CONTRACT OF OBJECTIVES AND PERFORMANCE

The agency's first performance contract with the State was signed on 15 December 2016 by Thierry Mandon, French Secretary of State for Research and Higher Education, and Michael Matlosz, ANR President and CEO. The contract, arising from discussions between the ANR and its supervisory ministries, marks a turning point for the agency, putting it on a new path towards progress in five priority areas and mapping out its strategy for 2016-2019.

A CLEAR AMBITION

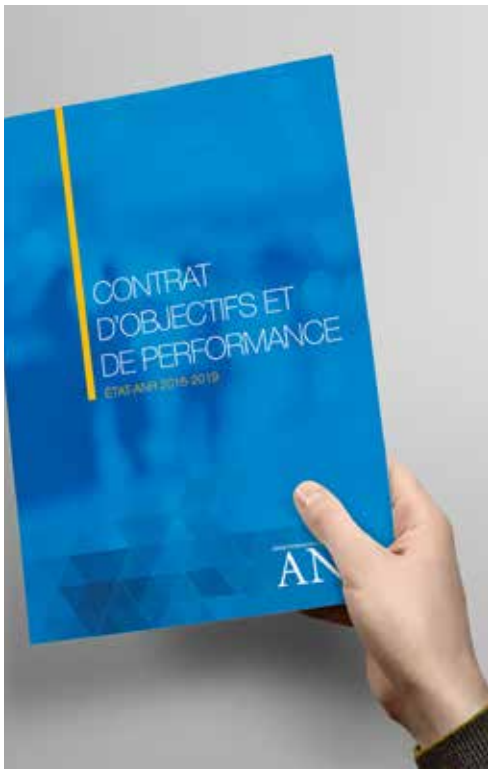
Signed on the agency's tenth anniversary, the 2016-2019 contract of objectives and performance reflects a clear ambition shared by the ANR and the French Ministry for Research to cement the ANR's position as France's leading competitive-based research funding organisation through the support to top-notch research, the promotion of dialogue, information and communication and the simplification of the agency's operations.

ACCOUNTABILITY

Under the terms of this contract, the ANR – set up 10 years ago – is now required to assess the impact of its funding and report on outcomes in the interest of continuous improvement. The new contract means that the agency is now committed to making its services simpler and more accessible, being clearer about what it does, and implementing more efficient processes.

The contract focuses on **five priorities:**

- Guarantee scientific excellence and a high-quality project selection process
- Prioritise and optimise European and international cooperation
- Carry out impact assessments and promote open data
- Provide a first-rate service
- Make the agency and its activities more efficient



2016, THE YEAR OF WORK TO IMPROVE EFFICIENCY AND SERVICE STANDARDS

In 2016 – the first year covered by the contract – the ANR started work on several key initiatives across all five priorities, making substantial progress on closer dialogue with communities and improvements to processes, management and analysis. In total, the agency introduced 14 performance indicators and launched 36 actions in 2016.

With regard to the selection process, for example, it made efforts to boost transparency, recruited Scientific Evaluation Panels, and conducted the ANR Tour campaign.

The agency also overhauled and simplified its financial rules, began work on a major project to streamline its past publications and introduced an internal control system.

FIVE PRIORITIES FOR 2016-2019

PRIORITY 1: GUARANTEE SCIENTIFIC EXCELLENCE AND A HIGH-QUALITY RESEARCH AND INNOVATION PROJECT SELECTION PROCESS

Project evaluation and selection are the mainstay of the agency's work. The ANR plans to improve fairness and transparency and make its procedures easy to understand and more efficient in accordance with international standards. The agency has embarked on ISO 9001 certification for its selection process.

PRIORITY 2: PRIORITISE AND OPTIMISE EUROPEAN AND INTERNATIONAL COOPERATION

The ANR has become increasingly involved in European and international projects in recent years, and has now pledged to make its collaborative activities clearer and more consistent, in line with France's national research policy, through closer ties with its domestic and foreign partners.

PRIORITY 3: CARRY OUT IMPACT ASSESSMENTS AND PROMOTE OPEN DATA

The ANR will strengthen, optimise and prioritise its impact assessment work to help it understand and describe the impact of its funding programmes on the scientific landscape and society at large. It also intends to make it easier to access application and funding data, and to develop the ANR's open data and open access policy.

PRIORITY 4: PROVIDE A FIRST-RATE SERVICE

The ANR is determined to engage in closer dialogue with its users and stakeholders and develop educational communications to boost satisfaction across the scientific community. The ANR pledges to overhaul its quality management process with an emphasis on raising service standards, focusing on providing timely, high-quality and transparent information to users and measuring satisfaction.

PRIORITY 5: MAKE THE AGENCY AND ITS ACTIVITIES MORE EFFICIENT

Since its creation a decade ago, the ANR has seen its activities expand significantly (more diverse calls for proposals, heightened international cooperation, management of the "Investments for the Future" programmes, etc.). These changes mean that the agency has to overhaul its working methods constantly – making them more efficient and effective – so that it is better able to address key challenges and user demands. The targets set out in the contract include improving budgetary, financial and accounting risk management, strengthening activity oversight and developing.

For each priority area, the ANR has a set of targets incorporating actions and monitoring and performance indicators for 2016-2019

18 TARGETS

129 ACTIONS
36 LAUNCHED
IN 2016

24 MONITORING
AND PERFORMANCE INDICATORS
14 INTRODUCED IN 2016

HIGHLIGHTS OF 2016

11 MARCH

"FLASH ASILE" PROGRAMME: FIVE PROJECTS RECEIVE €1.2 M IN FUNDING

In October 2015, the ANR launched a fast-track selection procedure for asylum, refugee and migration policy projects submitted through the generic call for proposals, with a view to ensuring that projects focusing on these topics receive funding quickly. Five projects were selected, and the research work began in spring 2016.

21 JUNE

THIRD INVESTMENTS FOR THE FUTURE PROGRAMME (PIA 3)

On 21 June, the President of France officially launched round three of the Investments for the Future Programme, with funding of €10 bn. The ANR was tasked with managing initiatives under two headings: "Supporting progress in teaching and research", and "Exploiting research".

15 MARCH

OPENING OF A NEW HEALTH RESEARCH PORTAL

The health research portal is the first initiative under the health research plan submitted to the government in July 2015 by Yves Lévy, Chairman of the French institute for health research. The portal, developed and run by the ANR, brings together all French public calls for proposals across translational, clinical and public health research. Its aim is to give research teams a clearer picture of available project-based funding options.

MARCH | APRIL | JUNE | JULY

6 APRIL

ANR CONFERENCE FOR YOUNG RESEARCHERS

"ANR and young researchers" was held at the Maison de la Chimie and organised by ANR in conjunction with the French Ministry for Research, the European Research Council, the French Academy of Technologies, the French Academy of Sciences and the French Parliamentary Office for the Evaluation of Scientific and Technological Options. One of the aims of the event was to promote the work and achievements of young researchers supported by the ANR since its inception.

APRIL

END OF THE IDEX PROBATIONARY PERIOD

Eight Initiatives of Excellence (IDEX) were reviewed by the international selection panel at the end of their probationary period, with the panel recommending next steps for each initiative to the government. Based on these recommendations, the French Prime Minister gave the green light to the AMIDEX (Marseille), UNISTRA (Strasbourg) and UB (Bordeaux) initiatives, extended the probationary period for PSL, IPS and SUPER, and terminated USPC and UNITI.

8-9 JULY

THIRD "RESEARCH AND CREATION EVENT" IN PARTNERSHIP WITH AVIGNON FESTIVAL

This event, held annually since 2014, puts the festival's artists in contact with researchers from across the social sciences, humanities and cognitive sciences, to explore how works of art are created and received. The theme for this edition was "Passion and Power". On day one, the event was attended by Najat Vallaud-Belkacem, French Minister for Higher Education and Research, and Louis Schweitzer, General Commissioner for Investment.

OCTOBER 2016

THE FIRST SPRINGBOARD-ERC CALL OPENS

This new funding instrument, part of the French Ministry for Research's simplification plan, aims to help young researchers working for French public research bodies who have failed to secure ERC Starting Grants or Consolidator Grants but who have worthwhile projects that merit funding. The ambition is to help them improve their proposal so they can submit a new application.

SUMMER

RESULTS OF THE 2016 GENERIC CALL

The first round of results for the 2016 generic call were published in early July for the Collaborative Research Projects (PRC), Collaborative Research Projects involving Enterprises (PRCE) and Young Researchers (JCJC) instruments. The International Collaborative Research Projects (PRCI) results were announced later in 2016, after joint selection with the agency's foreign partners. The full results of the 2016 generic call can be found on page 85.

15 DECEMBER

ANR AND THE FRENCH GOVERNMENT SIGN THEIR FIRST CONTRACT OF OBJECTIVES AND PERFORMANCE

On the agency's tenth anniversary, Thierry Mandon, French Secretary of State for Research and Higher Education, and Michael Matlosz, ANR President and CEO signed the first contract of objectives and performance between the agency and the French government, covering the period 2016-2019.

SEPTEMBER | OCTOBER | NOVEMBER | DECEMBER

SEPTEMBER/OCTOBER

LAUNCH OF THE FIRST ANR TOUR

The ANR held around 20 information meetings throughout France to give a clearer insight into its work and to present the 2017 Work Programme and generic call to scientific communities. The event, known as the "ANR Tour" and supported by regional CNRS branches and universities, was a resounding success, with almost 2,000 people attending the meetings.

16-17 NOVEMBER

DIGITAL TECHNOLOGY EVENT AT LA VILLETTE

In the last 10 years, the ANR has allocated approximately €1 bn in funding to nearly 2,600 digital science and technology projects. The second edition of the Digital Technology event paid tribute to more than 200 such projects.

18 NOVEMBER

FLASH DRONE DEMONSTRATION

The French General Secretariat for Defence and National Security (SGDSN) teamed up with the ANR to hold a demonstration, showcasing three systems to defend against small drones (ANGELAS, BOREADES and SPID) at Vélizy-Villacoublay Air Base. The three systems, which detect, identify and neutralise small-scale drones, stem from an ANR call for proposals in 2015 on the Ministry of Defence behalf, seeking solutions for the security industry.

PROJECTS SELECTED IN 2016: KEY FIGURES

The majority of the ANR's funding budget is allocated to research teams through competitive calls for proposals designed to select the best projects. In 2016, the agency awarded €457.6 m to more than 1,200 projects.

1

8,561

ELIGIBLE PROPOSALS RECEIVED
(IN STAGE 1 OR SINGLE STAGE)

2

4,593

PROJECTS EVALUATED
(IN STAGE 2 OR SINGLE STAGE)

1,257

PROJECTS FUNDED

€457.6 M

IN FUNDING WAS ALLOCATED THROUGH CALLS FOR PROPOSALS

14.7%

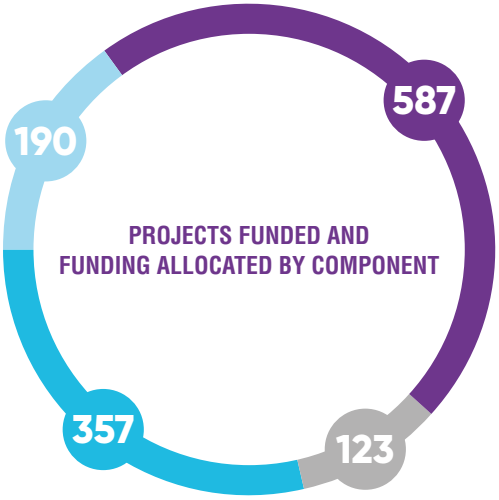
OF APPLICATIONS ACCEPTED

74%

OF COLLABORATIVE PROJECTS

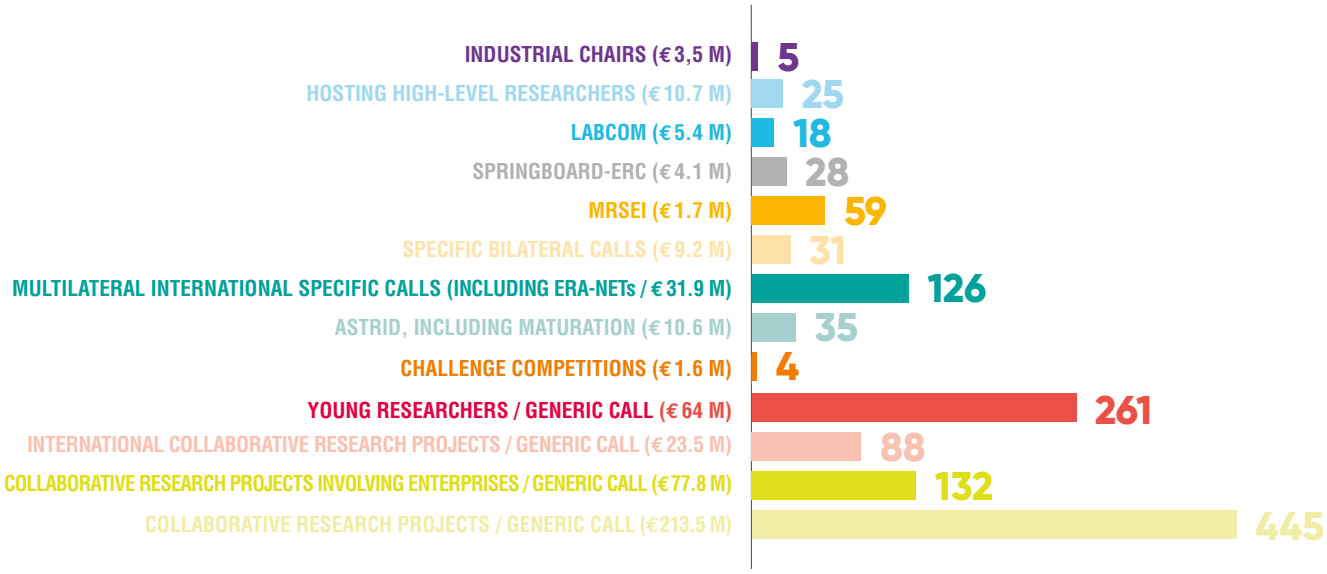
25

SPECIFIC INTERNATIONAL CALLS LAUNCHED

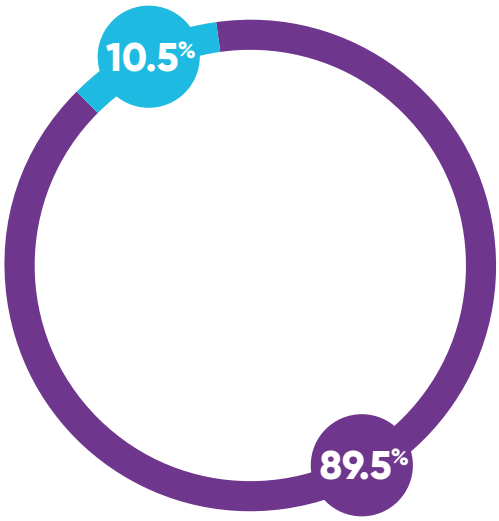


- Major societal challenges €235.7 M
- At the frontiers of research €43.5 M
- Building the European Research Area and France's international attractiveness €81.1 M
- Economic impact of research and competitiveness (excluding the Carnot programme, a non-call-based operation) €97.3 M

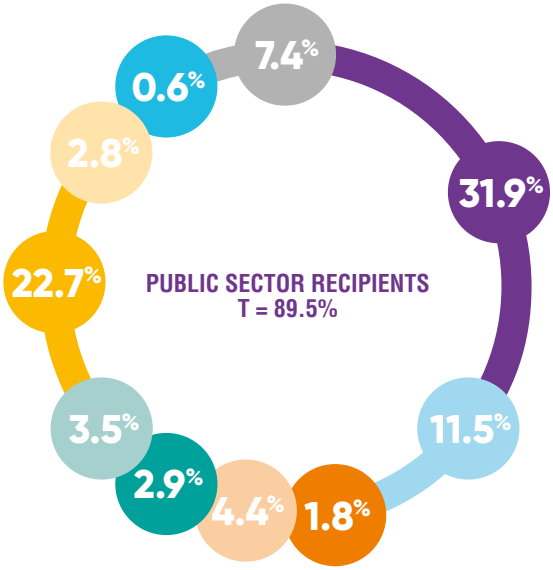
PROJECTS FUNDED AND FUNDING ALLOCATED BY INSTRUMENT TYPE



TOTAL FUNDING BY RECIPIENT TYPE



- Public sector subtotal
- Private sector subtotal



- CNRS
- INSERM
- INRIA
- INRA
- CEA
- Other research bodies (*)
- Universities
- Other higher education institutions
- Hospitals/healthcare
- Other public sector

(*) ENSAM-INED-GIP GRENOBLE-IRSTEA-CETIM-CIRAD-IFREMER-BRGM-IFP-INERIS-IRSN-LCPC-CSTB-LNE-CEREMA-ANSES

- Foundations
- Non-profit organisations
- Very small businesses
- SMEs
- Other businesses
- Other private sector

INVESTMENTS FOR THE FUTURE IN 2016

The Investments for the Future programmes feature ambitious projects, substantial sums of funding and terms of up to 10 years. For these reasons, the initiative is a separate component of the ANR's remit, requiring dedicated selection, evaluation and monitoring processes.

€3.028 BN

DISBURSED IN 2016,
A TOTAL OF €8.542 BN SINCE 2011 (INCLUDING CAMPUS PFE)

128

GRANT AGREEMENTS SIGNED,
A TOTAL OF 966 GRANT AGREEMENTS SINCE 2011

SELECTION

4

CALLS FOR PROPOSALS UNDER THE SECOND PROGRAMME

Convergence Labs phases 1 and 2, Hospital-University research in health phases 2 and 3, IDEX/ISITE phase 2, Development of Experimental Digital Universities

SELECTED PROJECTS

Hospital-University research in health phase 2 (June 2016)

€78.4 M AWARDED

51 SUBMISSIONS EVALUATED

10 WINNERS

Convergence Labs phase 1 (July 2016)

€51.4 M AWARDED

36 PROJECTS EVALUATED

5 PROJECTS SELECTED

Development of experimental digital universities
(December 2016)

€8 M AWARDED

24 SUBMISSIONS EVALUATED

5 PROJECTS SELECTED

MONITORING

15 FINANCIAL AND ACCOUNTING AUDITS OF PROJECTS (REPRESENTING 28 RECIPIENTS)

244 SITE VISITS BY ANR STAFF

31 EQUIPEX PROJECT TEAMS COMPLETED PHASE ONE

6 PROJECTS CLOSED

REVIEWS

- Mid-term reviews were conducted for 23 national biology and health infrastructure projects and 4 pre-industrial biotechnology demonstrator projects.
- Three-year reviews were completed for the first three Technology Transfer Acceleration Companies in group C and the first four Technological Research Institutes together with an initial review of an Energy Transition Institute.
- The eight IDEX initiatives were reviewed at the end of their probationary period.

FROM MONITORING TO MID-TERM REVIEW

The ANR monitors projects funded under the Investments for the Future programme on an annual basis, including site visits and examination of indicators and progress reports. Given their duration and importance and the amount of funding these projects receive, some also undergo reviews by international panels at the mid-term point or the end of the probationary period.

OUR ROLE 1

PROJECT-BASED FUNDING

As the leading project-based funding body in France, the ANR works with the entire research community, supporting projects that vary widely in theme, structure and funding needs. The agency is a unique player in France's national research and innovation landscape by virtue of the diversity of disciplines it supports, the variety of teams and organisations it finances, and the funding instruments deployed.

The ANR understands that research is a multi-faceted pursuit, and it deliberately targets all research communities, with a project-based funding model that helps drive French research and forge collaborative ties across Europe and around the world.

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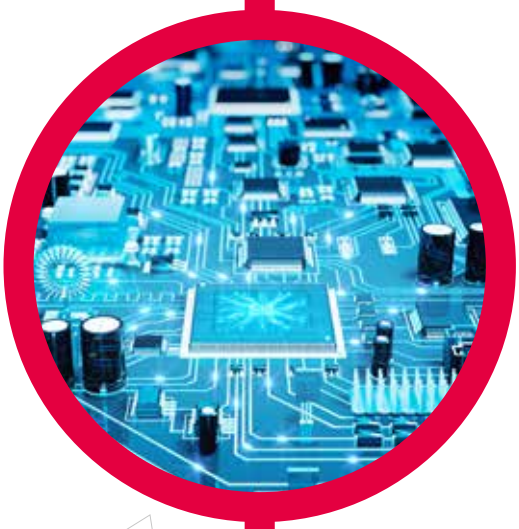
PROJECT-BASED FUNDING

Project-based funding is the mainstay of the ANR's work. The agency's model – competitive calls for proposals and a peer-reviewed selection process – abides by international standards. In the last 10 years, the ANR has used this very same model to help drive forward French research in all its forms.

The main thrust of the ANR's remit is to fund scientific and technology research projects selected via **competitive calls for proposals.** This funding model, which supplements regular government funding for research organisations, makes it easier to monitor research activities across various disciplines. Moreover, it helps fast-track scientific research work in areas defined as priorities by the government and focus funding on the best-performing research teams.

Project-based funding also fosters **interdisciplinary research** and partnerships, easing collaboration between teams of scientists from different disciplines and forging closer ties between **academic institutions and industry**. This funding model helps to break down barriers in French research, releasing its full creative potential.

Project-based funding is common practice in most top research countries (United Kingdom, Japan, United States, Germany, etc.) and raises the profile of French research on the **international stage**. It also promotes the development of European and international partnerships – vital for tackling the complex issues and major societal challenges we face today.



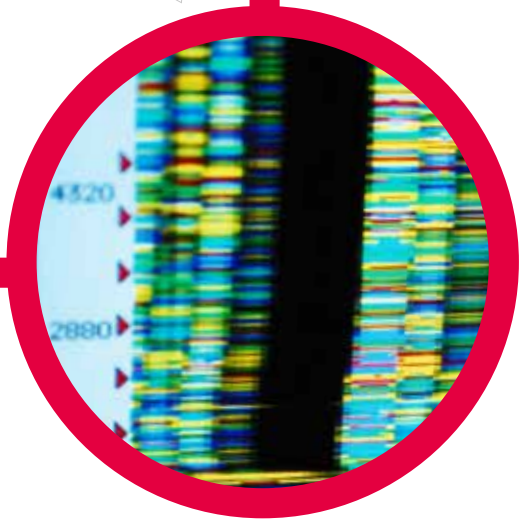
DIGITAL AND MATHEMATICS

PHYSICS, ENGINEERING, CHEMISTRY, ENERGY

HUMANITIES AND SOCIAL SCIENCES

ENVIRONMENT, ECOSYSTEMS, BIOLOGICAL RESOURCES

BIOLOGY, HEALTH



BREAKING DOWN THE BARRIERS BETWEEN DISCIPLINES

With project-based funding, different research teams can work together towards the same goal. The agency's model hinges on bridging the gap between scientific disciplines and research communities and, in doing so, breaking down barriers.

The ANR works to encourage cross-cutting, multi-disciplinary approaches and cultural diversity, breaking down barriers between research fields and spurring the research teams it funds to share their experiences. This model has three key benefits: it promotes mutual enrichment, it fosters resource-sharing and it ensures a big-picture approach to increasingly complex issues.

The ANR seeks to tackle the major challenges of our times by supporting multi-skilled project teams that draw in people with knowledge and expertise in different fields. Interdisciplinary research is vital if we are to come up with global responses to complex societal and environmental issues and drive progress.

This open-minded, outward-looking and knowledge-sharing mindset underpins everything the agency does, ensuring it makes a valuable contribution to French research.

74%

OF PROJECTS FUNDED IN 2016 WERE COLLABORATIVE

They bring together French teams from different organisations, French and foreign researchers, or partners from the worlds of academia and business.

203 ACADEMIC-INDUSTRY COLLABORATIONS FUNDED IN 2016

16% OF PROJECTS FUNDED IN 2016 INVOLVED A COMPANY

3,434 ACADEMIC-INDUSTRY PROJECTS FUNDED SINCE 2005

ENCOURAGING PARTNERSHIPS BETWEEN ACADEMIA AND INDUSTRY

The ANR encourages public-private partnerships in the same way as it promotes cross-cutting, multidisciplinary approaches, helping to forge closer ties in line with its remit.

Through this model, the agency seeks to foster economic value creation while accelerating technology transfer. Public-private partnerships also help narrow the gap between the public and private spheres, ensuring that academics address scientific matters of interest to the industrial world in their work. By building bridges between these worlds, the aim is to encourage academics to explore new research topics and bring their knowledge and expertise to the fore.

