



ANNUAL REPORT
2018



AGENCE NATIONALE DE LA RECHERCHE

ANR

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EDITORIAL

“ *The emergence of new ideas and teams is an important priority for research and requires the promotion of interdisciplinarity, which is encouraged by collaborative projects involving different research teams.* ”

By Thierry Damerval
ANR President and CEO

Guaranteeing that the best projects are selected, regardless of their origin, discipline or institution, and whether the research is basic or applied, is ANR's guiding principle.

This objective relies on both competitive, independent selection, based on the scientific expertise of peers, and a quality approach that enabled the Agency to achieve ISO 9001 certification in 2018 for all its project selection processes.

ANR occupies a key space in the public policy landscape for research and innovation as a funding body, state operator and partner of a growing number of institutions.

In line with the national and European strategic agendas, it responds to the priorities of national plans and to communities' funding needs. Through the Generic Call for Proposals, which represents over 70% of its budget, ANR supports scientific creativity on a free, open basis and funds over 1,000 research projects a year, more than 300 of them through its Young Researchers programme. In 2018, the French Minister of Higher Education, Research and Innovation, Frédérique Vidal, underlined her trust in the Agency by raising its resources. This enabled ANR to increase the selection rate for the Generic Call for Proposals from 13.2% in 2017 to 15.1% in 2018, with a future target of at least 20%.

The emergence of new ideas and teams is an

important priority for research and requires the promotion of interdisciplinarity, which is encouraged by collaborative projects involving different research teams. With its various funding instruments – the Generic Call for Proposals supporting projects designed on the initiative of researchers, and targeted calls for proposals responding to challenges and specifically supporting partnership-based research or the link between research and innovation – the Agency plays an important part alongside public and private laboratories and research institutions.

ANR also contributes to promoting and implementing open science, joining the cOAlition S group in 2018. This priority is part of France's National Open Science Plan, launched by the Minister for Higher Education, Research and Innovation.

2018 was a decisive and very constructive year for reinforcing information sharing, exchange and dialogue.

In its third year, the ANR Tour resulted in nearly thirty events in mainland France and overseas, attracting over 2,500 participants. The tour is an essential opportunity to meet research communities and players, scientific teams and managers.

The year also saw interactions with the five thematic research Alliances and with CNRS and Conference of University Presidents

in the context of the Programme Planning Steering Committees that we have set up, together with initiatives with our partners: the conference with the French Environment & Energy Management Agency (ADEME) on energy transition research, the conference with the French Agency for Food, Environmental and Occupational Health & Safety (Anses) on occupational health research, the LabCom conference and the annual global security event (WISG).

In terms of Investments for the Future, 2018 again illustrated the quality of our interactions with the Ministry and the French General Secretariat for Investment (SGPI), underlined particularly by the priority research programme Make Our Planet Great Again, launched by the French president, and the evaluation by an international jury of 115 Labex (laboratories of excellence) from the first Investments for the Future programme.

The coordination between research and innovation is another area of the Agency's work that was strengthened in 2018.

ANR is involved in several innovation steering bodies set up by the government, such as the French National Industrial Council, chaired by the Prime Minister, and the Innovation Council, co-chaired by Bruno Le Maire, France's Minister for Finance and the Economy, and Frédérique Vidal, the French Minister of Higher Education, Research and Innovation. We are already working towards these innovation objectives with partners including the General Secretariat for Defence and National Security, the Defence Innovation Agency (for the ASTRID and ASTRID Maturation programmes) and the French Biodiversity Agency. New interactions with decentralised authorities, starting with the French administrative regions due to their strong skills in economic development, should make it possible to constitute simplified funding opportunities coordinating the national and regional levels. Another area of our work is the development of partnerships to follow up project portfolios



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in order to smooth the transition towards innovation or social, medical or economic applications. This is the intention behind the strategic partnership signed this year with Bpifrance.

These advances were made possible by the collective mobilisation of our teams. I am deeply grateful for the work carried out to prepare the self-assessment report for the High Council for Evaluation of Research and Higher Education, whose committee visited in July 2019. Nearly 130 people within the Agency took part in the working groups set up at the end of 2018. The exercise illustrated a high level of dynamism and maturity in the collective analysis of our strengths, weaknesses and areas for improvement.

I particularly welcome the dialogue, the pleasure and the enthusiasm with which the teams worked together, and I want to thank all of them for their daily commitment, as well as the Governing Board and the Scientific Advisory Panel for their support.

At a time when the research planning bill announced by the Prime Minister is being drafted, we are fully aware of our responsibilities and our role in serving research.

KEY FIGURES FOR 2018

Activity



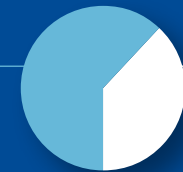
294
employees
(on 31/12/2018)



60%



40%



€672.4M
Funding budget in 2018

including

€518.1M
Allocated to calls for proposals

€34.3M
Operating budget in 2018

Projects funded



Nearly **18,500** projects funded since ANR was founded

In 2018

1,471
Projects funded

16.2%
Selection rate
across all calls

€352k
Average amount
per project funded

Funding opportunities



4 AAPG* instruments:
PRC, PRCI, PRCE, JCJC

► **€443,1 M** in 2018 compared with €420.6m in 2017

7 instruments dedicated to specific calls for proposals

LabCom shared laboratories, Industrial Chairs, MRSEI, Springboard-ERC, International Calls, Flash, Challenges

► **€63.5M** in 2018

1 specific ASTRID call for proposals⁽¹⁾

► **€11.5M** in 2018

1 Carnot programme to fund laboratories with the Carnot label
► **€62M** in 2018

⁽¹⁾ Fully funded by the AID (DGA)

Investments for the Future



€11.35BN
Under contract (since the PIA began in late 2018)

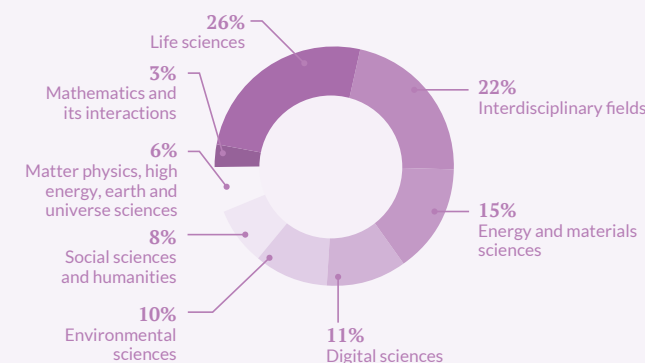
€8.56BN
Disbursements (since the PIA began in late 2018)

€3.1BN
Co-funding received by the projects (since the PIA began in late 2017)

Focus on the 2018 AAPG*

1,133 projects funded

15.1% selection rate (compared with 13.2% in 2017)



72% of projects funded involve collaboration between research teams

28% of projects funded are coordinated by a young researcher

9% of projects funded are European and international projects jointly funded with foreign agencies

* Generic Call for Proposals

2018 HIGHLIGHTS

March

The ROSE challenge at the Paris International Agricultural Show

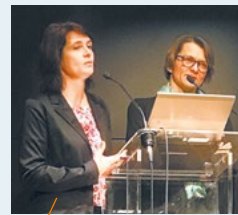
In the presence of the Minister of Agriculture, ANR, the French National Metrology and Testing Laboratory (LNE) and Irstea, presented the outlines and time scales of this innovative technology challenge aiming to reduce the use of pesticides in intra-row weed control.

In honour of women in science¹

Marking International Women's Day, ANR gave the floor to women in science: four researchers funded by the Agency presented their work on gender equality and gender issues.

Launch of the National Artificial Intelligence (AI) Research Strategy by the French president

ANR is mobilising its funding opportunities, including strengthened support for AI projects in its Generic Call for Proposals. In July, it launched a call for expressions of interest as part of the third Investments for the Future programme (PIA 3) to identify centres that could be awarded the Interdisciplinary Artificial Intelligence Institute label, a priority research programme².



In honour of women in science



June

ANR receives ISO 9001 certification

Following an audit conducted by AFNOR, ANR obtained ISO 9001 certification for all its project selection processes, including processes involving management and corporate management.

ADEME/ANR days: innovation for the energy transition

Nearly 300 participants explored the research work underscoring the energy transition supported by ADEME and ANR. Over 90 projects were presented, some with prospects for industrial partnerships or start-up creation.

Meeting funding recipients

Starting in 2017, the Agency organises an annual series of meetings to present its financial regulations and its evolution to the administrative and financial staff of research institutions and companies receiving funding.

September



Signature of DORA

Alongside many other organisations, ANR signed the San Francisco Declaration on Research Assessment (DORA), which encourages fairer evaluation of scientific research. For example, DORA emphasises the need to judge projects on their quality rather than the reputation or impact of their publications.

LabCom conference⁶

Over 400 participants, researchers, companies and research institutions came together to discover and discuss the LabCom programme, which aims to support the creation of laboratories shared between public research organisations and companies.