DEDICATED FUNDING INSTRUMENTS

The ANR has introduced a range of special funding instruments to encourage collaboration of this type. Collaborative Research Projects involving Enterprises (PRCE) – part of the generic call – are dedicated exclusively to collaborative research between the public and private sectors. LabCom, meanwhile, is an instrument covered by a separate call for proposals, where a public body and a business (SME or mid-sized corporation) come together to set up a joint laboratory.

The agency's Industrial Chairs instrument, while smaller in terms of volume, brings genuine added value to the table for the participating company (see page 28).

Finally, the ANR has managed the **Carnot** programme for France's Ministry for Research since 2006. This successful programme recognises and supports laboratories that make partnership-based research central to their strategy and focus their work on the needs of business and society. Under the scheme, the ANR makes an annual payment, calculated based on contractual partnership revenues.

MAKING RESEARCH GLOBAL

Research, together with its resources and challenges, is becoming an increasingly globalised discipline. The ANR is fully in tune with this trend, giving French teams the tools they need to establish European and international collaborations, raising the profile of French research outside the country and helping to develop the European Research Area (ERA).

The ANR has developed ever-more international partnerships and collaborations since its inception, with three aims in mind: to strengthen the position of French research on the international stage, to make French research teams more competitive at the European level and to foster collaboration between French researchers and the best teams from around the world. Promoting French research abroad is therefore one of the ANR's key missions, addressing several challenges at once.

ENCOURAGING INTERNATIONAL PARTNERSHIPS

The ANR supports the development of international research projects and works in tandem with other funding bodies to help French researchers collaborate with the best nternational teams. Some of these projects focus on specific themes, while others address broader topics that fall within the agency's remit. The ANR supports these projects either through the generic call for proposals, or via specific bilateral or multilateral calls.

RAISING THE PROFILE OF FRENCH RESEARCH IN INTERNATIONAL NETWORKS

The ANR plays an instrumental role in European and international research policy and is involved in various international and European events, forums and meetings, thereby helping raise the profile of French project-based research. The agency is a member of several bodies including Science Europe, the Global Research Council, the G8-HORCs and the Belmont Forum.

BUILDING THE EUROPEAN RESEARCH AREA

The ANR is actively involved in the construction of the European Research Area, launching collaborative calls for proposals with Europe's leading research countries and playing an instrumental role in the EU's multilateral programmes such as **ERA-NETs** and **Joint Programming Initiatives** (JPIs). The ANR is an active member of several JPIs, chairs the Water JPI, and co-chairs the FACCE-JPI.

In 2015, the agency launched a new programme called **Setting up European or International Scientific Networks,** an instrument to help French scientists develop collaborative research projects with partners in Europe or elsewhere in the world and successfully secure European or international funding for their work. The aim is to boost France's success rate in Horizon 2020 calls and to bolster the country's scientific standing by coordinating European and/or international projects.

The **Springboard-ERC instrument**, launched in late 2016, helps researchers working for public research bodies who have failed to secure ERC funding despite their project being rated "excellent". Under the scheme, these researchers receive support to improve their project and boost their chances of success (see page 29).

The ANR is also involved in advisory networks working on scientific policy and on the development and implementation of European agendas on key issues. It builds partnerships with other institutions to share best practice in research evaluation and funding.

€64.6 M

ALLOCATED TO INTERNATIONAL PROJECTS JOINTLY FUNDED WITH FOREIGN AGENCIES

245 **INTERNATIONAL PROJECTS JOINTLY FUNDED WITH FOREIGN AGENCIES**

19.5% **OF PROJECTS FUNDED IN 2016 WERE INTERNATIONAL PROJECTS JOINTLY FUNDED WITH FOREIGN AGENCIES**

QUANTERA: A NEW ERA-NET COFUND FOR QUANTUM TECHNOLOGIES

In 2016, the ANR teamed up with 31 other European research funding agencies to define and launch an ERA-NET COFUND to support quantum technology research. Dubbed QuantERA, the new network is coordinated by Poland's National Science Centre (NCN). As lead partner, the ANR is responsible for preparing and launching the cross-border call for research proposals.

The call, with a budget of € 34 M, was launched in early 2017.

QuantERA is supported by the EU as part of the preparations for the European 'Flagship' on the same theme.

For more information, visit **www.quantera.eu**

WHAT IS AN ERA-NET?

An ERA-NET is a network of funding agencies and research bodies supported by the European Commission. The instrument aims to develop and strengthen the coordination of national research programmes, with network partners launching regular international calls for proposals on specific themes, each partner funding researchers from its own country. The projects are selected through a competitive, Europe-wide peer review process.

GUARANTEEING AN ETHICAL, TRANSPARENT SELECTION PROCESS

The ANR allocates project-based funding via a competitive selection process based on peer review and aligned with international standards. Over time, the agency has introduced new tools to the process to place quality, transparency and ethics at the centre of its work.

The ANR's competitive selection process involves panels comprising external scientific personalities as well as the broadest possible community of external peer reviewers. The ANR brings in these experts on the recommendation of its evaluation panels, selecting them on the basis of competence, independence and integrity. Before being allowed access to the full documentation, each peer reviewer signs a confidentiality agreement, declares that they have no conflicts of interest and signs up to the ANR's Code of Ethics. These scientists play a key role in the project selection process, and the Scientific Evaluation Panels rely on their peer review reports. These reports inform panel discussions and proposal rankings.

DEDICATED TOOLS

The ANR introduced a **Code of Ethics** in 2009, detailing the best practice that everyone involved in the agency's activities must follow. The code ensures that the ANR's processes are transparent and guarantees compliance with selection criteria and the proper management of public funds.

In April 2011, the ANR set up a **Redress Committee**, a collegiate body that analyses and examines cases where things may have gone wrong in the selection process. Cases may be referred to the committee by either the applicant or the ANR at any stage of the selection process and under any of the agency's calls for proposals, except those covered by the Investments for the Future programme.

In June 2014, the ANR supplemented this system with a new **Policy for Ethics and Research Integrity**, which describes the fundamental principles to be adhered to during research or research training activities, together with the rights and responsibilities of everyone who supports, evaluates and performs research work. The researchers and applicant organisations, along with everyone involved in the activities of the ANR, must comply with this policy.

BETWEEN **20** AND **60%** OF PEER REVIEWERS ARE FOREIGN, ACROSS THE AGENCY'S EVALUATION PANELS.

KEY FIGURES: PEER REVIEW IN THE GENERIC CALL FOR PROPOSALS

STAGE 1: SELECTION OF PRE-PROPOSALS

6,446 PRE-PROPOSALS EVALUATED*

2,414 REVIEWERS INVOLVED IN TOTAL

- 1,644 PEER REVIEWERS
- 770 PANEL MEMBERS

29,954 REVIEWS APPROVED

STAGE 2: SELECTION OF FULL PROPOSALS

2,942 PROJECTS EVALUATED*

875 SCIENTIFIC EVALUATION PANEL MEMBERS

10,175 PEER REVIEWS CARRIED OUT

* These figures do not include international projects (PRCI) submitted under a "lead agency" procedure with Germany, Austria and Switzerland.

THE ANNUAL WORK PROGRAMME: THE FUNDING FRAMEWORK

Each year, the ANR produces a Work Programme setting out its research priorities and funding instruments for the coming year. This roadmap is developed in consultation with members of the research ecosystem and builds on France's national research strategy. The Work Programme is divided into four components. It is intended for all public and private scientific communities, including SMEs and very small businesses.

The ANR's Work Programme is determined by the "France Europe 2020" strategic agenda and France's National Research Strategy (SNR). It includes proposals from the research alliances, the CNRS and the relevant ministries. It is approved by the agency's Governing Board. The section on societal challenges also reflects France's priority areas of research as defined in the national research strategy. The 2017 edition, published in summer 2016, includes the simplification measures announced by Thierry Mandon, French Secretary of State for Research, on 28 April 2016 (see page 34).

CFP TYPE	GENERIC CALL FOR PROPOSALS	SPECIFIC CALL
Component 1 Major societal challenges	JCJC, PRC	Challenge competitions, Flash
Component 2 At the frontiers of research	JCJC, PRC, PRCE, PRCI	
Component 3 Building the European Research Area (ERA) and France's international attractiveness	PRCI	MRSEI, T-ERC, international calls (ERA-Nets etc.)
Component 4 Economic impact of research and competitiveness	PRCE	Labcom, industrial chairs, Carnot

A WIDE RANGE OF FUNDING INSTRUMENTS

The ANR has designed and implemented a wide range of funding instruments to cater to the project-based funding needs of different research communities. Each instrument has a clearly defined purpose. The agency regularly introduces new instruments in response to requests from the ministry and from the communities.

The ANR has introduced around a dozen funding instruments, which can be mobilised on behalf of the French government or public or private stakeholders. In the latter case, the organisation allocates a budget to the ANR to organise and manage a call for proposals on a theme of particular interest. Each year, for example, the French Defence Procurement Agency (DGA) commissions the ANR to organise the ASTRID and ASTRID Maturation calls for proposals and funds the selected projects.

FOR COLLABORATIVE RESEARCH

COLLABORATIVE RESEARCH PROJECTS

The aim of this system is to strengthen collaboration between teams that would not normally have worked together. The goal is to break away from conventional thinking and, in doing so, to achieve more ambitious outcomes.

COLLABORATIVE RESEARCH PROJECTS INVOLVING ENTERPRISES

This instrument enables a public research organisation and a business (irrespective of size) to work together on a subject of their choosing. The system helps drive innovation, fosters a multi-angled approach to research questions and gives businesses an opportunity to open up to new horizons.

INTERNATIONAL COLLABORATIVE RESEARCH PROJECTS

As part of its international cooperation policy, the ANR supports the development of international research projects, enabling French teams to apply for funding, via the generic call, for projects involving one or more foreign teams. The aim of this system is to strengthen the excellence, impact and reach of French research and to promote collaborative research in Europe and worldwide.

CHALLENGE COMPETITION

This instrument aims to encourage several teams to work simultaneously on the same targeted topic. By placing the research teams in competition with one another, the objective is to compare and contrast their respective approaches to an application or scientific question for a higher level of innovation.

LABCOM

The LabCom (joint laboratories) instrument was set up in 2013 to boost the potential for industrial partnerships in the world of academic research. The scheme helps these teams to set up long-term bilateral partnerships with businesses (especially SMEs and midsized corporations).

FLASH CALL FOR PROPOSALS

The purpose of the Flash system is to support urgent research that addresses scientific questions around a large-scale event or natural disaster. The aim is to fund the work necessary to obtain rare information and data that would otherwise be impossible to gather under normal circumstances.

FOR INDIVIDUALS

YOUNG RESEARCHERS

The Young Researcher instrument is intended to drive scientific innovation among young researchers, enabling applicants to work independently on a subject of their choosing.

INDUSTRIAL CHAIRS

The Industrial Chairs instrument aims to forge long-lasting partnerships between higher education and research institutions and businesses, in which a higher education and research chair half-funded by the partner company is hosted within the institution.

SPRINGBOARD-ERC

Set up in late 2016, this new funding instrument is aimed at French or foreign scientists working for French public research bodies who have failed to secure European Research Council (ERC) Starting Grants or Consolidator Grants but who have worthwhile projects that merit funding. The ambition is to help them improve their proposal so they can submit a new application with the best chance of success.

FOR PROJECT INITIATION

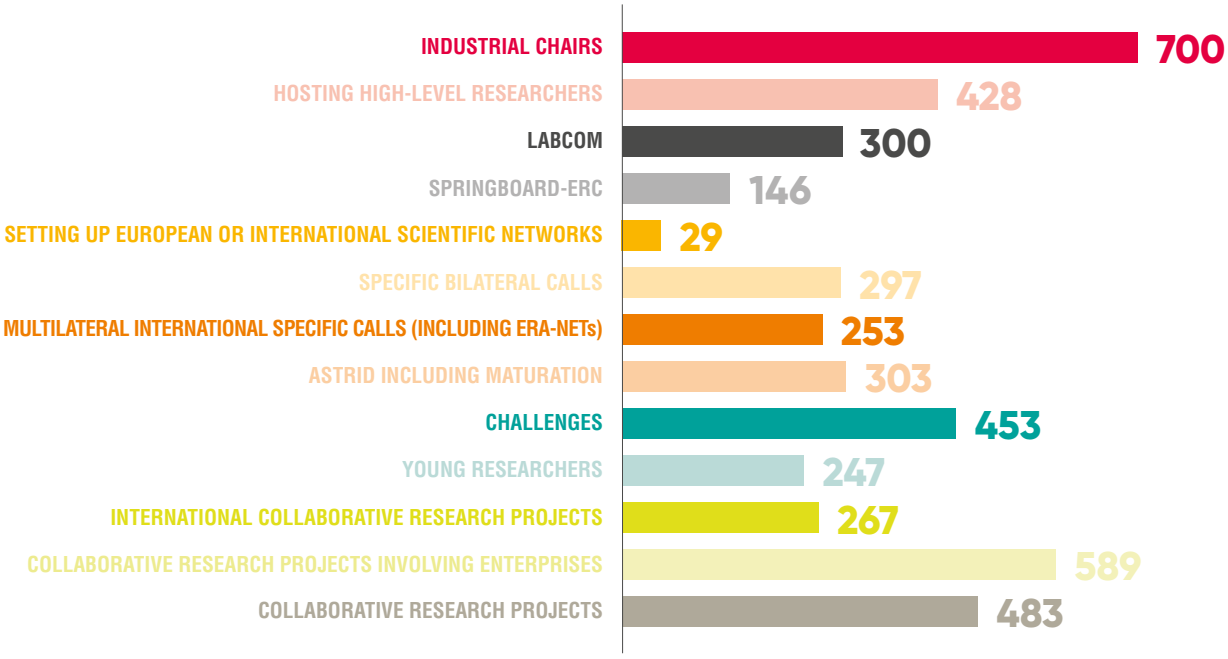
SETTING UP EUROPEAN OR INTERNATIONAL SCIENTIFIC NETWORKS

The aim of this instrument is to help French researchers build and lead cross-border networks, thereby encouraging French scientists to participate in European and international calls and, ultimately, to boost the visibility and reach of French research.

SPRINGBOARD-ERC: A BRAND-NEW INSTRUMENT TO DRIVE QUICK DECISION-MAKING

Designed to improve France's success rate in European Research Council (ERC) calls, SPRINGBOARD-ERC is one of the simplification measures announced by the French Secretary of State for Research in April 2016. It was set up by the ANR in summer 2016 as part of its 2017 Work Programme. The ANR has introduced dedicated provisions to fast-track the decision-making and funding process, including a simplified application package based on the application documents already submitted to the ERC. This means that applicants receive a quick response, approximately three months after the closing date. The selected projects receive funding of €150,000, for a period of 18 months. The first call under this instrument was launched in October 2016, and 28 researchers received funding.

AVERAGE FUNDING ALLOCATED PER INSTRUMENT (€K)



Each member's input and experience is key to reaching a balanced judgement.

Marcello Coradini
CHAIR OF THE SCIENTIFIC EVALUATION PANEL N°31

The role of Scientific Evaluation Panel "Reference" Chair was created in 2016. These experienced researchers have a three-pronged role within the agency: they act as the key liaison between the ANR and the scientific community within their field, they guarantee compliance with ethical rules in the selection process in accordance with the ANR's Code of Ethics, and they play a proactive role in driving continuous improvement across the agency's procedures. Interview with Marcello Coradini, Chair of Scientific Evaluation Panel 31, "Particle Physics, Astrophysics, Structure and History of the Earth".

WHAT ROLE DOES THE SCIENTIFIC EVALUATION PANEL PLAY IN THE SELECTION PROCESS?

Marcello Coradini: "The Scientific Evaluation Panel plays a key role, because it has the final say in selecting proposals. Although each member has an important part to play individually, the panel ultimately has collective and collegiate responsibility.

This year, the panel's role is even more important because the external peer reviewers no longer rank each proposal, limiting their input to comments only. This means that, for the first time, panel members will be responsible for ranking the proposals.

I supported this change for a number of reasons. Firstly, since the majority of proposals are of a very high standard, there were too many scores of A and A+, which made it difficult to decide between them. Secondly, certain criteria were sometimes poorly understood. I therefore fully supported making changes to the classification type. I should stress that the ANR listens closely and with sensitivity to comments from communities and panels. The agency is determined to keep improving its processes."

WHAT DOES YOUR ROLE AS "REFERENCE" CHAIR INVOLVE?

MC: "I'm a facilitator! The committee comprises scientists with a wealth of experience and strong personalities. It's my job to get them all working together collaboratively.

My role also involves organising the panel's work while playing an active role in the ANR's internal process. The panel's annual meeting is just the tip of the iceberg. As "reference" chair, I am both the representative of the community and the liaison with the ANR's management structure."

WHY DID YOU WANT TO BE INVOLVED IN THIS PROCESS?

MC: "I've been involved in research for more than 40 years now and I felt I could bring some useful experience to the table. At first, curiosity played a part. I really wanted to learn more about the ANR and discover its secrets. But more importantly, I wanted to do something to support research in France. I firmly believe that France is one of the countries that does the most to foster and support research. So for me personally, it was a real honour to be involved in managing scientific affairs in a country where research is a national priority."

HOW DOES THE ANR ASSIST YOU IN YOUR ROLE?

MC: "My job would be impossible without support from senior management. Everyone I've worked with at the ANR is exceptionally talented and dedicated. My colleagues have a wealth of scientific expertise, as well as integrity of thought and behaviour. They listen closely to what panel members say - we work with them rather than against them. The agency's staff are simply world-class!"

THE SELECTION PROCESS FOR THE GENERIC CALL

The selection process under the generic call for proposals is divided into two main stages and involves three types of stakeholder.

SCIENTIFIC CHALLENGE STEERING COMMITTEES (CPSD)

These committees are made up of members appointed by the ANR, including high-level experts from the worlds of academia and business, representatives of research alliances, and institutional representatives (ministries, agencies). The committees recommend to the ANR the pre-proposal selection thresholds based on the number of pre-proposals received and the focus of the agency's Work Programme, according to analyses of submissions and the selection.

SCIENTIFIC EVALUATION PANELS (CES)

These panels, led by a Chair, comprise French or foreign experts from the research communities relevant to the challenges and appointed by the ANR for their scientific expertise. They are involved in evaluating pre-proposals in stage 1 and full proposals in stage 2.

EXTERNAL PEER REVIEWERS

These individuals are appointed on the recommendation of the Scientific Evaluation Panels. Their role is to produce written reviews during the first or second stage of the evaluation process. They do not attend panel meetings.

STAGE 1

TO

CALL OPENS
PRCI : REGISTRATION PERIOD

PRC, PRCE, JCJC

Submission of pre-proposals

TO + 3 MONTHS

CALL CLOSES

CPSD

- 1 per challenge
- Examines the range of pre-proposals and determines pre-selection thresholds

CES

Each pre-proposal is evaluated and scored by at least three evaluators: external peer reviewers and/or committee members

TO + 4 MONTHS

REGISTERED PRCI ARE INVITED TO SUBMIT A FULL PROPOSAL

1ST STAGE RESULTS

≈45%

OF PROJECT COORDINATORS INVITED TO SUBMIT A FULL PROPOSAL

TO + MONTHS

STAGE 2

SUBMISSION OF DETAILED PROPOSALS

PEER REVIEWER OPINIONS

Each full proposal is evaluated by at least two external peer reviewers appointed by CES members

RIGHT OF REPLY TO PEER REVIEWERS

MEMBERS' OPINIONS

Each proposal is evaluated and scored by two CES members based on (1) the document submitted by the coordinator, (2) the external peer reviews received and any replies from the coordinator to these expert peer reviews and (3) their own opinions of the proposals

CES

Summary of the evaluations and ranking of the full proposals

TO + 12 MONTHS

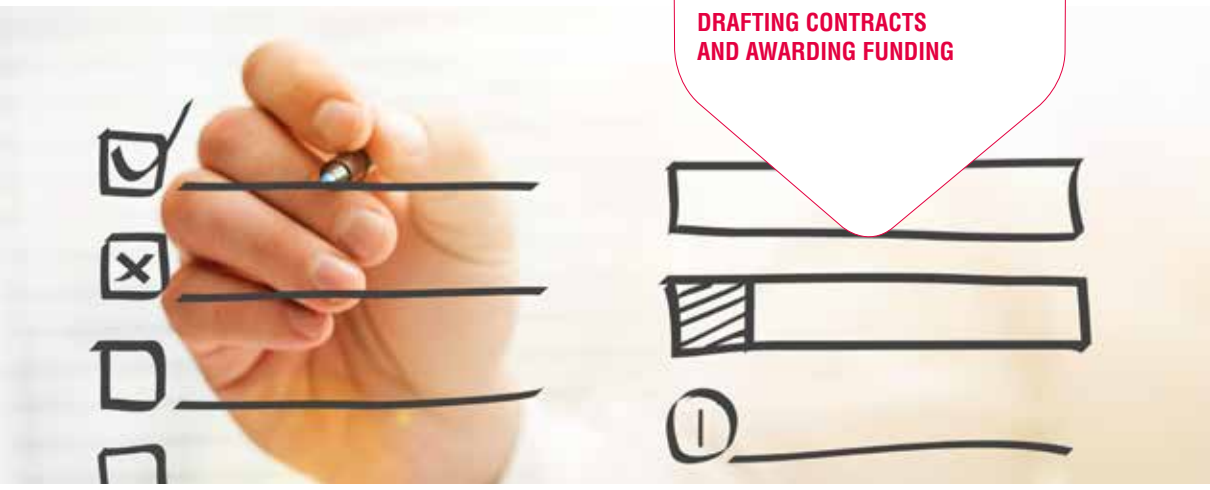
PUBLICATION OF RESULTS

EXPECTED SELECTION RATE

25 TO 30%

OF THE PROJECTS SELECTED IN STAGE 1

DRAFTING CONTRACTS AND AWARDING FUNDING



CPSD : Scientific Challenge Steering Committee
CES : Scientific Evaluation Panel

Making researchers' lives easier and giving them more time to focus on research

Yves Fort
ANR SCIENTIFIC OPERATIONS DIRECTOR

INTERVIEW

The ANR's 2017 Work Programme includes the simplification measures for higher education and research announced by Thierry Mandon, French Secretary of State for Research, in April and December 2016.The aim is to reduce red tape and give researchers more time to focus on research. Yves Fort, the ANR's Scientific Operations Director, talks about the agency 's work on this topic.

WHAT ROLE DID THE ANR PLAY IN THE MINISTRY'S SIMPLIFICATION DRIVE?

Yves Fort: "I think the term 'co-construction' sums up the process neatly. There was genuine dialogue with the ministry on this subject. The project was launched in late 2015 and early 2016. It was an open, collaborative process. Everyone in the higher education and research community was invited to submit proposals through contributions and via working groups. The agency wanted to use this simplification drive as an opportunity to rethink its own processes. We therefore sent a series of proposals to the ministry during the consultation phase. Then, once the measures were announced, we were consulted to ensure that the new actions were both practicable and feasible within the time frame."

WHAT DO THESE SIMPLIFICATION MEASURES COVER?

YF: "The two higher education and research simplification plans include around 70 measures, 11 of which directly affect the ANR (see box). The main aim is to make life easier for researchers, including simplifying the application process and cutting red tape while ensuring that we continue to manage rigorously the funds entrusted to us. There are also measures that focus on young researchers, improving the support system and helping them gain independence. Finally, the simplification measures aim to make our processes more transparent and make it easier for our various users to access information."

HOW ARE THE MEASURES BEING APPLIED?

YF: "Since we worked in tandem with the ministry before the announcements were made, we were able to start taking action across all areas in summer 2016. We have simplified the application documents for our calls for proposals and, in the same spirit, we have cut back on administrative and financial monitoring. We have also revised the dedicated funding instrument for young researchers to improve the support that they receive, and created Springboard-ERC an instrument that aims to boost France's success rate in European Research Council calls.

We have looked again at how we draft our Work Programme to give more prominence to basic research, and efforts in this vein will be intensified further in the 2018 Work Programme.