The third ANR Tour⁷

The ANR Tour visited over 20 cities in mainland France and the overseas territories thanks to support from research and higher education institutions. Over a month, more than 2,500 participants discussed the Work Programme, the terms of the calls for proposals and the evaluation process with the Agency.

Open science: ANR supports Plan S

ANR joined cOAlition S, a European initiative promoting free access to scientific publications. This commitment aligns with France's National Open Science Plan, launched in July by the French Minister for Higher Education, Research and Innovation.



November

Evaluation of 115 Labex

115 Labex (Laboratories of Excellence) from the first Investments for the Future programme were evaluated by a panel of 79 international scientists. The 103 projects with a positive assessment will receive additional funding over five years.



May



Make Our Planet Great Again (MOPGA): 14 new awardees in France, 13 in Germany

Launched by the French president, the MOPGA initiative aims to combat climate change and is a PIA3 priority research programme³. Following the second wave of applications, under joint French and German management, 14 new awardees in France and 13 in Germany will join the selected laboratories.

July

5th edition «At the Crossroads of Research and Artistic Creativity» organised in collaboration with the Avignon Festival⁴

Artists at the Festival and researchers in the humanities and social sciences, psychology, cognitive neuroscience and behavioural science compared their approaches to games and rules in human communication, life in society, power and personal identity.

First results of the 2018 Generic Call for Proposals (AAPG)

Covering three instruments within the Generic Call for Proposals, the first results were consolidated in early 2019 with projects on additional lists and PRCIs⁵ selected with international partner agencies.

October



Anses-ANR scientific meetings: occupational health research

These meetings reviewed the results of research supported by ANR and Anses in occupational health and the challenges of analysing professional risks to better combat and prevent pathologies associated with work environments.

Interdisciplinary Workshop on Global Security (WISG)

Organised with the Directorate General for Research and Innovation (DGRA), the Defence Procurement Agency (DGA) and the General Secretariat for Defence and National Security (SGDSN), WISG brought together nearly 200 players to focus on the scientific and societal issues of global security.



¹ <http://videos.actuelign.com/conferencev5.mp4>

² Scientific management by INRIA

³ Scientific management by CNRS

⁴ <https://www.youtube.com/watch?v=dDtgb6zkoc>

⁵ International collaborative research projects

⁶ <https://www.youtube.com/watch?v=Xb6wDzqtIlg>

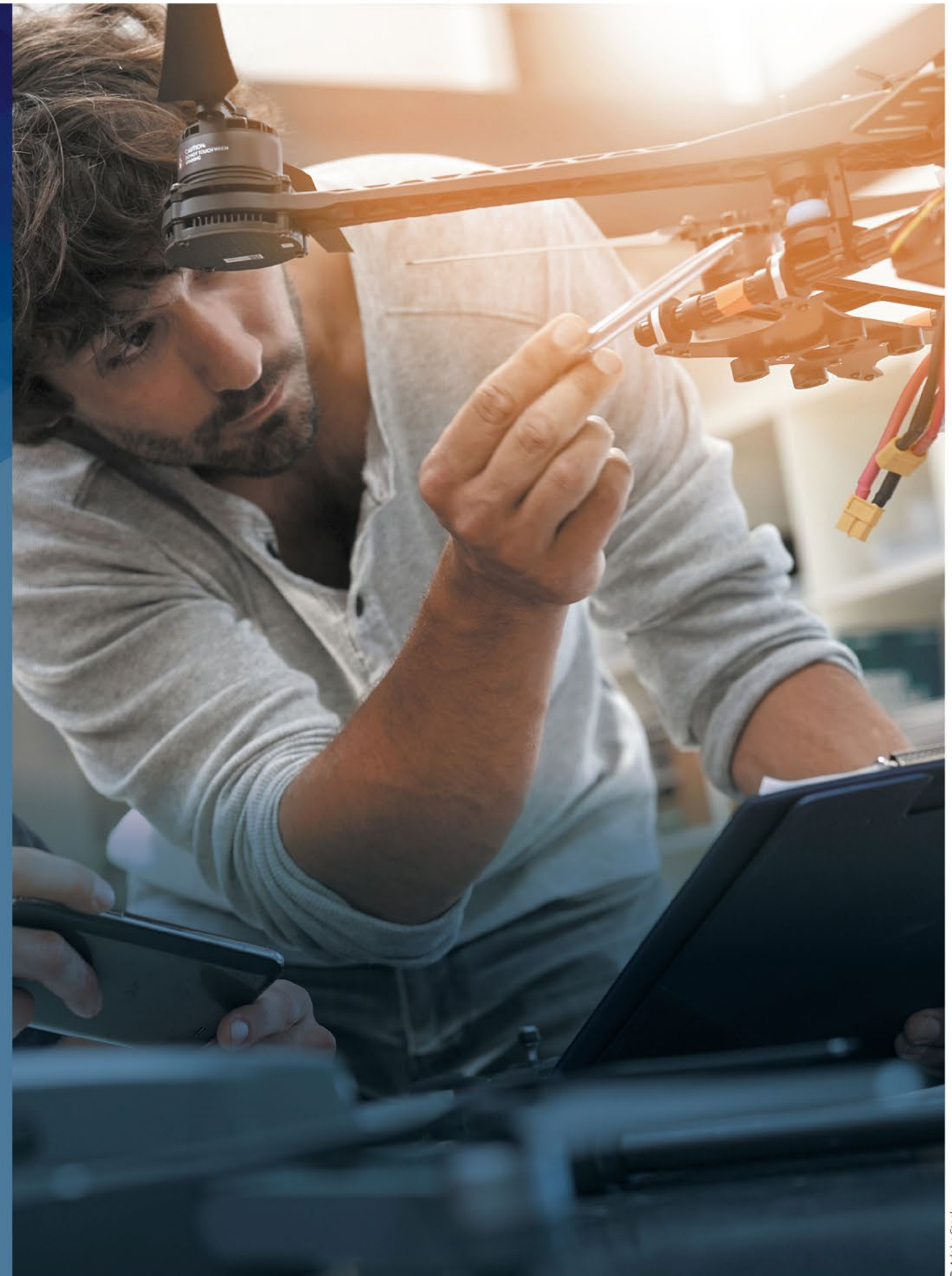
⁷ <https://www.youtube.com/watch?v=CHlrPshMh1s>

1

ANR,
supporting the best
scientific projects

Nearly
18,500
PROJECTS FUNDED
since 2005

Nearly
€8BN
allocated since 2005



An agency funding project-based research

The French National Research Agency (ANR) is the funding agency for project-based research in France. Under the authority of the French Ministry of Higher Education, Research and Innovation (MESRI), it supports collaboration between public research communities as well as public-private partnerships to stimulate the production of knowledge and innovation.

In France, ANR is the only multidisciplinary public funding agency for research projects. It covers the whole scientific spectrum except for space science, which is the responsibility of CNES, cancer research, AIDS/HIV and hepatitis, which are the responsibility of Inca and ANRS respectively. ANR funding covers both basic and applied research.

The funding it offers is allocated to the best scientific projects and research teams via competitive, independent selection mechanisms, favouring interdisciplinarity, the removal of barriers between scientific disciplines and the emergence of new projects.

A WORK PROGRAMME IMPLEMENTING THE NATIONAL RESEARCH PLAN

To complete its mission, the Agency implements the national plans decided by the French Ministry of Higher Education, Research and Innovation in line with the outlines of the National Research Strategy. It develops a **Work Programme in consultation with research and innovation communities** that is aligned with national priorities and European research fun-

ding initiatives. An annual roadmap for all French research players in all disciplines, the Work Programme describes the Agency's competitive calls for proposals and the ways in which they are evaluated and funded.



In France, ANR is the only multidisciplinary public funding agency for research projects.

Five missions

Initially founded in 2005 as a public interest grouping, ANR became a public administrative institution in January 2006. The 24th March 2014 decree, amending the previous 1st August 2006 decree, reinforced its missions:

- 1 **TO FUND AND PROMOTE** the development of basic and targeted research, technological innovation, technology transfer and public-private partnerships;
- 2 **TO IMPLEMENT** the programme approved by the Minister of Research, following consultation with the Ministers responsible for France's research organisations and public higher education institutions;
- 3 **TO MANAGE** major government investment programmes in the fields of higher education and research and to oversee their implementation;
- 4 **TO STRENGTHEN** scientific cooperation across Europe and worldwide by coordinating its Work Programme with European and international initiatives;
- 5 **TO ANALYSE** trends in research production and assess the impact of the funding it allocates on scientific output in France.