The ANR Tour campaign, meanwhile, was an opportunity to go out and meet the communities to talk about our Work Programme and answer their questions. We have introduced a rebuttal phase in the second stage of the 2017 generic call, enabling coordinators to add information supplementing the peer review, where they consider it necessary (see page 33). Finally, we have launched a new health research portal, in tandem with the Aviesan alliance, to provide better access to information about all public research projects focusing on health (see page 10)."

WHAT ARE THE NEXT STEPS?

YF: "We are upgrading our computer systems to make the project submission process easier and more secure, including a new unique identification number for all funding recipients, both public and private. However, this is a process that extends well beyond the agency's remit. The revised financial rules approved at the end of 2016 simplify the submission preparation process, with clearly defined expenditure categories. The project grant agreement procedure will also be sped up as a result. Once the next set of results is published in July 2017, we will get in touch with coordinators to ensure that the financial annexes are finalised quickly and partners are agreed individually by the end of the calendar year. We will also be continuing to inform and communicate with our communities, and will be running another ANR Tour campaign in autumn 2017.

Finally, we are working with other project-based funding bodies to look at ways to harmonise the administrative and financial documents involved in calls for proposals. We plan to launch other portals, similar to the health initiative but covering other disciplines. Examples include a portal for social sciences and humanities, which is now being deployed as set out in the ministry's social sciences and humanities plan. The support we receive from research alliances and the CNRS is invaluable in these processes."

SIMPLIFICATION MEASURES

MEASURES ANNOUNCED	ANR ACTION
Make the call for proposals application process simpler by reducing the project description to the bare minimum	The project description section has been shortened from 5 to 3 pages for pre-proposals and from 30 to 20 pages for full proposals.
Reduce administrative and financial monitoring for projects	Projects awarded funding in 2016 only submit a single mid-term scientific report (measure extended to the 2014 and 2015 editions).
Simplify the process of preparing administrative and financial documentation for calls for proposals	Revised financial rules passed in late 2016. Grant agreement templates simplified.
Make the ANR call for proposals submission process simpler and more secure	Ongoing upgrades to project submission information systems.
Give basic research more prominence in ANR calls for proposals	WP 2017: A new, dedicated component included under each challenge. WP 2018: Intensified efforts.
Fast-track projects submitted under the generic call for proposals	Effective from the 2017 edition following overhaul of the financial rules.
Make the ANR's project evaluation processes more transparent	Rebuttal phase introduced in stage 2 of the 2017 generic call.
Give a second chance to promising young researchers who failed to secure European funding	Springboard-ERC instrument created in autumn 2016.
Improve the support system for young researchers	Young researcher instrument expanded to include non-tenured researchers.
Limit the expansion in the number of publicly funded calls for projects	Thematic portals created to bring together all public calls for proposals in France.
Harmonise administrative and financial documentation for calls for proposals	Ongoing work with other project-based research funding bodies.

IMPROVING USER SATISFACTION

The ANR is keen to improve understanding of its activities, its calls for proposals and the fundamental principles on which projects are selected. With this in mind, the agency is working to better manage its relationships with the entire community – researchers, project coordinators, research bodies and others – through more sustained dialogue. This is one of the focuses of the agency's contract of objectives and performance 2016-2019.

As part of its efforts to become more efficient, effective and reliable, and to speed up its response times, the ANR has set about introducing a streamlined user relations management process. The aim is for the agency to deal more effectively with the entire project life cycle, from application through to closure, using a dedicated management tool to process and track requests and respond effectively to questions from the community.

The first step in this process is to carry out a detailed, exhaustive assessment of all the requests the agency receives and processes, across all areas of its activity and al its calls and funding instruments. This work began in 2016 and will continue in 2017.

The agency sees these efforts to better manage user relations as a prerequisite for improving satisfaction among the research communities.

SATISFACTION SURVEY

As part of this listening process, the ANR carried out a satisfaction survey among funded project coordinators in May 2016, inviting around 1,600 coordinators from 2014-2015 to complete an online questionnaire. The survey, which achieved a response rate of almost 42%, revealed that 71% of coordinators were generally satisfied across the project submission, selection and monitoring stages. However, the responses did reveal areas where things could be improved, such as better communication around the call for proposals, clearer administrative documentation and a more user-friendly submission platform. The ANR has used the findings of the survey to take corrective action in certain areas, including the call planning process and simplification of its administrative and financial processes, as well as providing more clarity on the selection procedures and evaluation criteria.

The agency will continue to measure and assess user satisfaction in a structured manner, with annual surveys among both successful and unsuccessful project coordinators (generic call for proposals and other calls) and public and private bodies.

FOSTERING EXCHANGES, MEETING COMMUNITIES

The ANR held around 20 information meetings at research and higher education institutions throughout France in September and October 2016 to give a clearer insight into its work. The aim of these meetings was to present the new Work Programme and the 2017 generic call to scientific communities, and to talk more generally about the ANR, how it works, its various funding instruments and the review process – all the key information that potential project coordinators need to submit successful proposals. During the event, known as the "ANR Tour" and supported by regional CNRS branches and universities, the agency met and answered questions from nearly 2,000 people, with questions and answers added to the FAQ section on the ANR's website.

The agency will continue its work to interact with the community, developing more direct, regular communication materials across all channels.

WEBSITE

1,087,154
VISITS

578,729
UNIQUE VISITORS

2,688,923
PAGE VIEWS

SOCIAL MEDIA (AS AT 31/12/16)

7,616 TWITTER FOLLOWERS
38% IN 1 YEAR

3,074 LINKEDIN FOLLOWERS
36% IN 1 YEAR

A SPECIFIC ASSIGNMENT

In 2010, the ANR was assigned a special mission to manage the first Investments for the Future programme, with dedicated processes and a specific framework. The third programme was announced in 2016, with the same objectives as its two predecessors: excellence, innovation and cooperation.

WHAT IS THE INVESTMENTS FOR THE FUTURE INITIATIVE?

The Investments for the Future initiative was initially conceived as a "large loan" initiative by the President of France. The initiative as it stands today is based on principles laid down by a committee chaired by Alain Juppé and Michel Rocard in 2009.

The aim is to modernise and strengthen French competitiveness by financing education and research and investing in innovative projects alongside the private sector and local authorities.

The programme focuses on five key job and growth-generating sectors:

- Higher education and training;
- Research;
- Industry and SMEs;
- Sustainable development;
- Digital technologies.

It is overseen by the General Commission for Investment (CGI), which reports to the Prime Minister. The Investments for the Future supervisory committee reviews the programmes and produces an annual activity report. Operational implementation of the programmes rests with operators.

3 PROGRAMMES

€57 BN
IN TOTAL FUNDING

3 Investments for the Future programmes:

- **PROGRAMME 1, launched in 2010, with a budget of €35 bn**
- **PROGRAMME 2, launched in 2013, with a budget of €12 bn**
- **PROGRAMME 3, launched in 2016, with a budget of €10 bn**

THE ANR'S ROLE

The ANR is the lead operator of the Investments for the Future initiative, with responsibility for 25 separate actions covering centres of excellence, health, biotechnology and research valorisation.

In 2010, the French government appointed the agency as the operator for all higher education and researchactions under the Investments for the Future programme, with €22.5 bn of the €35 bn total funding allocated to the first programme passing through the ANR. Most of the calls for proposals were launched in 2010 and 2011, and the agency is now responsible for funding the projects, conducting annual monitoring and organising periodic reviews by international panels. The first round of mid-term reviews took place in 2015 and continued in 2016.

Under the second programme, the ANR was once again confirmed as the operator for the Higher Education and Research component, with the actions under its management amounting to €4.1 bn in total funding. New calls for projects were launched in 2014, and a further four in 2016: Convergence Labs phases 1 and 2, Hospital-University research in health phases 2 and 3, "Initiatives of Excellence" phase 2, and Development of Experimental Digital Universities.

Under the thrid programme, officially approved in late 2016, the ANR has been tasked with overseeing projects and initiatives under two headings: "Supporting progress in teaching and research" and "Exploiting research". The first round of the calls was launched in early 2017.

SEPARATE MANAGEMENT

The Investments for the Future programme has three specific features that demand separate management:

- The majority of projects are selected and evaluated by international panels.
- The amount of funding assigned to the projects is substantial, covering periods that can extend up to 2029.
- The programme enables not only the financing of large-scale research projects, but also equipment and infrastructure projects (research equipment, biology and health research infrastructure, etc.) and research exploitation bodies.

UNDER THE INVESTMENTS FOR THE FUTURE PROGRAMMES, THE ANR MANAGES

€29.4 BN

ON THE FRENCH GOVERNMENT'S BEHALF.

Interpreting the government's intentions and leaving nothing in the shadows

Jean-Marc Rapp
CHAIR OF THE INITIATIVES OF EXCELLENCE PANEL

INTERVIEW

Jean-Marc Rapp has chaired the Initiatives of Excellence (IDEX) panel since 2011. Involved in the Investments for the Future programmes since the outset, he talks about his vision of the initiative, what he expects from it, and the important role that the ANR plays in the programmes.

WHAT ROLE DOES THE PANEL PLAY IN THE INVESTMENTS FOR THE FUTURE SELECTION PROCESS?

Jean-Marc Rapp: "First of all, the panel interprets, as accurately as possible, the government's intentions and the objectives of the Investments for the Future, turning them into concrete applications and criteria. It's important to remember that, in the beginning, the panel issued recommendations on how to organise and coordinate these criteria – recommendations that the government accepted.

The panel's next task is to familiarise itself with the projects, examine them in detail and then carry out interviews to ensure that nothing is left in the shadows.

I've introduced a specific process for this, which we've subsequently used in each session. More specifically, we take a 'test' application and each panel member analyses it independently before the plenary session, to make sure we're all reading from the same page before the exercise begins. It's a painstaking process, but it's something we do each and every time, even though we're now in our fifth session."

WHAT DOES YOUR ROLE AS CHAIR OF THE PANEL INVOLVE?

JMR: "As well as examining all the projects we receive, my role involves distributing our workload, making sure we stick to our work schedule, working with the ANR and the CGI on various documents for project coordinators and the panel, holding conference calls, preparing for and leading interviews and debates, proposing a procedure, and presenting the results to the steering committee, which is chaired by the French Ministry for Higher Education and Research."

WHY DID YOU WANT TO BE INVOLVED IN THIS PROCESS?

JMR: "I responded to a request from the minister in late 2010. The opportunity piqued my interest because I felt there was a mismatch between how the French system was organised and the quality of its researchers – in other words, France's system was so complex that it didn't do justice to the excellent teaching and research fellows we have in this country. The role was a chance for me to help develop a programme that raises the profile of teaching and research. So I accepted the position with relish."

HAVE THINGS CHANGED OVER TIME?

JMR: "Yes, we've seen quite a few changes over the last six years. Together with my colleagues on the panel, we've gradually noticed where things were overly complex or cumbersome and made some improvements.

Over the years, i've seen much more detailed comparative analyses from project coordinators. We've often asked project coordinators to look abroad to find institutions and universities to compare themselves against. Initially, the comparisons were far too superficial. That's improved over time, and we've seen institutions producing detailed and highly relevant analysis in comparison with the vocational training, governance or research policies of different universities. Analysing things in this way is a real boost for strategic thinking and project credibility."

HOW DOES THE ANR ASSIST YOU IN YOUR ROLE?

JMR: "The ANR assists me by working on call documents so I can provide the panel with well-written and informative material. It's a huge task that has to be done well in advance. I also get a lot of support from the agency on panel organisation and logistics, organisational support for conference calls and during interview week, website updates, and executive summaries and studies for the panel. Ultimately, there's a lot of sterling organisational work, much of which goes on behind the scenes."

2 OUR SUPPORT

FOR RESEARCH

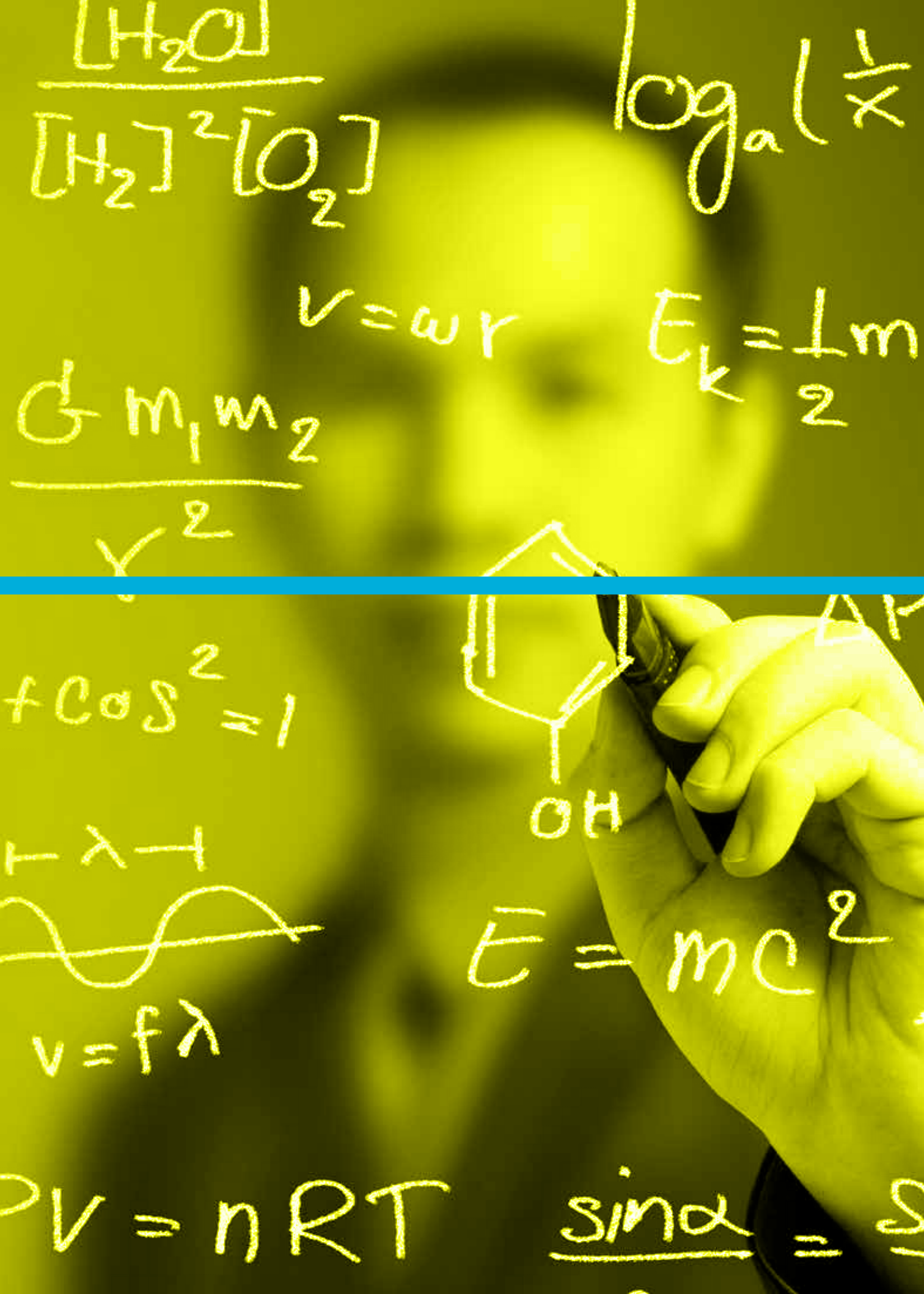
Project-based research funding is the mainstay of the ANR's work. To illustrate its action and the diversity of the research projects it supports, the agency presents around 20 research projects it has supported via its calls for proposals. These projects, which ended in 2016, are grouped together under five aspects of the ANR's work.

A sample of the actions managed by the ANR and projects supported under the Investments for the Future programmes is presented in a dedicated section.

1 ANR CALLS FOR PROPOSALS - P. 44

- Young researchers
- International
- Public-private partnership
- Basic research
- Research with high social or cultural impact

2 INVESTMENTS FOR THE FUTURE - P. 67


[H2O]
[H2]2[O2]
v=ωr
Ek=1/2m
Gm1m2
r2
+cos2=1
OH
λ
v=fλ
E=mc2
PV=nRT
sinα

FUNDAMENTAL PHYSICS

TINO
SCALING EFFECTS IN TIME-DELAYED NONLINEAR OPTICS

- **ANR PROGRAMME AND EDITION:** Materials and softwares for systems and communications (JCJC SIMI 3) 2012
- **ID:** ANR-12-JS03-0005
- **PARTNER:** Supélec
- **ANR GRANT:** €209 k
- **CONTACT:** Marc Sciamanna **Marc.Sciamanna@centralesupelec.fr**
- **WEBSITE:** **sites.google.com/site/anrtino/**

THE TINO PROJECT EXPLORES SCALING EFFECTS IN TIME-DELAYED NONLINEAR OPTICS

The TINO project looked at the presence of time delays in many systems when, for example, a feedback mechanism couples an output signal to an input. This project has had a major scientific impact on our understanding of fundamental physics, giving rise to several follow-on projects supported both in France and at European level and paving the way for further research into all-optical data storage.

Many dynamical systems experience a time delay when feedback couples an output signal to an input. Examples can be found in biology (neural networks, gene regulatory networks) and in social networks (car traffic jams, internet). Time-delayed coupling or feedback impacts the system dynamics significantly and can be responsible for the emergence of chaos or, conversely, spatial self-organisation in regular patterns. The resulting effects depend on the ratio between the feedback/coupling strength and the signal strength, but also, and in a more complex way, on the ratio between the time delay and the constant time and dimensional characteristics of the system.

The TINO project aimed to take advantage of advanced photonic systems engineering to provide a first in-depth understanding of these effects in time-delayed systems and to turn them into innovative applications.

MAJOR ADVANCEMENTS OF KNOWLEDGE

The project involved theoretical and experimental work combining laser physics and nonlinear optics. The researchers observed new dynamics in optical systems, including the first observation of rogue waves in an optical system caused by a time delay, the first observation of bistable optical patterns caused by convection and evidence of temporal chaos in the mid-infrared spectrum. The project has had a major scientific impact on our understanding of time-delayed optical systems, paving the way for commercial exploitation in the form of all-optical information processing.

These ground-breaking findings have been published in several high-level journals, including Nature Photonics, Light Science & Applications (Nature Publishing Group) and Physical Review Letters. The work begun by the TINO project is now continuing through several national and international projects (H2020 PHRESCO, ERDF PHOTON and APOLLO) and led to the creation of the first French photonics chair at Centrale Supélec in 2017, supported by the Fondation Supélec, Airbus Group (GDI Simulation), the European Union (ERDF), the French government, the Grand-Est Region, the Moselle Department, and Metz Métropole.

IMMUNOLOGY

STROMA
IMMUNOBIOLOGY OF LYMPHOID STROMAL CELLS

- **ANR PROGRAMME AND EDITION:**
  Microbiology, immunology, infectiology (JCJC SVSE 3) 2012
- **ID:**
  ANR-12-JSV3-0001
- **PARTNER:**
  Centre d'Immunologie de Marseille-Luminy
- **ANR GRANT:**
  €280 k
- **CONTACT:**
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  bajenoff@ciml.univ-mrs.fr

TOWARDS A BETTER UNDERSTANDING OF LYMPHOID STROMAL CELLS

Long considered inert elements of the secondary lymphoid organs, stromal cells in fact appear to have their own immunological functions. The aim of the STROMA project was to advance our understanding of these cells. It revealed how they play a role in supporting and regulating the body's immune response. On the strength of these findings, Marc Bajénoff – the young researcher who coordinated the project – secured a grant from the prestigious European Research Council (ERC) to continue working independently on his research.

The secondary lymphoid organs (spleen, lymph nodes and lymphoid tissue) are composed mostly of lymphocytes (~95%) and lymphoid stromal cells (~5%) that form the structural framework of these organs.

These cells have long been considered as inert elements of the immune system. This view has dramatically changed in recent years, when it was discovered that various stromal cell subsets create dense three-dimensional cellular networks that produce lymphocyte survival signals, generate "roads" on which lymphocytes migrate, and continuously provide nutrients and cells to the SLOs. Lymphoid stromal cells clearly play various essential roles in the proper development of immune responses. Manipulating lymphoid stromal cells thus has the potential to modulate immune functions, but this objective is not possible with the current state of knowledge.

SUPPORTING AND REGULATING IMMUNE RESPONSE

With this in mind, the STROMA project aimed to advance our understanding of these cells, their dynamics, their interactions and their behaviour in immune response. A "multicoloured" mouse model was developed, allowing each stromal cell to acquire a different fluorescent colour from its neighbour and to transfer this colour to its descendants, making it possible to determine what happens to these cells and to track their differentiation in situ.

Using this model, it was possible to show the origin and behaviour of certain lymphoid stromal cells. The findings were published in several articles, including in high-impact journals. Marc Bajénoff, the project coordinator, has since set up his own team and secured a Consolidator Grant from the ERC, allowing him to continue working on his research topic. The STROMA project therefore perfectly illustrates the purpose and ambition of the Young Researchers instrument.

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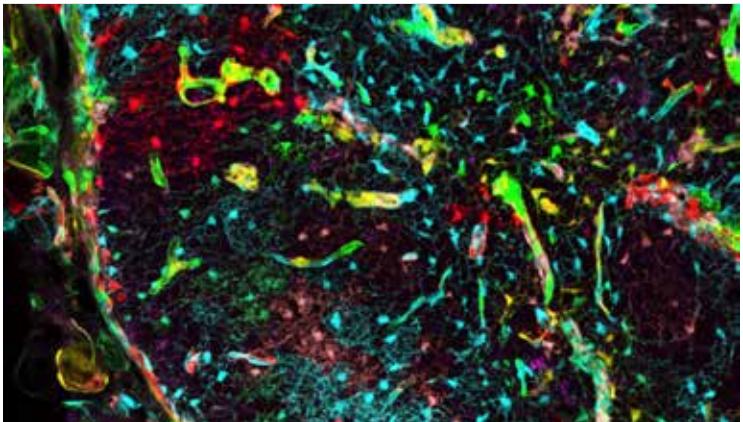

CLIMATE CHANGE

ESCAPE
ENVIRONMENTAL AND SOCIAL CHANGES IN AFRICA: PAST, PRESENT AND FUTURE

- **ANR PROGRAMME AND EDITION:**
  Environmental, planetary and social changes (CEP&S) 2010
- **COORDINATING ENTITY:**
  French National Institute for Research for Sustainable Development (IRD)
- **PARTNERS:**
  - CIRAD - BIOS Department
  - HSM CNRS - Languedoc-Roussillon Regional Delegation
  - CNRS-GAME (CNRM) - Midi-Pyrénées Delegation
  - GET CNRS - Midi-Pyrénées Regional Delegation
  - OMP CNRS - Midi-Pyrénées Regional Delegation
  - Laboratory of Oceanography and Climate: Digital Experiments and Approaches – IRD
  - Institute of Geoscience and the Environment – IRD
  - Population-Environment-Development Laboratory – IRD
  - Several African institutes (AGRHYMET, CEFORP, UCAD, LPAOSF, LASDEL, IER, DNM Mali, FRICARICE, ICRISAT) were involved in the project as subcontractors and/or steering committee members.
- **ANR GRANT:**
  €1,660 k
- **CONTACT:**
  Benjamin Sultan
  benjamin.sultan@ird.fr
- **WEBSITE:**
  www.escape.locean-ipsl.upmc.fr

THE ESCAPE PROJECT FOCUSES ON THE VULNERABILITY OF RURAL SOCIETIES TO CLIMATE CHANGE IN SUB-SAHARAN AFRICA

Sub-Saharan Africa is particularly vulnerable to climate change. Its highly variable climate has an impact on agriculture against a backdrop of socio-economic conditions in an often fragile balance. ESCAPE, a joint project involving teams from France and Africa, assessed the vulnerability of rural societies in this region to environmental and climate change and explored potential avenues for adaptation to mitigate this vulnerability.

Rural populations in sub-Saharan Africa face recurring food crises, which are likely to be aggravated by the effects of climate change. The future of this region thus depends largely on the ability of the agricultural sector to adapt to climate risk and guarantee food security for a growing population, in a part of the world where water resources are becoming scarcer and soil quality is deteriorating. The ESCAPE project, involving researchers from eight French laboratories and ten African institutes, assessed the vulnerability of rural societies to climate change.

SIGNIFICANT RESPONSE AND ADAPTATION CAPACITY

The project showed that the drought that occurred in the 1980s has given way to a wetter climate, although still drier than in the 1950s and 1960s. As such, vegetation has recovered, heralding new opportunities for agriculture. However, the project also found evidence of new emerging risks, such as more violent rainfall events, floods and rising temperatures that threaten agriculture in the Sahel region at a time of heightened vulnerability fuelled by rampant population growth.