Nearly
18,500
PROJECTS FUNDED
since the Agency was
founded with a total of
almost
€8BN



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In line with the plan for the Agency's evolution, adopted in June 2017 by the Governing Board, the Ministry wanted to involve scientific communities more closely in planning for 2019. To define its programme, **ANR created seven Programme Planning Steering Committees (CPPs)** at the beginning of 2018. These consultative bodies include representatives of ANR, MESRI, the other ministries involved, the thematic research Alliances (Aviesan, Ancre, Allistène, AllEnvi and Athéna), CNRS, the Conference of University Presidents (CPU) and private research. All the proposals from the CPPs were incorporated into the 2019 Work Programme adopted by the ANR Governing Board on 3rd July 2018. The programme also contains national priorities and plans, such as artificial intelligence. ▮

On the way to impact

2018 was an important year for studying the impact of funding on research projects, one of the Agency's missions. A dedicated workshop on 6th July 2018 summarised the actions already taken and defined common principles in agreement with research players. **An outline report¹ set out strategic guidelines: the definition of impact, ex post evaluation and the impact pathway of the projects funded** (academic results, the contribution to scientific knowledge, the economy, innovation and the impact on society). **These impact studies will be deployed for individual portfolios of projects**, constituted according to a variety of criteria (year, theme, funding instrument, national plan, host region etc.) and analysed on the basis of different types of quantitative or qualitative indicators. At the 23rd International Conference on Science and Technology Indicators in Leiden in September 2018, ANR demonstrated the fundamental contribution of data, which must be diverse, open and transparent for successful impact analysis.

¹ Presented to the Governing Board in November 2018

ANR, operator of the Investments for the Future programme



ANR has been the operator of the Investments for the Future programmes (PIA) in the field of higher education and research since 2010. It organises the selection of large-scale projects, which can extend to over ten years, together with contracts, funding, follow-up and evaluation on behalf of the French state. It is also responsible for conducting impact studies.

LARGE-SCALE PROJECTS

The budget allocated to ANR for PIA 1, 2 and 3 is €29.85 billion out of a total of €57 billion. In 2018, with the signature of 90 new funding agreements, the portfolio represents 679 projects. The governance of each PIA initiative involves a steering committee chaired by the Minister(s) responsible for the initiative. This committee makes decisions or submits proposals to the Prime Minister.

Based on an evaluation by international panels, by decision of the Prime Minister, funding has been awarded to:

- ▶ **32 projects under the Make Our Planet Great Again (MOPGA) call for proposals.** This call is aimed at researchers based outside France who want to collaborate with French partners on high-level projects on climate change.
- ▶ **19 projects as part of phase 2 of New University Curricula (NCU2),** a programme supporting far-reaching change in the courses offered by universities, schools and groups of institutions.
- ▶ **1 project with the University Hospital Institutes label, phase 2 (IHU2),** a centre of excellence centred on restoring vision.

In parallel, three calls for proposals or for expressions of interest were launched in 2018 within PIA 3, part of France's Investment Plan:

- ▶ **Research Hospitals phase 4 (RHU4),** to encourage productive long-term partnerships between academic and industrial teams in health and clinical research.
- ▶ **Interdisciplinary Artificial Intelligence Institutes (3IA),** part of the national AI programme, which aims to support four to five centres in the

field. Four projects out of 12 were invited to submit full proposals in 2019.

- ▶ **University Research School phase 2 (EUR2),** to reinforce the impact and international attractiveness of the winning university sites.

The funding awarded to these projects does not appear in the ANR budget. It is subject to specific monitoring on behalf of the French General Secretariat for Investment (SGPI) and the ministries concerned. //

Projects evaluated in 2018

- ▶ **Initiatives of Excellence (IDEX):** evaluation of three PIA 1 projects, one of which, IDEX Sorbonne Université, received the label permanently.
- ▶ **Technology Transfer Acceleration Companies (SATT),** phases A and B: evaluation of the second three-year period resulting in renewed funding
- ▶ **Laboratories of Excellence (LabEx):** 103 projects extended for five years following evaluation

Projects monitored since 2010

- ▶ 77 Equipex, national biology and health infrastructure and pre-industrial biotechnology demonstrator projects have reached the end of their tranche of investment
- ▶ 48 projects have ended
- ▶ Over 2,200 site visits have been conducted by ANR
- ▶ 975 amendments to funding agreements have been signed and 44 financial audits conducted

interview

Three questions for... Manuel Tunon de Lara

© Arthur Pequin for the University of Bordeaux



“We have moved from the management of a project evaluated by an international panel, very well supported by ANR, to the implementation of a strategy by a university that has to live up to its responsibilities.”

Manuel Tunon de Lara
President of the University of Bordeaux
and Chair of the Management Board
of IDEX Bordeaux

The University of Bordeaux Initiative of Excellence (IDEX) project was selected in 2011 under the first Investments for the Future programme (PIA1) managed by ANR. Manuel Tunon de Lara presents the main benefits of the system for his university.

What is the ambition behind your Initiative of Excellence?

The goal is to create a new university model in Bordeaux that meets international standards, is driven by the highest level of research and weaves a new ecosystem of innovation around it. Our strategic plan University 2025 (U25) translates this

ambition into ten priority goals. With major challenges on all sides pushing it towards renewal, the university must play a new role in the region. This is essential to remain competitive in the globalised context of higher education and research, and a duty if we are to continue to play a role in the production of advanced knowledge that can illuminate the future. This

evolution must take place with support from research organisations and partners with a stake in this transformation.

What has this funding from the Investments for the Future programme enabled you to do?

It was crucial in initiating the transformation. In terms of research, we consolidated all our strategic choices with a PIA mechanism (mostly Labex, but also Equipex, cohort, IHU etc.). The first Labex laboratories, evaluated highly in scientific terms, are coming to an end and we are trying to measure their impact on our trajectory in addition to the work done by ANR. We are now taking a new step in the structuring of research with the recent creation of about ten new departments, co-funded by IDEX, focusing on major programmes involving societal challenges. They will drive our research and innovation strategy. Finally, our image studies show that the creation of the University of Bordeaux and its IDEX label have improved the site's attractiveness, including at international level. We need to continue working on our identity, which involves our partners going in the same direction.

What did the final confirmation of IDEX Bordeaux in 2016 change?

We have moved from the management of a project evaluated by an international panel, very well supported by ANR, to the implementation of a strategy by a university that has to live up to its responsibilities. This new approach, perhaps more demanding, requires everyone to sign up to the defined trajectory. The freedom we now have is of course a major asset for the governance of this investment programme. In addition, the four confirmed IDEX at the universities of Bordeaux, Aix-Marseille, Strasbourg and Sorbonne-Université collaborate much more, without competition: we pool whatever we can and try to contribute together to the transformation of higher education, research and innovation in France.

An agency with strong values and commitments

As part of its mission to fund the best scientific projects, ANR takes care to ensure strict compliance with ethical rules in its peer reviews of proposals. In 2018, the Agency strengthened its commitments in its work alongside scientific communities and research funding bodies by signing declarations and taking part in several initiatives.

FOR A CULTURE OF RESEARCH INTEGRITY

Since its creation, ANR has been guided by rules of best practice in the evaluation of scientific projects. **The basic values of science, such as impartiality, independence, rigour, integrity and transparency, have always been at the heart of its activities.** Procedures for managing conflicts of interest were defined very early. The Agency adopted an initial ethical charter in 2009. It continued this commitment in 2014 by adopting a policy on ethics and scientific integrity.

In 2018, the Agency revised its Code of Ethics, evolving it into a **Code of Ethics and Scientific Integrity** in response to the recommendations of a

report¹ submitted by Pierre Corvol to the Secretary of State for Research in June 2016. As well as creating a French office dedicated to scientific integrity in March 2017, the report recommended deploying principles relating to integrity and grievance procedures within organisations.

The Code was accompanied by the nomination of an **ethics and scientific integrity officer** responsible for deploying the Agency's ethics and integrity plan and for providing training to all staff and to panel chairs on preventing and managing conflicts of interest. The officer collects and processes allegations of breaches of integrity, respecting confidentiality and following the procedure in place.



Since its creation, ANR has been guided by rules of best practice in the evaluation of scientific projects.

A CONCERTED POLICY IN FAVOUR OF OPEN RESEARCH

Given the broad disciplinary spectrum of the projects it funds, the Agency contributes to the growth of open science for all. In constant dialogue with researchers and research and innovation players such as funding bodies, research organisations, universities and schools, it plays a driving role in the creation of a jointly defined policy, which was accelerated in 2018.

France's National Open Science Plan, announced on 4th July 2018 by Frédérique Vidal, the Minister of Higher Education, Research and Innovation, has two aspects with an impact on the Agency: free access to publications arising from research projects receiving public funding and the opening up of research data. **ANR's open science policy** is fully aligned with this framework: funded researchers undertake to submit their publications to an open archive, either the national HAL archive (Hyper Articles on Line) or a local institutional archive, in compliance with the Digital Republic act. In 2013, ANR became one of 26

institutions to sign the Partnership Agreement to Foster Open Archives (Convention de partenariat en faveur des archives ouvertes), which supports HAL, the free, shared, multidisciplinary archive platform. ANR's 2019 Work Programme also recommends that project coordinators should publish in native open-access journals, and requests a data management plan for each funded project that complies with the principle "as open as possible, as closed as necessary".