Rural societies are well aware of these changes and demonstrate a significant spontaneous capacity to respond and adapt, even though not all of the observed societal transformations are direct responses to these changes. The project then explored relevant adaptation options that were both scientifically robust and socially acceptable for stakeholders in the rural world. The results of the ESCAPE project give a better understanding of the complex interactions between humans and nature and provide a frame of reference for inclusion in forecasting and decision-making relating to climate risk management. The project also mobilised a multi-disciplinary community (social scientists, agronomists, ecologists, climatologists and soil scientists) and encompassed a wide array of research activities, while building on the outcomes of several previous projects.

CLIMATE CHANGE

GREENLAND'S CLIMATE UNDER THE MICROSCOPE

GREENLAND
GREEN GREENLAND

- **ANR PROGRAMME AND EDITION:**
  Environmental, planetary and social changes (CEP&S) 2010
- **ID:**
  ANR-10-CEPL-0008
- **PARTNERS:**

- Chrono-Environment Laboratory (CNRS University of Burgundy Franche-Comté)
- CNRS Physical Geography Laboratory
- Climate and Environmental Science Laboratory (CEA, CNRS, University of Versailles - Saint-Quentin-en-Yvelines)
- National Meteorological Research Centre (CNRS, Météo France)
- Glaciology and Environmental Geophysics Laboratory (CNRS - Joseph Fourrier University Grenoble)
- ERIN (University of Nîmes) Cultures Environments Arctic Representations Climate (University of Versailles - Saint-Quentin-en-Yvelines)

- **ANR GRANT:**
  €1,200 k
- **CONTACT:**
  Valérie Masson-Delmotte
  valerie.masson@cea.fr
- **WEBSITE:**
  www.cnrseditions.fr/sciences-de-la-terre/7339-le-groenland.html

The links between Greenland and global climate are often seen in the media. Pictures of melting coastal glaciers are used to illustrate the impact of climate change and the risks of rising sea levels. Climate sceptics, meanwhile, argue that Greenland was warmer at the time of the Viking settlements than today. The GREENLAND project sought to provide factual insights into this question, combining approaches from the human sciences and from climate and environmental sciences.

How do Greenland's farmers perceive climate change and adapt their activities? What impacts have mediaeval and modern agriculture had on the natural environment? What insights can we glean from the Earth's natural archives (lake sediments, ice cores, etc.) and from historical archives (logbooks)? Has climate change been uniform across Greenland? The GREENLAND project aimed to address these questions, drawing together 45 researchers from seven French laboratories and colleagues from different countries, representing a wide range of disciplines: environmental psychology, archaeology, analysis of lake sediments, glaciers and ice cores, analysis of historical documents, climate modelling, remote sensing of vegetation productivity and modelling of vegetation and livestock potential.

THE DECISIVE WEIGHT OF HUMAN INFLUENCE

The GREENLAND project gathered new data, providing important insights into climate change in Greenland. It also provided precise information about the environmental impact of agriculture in the mediaeval and modern eras. Over the last millennium, and still today, climate variability and atmospheric composition in Greenland have been dominated by large-scale processes linked to atmospheric circulation and the North Atlantic Oscillation.

However, the various analyses conducted during the project converged towards the conclusion that human activity has had a decisive impact on long-term warming trends. The project also showed that climate change is a reality for today's farmers in Greenland, who are feeling the collateral effects of rising temperatures – more frequent droughts and changes to biodiversity – and are deploying short-term adaptation strategies.

The findings have appeared in several publications, as well as in a collective work entitled *Groenland : climat, écologie et société* published by the CNRS. The research has paved the way for new, integrated research at the interface between the social sciences and humanities, climate and environmental sciences, and life sciences.

NANOSCIENCE, PHYSICAL CHEMISTRY

CLINT
CARBON NANOMATERIALS AND IONIC LIQUIDS: FROM FUNDAMENTALS TO APPLICATIONS IN SUSTAINABLE TECHNOLOGIES

- **ANR PROGRAMME AND EDITION:**
  Blanc international II – SIMI 10 – Nanoscience (Blanc International – SIMI10) 2012
- **ID:**
  ANR-12-IS10-0003
- **PARTNERS:**
  - IST Centro de Quimica Estrutural
  - ICCF Institute of Chemistry of Clermont-Ferrand
  - ITQB Instituto de Tecnologia Quimica e Bilogica
  - LC2P2 Laboratory of Chemistry, Catalysis, Polymers and Processes
- **ANR GRANT:**
  €260 k
- **CONTACT:**
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CLINT: ADVANCING OUR UNDERSTANDING OF THE INTERACTIONS BETWEEN IONIC LIQUIDS AND NANOMATERIALS

The main aim of the CLINT project was to advance our understanding of the interactions between ionic liquids and carbon nanomaterials, paving the way for new applications of these promising materials and solvents. The project combined the skills of two French teams and two Portuguese teamsspecialising in fluorinated carbon nanomaterials, ionic liquids, molecular simulation and physical chemistry.

It is essential to fully understand the molecular interactions and properties of liquid media to be able to use them in processes with nanomaterials. Liquid media can be used for exfoliation, to create suspensions or to enact chemical changes. Liquid electrolytes are equally important for capacitors and batteries. However, to be able to optimise the choice and design of liquid media, progress needs to be made in our knowledge of liquid and nano-object interfaces – an interdisciplinary field that combines the physical chemistry of liquids and the science of nanomaterials. The CLINT project therefore brought together four teams – two French and two Portuguese – specialising in highly complementary areas: fluorinated carbon nanomaterials, ionic liquids, molecular simulation and physical chemistry.

FOUR HIGHLY COMPLEMENTARY TEAMS

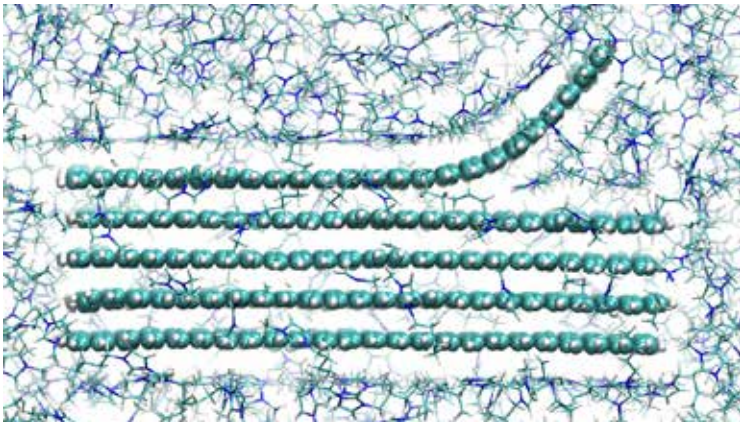
The research work combined complementary experimental and simulation methods. One of the innovative features of this project was the synthesis and characterisation of fluorinated carbon nanomaterials, with unique properties and interactions.

One major outcome of the work was the identification of the key factors in determining the right solvents for nanomaterial exfoliation and dispersion, paving the way for the design of processes to prepare these nanomaterials in large quantities. After studying different classes of liquids and nanomaterials, the CLINT project also revealed the importance of the shape of solvent molecules, showing in particular how planar molecules interleave better between layers during the exfoliation process. On the strength of this work, the coordinator was invited to spend a year as a visiting professor at MIT in 2014 to work on an international collaboration, and post-docs and PhD students also had a chance to visit MIT under the same partnership.

IONIC LIQUIDS

Ionic liquids are a recently identified class of fluids consisting entirely of ions, with adjustable properties, and with promising applications as both solvents and electrolytes.

Molecular simulations of graphene exfoliation in ionic solvents



INFORMATION TECHNOLOGY

AVOIDING RUN TIME ERRORS IN SAFETY-CRITICAL EMBEDDED SOFTWARE

STATIC ANALYSIS OF EMBEDDED ASYNCHRONOUS REAL-TIME SOFTWARE

- **ANR PROGRAMME AND EDITION:**
  Digital Engineering and Security (INS) 2011
- **ID:**
  ANR-11-INSE-0014
- **PARTNERS:**
  - Airbus Operations SAS
  - ENS (Ecole Normale Supérieure)
- **ANR GRANT:**
  €518 k
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  www.absint.com/astree/

Embedded software is increasingly widespread across a range of applications in aircraft, trains, devices and weapons systems. Given the potential economic and human cost of errors in these applications, it is essential to ensure that the software runs reliably. AstréeA – a joint project between a team from the École Normale Supérieure and Airbus – has developed solutions that are now in use in industry.

The reliability of safety-critical embedded software, such as the code found in the aeronautical, rail, automotive and medical industries, is of paramount importance as any error may have catastrophic economic or human consequences.

The cost of testing, the main validation method in use, is unfortunately becoming prohibitive when faced with the continually increasing complexity of embedded systems. Consequently tests generally cover only a small fraction of all possible runtime situations, and certain errors may never be identified during testing. The AstréeA project aimed to address this problem through static analysis using abstract interpretation to develop automatic verification tools for embedded software.

SOLUTIONS NOW USED IN INDUSTRY

AstréeA is based on previous work by the IT Laboratory at the École Normale Supérieure on the development of a static analyser for real-time embedded software. Known as Astrée, the solution is now marketed and used in industry.

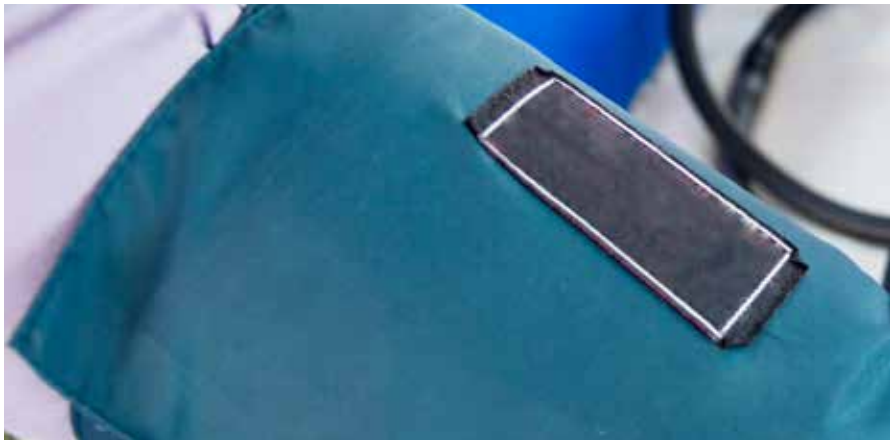
The AstréeA project, meanwhile, focused on run-time errors in asynchronous software, developing a prototype based on Astrée. The project team developed new abstractions of scheduling and memory models, not only making major improvements to the analyser's accuracy in large-scale avionics applications (fewer false alarms), but also extending the solution to larger classes of concurrent embedded software. The advances are testament to the possibilities for scientific and technical innovation and the ability to transform innovations developed in academic laboratories into technologies that can be deployed in industry. The AstréeA prototype analyser has been licensed to AbsInt and included in commercial versions of the Astrée solution since 2015. These versions of Astrée are used in production settings by Airbus and across the automotive industry.

HEALTH

TOWARDS NEW DRUGS TO TREAT HYPERTENSION

CLINAPAI
CLINICAL TRIAL PHASE IIA OF THE FIRST APA INHIBITOR (QGC001) AS CENTRAL ACTING ANTIHYPERTENSIVE AGENT AND DEVELOPMENT OF NEW "BEST IN CLASS" APA INHIBITORS

- **ANR PROGRAMME AND EDITION:**
  Biomedical Innovation in Public-Private Research Partnership (RPIB) 2013
- **ID:**
  ANR-13-RPIB-005
- **PARTNERS:**
  - Quantum Genomics SA
  - Central Neuropeptides and Regulations of Body Fluid Homeostasis and Cardiovascular Functions laboratory (INSERM U1050, Collège de France)
  - AP-HP, Hypertension Department and Clinical Investigation Centre, Georges Pompidou European Hospital
- **ANR GRANT:**
  €1,000 k
- **CONTACTS**
  Industrial: **fabrice.balavoine@quantum-genomics.com**
  Academic: **c.llorens-cortes@college-de-france.fr**
- **WEBSITE:**
  www.college-de-france.fr/site/en-cirb/llorens-cortes.htm



CLINAPAI, an extension of two previous projects backed by the ANR in 2005 and 2008, marks another step forward in the development a new drug to treat high blood pressure. Following promising results, the collaboration between the academic laboratory and its industry partner was strengthened in 2015 with the creation of a new, joint laboratory known as CARDIOBAPAI.

Hypertension (or high blood pressure) is a major cardiovascular risk factor and the leading cardiovascular cause of death worldwide. Despite the existence of many classes of blood pressure treatments, the condition is still difficult to control. In France, only 50% of patients with hypertension has a well-controlled blood pressure. Consequently, there is still a need to develop new classes of antihypertensive agents with different mechanisms of action. Against this backdrop, the CLINAPAI project aimed to prove the efficacy and safety of a new class of compounds, known as aminopeptidase A (APA) inhibitors, for use as centrally-acting anti-hypertensive treatments among patients with high blood pressure. The work drew on research conducted in the laboratories of Dr C Llorens-Cortès (INSERM U691/U1050, Collège de France) and Professor BP Roques (INSERM U640), including two projects previously funded by the ANR. A 2005 proof of concept study showed the efficacy of the first APA inhibitor (RB150/QGC001) in hypertensive animals. In 2008, the BAPAI project revealed the mechanism by which this substance acts in two experimental hypertension models and then enabled two phase I clinical trials to be conducted in humans.

The CLINAPAI project comprised three complementary components:

- An RB150/QGC001 efficacy and tolerance study in a phase IIa clinical trial among hypertensive patients;
- A study in hypertensive rats looking at the properties of another APA inhibitor (NI956/QGC006), more powerful and more selective than RB150/QGC001;
- Research into new APA inhibitors, potentially more effective than known best in class substances.

ANOTHER STEP TOWARDS THE DEVELOPMENT OF A "DRUG CANDIDATE"

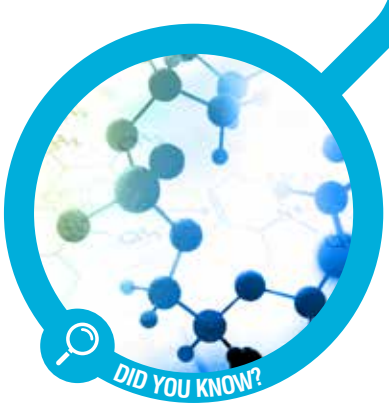
Very few academic research projects, aiming is to identify a new treatment target and develop a new molecule acting on this target result in phase II clinical trials for the treatment of high blood pressure. One of the outcomes of the CLINAPAI project was an exploratory phase IIa trial to assess the efficacy of the drug candidate RB150/QGC001 against a placebo. The trial involved a cohort of 34 patients with grade I or II hypertension and was led by Professor Michel Azizi (Georges-Pompidou European Hospital). The findings pave the way for further clinical development of the drug candidate for hypertension. The CARDIOBAPAI LabCom was set up in early 2015 under the leadership of Dr C Llorens-Cortes to continue the work supported by the ANR since 2005. The laboratory is a joint initiative of the INSERM Central Neuropeptides and Regulation of Body Fluid Homeostasis and Cardiovascular Functions laboratory (Centre for Interdisciplinary Research in Biology, Collège de France) and the company Quantum Genomics. It brings together a wide range of specialists to carry out cross-cutting research from molecule through to clinical trials.

Aminopeptidase A is an enzyme that causes angiotensin II to metabolise to angiotensin III in the brain, where it has a stimulating effect on blood pressure among hypertensive animals.

METROLOGY

CRYOMAS4DNP
CRYOGENIC MAGIC-ANGLE SPINNING DYNAMIC NUCLEAR POLARISATION ENHANCED-NMR AT HIGH MAGNETIC FIELD

- **ANR PROGRAMME AND EDITION:**
  Blanc - SIMI 8 - Solid-state chemistry, colloids, physical chemistry
- **ID:**
  ANR-12-BS08-0016
- **PARTNERS:**
  - Institute for Nanoscience and Cryogenics INAC-MEM and INAC-SBT (CEA, Grenoble Alpes University & CNRS)
  - Bruker Biospin
  - Institute for Nanoscience and Cryogenics, CNRS French National High Magnetic Field Laboratory
- **ANR GRANT:**
  €562 k
- **CONTACT:**
  Gaël De Paepe
  gael.depaepe@cea.fr
- **WEBSITE:**
  www.youtube.com/watch?v=VviniF4sFtg



NMR spectroscopy is one of the most powerful measurement methods available, capable of determining the structure of molecules at atomic level.

A STEP FORWARD IN NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

The aim of the CryoMAS4DNP project was to improve analysis methods using nuclear magnetic resonance spectroscopy to enable the study of increasingly complex systems. The project, bringing together experts from the Institute for Nanoscience and Cryogenics (CEA, Grenoble Alpes University & CNRS) and industry partner Bruker Biospin, led to the development of a new instrument and associated methodology. The findings have been widely published and patents have been registered.

Up to now, the main strategy for circumventing sensitivity problems in NMR (Nuclear Magnetic Resonance) spectroscopy has involved gradual increases in the magnetic fields used. However, this solution is technically limited and many studies, including large bio-molecules and systems of interest for nanoscience, catalysis, etc., still require significant increases in sensitivity. Complementary approaches based on nuclear hyper polarisation techniques represent an attractive alternative and are able to provide several orders of magnitude of increased sensitivity (2 to 5). In the case of solid-state NMR, microwave-induced DNP (Dynamic Nuclear Polarisation) performed with high-power microwave sources and combined with low temperature has recently emerged as an appropriate answer to the sensitivity limitation, even at high magnetic fields.

POSITIVE OUTCOMES FOR BASIC RESEARCH AND INDUSTRIAL EXPLOITATION

In its quest to enhance sensitivity by several orders of magnitude and substantially reduce the time required to take measurements, the CryoMAS4DNP project aimed to carry out a dynamic nuclear polarisation experiment within a strong magnetic field (10 Tesla), under high-resolution MAS (magic-angle spinning) conditions and at cryogenic temperatures (10-100 K) that had so far been inaccessible.

To achieve this aim, the project developed new instrumentation comprising a cryogenic system and an extremely low-temperature MAS-DNP probe, along with an associated methodology (pulse sequences, data interpretation, polarising agents, sample preparation protocol, etc.). The work has been widely published and several patents have been registered, and the research has been effectively exploited for both basic research and industrial applications. Work on the project is continuing through collaboration between the partners. The project outcomes have helped the coordinator to obtain ERC funding, have undoubtedly raised the profile of the academic partners and have enabled Bruker to cement its market-leading position in DNP.

PROJECT AT A GLANCE

MATERIALS, PROCESSES

TAPAS
THERMOPLASTIC PROCESS FOR AUTOMOTIVE COMPOSITE STRUCTURES

- **ANR PROGRAMME AND EDITION:**
  Materials and Processes for High-Performance Products 2011
- **ID:**
  ANR-2011-RMNP-020
- **PARTNERS:**
  - SOLVAY R&D (Rhodia Opérations)
  - Hutchinson, CDR
  - CNRT Caen (LOMC + CRISMAT)
  - Contacts and Structures Mechanics Laboratory (LaMCoS) (INSA Lyon)
  - Isojet Equipements
  - Laboratory of Thermo-Kinematics (LTN) (Polytech Nantes)
  - Techni-Modul Engineering
  - Research Institute of Civil Engineering and Mechanics (GeM) (ECN)
- **ANR GRANT:**
  €1,132 k
- **PROJECT COORDINATOR:**
  Gilles Orange
  gilles.orange@solvay.com
- **WEBSITE:**
  www.axelera.org/actualites/projet-tapas/

TAPAS OVERCOMES THE BARRIERS TO THE USE OF THERMOPLASTIC COMPOSITES TO MANUFACTURE COMPLEX GEOMETRY PARTS

The TAPAS project is aimed first and foremost at the automotive industry, exploring ways to manufacture thermoplastic composite parts that meet the cost and mass production demands of vehicle manufacturers.

Thermoplastic matrices are becoming the material of choice for continuous reinforced composite parts in the automotive industry, due to their smaller environmental footprint and their good behaviour under crash stress, making structures lighter and paving the way for less energy-hungry vehicles.

However, the inability to produce parts with complex geometries economically greatly limits the use of these materials for applications in medium to large production runs. A number of technological barriers (heat transfer, fibre impregnation and control of thermoplastic matrix re-crystallisation) still need to be overcome. The TAPAS project aims to address these challenges.

A FUNCTIONAL PART PRODUCED

Through close collaboration between industrial firms (corporations and SMEs) and renowned academics, the project successfully demonstrated the feasibility of a new way to manufacture parts directly from high-fluidity polymers – a technological breakthrough that offers an alternative to reactive and semi-reactive methods.

The project team then optimised the balance of materials (polymer/reinforcement) and analysed process parameters in the laboratory, using a multi-scale, multi-physics approach, from preforming and high-temperature impregnation (moulding, flowing) through to consolidation (crystallisation, removal). The innovation lies in the direct use of a liquid polymer, meaning that the process requires no chemistry whatsoever, right through to the production of the parts. A functional 3D part (suspension wishbone with perpendicular ball pins) was manufactured, providing a 25 to 50% weight saving (depending on the nature of the reinforcement) compared with current metal parts.

The new technology has instant economic benefits for the industry partners, enabling them to cement their position in their existing composite markets and look to move into mass-production markets. The work is continuing under the INCREASE project, backed by the Plastipolis, Axelera and Techtera clusters and funded by the Single Interministeral Fund (FUI), which aims to develop an automated thermoplastic matrix composite production unit.

PLANT BIOLOGY

HOW TRIPARTITE SYMBIOSIS EXPLAINS THE ORIGINS OF PHOTOSYNTHESIS

MÉNAGE À TROIS
METABOLIC SELECTION OF A TRIPARTITE SYMBIOSIS EXPLAINS THE ORIGIN OF PLANT LIFE ON EARTH

- **ANR PROGRAMME AND EDITION:**
  Blanc – SVSE 2 – Cell biology, development biology (Blanc SVSE 2) 2012
- **ID:**
  ANR- 12-BSV2-0009
- **PARTNERS:**
  - Pasteur Institute, Paris
  - UMR CNRS USTL 8576 Centre for Structural and Functional Glycobiology
- **ANR GRANT:**
  €338 k
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Chloroplasts are the structures in plant cells responsible for photosynthesis. We currently have an incomplete understanding of the precise origin of these structures, which are present throughout the plant kingdom. The "Ménage à trois" project has advanced our knowledge and revealed the role of an intracellular bacterium, Chlamydia, in the origins of chloroplast.

Chloroplasts are structures found inside plant cells. They are instrumental in the mechanism of photosynthesis, converting carbon dioxide into oxygen. The generally accepted theory is that the origin of chloroplasts lies in the incorporation of a cyanobacterium into a eukaryotic host cell. However, this theory does not explain how the cyanobacterium became a separate internal structure (a plastid) within plant cells, forming part of their metabolism and transmitted down the generations. Moreover, although bacteria are internalised in a eukaryotic host cell relatively frequently, it is not yet understood how all eukaryotes capable of photosynthesis descend from a single ancestor and, therefore, a single internalisation event.

THE ROLE OF INTRACELLULAR PARASITIC BACTERIA

This project, a joint initiative by teams from the University of Lille and the Pasteur Institute, marks the first time that researchers have proposed a detailed mechanism to explain the origins of chloroplast. The proposed theory suggests an interaction between three partners: the host eukaryote, the plastid's cyanobacterium ancestor and intracellular pathogens (Chlamydia bacteria). Under this mechanism, the cell that incorporated the plastid's cyanobacterium ancestor is supposed to have been infected by Chlamydia-type symbiotic pathogenic bacteria. The cell then synthesised a starchy reserve polysaccharide in its cytosol. The metabolism of this polysaccharide, involving three rather than two genomes, was behind the symbiotic link needed to kick-start photosynthesis.

The work has been published widely, including a paper in the journal Nature in 2016. The partners are continuing their work via the Expendo project, funded by the ANR under the "other-knowledge challenge" in the 2014 generic call.

ENERGY

A BETTER UNDERSTANDING OF LITHIUM-ION BATTERY DEGRADATION

ALIBABA
ANALYSIS AND MULTI-SCALE MODELLING OF LI-ION BATTERY DEGRADATION FOR BOTTOM-UP LIFETIME ASSESSMENT

- **ANR PROGRAMME AND EDITION:**
  Sustainable Electricity Production and Management (PROGELEC) 2011
- **ID:**
  ANR-11-PRGE-0002
- **PARTNERS:**
  - Institute Charles Gerhard Montpellier, CNRS
  - Reactivity and Solids Chemistry Laboratory, CNRS
- **ANR GRANT:**
  €488 k
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  modeling-electrochemistry.com/ms-liber-t/

Improving energy storage systems is vital to optimising the electricity production and usage cycle. The ALIBABA project focused on lithium-ion batteries and the processes that cause them to degrade. A non-profit piece of software – the first multi-scale "bottom-up" model – was instrumental to the research, allowing the team to study, understand and predict electrochemical reactivity at the interfaces inside this type of battery, and its effect on degradation.

Electricity management has become one of the major challenges of the 21st century, as part of efforts to reduce fossil fuel consumption, increase the share of renewables in the energy mix, and develop electric vehicles. Energy storage is a key link in the electricity production, management and usage chain.

With this in mind, the ALIBABA project sought to model the electrochemical and chemical phenomena occurring at the interfaces inside lithium-ion batteries. The project team, comprising French theoretical physicists and chemists alongside experimental researchers, had to model electrochemical phenomena at microscopic scale (calculation from scratch) to determine the most relevant macroscopic model to describe the electrochemical processes inside batteries in normal operating conditions. The resulting multi-scale physical and chemical model can now be used to study and predict the behaviour of various electrochemical systems in order to optimise their performance.

A NEW NON-PROFIT SOFTWARE PROGRAM

The model was implemented using an algorithm based on a set of interdependent modules, capable of predicting the influence of operating conditions (rated current, cell temperature) and electrode and electrolyte composition (solvent type, lithium salt concentration, active material type, etc.) on the static and dynamic response of lithium-ion batteries.

The non-profit software, known as MS LIBER-T, is the first multi-scale "bottom-up" model based on parameters that can be extracted directly from atomic calculations (at micrometric, nanometric and mesometric scales). The outcomes of the ALIBABA project pave the way for further modelling. Several new projects, funded at regional and European level, have been launched to carry on this work.

GENETICS, EVOLUTION

EXPLORING THE GENETIC MECHANISMS BEHIND THE EVOLUTION OF ANIMAL MORPHOLOGY

FLYSPOT
THE EVOLUTION OF MORPHOLOGICAL NOVELTY: FROM THE EMERGENCE OF A NEW REGULATORY FUNCTION TO GENE NETWORK REWIRING

- **ANR PROGRAMME AND EDITION:** Blanc – SVSE 2 – Cell biology, development biology (Blanc SVSE 2) 2011
- **ID:** ANR-11-BSV2-0009
- **PARTNER:** Developmental Biology Institute of Marseille
- **ANR GRANT:** €400 k
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- **WEBSITE:** **www.ibdm.univ-mrs.fr/fr/equipe/evolution-et-developpement-de-la-morphologie-et-du-comportement/**
- **WEB BOOK:** **latachededarwin.herokuapp.com**

Benjamin Prud'homme and his team are studying the genetic sequences responsible for the appearance of a pigment pattern on wings of male fruit flies in an effort to understand the genetic mechanisms behind the evolution of animal morphology. The work, including the Flyspot project, has led to a new model explaining how this pigment pattern appeared and its spatial diversification through the course of evolution.

The diversity of forms and behaviours in the animal world is a result of evolution, which arises from complementary forces. First, random gene mutations produce variations in morphology or cause new traits to appear. Second, environmental factors impose selective pressures that determine the survival of these variations. However, our current knowledge of the genetic mechanisms shaping the evolution of animal morphology is still very limited. The Flyspot project sought to advance our knowledge in this area by describing and characterising the genetic interactions responsible for the formation and evolution of a black pigment pattern found exclusively on the wings of male fruit flies.

A GENETIC MODEL TO EXPLAIN THE APPEARANCE AND EVOLUTION OF THE PIGMENT PATTERN

The pigment pattern plays a role in courtship display. The patterns have different forms and intensities across species, and some species have no patterns at all. The researchers aimed to understand how this pigment pattern emerged, over the course of evolution, through the formation of a gene network. The project used a number of different approaches (genetics, genomics, transgenesis) and studied various fruit fly species, resulting in a new genetic model explaining how this pigment pattern appeared and its spatial diversification through the course of evolution.

The project outcomes were published in the prestigious journal *Science* in 2013. The work is currently ongoing under a second project, funded by the European Research Council (ERC). The project team has also published a web book, entitled *La tâche de Darwin*, which provides an easy-to-understand overview of the questions that guided the Flyspot project, its methodology and its key findings.

ECOTOXICOLOGY, DRUGS

PHARM@ECOTOX
PHARMACEUTICAL RESIDUES AND ECOTOXICOLOGY IN SEAWATER

- **ANR PROGRAMME AND EDITION**
  Contaminants, Ecosystems, Health (CES) 2010
- **ID:**
  ANR-10-CESA-013
- **PARTNERS:**
  - CERMN, University of Caen
  - ISM-LPCT, University of Bordeaux
  - GMPc, University of Caen
  - BOREA, University of Caen
  - LIEC, University of Lorraine
- **ANR GRANT:**
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WHAT IMPACT DO DRUG RESIDUES HAVE ON AQUATIC ORGANISMS?

The ever-growing consumption of drugs and the release of residues into the environment raises the prospect of chronic contamination of habitats and the impact on ecosystems. The pharm@ecotox project focused on freshwater and saltwater aquatic organisms. The findings point to real environmental risks and call for better environmental risk assessment in drug-related regulations.

Steadily increasing drug consumption and the development of better environmental analysis methods have revealed the presence of drug residues in all aquatic compartments. Unlike conventional pollutants, these substances are mostly released continuously at low doses into the environment, leading to potential chronic contamination. The risk that these residues pose to the environment is still poorly understood. It is therefore vital to further our understanding in this area, for both environmental and economic reasons, since this contamination could have an impact on the fishing and shellfish industries. The aim of the pharm@ecotox project was to assess the impact of these substances on freshwater and saltwater organisms, using an integrated approach to link observed effects on organisms with environmental contamination measurements.

ADVANCING OUR UNDERSTANDING OF ENVIRONMENTAL CONTAMINATION AND TOXIC EFFECTS

The environmental analysis work was guided by computer-based screening of the most commonly consumed molecules and expert input from various contributors. In total, the project conducted research into more than 150 molecules. The data were then used to guide a toxicity analysis, testing the impact of around 50 molecules on freshwater and saltwater shellfish and algae using conventional ecotoxicity tests. The research revealed the molecules of most concern and their mode of action *(in silico* analysis).

A large number of molecules were identified as having a contaminating effect on the environment. Although these molecules were found to occur in low concentrations (a few ng/L), they are nevertheless significant. The project team also identified ten molecules that were present in all environments.

In terms of toxicity, the project's findings suggest that antifungal, antibiotic and antidepressant drugs have a particularly concerning impact. The researchers also found that exposure to psychotropic drugs has an effect on the immune, brain and development functions of organisms living in the environments studied. As well as demonstrating environmental problems, the project also raised questions around food quality and the social and medical acceptability of "uncontrolled" drug consumption (and drug residues). Moreover, the findings of the study suggest that drug regulations should include a requirement for a risk assessment to determine the impact of drug residues on aquatic organisms.

MATHEMATICS

GEODYM
GEOMETRY AND DYNAMICS OF MODULI SPACES

- **ANR PROGRAMME AND EDITION:**
  Blanc – SIMI 1 – Mathematics and Interactions (Blanc SIMI 1) 2011
- **ID:**
  ANR-11-BS01-0004
- **PARTNERS:**
  - Marseille Mathematics Institute, CNRS
  - Collège de France
  - Mathematics Research Institute of Rennes University of Rennes I
- **ANR GRANT:**
  €250 k
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Maxim Kontsevich with a square-tiled surface, one of the project's key subjects of study

BRINGING TOGETHER WORLD-RENOWNED EXPERTS IN GEOMETRY AND DYNAMICAL SYSTEMS

GeoDyM (Geometry and Dynamics of Moduli Spaces) was a mathematics project that focused on dynamical systems, located at the frontier between geometry, algebraic geometry, combinatorial topology and representation theory. It involved leading French experts from three centres of excellence. The cutting-edge research helped resolve a number of open problems that had long stumped mathematicians, with potential benefits in areas such as crystallography, statistical physics and information technology.

Certain classical problems in one-dimensional dynamics, polygonal billiards and surface foliations can be solved using recent knowledge about moduli spaces. Conversely, dynamical and geometric methods have produced results about moduli spaces that were difficult to obtain through algebraic geometry or complex analysis approaches. The GeoDyM project focused on a number of open problems in fundamental mathematics: square-tiled surfaces and Veech surfaces including their continuous fraction algorithms, geometric compatification of strata and the ergodic properties of infinite translation surfaces.

NEARLY 100 PUBLICATIONS

This ambitious project brought together three teams of world-leading experts in geometry and dynamical systems based in Rennes, Marseille and Paris. It gave rise to a series of sub-projects in collaboration with renowned international scientists. One of the project's key outcomes was to forge closer working ties through meetings and visits. Nearly 100 publications have stemmed from the work, including several articles in prestigious journals (such as Annals of Math. and Acta Math.). Several project members have also received some of the top prizes in mathematics for their work. Arthur Avila, a 15% project member, was awarded the Fields Medal in 2014 and Maxim Kontsevich, a 40% project member, received the 2015 Breakthrough Prize in Mathematics and the 2012 Shaw Prize.

LITERATURE

FLAUBERT AND THE POWER OF IMAGES

FLIM
FLAUBERT AND THE POWER OF IMAGES

- **ANR PROGRAMME AND EDITION:**
  Franco-German call in Social Sciences and Humanities – 2012
- **ID:**
  ANR-12-FRAL-0005
- **PARTNERS:**
  - Institute of Modern Texts and Manuscripts – Ecole Normale Supérieure, France
  - Ludwig-Maximilians-Universität München, Germany
- **ANR GRANT:**
  €178 k
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What role do images play in Flaubert's work? What is the relationship between the author, his writings and images? What iconographic sources inform his imagination and his writings? The FLIM project sought to answer these questions by comparing Flaubert's corpus with the actual iconographic materials the author integrated into his texts, and how he transformed these images into writing, marking a new exploration of the writer's works.

The FLIM project followed on from a previous project, Fractal, which looked at the influence of religion, myths and the ancient world in Flaubert's work. FLIM took a different tack, focusing on how images informed the writer and his work, together with his relationship with 19th century imagery, the iconographic sources of his imagination and writings (travel diaries, drafts, final texts) and new image technologies. The aim of the project was to define both the visual paradigm that dominates Flaubert's work and the new dialectical status that Flaubert establishes between text and image in terms of reciprocal tension and autonomy. The idea was to put Flaubert's work in the perspective of art history and visual techniques, taking into account the set of relations the writer built between his work, his iconographic references and his theoretical propositions about images.

COMPARING WRITINGS, MANUSCRIPTS AND ICONOGRAPHIC MATERIAL

The joint French and German team behind the project compared Flaubert's corpus (published works and manuscripts) with the iconographic materials the author integrated into his texts and transformed into writing. The researchers showed how Flaubert sought to combine the logic of images and the logic of writing, suggesting the radical irreducibility of text and image (hence the prohibition of illustrations), such that the image better embodies an energy that the text can then harness in its own way.

The project broadened the scope of research into images in Flaubert (mental images, visual devices, stylistic images). It also paved the way for the exploration of how Flaubert worked with images in his writings by the study of drafts and manuscripts and, more generally, the construction of a theoretical method of the relationships between writing and image. Finally, the project team created a Flaubert digital image library – an online database (1,000 images and 1,500 notices) that explores the link between text and image and can be transposed to other 19th century writers.

PROJECT AT A GLANCE

CELLULAR BIOLOGY

SSOTR
MECHANISM OF PROTEIN BIOSYNTHESIS IN PROKARYOTES AND EUKARYOTES STUDIED BY X-RAY ANALYSIS

- **ANR PROGRAMME AND EDITION:**
  Blanc – SVSE 8 – Biochemistry, molecular and structural biology – 2011
- **ID:**
  ANR-11-BSV8-0006
- **PARTNER:**
  European Centre for Biological and Medical Research (CERBM)
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X-ray crystallography is an experimental technique for determining the arrangement of atoms within crystals, in which a beam of X-rays strikes a crystal, causing the beam to be diffracted in different directions.

SOCIAL OR CULTURAL IMPACT

ADVANCING OUR KNOWLEDGE OF THE STRUCTURE OF THE RIBOSOME TO BETTER UNDERSTAND PROTEIN SYNTHESIS

The ribosome is a molecule involved in protein synthesis, a mechanism that is vital to cell function. The SSTOR project sought to advance our understanding of this process, pushing the boundaries of knowledge about the atomic-level structure of ribosomes. The findings have paved the way for the development of new treatments targeting infectious diseases, cancer and even developmental disorders.

The ribosome is a large, complex structure (more than 150,000 atoms), consisting of RNA and proteins. It is found in bacteria cells and in the cells of the most advanced organisms (eukaryotes). This vital structure is instrumental in the synthesis of proteins from the genetic code. Changes to this machinery, known as translation, are the cause of many human diseases. Better understanding the relationship between the ribosome's structure and function is therefore vital, and could open the door to the development of new treatments for infectious diseases (antibiotics and antiviral drugs), cancer and developmental disorders.

A NEW DECODING MODEL

The SSTOR project followed on from studies of the structure of bacterial ribosomes – research that won the Nobel Prize in Chemistry in 2009. The project aimed to further our understanding of the structure of the eukaryotic ribosome in its functional states (in the presence of functional ligands) using X-ray crystallography (see box).

The main challenges facing a project of this type are to isolate a large quantity of functional ribosomes and to obtain crystals suitable for X-ray crystallography. In some cases it can take months, or even years, to prepare each new type of crystal (for example, a ribosome with an inhibitor or a functional ligand).

Using the data obtained during the project, the researchers came up with a new decoding model that could explain why mis-sense errors occur in proteins during translation, and obtained a collection of inhibitors targeting eukaryotic and prokaryotic ribosomes. The findings were published in around 15 different papers, including articles in leading journals such as *Nature, Nature Structural & Molecular Biology and Nature Communications.* The project coordinator also launched a company, RiboStruct, to exploit the laboratory findings.

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TRANSLATION

TRANSREAD
ENRICHING BILINGUAL READING AND INTERACTION WITH CROSS-LINGUAL ALIGNMENTS

- **ANR PROGRAMME AND EDITION:**
  Digital Content and Interactions (CONTINT) 2012
- **ID:**
  ANR-12-CORD-0015
- **PARTNERS:**
  - Centre for IT and Communications Studies and Research, LIMSI-CNRS
  - Computer Science Laboratory for Mechanics and Engineering Sciences
  - Softissimo
- **ANR GRANT:**
  €594 k
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USING ALIGNMENT DATA TO DEVELOP MULTILINGUAL APPLICATIONS

The TransRead project aimed to cater to the growing demand for translation services among people with a partial knowledge of another language, spurred by the increasing number of interactions taking place between people and/or companies speaking different languages. The project involved the development of a prototype bilingual reader and associated annotated multilingual corpuses.

Owing to the globalisation of communication and the advent of the internet, a growing number of interactions take place between individuals and/or companies speaking different languages, both virtually and in real life. This leads to growing demand for translation services, accompanied by unprecedented growth and astonishing progress in machine translation, making it one of the key technologies of an increasingly multilingual internet.

In this context, the objective of TransRead was to study new multilingual text processing applications aimed at making it easier for readers with intermediate knowledge of a foreign language to read multilingual documents. Contrarily to black-box approaches, which target monolingual users, TransRead is primarily concerned with viewing bilingual texts and their cross-lingual links. Applications that harness new mobile technologies (such as touch-screen tablets and e-readers) may be of interest to numerous different audiences, including foreign language learners, people working in international settings, residents of multilingual countries or, a more industrial environment, translators and people working in literary, technical, legal or commercial publishing.

A PATENTED PROTOTYPE BILINGUAL READER

By analogy with subtitling, one of the aims of TransRead was to explore possible ways in which books could be subtitled. The project also looked at how the use of cross-lingual alignments at phrase and word group level and at dictionary entry level could make it easier for people to read works in the original version and enrich the experience. The research work resulted in the specification, production and testing of an initial prototype of a bilingual reader. The research team used the prototype, produced in parallel with associated annotated corpuses, to assess the device's utility and ergonomics. The prototype also paves the way for the development of new devices, particularly for language learners.

ARCHITECTURE, ENGINEERING

REPARH (RECONSTRUCTION TO DEFEND AGAINST NATURAL DISASTERS IN HAITI) (EARTHQUAKES/ HURRICANES)

- **ANR PROGRAMME AND EDITION:**
  Flash Haiti - 2010
- **ID:**
  ANR-10-HAIT-0003
- **PARTNERS:**
  - Grenoble School of Architecture (ENSAG), AE&CC research unit
  - Joseph Fourier University (Grenoble Alpes University), 3SR laboratory
  - Support Group for Rural Development (GADRU)
  - Other partners: EPPMPH, ENH-PRESTEN, Concert-Action, Iratam, VEDEK, PAPDA and PADED NGO platforms, Planète Urgence, Atelier Jacmel, Entrepreneurs du Monde, Misereor, FAP, SC-CF, UN-Habitat, IFRC, IVALSA and FCBA.
- **ANR GRANT:**
  €569,434 of a total budget of around €1.8 million
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REBUILDING HAITI AFTER THE EARTHQUAKE

In the wake of the January 2010 earthquake that struck Haiti, post-disaster analysis has shown that traditional buildings fared considerably better than more modern concrete buildings. The REparH project conducted field assessments and literature reviews to develop long-term technical and architectural solutions in tandem with local partners and with appropriate scientific support.

The REparH project was developed following the dramatic earthquake that occurred in Haiti on 12 January 2010. Disaster assessment showed that the traditional timber-framed houses – a construction method abandoned since the mid-20th century – were much more resistant to the earthquake than more modern concrete homes built with construction methods that are expanding across the country. With concrete now the material of choice in urban areas, the impact of the earthquake was aggravated because of poor construction standards, with many people preferring concrete buildings as a social status symbol without having the necessary knowledge, technical skills or high-quality materials.

The REparH project sought to address this issue by combining a cross-disciplinary scientific approach with realities and projects on the ground. It developed a high-quality project methodology and architectural responses based on socially acceptable and scientifically robust building solutions, promoting new construction cultures that took account of established local practices. Based on a field analysis and a review of the available literature, the project team developed long-term technical, economic, social and architectural solutions in tandem with local project partners.

DISASTER-RESISTANT HOMES AND MORE

The braced timber-frame construction system, which was improved under the project, was approved by Haiti's Ministry for Public Works, Transport and Communication, which oversaw the reconstruction work. The REparH project thus helped make buildings less vulnerable to major risks (earthquakes and hurricanes) and improve community resilience. It also contributed to the creation of a professional sector, with a federation of trained tradespeople at its core.

More than 2,000 families have benefited directly from the research, finding a new home or having their existing home repaired. As of the end of 2015, more than 2,000 other families have benefited indirectly from the training delivered to site managers and professionals and the dissemination of construction system specifications. The work was ongoing at the end of 2016, with several thousand more homes being built.

The first schools have been built using the same construction principles, and the method is now being deployed by other local and international organisations such as UN-Habitat, IFRC and IOM.

The newly constructed buildings successfully weathered Hurricane Matthew in 2016, and the "Local Construction Cultures" methodology developed during the project is now being taken up by the national authorities, as well as major institutions and organisations involved in risk prevention and management. Finally, the project resulted in two PhD theses (in architecture and engineering), several articles, an exhibition and a publication outlining the findings.

RESEARCH FUNDING IN EMERGENCIES

The REparH project was funded via the Flash Haiti call, set up to address urgent needs in the wake of the Haiti earthquake in 2010. After a fast-track evaluation process, eight projects were launched within four months of selection. The projects received total funding of €3.4 m, and were designed to learn lessons from the disaster through scientific analysis and data acquisition in an exceptional and rarely studied post-crisis context.

SECOND WORLD WAR

CINESOV
CINEMA IN THE SOVIET UNION AT WAR, 1939-1949

- **ANR PROGRAMME AND EDITION:**
  Blanc – SHS 3 – Cultures, arts, civilisations 2012
- **ID:**
  ANR-12-BSH3-0008
- **PARTNERS:**
  - Arts, Civilisation and History of Europe (ARCHE)
  - Intermediality and Performing Arts Department (ARIAS)
  - Franco-Russian Research Centre, Moscow
- **ANR GRANT:**
  €235 k
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Film screening with sound, organised for soldiers on the Southern Front in 1942.
© RGAKFD

CINEMA AS A POLITICAL, SOCIAL, INDUSTRIAL AND COMMERCIAL OBJECT

The CINESOV project aimed to explore Soviet cinema policy and its economic and social implications in the Soviet Union at war between 1939 and 1949. The project drew on images, rushes and paper sources to show how the Soviet Union had its own, unique cinematic take on the Holocaust. The findings were exhibited at the Shoah Memorial between January and November 2015.

Much has been written about the role of cinema as a propaganda tool in the Second World War, and later as the primary medium for shaping the narrative of conflict. Yet our country-by-country knowledge remains patchy. The film industries in Hollywood, the UK, France, Germany and Italy have already been the subject of research, looking at their business model, output and how their films have been distributed and received. But research into the industry in the Soviet Union is still piecemeal by comparison. The CINESOV project therefore aimed to explore Soviet cinema policy and its economic and social implications in the Soviet Union at war between 1939 and 1949. After conducting an inventory of fiction and documentary films from the Second World War and the immediate aftermath, the researchers looked at how themes and genres were reshaped during the conflict, production methods (evacuation of major studios in central Asia, occupation of others, then re-establishment of Soviet dominance post-liberation), the seizure of films and equipment in Berlin in 1945 and the effects on facilities in the post-war period. The project team also analysed how cinema was used as a propaganda tool, both within the Soviet Union and around the world.

WIDE-RANGING COMMUNICATION AND SEVERAL FOLLOW-ON PROJECTS

One of the strengths of the project lay in the use of a specific approach to the history of cinema that had never before been applied in a Soviet context. The methodology involved considering fiction and non-fiction works and rushes from the archives on the same level, analysing cinema as a political, social, industrial and commercial object through both images and paper sources. The project proposed a new approach to the history of the Holocaust in the east, showing how the Holocaust was treated in a unique way in Soviet cinema and revealing the social exclusion and heroisation strategies that were used during this period.

One of the key project outcomes was an exhibition entitled *Filmer la guerre : les Soviétiques face à la Shoah* (Filming the War: the Soviets and the Holocaust), staged at the Shoah Memorial between January and September 2015 to mark the 70th anniversary of the discovery of the death camps. A catalogue was also produced for the occasion, disseminating the project's findings to the public. The results were also published in the proceedings of an international conference on Soviet film in 1939-1949, allowing the project to reach out to Russian-speaking readers, with a programme, conference and journal edition taking a different look at Soviet war propaganda in film. The project gave rise to two PhD theses, as well as to three follow-on research projects – *"Images of Justice: Nazis and collaborators on trial in liberated Europe"* (funded by the CAP Labex); *"War crime trials in the Soviet Union, 1943-1991: the challenges of selective media coverage"* (a joint French and Russian project, FMSH/RGNF); and *"Nazi war crimes in the courtroom – central and eastern Europe 1943-1991. Between condemnation of violence and drive to national reconciliation"* (a JCJC project funded by the ANR).

IT SECURITY

MBT_SEC
MODEL-BASED TESTING FOR SECURITY COMPONENTS

- **ANR PROGRAMME AND EDITION:**
  Specific support for research and innovation for defence: Maturation and Development (ASTRID-Maturation) 2013 edition

Fully funded by the Direction Générale de l'Armement

- **ID:**
  ANR-13-ASMA-0003
- **PARTNERS:**
  - FEMTO-ST Institute (Franche-Comté Electronics, Mechanics, Thermal and Optics – Science and Technology) – UMR 6174
  - SMT Smartesting Solutions & Services
- **ANR GRANT:**
  €451 k
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GENERATING TESTS AUTOMATICALLY FOR SECURITY COMPONENTS

Security components play a vital role across many applications, from authentication and cryptography to bank transactions and access control systems. It is therefore essential to keep these components running reliably and protect them from potential attack. The MBT – Sec project aimed to develop automated test methodsfor these components.