To facilitate the establishment of an approach shared at national level, an **Open Science Committee**, including ANR representation, has been created by the French Ministry of Higher Education, Research and Innovation (MESRI).

The Agency also advocates the French positions on these themes at European and international level. In 2018, it joined Germany and the Netherlands in the **GOFAIR** initiative, which supports the application of FAIR principles (Findability, Accessibility, Interoperability and Reuse of data). On 4th September 2018, it joined **cOAlition S**, which

brings together 13 funding bodies (15 in 2019) to promote free access to scientific publications arising from research work and research data by implementing **Plan S**. This plan is supported by the European Commission and the European Research Council (ERC). Within the coalition, ANR argues for the French vision of bibliodiversity and the long-term conservation of publications in open institutional archives. ...



On 4 September 2018, the Agency joined cOAlition S, which brings together 13 funding bodies (15 in 2019) to promote free access to scientific publications arising from research work and research data by implementing Plan S.

Signature of the Code of Research Ethics

In March 2018, along with several universities and public research bodies, ANR signed the National Code of Research Ethics.

The output of joint discussions, the document transposes at national level the international texts that have led to the issue of scientific integrity being recognised and defined: the European Charter for Researchers (2005), the Singapore Statement on Research Integrity (2010) and the European Code of Conduct for Research Integrity (2011). The Code also aligns with the outlines of the European HORIZON 2020 programme on best European research practice.



¹ Overview and proposals for the implementation of the National Code of Scientific Integrity

••• TOWARDS GENDER EQUALITY IN SCIENTIFIC RESEARCH

Together with other public agencies, ANR has committed to working towards gender equality in higher education and research. It has incorporated the principle of gender equality into its Code of Ethics and Scientific Integrity. The Agency aims to ensure that scientific communities always consider sex and/or gender aspects in both knowledge production and scientific evaluation.

ANR highlights examples of good practice and guides the development of approaches to avoiding unconscious gender bias in peer review processes, measuring and monitoring gender inequality and improving funding allocation practices.

The Agency asks project coordinators to take gender into account in the design and execution of their research projects.



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Going further, training in gender issues is given to chairs of Evaluation Panels. ANR also targets parity in the make-up of the panels.

Moreover, in order to address the over-representation of men in science and to encourage young women to pursue careers in fields where they are absent or in a minority, the Agency is committed to showcasing women in science who have secured ANR funding or are involved in Scientific Evaluation Panels.

ANR is also a member of the national working group on obstacles to women's careers in higher education and research, which aims to review the situation and formulate recommendations to reinforce the development and evaluation

of policies to support equality in the workplace. ANR's contribution relates to the gender dimension in selection bias.

As a member of **Science Europe**, taking part in the **Gender and Diversity working group**, the Agency has also contributed to the development of a practical guide¹ designed to improve gender equality in research organisations.

To support and structure these initiatives, the Agency has responded to a H2020 call with eight European partners coordinated by CIRAD, obtaining European funding in 2018 to implement an action plan as part of the **Gender-SMART** project, which aims to strengthen impartiality in project selection by ensuring all pro-

jects are treated equally, whether they are coordinated by a man or a woman. To define relevant measures for implementation, analyses of the selection data will be conducted. These will be supplemented by interviewing researchers and observing panel meetings. Training materials for Agency staff and panel members will be developed based on the findings.

THE SAN FRANCISCO DECLARATION: FAIRER ASSESSMENT OF SCIENTIFIC PROJECTS

As a signatory of the **San Francisco Declaration on Research Assessment (DORA)** on 7th September 2018, alongside many other research organisations and institutions worldwide, ANR supports the adoption of improved practices in research evaluation.

THE NAGOYA PROTOCOL: MOBILISATION FOR THE RESTORATION OF BIODIVERSITY

Misuse of today's techniques for biological and genetic exploration could threaten biodiversity, promote biopiracy or lead to the benefits of genetic resources being unfairly distributed. The Nagoya Protocol, adopted in 2010 at the 10th Conference of the Parties to the Convention on Biological Diversity (COP 10), was ratified in France in August 2016 with the adoption of the law for the reconquest of biodiversity, nature and landscapes. It requires increased transparency and traceability from the suppliers and users of genetic resources and data. **ANR ensures the projects it funds comply with the regulatory provisions and requires them to provide declarations of due diligence.**

The Agency also invites project coordinators to declare any use of genetic resources when submitting their proposals. ▮

Finally, ANR is involved in the European **GENDER-NET Plus** programme (ERA-NET 2017-2022), in which 16 organisations from 13 countries aim to support the deployment of research into gender issues in several disciplinary fields.