Security components are a strategic issue for computer system security of computer systems, in both defence applications (e.g. encryption and authentication) and civilian applications (e.g. smart cards and access control systems). Security testing of these components aims to ensure that clearly defined security properties, such as confidentiality or integrity, are correctly implemented inside the component. It is also important to test for potential vulnerabilities when the component faces attacks or malicious behaviours.

The MBT_Sec project, which was fully funded by the French defence procurement agency (DGA), aimed to develop an environment that would automatically generate tests for security components fully funded by the Direction Générale de l'Armement military procurement agency. Its goal was to increase the technological maturity of the results obtained during the ASTRID OSeP project.

NEW SOFTWARE SOLUTIONS

The project addressed three technological obstacles: scaling up the automated test generation algorithms; adapting the behavioural modelling language to the specific target of security components; and controlling the test generation with patterns formalising the security properties to test.

The project teamed up with an SME and a higher education and research institution to tackle these questions. Through experimental work (some carried out in real conditions), the researchers proposed highly competitive software solutions for two classes of client: defence (cryptography) and civilian (electronic transactions). The project findings opened new avenues for further research and innovation in IT security, particularly in the areas of robustness and vulnerability. The project also helped establish stable industrial research activity in France in high-potential fields (such as the banking sector).

PROJECT AT A GLANCE

LINGUISTICS

DO LANGUAGES AND GENES CORRELATE? A CASE STUDY IN NORTH-WESTERN CHINA.

- **ANR PROGRAMME AND EDITION: :**
  Blanc - SHS2 - Human development and cognition, language and communication - 2012
- **ID:**
  ANR-12-BSH2-0004
- **PARTNER:**
  East Asia Linguistics Centre – EHESS
- **ANR GRANT:**
  €200 k
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  www.inalco.fr/equipe-recherche/centre-recherches-linguistiques-asie-orientale

SOCIAL OR CULTURAL IMPACT

COMBINING LINGUISTICS AND GENETICS TO BETTER UNDERSTAND THE EVOLUTION OF LANGUAGES

The LANGECO project partners took a unique approach in an effort to advance our understanding of languages in the border region between the Chinese provinces of Gansu and Qinghai, comparing research findings in linguistics and genetics. The work provided a clear insight into the evolution of the Dongxiang (Santa) language and identified a little-known language, Xuejiawan.

Linguistic data is often hard to interpret without further information from other areas of research. Breakthroughs in linguistic research require a new approach. The LANGECO project therefore attempted to break the barrier between human sciences and natural sciences to reconsider language diversity on the basis of current research results in linguistics and genetics.

The project focused specifically on the border region between Gansu and Qinghai provinces in China. Located along a section of the Silk Road, this linguistic area is extremely complex: it is inhabited by different ethnic groups speaking several languages from different language families, all of which have had a remarkable influence on the Chinese language.

A BETTER UNDERSTANDING OF DONGXIANG AND THE DISCOVERY OF A LITTLE-KNOWN LANGUAGE

The project team examined the correlation or non-correlation between languages and genes across several population groups in the region. Their work provided a clear picture of the history of human migration between central and eastern Asia, along with insights into both divergence (languages from the same origin) and convergence (different languages in a linguistic area). The findings, which span linguistics, history and biology (genetics), show that Dongxiang is a new language belonging to the Mongol family, whose original lexicon has been replaced. The team also studied Xuejiawan – a previously unknown (non-Chinese) language.

The findings have appeared in around 30 international publications in Chinese and English. The project team is still working on the research, expanding the scope of their study and teaming up with China's Ministry of Education in 2016. Four books relating to the project have been published or are pending publication.

Wang family mosque in Tangwang / photo credit Dan Xu-Song

PHYSICS

ENS-ICFP
INTERNATIONAL CENTRE FOR FUNDAMENTAL PHYSICS AND ITS INTERFACES

- **PROGRAMME:**
  Laboratories of Excellence
- **ID:**
  ANR-10-LABX-0010
- **PARTNERS:**
  - Paris Sciences Lettres – Quartier Latin (coordinating institution)
  - Ecole Normale Supérieure, Paris
  - Collège de France
  - Paris Observatory
  - CNRS Paris B
  - Pierre and Marie Curie University
- **START DATE, PROJECT DURATION:**
  13/04/2011, 104 months
- **PIA GRANT:**
  €7.8 M
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LABORATORIES OF EXCELLENCE

Launched in 2010, the Laboratories of Excellence (Labex) programme aims to provide internationally recognised laboratories with the means to compete with their foreign counterparts on an equal footing.

- **€1.5 bn in total funding over 10 years**
- **171 supported projects**
- **Funding of €2-20 M per project**

ATTRACTING THE WORLD'S TOP STUDENTS AND YOUNG SCIENTISTS

The ENS-ICFP Labex (International Centre for Fundamental Physics) received funding under the Laboratories of Excellence component of the first Investments for the Future programme. It aims to make the École Normale Supérieure's physics department more attractive by expanding its recruitment pool through two key levers: a master's programme and a chair system.

The main aim of the ENS-ICFP Labex is to boost the international appeal of the ENS physics department by deploying two major tools. On the teaching side, the ICFP master's programme selects students from across the globe and delivers teaching in English through its partner institutions. The integrated, diverse programme of theoretical and experimental fundamental physics covers a broad spectrum of subjects including particle physics, statistical physics, atomic physics, condensed matter physics, astrophysics and biological physics. The Labex awards six scholarships each year. On the research front, the Junior Research Chair programme recruits talented young scientists (theoretical or experimental) for three or four years, giving them an opportunity to carry out cross-cutting research projects across the physics department's five laboratories.

COMPETING WITH THE BEST UNIVERSITIES IN THE ENGLISH-SPEAKING WORLD

For 2012-2015, 53% of the Labex budget was allocated to recruiting 11 junior researchers (around €350 k per project). Four years on from its inception, the Labex has produced 46 publications, including 30 in 2016 alone, and has secured 11 ERC grants.

Its members have landed numerous prizes and awards including, for 2015-2016, two CNRS bronze medals, one Boltzmann Medal, one member elected to the Collège de France, one IEEE Honorary Membership, one Grand-Croix de la Légion d'Honneur and various prizes for the department's researchers and PhD students. The Labex continues to grow as it seeks to stay competitive with the best universities in the English-speaking world.

Its appeal is evident, with a four-fold rise in master's programme applications, especially among applicants from abroad.

TRANSPLANTS: A DEDICATED CENTRE FUNDED BY THE UNIVERSITY HOSPITAL INSTITUTES PROGRAMME

Sustaining progress in transplantation techniques requires a better understanding of immune response and tolerance mechanisms in transplant recipients. Since 2012, the European Centre for Transplantation and Immunotherapy Sciences (CESTI) has received funding as a "promising project" under the University Hospital Institutes element of the first Investments for the Future Programme. Four years on, the project is already delivering results.

The field of transplantation has seen remarkable progress in recent years, with major improvements in transplanted organ survival rates and transplants being offered to treat new pathologies, and in ever older patients. New cell and gene transplant therapies are also emerging, marking the beginning of a new chapter in the history of medicine. However, these strategies all face the same obstacle: the recipient's immune system. It is therefore vital to further our understanding of immune system responses to fine-tune these techniques.

A UNIFYING STRUCTURE

This question lies at the heart of CESTI's work. The centre's research focuses on better understanding the immune response and promoting transplant tolerance. The work is led by Nantes University Hospital and coordinated by Professor Gilles Blancho, a nephrologist at the hospital and head of the Institute of Transplantation, Urology and Nephrology. This unifying project involves more than 400 doctors, researchers and employees from across the hospital's clinical departments, six Inserm/INRA joint research units hosted at the hospital and at Oniris, five clinical research platforms at the hospital and a research team from Rennes University Hospital. CESTI's work focuses on key medical challenges, offering novel therapeutic approaches to a wide range of pathologies including kidney failure, type 1 diabetes, skin conditions and burns, cell transplants, retinal conditions, muscular disorders, genetic disorders and chronic respiratory failure.

PROMISING RESULTS

Four years on from its inception, the project has already delivered scientific and medical results and has significantly broadened its appeal. CESTI scientists have produced around 300 papers, including several articles in high-impact journals. The research work has given rise to 20 patents, and four start-ups have been created to exploit the results. Two clinical trials were launched in 2015 – both world firsts in the area of transplantation. CESTI has also boosted its appeal through its work, having recruited an associate professor from the University of California to develop a new line of research in precision medicine. Moreover, the centre has landed major co-funding grants – around €10 m since the project was launched – alongside €5 m from the Investments for the Future programme. The co-funded grants have come from local authorities (€2.5 m each from Nantes Métropole and the Pays de la Loire Region), associations (FRM, AFM, etc.) and funding bodies in France (EFS, ANR) and Europe. Another marker of the project's achievements is the recent success of the "NEXT" ISITE submission on engineering and health, with CESTI at its centre.

PROJECT AT A GLANCE

MEDICINE, IMMUNOLOGY

IHUB CESTI
EUROPEAN CENTRE FOR TRANSPLANTATION AND IMMUNOTHERAPY SCIENCES

- **PROGRAMME:** University hospital institutes (IHU)
- **ID:** ANR-10-IBHU-0005
- **PARTNERS:**
  - Nantes University Hospital (coordinating institution)
  - Rennes University Hospital
  - University of Nantes
  - Nantes Atlantic College of Veterinary Medicine, Food Science and Engineering (ONIRIS)
- **START DATE, PROJECT DURATION:** 01/07/2012 – 72 months
- **PIA GRANT:** €5 M
- **CONTACT:** Gilles Blancho **gilles.blancho@chu-nantes.fr**
- **WEBSITE:** **www.cesti.univ-nantes.fr/index.php/fr**

UNIVERSITY HOSPITAL INSTITUTES

Launched in 2010, the University Hospital Institutes (IHU) programme aims to support centres of excellence in research, care, training and technology transfer in the health field.

- **6 IHU projects**
- **€349 M in total funding over 10 years**
- **Funding of €47-65 M per project**
- **6 promising projects (including CESTI)**
- **Funding of €4-8 M per project**
- **€35 M over 5 years**

HUMANITIES, SOCIAL SCIENCES

LABEX
BORDEAUX ARCHAEOLOGICAL SCIENCES (LASCARBX)

- **PROGRAMME:**
  Laboratories of Excellence
- **ID:**
  ANR-10-LABX-0052
- **PARTNERS:**
  - University of Bordeaux (coordinating institution)
  - Bordeaux Montaigne University
  - CNRS
  - French Ministry of Culture and Communication
- **START DATE, PROJECT DURATION:**
  13/04/2011, 104 months
- **PIA GRANT:**
  €7.8 M
- **CONTACT:**
  Valérie Fromentin
  Valerie.Fromentin@u-bordeaux-montaigne.fr
- **WEBSITE:**
  lascarbx.labex.u-bordeaux.fr

TURNING BORDEAUX IN A WORLD-LEADING CENTRE OF EXCELLENCE IN ARCHAEOLOGY

The Archaeological Sciences Labex in Bordeaux, supported under the Laboratories of Excellence element of the first Investments for the Future programme, combines the knowledge and expertise of three local research laboratories. Five years after its launch, the University of Bordeaux was recently placed no.1 in France and no.16 worldwide for archaeology in an international ranking.

The Archaeological Sciences Labex in Bordeaux is an interdisciplinary research programme that draws on complementary expertise from three local archaeology research laboratories. The Labex works on archaeology in its broadest sense, encompassing historical sciences, materials science, life sciences, earth sciences and digital humanities.

The only cluster of excellence of its type in Europe, the Labex combines research, teaching and economic, societal and heritage exploitation. The chosen theme – "How ancient societies used the world: processes and forms of long-term spatial appropriation" – looks at space in all its facets (environment, settlement, territory), over a long chronological scale (from prehistory to the late Middle Ages) and across all the diversity of its interactions with man.

A FRUITFUL PARTNERSHIP BETWEEN THREE LABORATORIES

Five years since the project was launched, the University of Bordeaux was recently placed no.1 in France and no.16 worldwide for archaeology in the QS Ranking by Subject – a global subject-specific university ranking produced by British think-tank Quacquarelli Symonds.

This success is down to the partnership between three research laboratories, which have pooled their strengths, broken down barriers between disciplines and adopted international standards, boosting the number and reach of their publications and attracting young researchers from around the world in the process. The Labex has so far given rise to 183 publications since its inception, including 97 in 2016 alone.

Its scientists have also been awarded various prizes and distinctions, including two appointments as senior members of the Institut Universitaire de France, one silver medal and two bronze medals from CNRS, one researcher appointed as foreign correspondent of the Académie des Inscriptions et Belles-Lettres, one Plottel Prize from the Académie des Inscriptions et Belles-Lettres, one scientist made Chevalier of the Légion d'Honneur, one title of officer of the Ordre des Palmes Académiques, and one Chevalier of the Ordre des Arts et Lettres. Two of the Labex's researchers are among the world's top 3,000 most cited scientists across all disciplines – the only French researchers included in the list for social sciences and humanities.

Painted cave (the Chauvet cave in Ardèche). Photo credit P Guibert, IRAMAT-CRP2A

MATERIALS

THE M2P IRT DEVELOPS A NEW SURFACE TREATMENT PROCESS FOR LIGHT ALLOYS

MATERIALS, METALLURGY AND PROCESSES IRT, MICRO-ARC OXIDATION (MAO), PROJECT

- **PROGRAMME:** Technological Research Institutes
- **ID:** 10-AIRT-0004
- **PARTNERS:**
  - Materials, Metallurgy and Processes IRT (coordinating institution)
  - Industry partners: Safran, DCNS, GIT, SLCT, CM2T, Alliage
  - Academic partners: IJL (UL), LaBPS (ENIM), UTINAM (UFC), IS2M (UHA)
- **START DATE, PROJECT DURATION:** 17/06/2013, 53 months
- **PIA GRANT:** €1.8 M
- **CONTACT:** Joffrey Tardelli **Joffrey.tardelli@irt-m2p.fr**
- **WEBSITE:** **www.irt-m2p.eu**

The M2P Technological Research Institute (IRT), which conducts research into materials and processes, has developed a new process to apply ultra-hard ceramic coatings to light alloy parts. This innovative process, originating under the MAO project, was exploited straight away through the IRT's pilot platform, which is used by a range of industry partners.

The Micro-Arc Oxidation (MAO) project developed an innovative process to apply coatings to light alloy parts designed for exacting applications such as titanium fins in aircraft engines. The process involves applying an ultra-hard ceramic coating to the surface of the parts to improve resistance to wear, friction and corrosion. The coating is particularly beneficial on relatively soft metals such as aluminium. The M2P IRT and its partners built on previous work by the Institut Jean Lamour on plasma electrolysis and technology of Russian origin known as plasma electrolytic oxidation, defining new pulse-current generator architectures. The generators, designed and assembled in France, are used to generate electric micro-arcs that produce the ceramic coating on the surface of metal parts.

AN INNOVATIVE PROCESS EXPLOITED THROUGH A PILOT PLATFORM

One of the stand-out features of the project was the model partnership with industrial firms (Safran, GIT, DCNS, SLCT, Alliage, etc.), which led to the development of an innovative metal surface preparation process and patents covering the chemical composition of new electrolytes – a remarkable leap forward in technology in the space of just two years. The research outcomes were immediately exploited via a pilot platform, the cornerstone of the IRT's technology transfer policy for surface treatment innovations.

The M2P IRT's platform, encompassing this niche technology alongside other innovations, has become the go-to destination for innovation in the field – a fact reflected in the sheer number of industry partners (corporations, SMEs and SMIs) already using the platform.

TECHNOLOGICAL RESEARCH INSTITUTES

The Technological Research Institutes (IRT) are thematic, market-oriented and interdisciplinary entities funded under the first phase of the Investments for the Future programme. Their role is to develop highly competitive technology and business sectors. Through joint work between academics and industry partners, the IRTs work on innovation in fields of strategic importance for France. Each IRT draws together high-level experts, as well as cutting-edge equipment and technology platforms, taking applied research projects through to demonstration and industrial prototyping, and identifying ways to exploit their results commercially. They help raise the profile of French innovation on the international stage.

- **€2 bn in total funding over 10 years**
- **8 projects supported**
- **Funding of €50-180 M per IRT**

HEALTH

IBFC
IMPLANTABLE BIOFUEL CELLS

- **PROGRAMME:**
  Nanobiotechnology
- **ID:**
  10-NANB-0003
- **PARTNERS:**
  - Grenoble Alpes University (coordinating institution)
  - CEA
  - INP Grenoble
  - SORIN
- **START DATE, PROJECT DURATION:**
  01/04/2012, 48 months
- **PIA GRANT:**
  €2.2 M
- **CONTACT:**
  Donald Martin
  don.martin@imag.fr
- **WEBSITE:**
  www.ibfc.fr

NANOBIOTECHNOLOGY

Launched in 2010, the Nanobiotechnology programme aimed to make a significant contribution to health through nanomedicine research, and to environmental science through work on nanoecotoxicology. The call for proposals invited applications for technology research that complemented existing ANR research support programmes. The supported projects have led to working proofs of concept that could subsequently be produced on an industrial scale, as well as generating new knowledge and intellectual property.

- **€18,8 bn in total funding over 5 years**
- **8 supported projects**
- **Funding of €0.7 M - €7.3 M per project**

TOWARDS BIO-POWERED MEDICAL DEVICES

The aim of the IBFC project was to advance the technology of biofuel cells, which could help make implantable medical devices safer and longer-lasting. The project, funded under the Nanobiotechnology element of the first Investments for the Future programme, resulted in the development of an autonomous wireless pacemaker that has been successfully tested in animals.

Doctors and health specialists are harnessing developments in biomedical devices, making increasing use of implantable devices to treat conditions ranging from birth defects through to organ failure. Battery-powered implantable devices such as pacemakers have been around for half a century.
The emergence of lithium batteries in the late 1960s made it possible to develop smaller, more reliable devices with a longer life. However, these batteries pose a series of problems and various researchers have looked at ways to develop alternative energy sources that are safer, more reliable and able to operate independently for extended periods without the need for recharging or an external power supply. One of the most promising avenues is the use of biofuel cells, which run off energy from the human body. The aim of the IBFC project was to optimise the performance of these cells using nanobiotechnologies.

SUCCESSFUL ANIMAL TESTS

The four-year project, which ended in late March 2016, involved four partners with highly complementary expertise: the University of Grenoble, Grenoble Institute of Technology (INP), the CEA and private-sector firm Sorin. The researchers successfully combined a fully autonomous biofuel cell with a prototype pacemaker developed by the firm. The wireless, standalone device was successfully tested in small animals over a period of several months. The project's findings are of interest for all implantable devices.

Consortium members Philippe Cinquin, Serge Cosnier, Chantal Gondran and Fabien Giroud reached the final of the 2014 European Inventor Award for their work on an implantable biofuel cell that runs on glucose. The project has also given rise to eight patents and a start-up led by partner laboratory TIMC-IMAG, with support from a maturation fund from Grenoble-based technology transfer acceleration company (SATT) Linksium. The work is currently ongoing, notably as part of the ANR BioWATTS project.

As well as pacemakers – the best-known implantable devices – there are also implantable hearing aids, neurostimulators and drug pumps.

3 UR STRUCTURE

The ANR celebrated its 10th anniversary in 2016 and signed its first contract of objectives and performance to mark the occasion, symbolisingthe beginning of a new chapter in its history. The contract, between the agency and the French government, sets out a number of strategic and operational principles that will guide the ANR's development and help it improve going forward.

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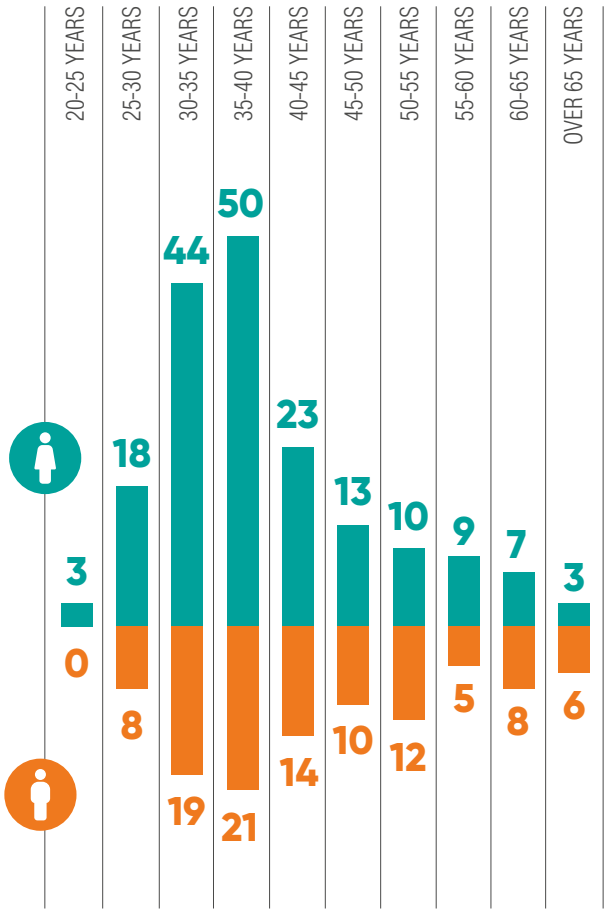
MAINTAINING A STABLE WORKFORCE AND SUPPORTING ORGANISATIONAL CHANGE

The ANR's organisation and role have evolved over the ten years of its existence, and this has required adaptations to its human resources policy. Every effort has been made to provide an attractive place to work, with a view to managing these changes in the best way possible. Every effort has been made to provide an attractive place to work, with a view to managing these changes in the best way possible.

In 2016 the ANR continued its efforts, begun in 2013, to stabilise workforce numbers. At the end of 2016, the rate of fixed-term contracts remained steady at around 23% (compared with 58% at the end of 2012, i.e. a drop of more than 50%). The agency's ambition is to harness existing knowledge, harmonise practices and, ultimately, drive performance.



Two-thirds of the agency's staff are women (65%, compared with 35% men), and the average age is 41.3 years. 61% of its staff work in scientific and finance roles, 28% in support roles, and 11% in managerial positions.

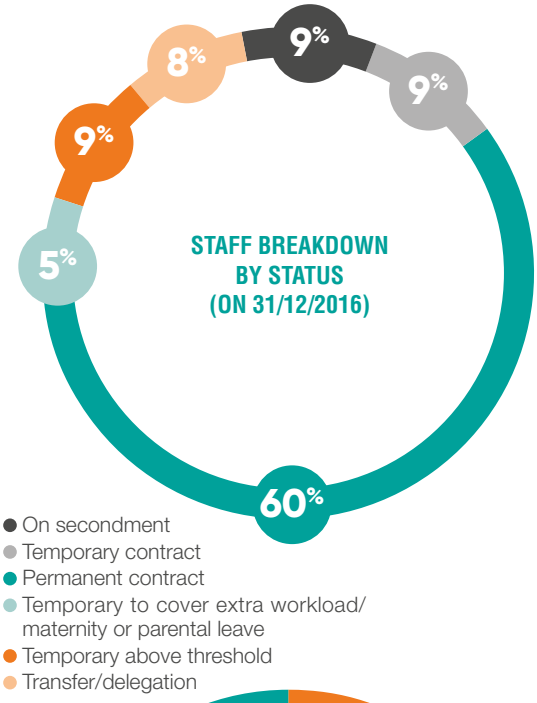
Following sharp growth between 2009 and 2011, when the agency brought support functions back in-house and took over management of the Investments for the Future programme, the ANR's workforce numbers have been relatively stable since 2012. In 2016, the agency had 283 employees (260 full-time equivalents worked).

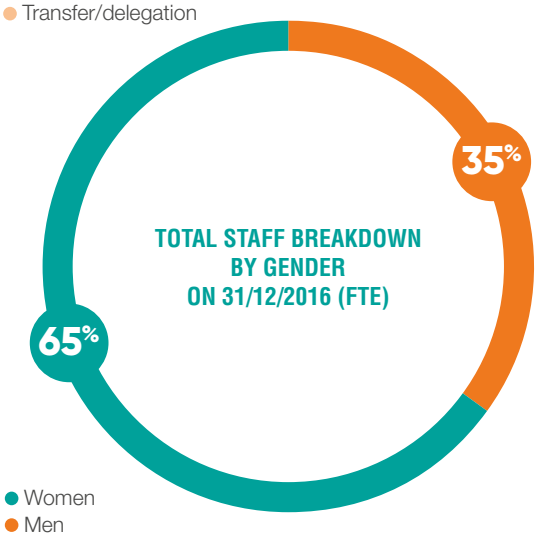
NEW JOBS AND SKILLS FRAMEWORK

The ANR adopted and implemented its new jobs and skills framework in 2016, after two years of collective work. The framework is part of the agency's jobs and skills planning policy, which aims to help the ANR prepare for future changes by fine-tuning employees' competencies. Ultimately, the aim is to plan ahead and take corrective action where necessary to limit gaps between the agency's needs and resources – first and foremost in terms of workforce numbers, but also in terms of skills, identifying what expertise is required in accordance with its policies and strategy. By looking ahead to the future, the ANR can then develop different adaptation scenarios.

Deployment of this policy within the agency will ensure that career plans are developed for each employee, reinforce the resources allocated to staff so they can plan ahead for changes in their role and ensure that the agency discusses strategic changes, and their consequences for jobs and roles, with labour relations partners.

The framework is a key tool that will be beneficial across the human resources spectrum, with direct implications for staff recruitment, appraisals and mobility. It will also feed into training programmes and foster more detailed communication about jobs and careers within the agency. The framework was used for annual appraisals for the first time in 2016, and will gradually be rolled out across all aspects of human 3 resources.





THE ANR'S PRIORITY: QUALITY OF LIFE IN THE WORKPLACE

In 2014, the ANR's senior management decided to launch a major new initiative focusing on quality of life in the workplace. The process began with an anonymous survey of all employees in 2015. The results of the survey were then used to draw up an action plan to improve quality of life in the workplace and prevent psychosocial risk factors. The plan, coordinated by volunteer representatives within each of the agency's entities, sets out actions focusing on improvement (organisation of work, planning, working conditions, social and cultural action, etc.) and development (management, internal communication).

As part of this process, a new risky reporting procedure and a network of contact points was set up in 2016.

SCIENTIFIC OPERATIONS: A BRAND-NEW ROLE

The role of Scientific Evaluation Panel "Reference" Chair was created in 2016. These experienced researchers, with outstanding reputations in France and on the international stage, devote 20% or 30% of their working time to serving the agency. They have a three-pronged role: they act as the key liaison between the ANR and the scientific community within their field, they guarantee compliance with ethical rules in the selection process in accordance with the ANR's Code of Ethics, and they play a proactive role in driving continuous improvement across the agency's procedures. They are appointed for a term of one year, renewable for a further two terms. Vacancy notices were published during the year, with a view to recruiting the chairs in autumn 2016 in time for the first evaluation phase of the generic call. *Read the Interview with Marcello Coradini, Chair of Scientific Evaluation Panel 31, "Particle Physics, Astrophysics, Structure and History of the Earth" (see page 30).*

INTERNAL CONTROL AND QUALITY MANAGEMENT: TWO COMPLEMENTARY SYSTEMS

Last year was a watershed for risk management at the agency, marked by sweeping changes and an ambitious new policy on quality management and internal control. In accordance with the contract of objectives and performance, the aim is to achieve ISO 9001 certification for two processes: the selection process by the end of 2017 and user relations by 2018. The ANR also has another, longer-term objective: to have its financial statements certified by statutory auditors in 2020.

The impact of these far-reaching objectives was already felt in 2016, and they will have major implications for the agency over the coming three years as it prepares for these deadlines. A new internal control procedure was established in 2016, primarily focusing on the agency's budget and accounting operations.This marks a new beginning for the agency, which has never had a system of this type before. An initial risk management assessment was carried out, and the findings will form the basis for its work and improvement efforts in the coming years. The assessment used a risk scoring system – a standard tool developed by the Public Finances Directorate General (DGFiP) and deployed across all public bodies.

Based on the four criteria (traceability, documentation, oversight and organisation), the ANR obtained an initial average score of 2 (on a scale of 1 to 5). The aim is to achieve a score of 3 (standardised) in 2018, then 4 (assessed) in 2019. This represents an ambitious target, given that less than 10% of public entities are currently at levels 4 and 5.

The ANR is committed to seeing this process through to completion and setting an example for others to follow, as it seeks to have its financial statements audited in 2020 in accordance with the terms of contract of objectives and performance.

In parallel, the agency also resumed its quality management system, updating its internal process map. In 2017, the ANR will identify process leads and write up formal processes and procedures with a view to obtaining a new ISO 9001 certification, focusing first on its selection process.

By introducing the new internal control system and resuming the quality management system, this new organisational approach will cover all of the agency's roles and functions. The challenge now is to coordinate these two processes, which will provide a more global view of risk management, identifying potential efficiency gains, and avoiding using the same staff for both quality and internal control.

GOOD TO KNOW!

Internal control is a process defined and implemented by an organisation to provide reasonable assurance that it will attain its objectives.

It encompasses a set of resources, methods, procedures and actions specific to each organisation's structure, which:

- help the organisation manage its activities, conduct its operations efficiently, and safeguard its resources
- provide a detailed insight into major operational, financial or compliance risks.

The purpose of internal control is to ensure that the organisation complies with laws and regulations, follows instructions and guidance from senior management, protects the reliability and integrity of financial information and drives operational effectiveness and efficiency.

A **quality management system** is a cross-cutting approach that aims to define the organisational structure as a whole, each individual's responsibilities and the procedures and resources necessary to implement an effective quality management policy that aligns with the organisation's strategy and delivers user satisfaction. A quality management system ensures the traceability of operations and helps the organisation leverage its knowledge.

EXTERNAL AUDIT: ANOTHER STRING TO THE RISK MANAGEMENT BOW

Alongside these two programmes focusing on internal risks, the agency also introduced recipient audits, focusing on external risks in its relationship with users and recipients. The purpose of these audits, conducted on behalf of the agency, is to ensure that project-based research funding is used properly, i.e. for the scientific objectives for which it is intended and in accordance with the financial rules.

The aim is to move forward on these three systems – internal control, quality management and recipient audit – together, so that each feeds into the others. This will enable the agency to identify potential leverage, harness best practice, share working methods and drive up performance.

THE CLOSURE OF THE 2006-2010 EDITIONS: ANOTHER RISK MANAGEMENT DRIVE

A number of the projects selected in the 2006-2010 editions have yet to be finalised because documentary evidence is lacking. At its meeting on 27 September 2016, the ANR's Governing Board voted in favour of a "closure of former editions plan " to finally close these editions. Under the plan, exemptions to the three relevant financial regulations will be granted. The plan is managed internally by a dedicated project team liaising with funding recipients. Between February 2017 and 2019, the ANR will send formal notice letters, specific to each edition, to the relevant institutions and entities to request the missing documentation. The plan will help clear a backlog of some 3,000 outstanding files and make the figures on the amount the agency owes to its recipients more reliable.

BUDGET

In 2016, the ANR received a funding budget of €574.6 M. The first amending budget, passed in June 2016, saw the funding budget rise by €63.9 m in the wake of the French President's announcement of additional support for French scientific research. This commitment was confirmed in 2017, with a further increase of €44.7 M in the funding budget, benefiting most of the agency's instruments.

ANALYSIS OF RESOURCES FOR THE 2016 FINANCIAL YEAR

The revenues are broken down by type under two separate headings, as required by France's public budget and account management reform : earmarked revenues and global revenues.

In 2016, total resources stood at €569.3 M.
Global revenues were €551.7 M, primarily consisting of grants: €515.2 M for funding and €28.9 M for public service costs.
Earmarked revenues stood at €17.6 M, consisting chiefly of revenues for co-funding and projects funded by the European Commission, and Investments for the Future management costs (reimbursement of the ANR's expenditure for managing the programme).

ANALYSIS OF EXPENDITURE FOR THE 2016 FINANCIAL YEAR

The commitment appropriations for 2016 stood at € 627.8 M, up 11.7% on 2015. Payment appropriations were € 585.1 M, down 14.3% on 2015, primarily for funding expenditure.

Funding expenditure stood at €550.8 M, or 94.1% of the agency's total expenditure in 2016.

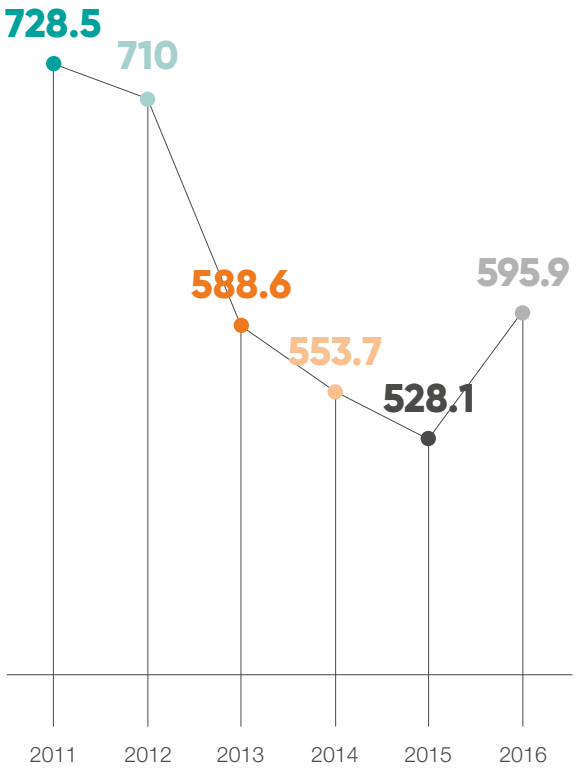
Expenditures relating to the management budget comprised €34.3 M of payment appropriations, representing a budget execution rate of 95.7% (against the final budget voted on in 2016).

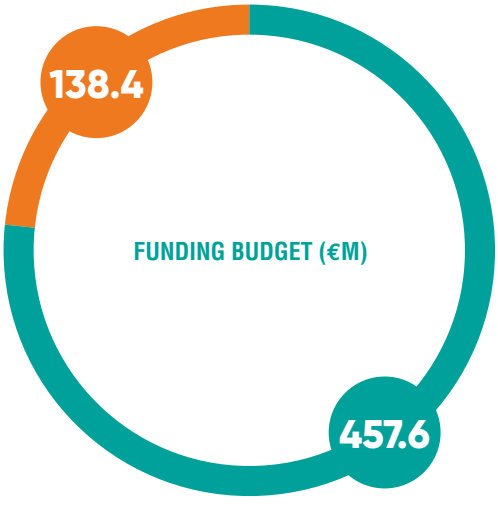
FUNDING BUDGET

In terms of commitment appropriations,the agency disbursed €595.9 M of its 2016 funding budget, i.e. 99.9% of the appropriations agreed under the second amending budget.

Commitments for calls for proposals stood at €457.6 M in 2016, compared with €390.2 m in 2015, a rise of €67.4 M or 17.3%. In total, the agency funded 1,257 projects in 2016, against 1,049 in 2015 (an increase of 208 projects or 19.8%). Commitments outside calls for proposals (INCA, Basic Technological Research, Préciput and Carnot Institutes under component 4) were €138.5 M (of commitment appropriations) in 2016.

ANR FUNDING BUDGET (€M)





● Allocated to calls for proposals
● Allocated outside calls for proposals

The ANR's funding budget for 2016 comprised four components – the generic call and the specific calls. The proportion of the four-component budget (€515.4 M) allocated to each component is shown below. The figures show a €69.2 M (15.5%) increase in commitment appropriations between 2015 and 2016.

2016 CA DISBURSEMENTS (INCLUDING CO-FUNDING IN M*)	DISBURSED 2014	DISBURSED 2015	AB2 2016	DISBURSED 2016	2016 VS AB2 2016 IN %	2016 VS 2015 IN %
Component 1 Major societal challenges	195.6	191.6	227.2	235.6	3.7 %	23 %
Component 2 At the frontiers of research	36.0	32.7	43.7	43.5	-0.5 %	33 %
Component 3 Building the European Research Area (ERA) and France's international attractiveness	73.9	70.9	91.3	81.1	-11.1 %	14.4 %
Component 4 Economic impact of research and competitiveness	165.9	150.9	154.0	155.1	0.7 %	20.8 %
TOTAL OF ALL 4 COMPONENTS	**471.3**	**446.2**	**516.2**	**515.4**	**-0.2 %**	**15.5 %**

In 2016, payment appropriations for funding charges stood at €551 M, against €649.4 M in 2015. This fall was due to a reduction in the agency's available cash. Expenses were broken down as follows:

- €403 M in payment appropriations for calls for proposals (against €479.3 M in 2015).
- €148 M in payment appropriations outside calls for proposals. Non-call liquidations stood at €148 M, of which €63.9 M was for commitments prior to 2016 and €84.1 M was for the 2016 edition, including INCA (€38 M), Carnot Institutes (€32.7 M), Préciput (€12.9 M) and RTB (€0.6 M).

MANAGEMENT BUDGET

In 2016, the ANR's total headcount was 233.7 full-time equivalents worked (FTEW), an increase of 4.5 FTEW (up 1.96%) on 2015. The agency's total workforce increased by 6.9 FTEW (above the employment level ceiling) to support its international development.

There are three envelopes for the expenditures associated with the management budget: Personnel, Operations and Investment.

In 2016, management budget expenditures amounted to €31.8 M of commitment appropriations. The Personnel Operations envelope stood at €17 M and the Operations envelope at €14 M.

In 2016, the Investment envelope amounted to €0.8 M.

In 2016, management budget expenditures through payment appropriations stood at €34.3 M, down €1.5 M on the second amending budget and up €1.1 M on 2015: €17 M for Personnel, €16.1 M for Operations and €1.3 M for Investment.

- Human resources management expenses, excluding pay, represented €3.28 M.
- Expenses associated with the organisation/participation in events amounted to €3.7 M.
- Expenditure on facilities and premises amounted to €4.17 M.
- Information and communication expenses amounted to €1.7 M.
- Information processing expenses represented €2 M.
- Other expenses represented €1.2 M.

CASH

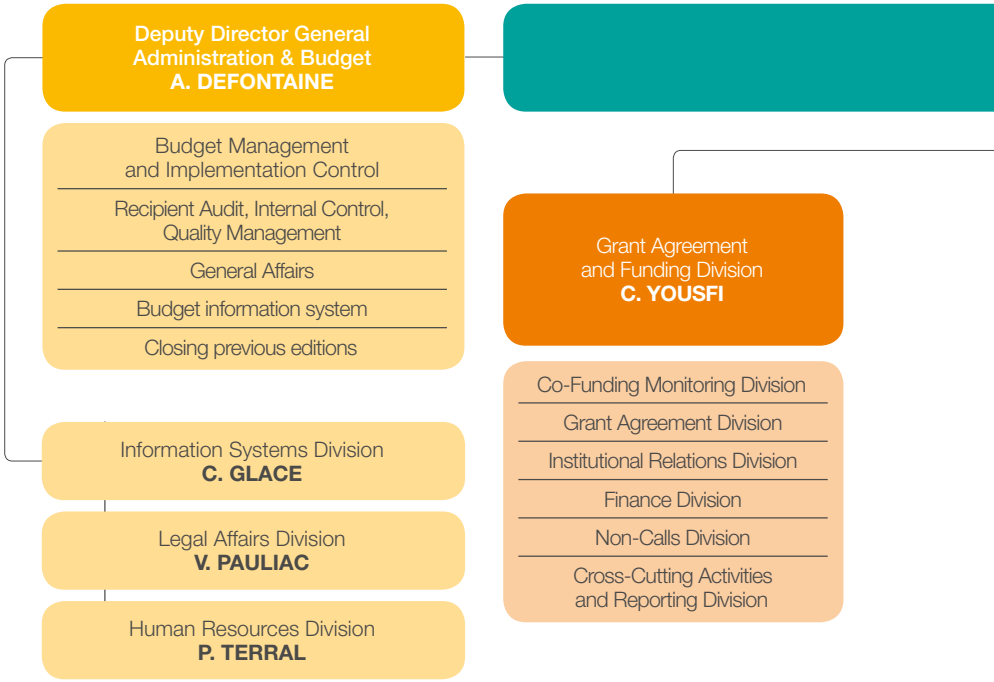
As at 1 January 2016, the ANR's cash balance was €26.7 M. At 31 December 2016, the cash balance stood at €19 M.

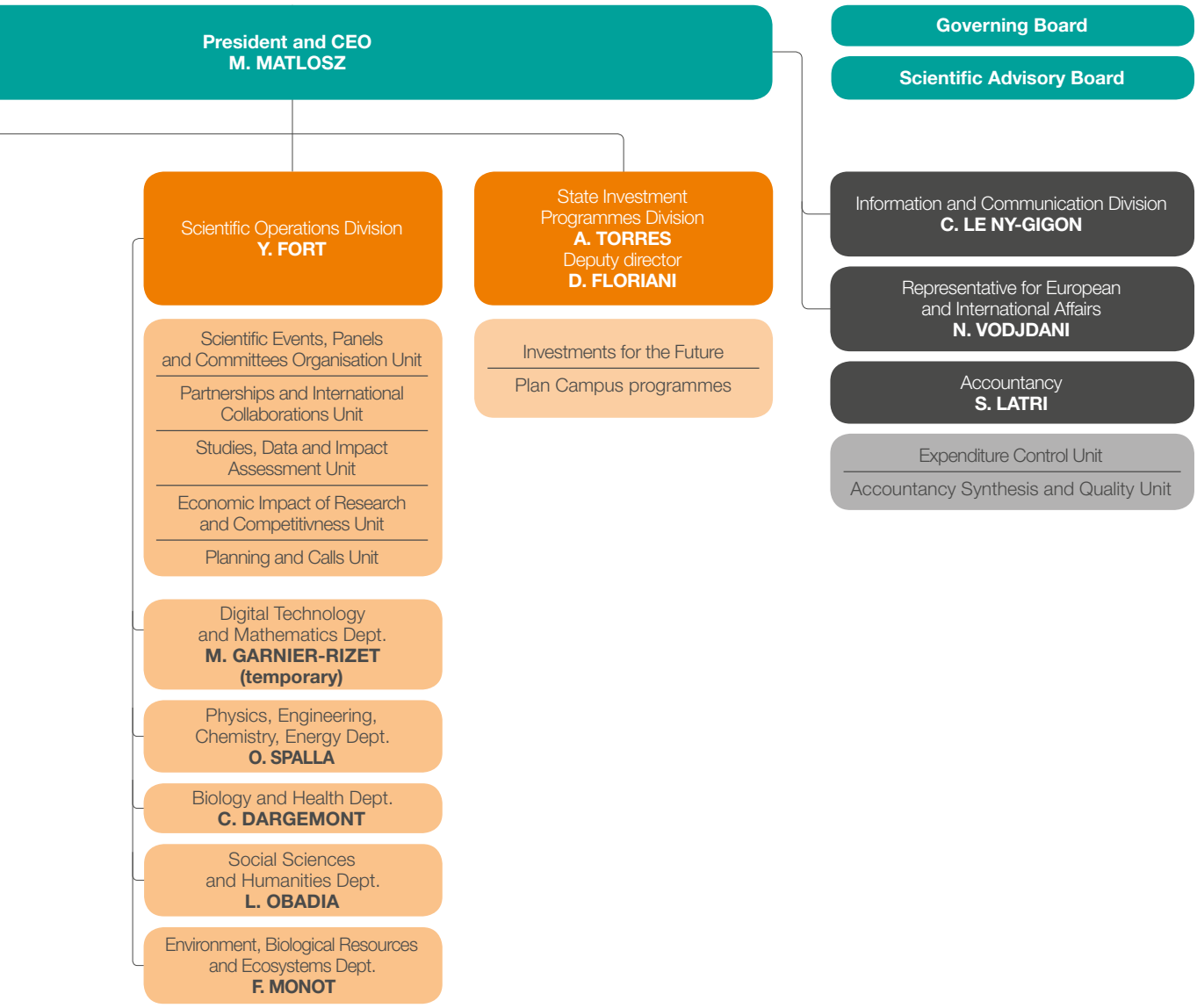
RESULTS

The 2016 results showed a loss of €146.4 M, against a forecast loss in the second amending budget of €64.2 M. This discrepancy arose from a change in the way provisions were accounted for at the end of 2016 compared with previous years, to comply with the 26 June 2015 instruction from the Public Finances Directorate General (DGFiP) on funding system accounting.To comply with this instruction the ANR had to identify, for all editions and all ongoing research projects, deadlines subject to supporting documents that could constitute uncertain debt and, therefore, be recorded as off-balance-sheet commitments.

THE ANR'S ORGANISATION CHART AT 03/04/2017

The ANR is a public administrative body under the authority of the French Minister of Research. It is administered by a Governing Board and directed by its President and CEO. The President and CEO is assisted by one or more Deputy Directors General and a Scientific Advisory Board. Governance procedures are defined by the Decree of 1 August 2006 as amended.




President and CEO
M. MATLOSZ
Governing Board
Scientific Advisory Board
Scientific Operations Division
Y. FORT
State Investment Programmes Division
A. TORRES
Deputy director
D. FLORIANI
Information and Communication Division
C. LE NY-GIGON
Representative for European and International Affairs
N. VODJDANI
Accountancy
S. LATRI
Expenditure Control Unit
Accountancy Synthesis and Quality Unit
Scientific Events, Panels and Committees Organisation Unit
Partnerships and International Collaborations Unit
Studies, Data and Impact Assessment Unit
Economic Impact of Research and Competitivness Unit
Planning and Calls Unit
Digital Technology and Mathematics Dept.
M. GARNIER-RIZET
(temporary)
Physics, Engineering, Chemistry, Energy Dept.
O. SPALLA
Biology and Health Dept.
C. DARGEMONT
Social Sciences and Humanities Dept.
L. OBADIA
Environment, Biological Resources and Ecosystems Dept.
F. MONOT
Investments for the Future
Plan Campus programmes

GOVERNING BOARD AT 14/03/2017

The deliberations of the Governing Board determine the affairs of the institution. In addition to the agency's President, the Governing Board comprises 19 members:

Six representatives of the State: two representatives of the Minister of Research; a representative of the Minister of Higher Education; two representatives of the Minister of Industry; a representative of the Budget Minister;

- Alain Beretz, Director General for Research and Innovation
- Guillaume Gaubert, Financial Affairs Director, General Secretariat of National Education, Higher Education and Research
- Simone Bonnafous, Director General for Higher Education and Employability
- Pascal Faure, Director General for Enterprise
- Benoît Legait, President of the Technology and Society Section, General Council of the Economy, Industry, Energy and Technologies
- Arnaud Jullian, Deputy Director, Budget Directorate

Six qualified personalities representing the major scientific fields, including at least one representative of the Conference of Heads of Higher Education Institutions:

- Fabienne Blaise, President, Lille 3 University
- Alain Fuchs, President Director General, French National Centre for Scientific Research (CNRS)
- François Houllier, Administrator, Sorbonne Paris Cité University (USPC)
- Yves Levy, President Director General, French Institute of Health and Medical Research (INSERM)
- Brigitte Plateau, President, Grenoble Institute of Technology (INP Grenoble)
- Françoise Touboul, Scientific Advisor, French Alternative Energies and Atomic Energy Commission (CEA)

Four qualified personalities from the business world chosen for their competence in the field of research and technological development:

- Yann Barbaux, Chief Innovation Officer, Airbus
- Marie Meynadier, Chief Executive Officer, EOS Imaging
- Jean-François Minster, former Scientific Director, Total
- Nathalie Ravilly, President, Thales Corporate Ventures

The Vice President of the National Strategic Council for Research:

- Pascal Colombani

Two elected personnel representatives, and their deputies, elected for a period of three years by the agency's personnel.

In addition, attending the Board in an advisory status:

- The Chair of the Governing Board of the public establishment BPI-Group or his representative
- The French General Commissioner for Investment or his representative
- ANR's Deputy Director General
- The Budget Controller
- The Accountancy Officer
- Head of management control and budgetary execution

SCIENTIFIC ADVISORY BOARD

The Scientific Advisory Board is the agency's body for reflection and debate on the preparation and implementation of its annual Work Programme. The Board assists the President of the agency in the strategic guidance of the institution. The Board is consulted on:

- The preparation of ANR's annual Work Programme and its implementation report,
- The implementation of the evaluation of the research offering and impact assessment studies,
- The creation or abolition of the agency's scientific departments, their name and scope,
- The appointment of the Scientific Department Heads and the renewal of their functions.

The Board may also be consulted by the Governing Board or the President of the agency on matters falling within the competence of the institution.

COMPOSITION

In addition to the agency's Scientific Department Heads, the Scientific Advisory Board consists of external personalities, including the Chair of the Board, appointed by the ANR's President for a renewable two-year term:

Personalities external to the institution, foreign personalities in particular, selected for their scientific and technical competence in the agency's areas of activity:

- Sébastien Candel, President of the French Academy of Sciences
- Alice Dautry, Member of the French Academy of Technologies, former President of the Pasteur Institute
- Rick Rylance, Director of the Institute of English Studies of the University of London's School of Advanced Study
- Ernst-Ludwig Winnacker, Secretary General of the Human Frontier Science Program (HFSP), former President of the German Research Foundation (DFG) and former Secretary General of the European Research Council (ERC)

Personalities from the business world chosen for their competence in the operation and constraints of national research, development and innovation funding agencies:

- Susan Fleet, former CEO of Britest Limited (Chair of the Board)
- Ulrike Decoene, Head of the AXA Research Fund

OPERATION

The Scientific Advisory Board meets at least three times a year upon convocation by the President of the agency or at the written, reasoned request of two-thirds of its members.

Its composition, the process for appointing its members and its rules of procedure are set out by the Ministerial Order of 10 September 2015.

REVIEW OF 2016 CALLS FOR PROPOSALS

	PROJECTS REVIEWED IN PHASE 2 OR SINGLE PHASE	PROJECTS FUNDED
Component 1: Societal challenges	**1,904**	**587**
Generic call (PRC, JCJC)	1,897	583
Challenges	7	4
Flash*	NA	NA
Component 2 : At the frontiers of research	**398**	**123**
Generic call – all-knowledge challenge (PRC, JCJC)	398	123
Component 3 : Building the European Research Area (ERA) and international attractiveness	**1,653**	**357**
Generic call (PRCI)	674	88
MRSEI	127	59
T-ERC	28	28
Bilateral international calls	163	31
Multilateral international calls	495	126
ACHN	166	25
Component 4 : Economic impact of research (excluding Carnot; non-CFP operations)	**638**	**190**
Generic call – PRCE	412	132
ASTRID including Maturation	141	35
Labcom	72	18
Industrial chairs	13	5
TOTAL	**4,593**	**1,257**

*Flash Asile projects were supported through the generic call

SUCCESS RATE RELATIVE TO NUMBER OF ELIGIBLE PROPOSALS (2ND REVIEW STAGE OR SINGLE-STAGE CALL FOR PROPOSALS)	GLOBAL ANR FUNDING (M€)	% OF GLOBAL ANR FUNDING
	235.7	**51.5%**
30.7%	234	51.1%
57.1%	1.6	0.3%
NA	0.1	
	43.5	**9.5%**
30.9%	43.5	9.5%
	81.1	**17.7%**
NA	23.5	5.1%
46.5%	1.7	0.4%
NA	4.1	0.9%
19%	9.2	2%
25.5%	31.9	7%
15.1%	10.7	2.3%
	97.3	**21.3%**
32%	77.8	17%
24.8%	10.6	2.3%
25%	5.4	1.2%
38.5%	3.5	0.8%
	457.6	**100%**

CREDIT BREAKDOWN BY BENEFICIARY TYPE (VALUES)

	TOTAL COMMIT-MENTS (€)	CNRS	INSERM	INRIA	INRA	IRD	CEA	OTHER RESEARCH BODIES (*)	RESEARCH BODIES SUBTOTAL	UNIVERSI-TIES
Component 1 : Societal challenges	235,817,849	84,426,953	41,835,357	4,627,890	11,444,440		6,205,006	2,572,354	151,111,999	54,221,001
PRC	180,756,779	64,511,236	36,036,407	2,843,051	9,720,270		5,077,204	1,673,520	119,861,687	38,404,522
JCJC	53,325,106	19,627,138	5,798,950	1,784,839	1,724,170		1,127,802	798,834	30,861,733	15,411,437
Flash drones in challenge 9	100,000							100,000	100,000	
ASTRID inc. Maturation										
Challenges	1,635,964	288,579							288,579	405,042
Component 2 : At the frontiers of research	43,574,352	26,278,409	392,808		829,946		502,706	2,131,294	30,135,163	9,702,598
PRC All-knowledge challenge	32,863,476	19,301,098	392,808		829,946		281,715	2,131,294	22,936,861	6,617,709
JCJC All-knowledge challenge	10,710,876	6,977,311					220,991		7,198,302	3,084,889
Component 3 : Building the ERA and international attractiveness	80,917,379	18,643,738	5,953,491	1,620,578	2,586,861		2,595,705	2,626,912	34,027,285	16,942,206
PRCI	32,673,866	11,027,864	5,591,974	864,036	2,586,861		1,511,644	485,178	22,067,557	9,060,878
ERANET, JPI, etc.	31,717,513	1,007,740	213,408	700,542			199,504	91,800	2,212,994	2,210,619
ACHN-hosting high-level researchers	14,848,699	6,304,316					794,566	1,990,254	9,089,136	4,971,077
MRSEI	1,677,301	303,818	148,109	56,000			89,991	59,680	657,598	699,632
Component 4 : Economic impact of research	97,240,016	16,742,085	4,283,232	1,846,793	5,071,828		3,934,152	8,722,490	40,600,580	22,994,881
PRCE	77,758,834	14,398,263	3,425,878	1,546,793	4,471,228		3,431,416	5,329,444	32,603,022	17,119,800
ASTRID inc. Maturation	10,600,000	1,743,822	857,354				202,736	1,293,046	4,096,958	3,110,071
Labcom	5,400,000	600,000		300,000			300,000	2,100,000	3,300,000	2,100,000
Industrial chairs	3,481,182				600,600				600,600	665,010
TOTAL CFP	**457,549,596**	**146,091,185**	**52,464,888**	**8,095,261**	**19,933,075**		**13,237,569**	**16,053,050**	**255,875,027**	**103,860,686**

*ENSAM-INED-GIP GRENOBLE-IRSTEA-CETIM-CIRAD-IFREMER-BRGM-IFP-INERIS-IRSN-LCPC-CSTB-LNE-CEREMA-ANSES

Excluding CFP										
Carnot Institutes (under component 4)	57,960,000									
RTB (Basic Technology Research)	3,800,000									
INCA	38,000,000									
Preciput	38,600,000	5,366,120	1,788,236	697,086	1,606,833	218,436	1,762,696	3,689,615	15,129,022	20,598,126
TOTAL exc. CFP	**138,360,000**									
TOTAL ANR budget in CA	**595,909,596**									

OTHER HIGHER EDUCATION INSTITUTIONS	HOSPI-TALS/ HEALTH	MISC. PUBLIC	PUBLIC SUBTOTAL	FONDA-TIONS	ASSOCIA-TIONS	VSE	SME	OTHER BUSINESS	MISC. PRIVATE	PRIVATE SUBTOTAL
6,913,726	2,155,387	6,535,754	220,937,867	12,999,234	837,498		434,023	30,284	1,107,481	15,408,520
5,365,477	1,810,651	4,081,300	169,523,637	9,572,522	632,817		60,552	30,284	936,967	11,233,142
1,149,891	344,736	2,454,454	50,222,251	3,426,712	204,681					3,631,393
			100,000							
398,358			1,091,979				373,471		170,514	543,985
1,270,185		1,870,084	42,978,030	535,637	60,685					596,322
1,101,705		1,610,879	32,267,154	535,637	60,685					596,322
168,480		259,205	10,710,876							
1,747,687	30,000	23,653,010	76,400,189	2,900,244	429,224	40,627	724,228	212,751	210,116	4,517,190
1,545,431			32,673,866							
		23,625,009	28,048,622	2,111,758	369,411	40,627	724,228	212,751	210,116	3,668,891
			14,060,213	788,486						788,486
202,256	30,000	28,002	1,617,488		59,813					59,813
2,651,593	734,409	1,981,646	68,963,109	2,270,354	4,001,991	3,346,955	8,390,281	5,537,502	4,201,286	27,748,369
1,411,166	666,369	1,981,646	53,782,003	2,065,561	2,368,756	3,103,638	7,196,199	4,649,275	4,064,864	23,448,293
537,415	68,040		7,812,484	204,793	120,675	243,317	1,194,082	888,227	136,422	2,787,516
			5,400,000							
703,012			1,968,622		1,512,560					1,512,560
12,583,191	**2,919,796**	**34,040,495**	**409,279,195**	**18,705,469**	**5,329,398**	**3,387,582**	**9,548,532**	**5,780,537**	**5,518,883**	**48,270,401**
353,012	165,706	2,354,134	38,600,000							

CREDIT BREAKDOWN BY BENEFICIARY TYPE

	TOTAL COMMIT-MENTS (€)	CNRS	INSERM	INRIA	INRA	IRD	CEA	OTHER RESEARCH BODIES (*)	RESEARCH BODIES SUBTOTAL	UNIVERSI-TIES
Component 1 : Societal challenges	235,817,849	35.8%	17.7%	2%	4.9%		2.6%	1.1%	64.1%	23%
PRC	180,756,779	35.69%	19.94%	1.57%	5.38%		2.81%	0.93%	66.3%	21.25%
JCJC	53,325,106	11.24%	3.57%	1.09%	0.96%		0.64%	0.44%	57.9%	8.74%
Flash drones in challenge 9	100,000								100%	
ASTRID inc. Maturation										
Challenges	1,635,964	0.16%							17.6%	0.22%
Component 2 : At the frontiers of research	43,574,352	60.31%	0.90%		1.90%		1.15%	4.89%	69.2%	22.27%
PRC All-knowledge challenge	32,863,476	10.68%	0.22%		0.46%		0.16%	1.18%	69.8%	3.66%
JCJC All-knowledge challenge	10,710,876	3.86%					0.12%		67.2%	1.71%
Component 3 : Building the ERA and international attractiveness	80,917,379	23.04%	7.36%	2%	3.20%		3.21%	3.25%	42.1%	20.94%
PRCI	32,673,866	6.10%	3.09%	0.48%	1.43%		0.84%	0.27%	67.5%	5.01%
ERANET, JPI, etc.	31,717,513	0.56%	0.12%	0.39%			0.11%	0.05%	7%	1.22%
ACHN-hosting high-level researchers	14,848,699	3.49%					0.44%	1.10%	61.2%	2.75%
MRSEI	1,677,301	0.17%	0.08%	0.03%			0.05%	0.03%	39.2%	0.39%
Component 4 : Economic impact of research	97,240,016	17.22%	4.40%	1.90%	5.22%		4.05%	8.97%	41.8%	23.65%
PRCE	77,758,834	7.97%	1.90%	0.86%	2.47%		1.90%	2.95%	41.9%	9.47%
ASTRID inc. Maturation	10,600,000	0.96%	0.47%				0.11%	0.72%	38.7%	1.72%
Labcom	5,400,000	0.33%		0.17%			0.17%	1.16%	61.1%	1.16%
Industrial chairs	3,481,182				0.33%				17.3%	0.37%
TOTAL CFP	**457,549,596**	**31.93%**	**11.47%**	**1.77%**	**4.36%**		**2.89%**	**3.51%**	**55.9%**	**22.70%**

*ENSAM-INED-GIP GRENOBLE-IRSTEA-CETIM-CIRAD-IFREMER-BRGM-IFP-INERIS-IRSN-LCPC-CSTB-LNE-CEREMA-ANSES

Excluding CFP										
Carnot Institutes (under component 4)	57,960,000									
RTB (Basic Technology Research)	3,800,000									
INCA	38,000,000									
Preciput	38,600,000	13.9%	4.6%	1.8%	4.2%	0.6%	4.6%	9.6%	39.2%	53.4%
TOTAL exc. CFP	**138,360,000**									
TOTAL ANR budget in CA	**595,909,596**									

OTHER HIGHER EDUCATION INSTITUTIONS	HOSPI-TALS/ HEALTH	MISC. PUBLIC	PUBLIC SUBTOTAL	FONDA-TIONS	ASSOCIA-TIONS	VSE	SME	OTHER BUSINESS	MISC. PRIVATE	PRIVATE SUBTOTAL
2.9%	0.9%	2.8%	93.7%	5.5%	0.4%		0.2%		0.5%	6.5%
2.97%	1.00%	2.26%	71.9%	5.30%	0.35%		0.03%	0.02%	0.52%	6.2%
0.69%	0.19%	-0.08%	21.3%	1.90%	0.11%					6.8%
0.22%			0.5%				0.21%		0.09%	33.3%
2.91%		4.29%	18.2%	1.23%	0.14%					1.4%
0.61%		0.89%	13.7%	0.30%	0.03%					1.8%
0.09%		0.14%	4.5%							
2.16%	0.04%	29.23%	32.4%	3.58%	0.53%	0.05%	0.90%	0.26%	0.26%	5.6%
0.85%			13.9%							
		13.07%	11.9%	1.17%	0.20%	0.02%	0.40%	0.12%	0.12%	11.6%
			6.0%	0.44%						5.3%
0.11%	0.02%	0.02%	0.7%		0.03%					3.6%
2.73%	0.76%	2.04%	29.2%	2.33%	4.12%	3.44%	8.63%	5.69%	4.32%	28.5%
0.78%	0.37%	1.07%	22.8%	1.18%	1.33%	1.74%	4.13%	2.62%	2.30%	30.2%
0.30%	0.04%		3.3%	0.11%	0.07%	0.13%	0.66%	0.49%	0.08%	26.3%
			2.3%							
0.39%			0.8%		0.84%					43.4%
2.75%	**0.64%**	**7.44%**	**89.45%**	**4.09%**	**1.16%**	**0.74%**	**2.09%**	**1.26%**	**1.21%**	**10.5%**
0.9%	0.4%	6.1%	100.0%							

ANR SUPPORT FOR PROJECTS CERTIFIED BY COMPETITIVE CLUSTERS THROUGH ITS 2016 CALLS FOR PROPOSALS		
CLUSTER NAME	NUMBER OF PROJECTS FUNDED	GRANTS ALLOCATED TO CERTIFIED PROJECTS (IN M€)
Advancity, the Smart Metropolis Hub	1	0.45
Aerospace Valley	10	5.40
Agri Sud-Ouest Innovation	9	4.80
Alsace BioValley	1	0.36
ASTECH	8	4.38
Atlanpole Biotherapies	4	1.69
AVENIA	1	0.50
AXELERA	11	5.26
Cancer-Bio-Santé	4	2.61
Cap Digital Paris-Région	7	4.27
CAPENERGIES	2	0.96
Cereal Valley	4	1.80
Cosmetic Valley	1	0.40
DERBI (Renewable Energy in Construction and Industry)	3	1.62
DREAM "Water Resources & Aquatic Environment"		
EAU	1	0.71
ELASTOPOLE	1	0.49
ELOPSYS	7	3.44
EMC2 (Metal Assemblies and Complex Composites)	2	1.04
Eurobiomed	5	2.45
Fibres	2	1.02
Hippolia	1	0.30
HYDREOS	1	0.55
iDforCAR	2	1.26
Images & Networks	7	3.36
IMAGINOVE	5	2.37
IAR (Industry and Agro-Resources)	3	1.29
i-Trans (association promoting land transport)	1	0.64
LUTB Transport & Mobility Systems	3	2.10
LYON BIOPOLE	13	7.16
Materalia	8	3.38
MATIKEM	3	1.01
Medicen	4	2.13
Mer Bretagne Atlantique	9	3.77
Mer Méditerranée	2	0.91
Microtechniques	4	2.26
MINALOGIC	10	5.25
MOV'EO	5	2.27
Novalog		
Nuclear Valley	3	1.38
Nutrition Health Longevity	1	0.64

INTITULE POLE	NOMBRE DE PROJETS FINANCÉS	AIDE ALLOUÉE AUX PROJETS LABELLISÉS (EN M€)
OPTITEC	4	1.99
PASS (Perfumes, Aromas, Scents and Flavours)	1	0.44
PEGASE	2	1.08
PLASTIPOLIS	1	0.30
European Ceramics Centre	3	1.28
Risques	4	2.22
Route des Lasers	5	2.29
S2E2 (Smart Electricity Cluster)	2	1.60
SCS (Secured Communicating Solutions)	3	1.82
SYSTEMATIC Paris région	4	2.01
TECHTERA (Textiles and Functional Materials)		
TENERRDIS	6	3.08
TERRALIA	1	0.30
TES (E-Secure Transactions)	3	2.20
TRIMATEC	4	1.29
UP-TEX	2	0.86
VALORIAL	3	1.94
VEGEPOLYS	8	3.86
Véhicule du futur	1	0.21
VIAMECA	5	2.31
VITAGORA	2	1.22
XYLOFUTUR	1	0.31
TOTAL	**234 projects**	**€118.24 M**

SPECIFIC INTERNATIONAL CALLS FOR PROPOSALS 2016

	THEME	2016 COMMITMENTS (M€)	NUMBER OF PROJECTS FUNDED
Challenge 1 - Efficient resource management and adaptation to climate change			
Multilateral call in the framework of the Belmont Forum and the JPI Climate	Climatic services	1.7	4
Multilateral call in the framework of the ERA-NET Cofund BIODIVERSA 3	Biodiversity	4.9	16
Multilateral call in the framework of the COFASP ERA-NET	Fishing, aquaculture and the processing and transformation of seafood products	0.8	4
Multilateral call in the framework of the ERA-NET Cofund WATERWORKS 2015 –Water JPI WATER and FACCE JPI	Sustainable management of water resources in the agriculture, forestry and freshwater aquaculture sectors	1.4	6
Multilateral call in the framework of the ERA-NET Cofund SusAn – FACCE JPI	Sustainable animal production systems	1.3	7
Multilateral call in the framework of the Sum FOREST ERA-NET	Sustainable forests	0.7	3
Challenge 1 subtotal		10.8	40
Challenge 3 - Industrial renewal			
ANR-JST France-Japan bilateral call	Molecular technology	1	4
Challenge 3 subtotal		1	4
Challenge 4 - Health and well-being			
CoEN JTC maturation multilateral call: national neurodegenerative diseases plan (JPI JPND)	Neurodegenerative diseases	1.5	7
CRCNS multilateral call (USA, Israel, Germany)	Computational neuroscience	1.5	6
Multilateral call in the framework of ERA-CVD	Cardiovascular disease	2.6	11
Multilateral call in the framework of the ERA-NET Cofund ERA-HDHL/JPI HDHL	Nutritional biomarkers	1.4	5
Multilateral call in the framework of the EuroNanoMed II ERA-NET	Nanomedicine	2.3	8
Multilateral call in the framework of the INFECT-ERA ERA-NET	Infectious diseases	1.5	6
Multilateral call in the framework of JPI AMR	Anti-microbial resistance	0.1	2
Multilateral call in the framework of JPI JPND	Neurodegenerative diseases	0.1	1
Multilateral call in the framework of the ERA-NET Cofund JPI-EC-AMR-(JPI AMR)	Anti-microbial resistance	1.9	7
Multilateral call in the framework of the NEURON 3 ERA-NET	Central nervous system	2.1	7
Challenge 4 subtotal		15	60
Challenge 5 - Food security and demographic challenges			
Multilateral call in the framework of the ARIMNET 2 ERA-NET	Agricultural research in the Mediterranean	1.7	7
Multilateral call in the framework of the ERANET MED ERA-NET	Mediterranean	1.5	9
Challenge 5 subtotal		**3.2**	**16**

SPECIFIC INTERNATIONAL CALLS FOR PROPOSALS 2016	THÉMATIQUE	ENGAGEMENTS 2016 (M€)	NOMBREDE PROJETS FINANCÉS
Challenge 7 - Information and communication society			
Multilateral call in the framework of the Chist-ERA 2 ERA-NET	STIC	1.4	6
Multilateral call in the framework of the FLAG-ERA ERA-NET	Flagships	1.4	3
Challenge 7 subtotal		2.8	9
Challenge 8 - Innovative, inclusive and adaptive societies			
ANR-DFG France-Germany bilateral call	Human and social sciences	2.9	13
ANR-FQRS France-Quebec bilateral call	Human and social sciences	2.2	10
Multilateral call in the framework of JPI MYBL	Social protection, well-being and demographic change	0.2	1
Challenge 8 subtotal		5.3	24
Challenge 9			
ANR-BNBF France-Germany bilateral call	Global security	3	4
Challenge 9 subtotal		3	4
Across all challenges			
TOTAL		**41.1**	**157**

INVESTMENTS FOR THE FUTURE*	
Total authorised	6,943,128,214
Disbursements	4,159,100,416
Total contracted	6,470,204,271

* Excluding campus and Saclay

INVESTMENTS FOR THE FUTURE – DISBURSEMENT STATUS BY REGION ON 31/12/2016*

MAIN PROJECT REGION	NUMBER OF PROJECTS	TOTAL AUTHORISED (€)	DISBURSEMENTS (€)	STILL TO BE DISBURSED (€)
Auvergne-Rhône-Alpes	93	1,166,452,351	604,885,928	561,566,423
Bourgogne-Franche-Comté	9	101,320,735	48,630,191	52,690,544
Bretagne	18	288,866,524	156,877,662	131,988,862
Centre-Val de Loire	7	50,250,805	23,547,948	26,702,857
Grand Est	33	537,139,706	404,699,506	132,440,200
Hauts de France	28	390,021,107	207,103,453	182,917,654
Île-de-France	232	2,658,966,072	1,613,473,489	1,043,939,194
Normandie	11	69,017,039	39,631,937	29,385,101
Nouvelle Aquitaine	30	370,079,122	280,791,243	89,287,880
Occitanie	46	667,319,269	391,290,237	276,029,032
Pays de la Loire	10	163,077,300	75,542,014	87,535,286
Provence-Alpes-Côte d'Azur	34	431,218,184	295,826,807	135,391,377
TOTAL	**551**	**6,893,728,214**	**4,142,300,416**	**2,749,874,409**

* Excluding campus and Saclay/excluding CVT

INVESTMENTS FOR THE FUTURE - DISBURSEMENT STATUS BY ACTION ON 31/12/2016*				
NAME OF ACTION	NUMBER OF PROJECTS	TOTAL AUTHORISED (€)	DISBURSEMENTS (€)	STILL TO BE DISBURSED (€)
Bioinformatics	12	17,130,082	15,426,900	1,703,182
Biotech – Bioresources	13	88,213,632	54,741,462	33,472,170
Cohorts	10	74,467,076	43,935,543	30,531,533
Thematic development consortia (CVT)	6	49,400,000	16,800,000	32,600,000
Demonstrators	4	77,993,735	56,665,396	21,328,339
Development of Experimental Digital Universities	5	8,000,000		8,000,000
Equipment of excellence	93	591,902,706	482,973,405	107,735,912
Equipment of excellence 2	3	37,000,000	21,900,000	16,000,000
IDEX/I-SITE	4	32,000,000	32,000,000	0
Infrastructure	23	496,637,699	365,687,011	130,950,688
Initiative of excellence (including Labex and IDEFI in IDEX)	110	1,666,228,215	1,219,004,968	447,223,247
Initiative of excellence in digital education	12	12,290,000	3,539,557	8,750,443
Initiative of excellence in innovative education (excluding IDEX)	28	143,700,000	93,956,917	49,743,083
Carnot institutes	55	136,208,542	62,522,003	73,686,539
Convergence institutes	5	51,476,000		51,476,000
Technology research institutes	8	919,954,822	307,977,429	611,977,393
Energy transition institutes (EX IEED)	12	367,325,393	133,642,301	232,423,092
University hospital institutes	6	349,329,163	244,805,827	104,523,336
University hospital institutes B	6	35,000,000	31,500,000	3,500,000
Laboratories of excellence (excluding IDEX)	82	730,778,620	412,064,817	318,713,803
Nanobiotechnology	8	18,842,529	15,620,232	3,222,297
University cancer hospital centre (PHUC)	2	20,000,000	17,152,800	2,847,200
University hospital health research	14	110,900,000	15,911,440	94,988,560
Technology transfer acceleration companies	15	858,800,000	482,689,372	376,110,628
Nuclear safety	21	49,550,000	28,583,035	20,966,965
TOTAL	**557**	**6,943,128,214**	**4,159,100,416**	**2,782,474,409**

* Excluding campus and Saclay

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