Developed on the initiative of researchers from the American Society for Cell Biology (ASCB), the document sets out 18 recommendations for research organisations, funding bodies, publishers and researchers. In particular, it recommends no longer measuring publication quality with tools such as the impact factor (average number of citations relative to the number of articles in the journal).



ANR asks that bibliometric indicators be avoided when evaluating the projects submitted to its calls for proposals. It has provided training and information for the chairs of its Evaluation Panels to convey the message that a journal's reputation and the quantity of its citations are not a basis for prejudging a project's scientific quality.

//
The Agency aims to ensure that scientific communities always consider sex and/or gender aspects in both knowledge production and scientific evaluation.

¹ https://www.scienceeurope.org/wp-content/uploads/2017/01/SE_Gender_Practical-Guide.pdf



An agency recognised for its expertise

The ANR selection process is based on peer review in accordance with international practice. Keen to ensure the quality of its operation, the Agency certified all its processes relating to selection according to the ISO 9001 standard in 2018. Besides this expertise in evaluation and selection, it has also reduced the administrative workload for applicants to simplify the procedure. These developments are the result of listening and regular dialogue with scientific communities.

PROJECT EVALUATION AND SELECTION, PEER EXPERTISE

In accordance with international principles, including fair treatment for all applicants and transparency in all evaluation processes, the Agency selects the best scientific proposals based on evaluation criteria that are formalised and published.

Across all calls for proposals, scientific projects are reviewed by panels consisting of qualified scientific figures from outside the Agency. The panels are a place for dialogue about the scientific quality of the projects, which they review and classify according to the evaluation criteria. Every year, ANR mobilises the services of over a thousand scientists on its panels, together with many more for external reviews.

According to the rules on calls for proposals defined by the Agency's Work Programme, panel members can ask a number of specialist peer reviewers in the field relevant to the project being assessed to provide a confidential, independent external evaluation. Peer reviewers commissioned in this way have no links or communication with the panel as a whole. In the context of the AAPG, these peer reviews are always sent to project coordinators, who have the right to respond with factual information before the panel meets.

ANR also undertakes to respond to all queries submitted within two months of coordinators being informed that

their proposal is ineligible or told the reasons for its non-selection. It examines the scientific and legal status of the query and decides whether to confirm, change or re-examine its decision. In 2018, out of 190 appeals submitted for the AAPG and 14 for other calls for proposals, eight projects were re-evaluated and one was selected and funded.



Scientific projects are reviewed by panels consisting of qualified scientific figures from outside the Agency.



interview

Three questions for... Marie-Bénédicte Romond

Marie-Bénédicte Romond is a professor of bacteriology and virology at the Faculty of Pharmaceutical and Biological Sciences in Lille. She has chaired the Food and Food Systems Evaluation Panel (CE21) for the Generic Call for Proposals (AAPG) since 2017.

By what criteria do the scientific evaluation panels assess the projects they receive?

Scientific quality is the first criterion: we support innovative projects with clear objectives and well-targeted methodologies. But attractive ideas are not enough to

be chosen: the concrete organisation of the project and the skills and resources allocated to it are also crucial. Finally, the project's impact is decisive, and especially its socio-economic effects: does it offer innovative solutions; does it respond to society's needs? Research oriented towards food typically has a rapid impact on people's everyday lifestyles.



Our training in the rules for evaluating, classifying and selecting projects takes place twice a year.



Marie-Bénédicte Romond Scientific Evaluation Panel Chair

Who are the members of scientific evaluation panels?

They are scientists (researchers, academics) recognised in their area of expertise, even the most recent or interdisciplinary fields. Each one evaluates a portfolio of projects. Panel members have a one-year term, which can be renewed twice. One third of the panel is renewed every year. In this recruitment process, which is one of my responsibilities, I take inspiration from the practices of European scientific evaluation panels I belong to – I try to balance French and European colleagues and ensure parity between men and women.

During the evaluation, what guarantees do the panel chairs offer?

Our training in the rules for evaluating, classifying and selecting projects takes place twice a year. I remind the panel that our mission is to evaluate a project's novelty and the consortium's ability to fulfil its objectives. As the impact factor of publications cannot predict the success of a truly new project, I recommend evaluating the team's potential by analysing their work and their ability to communicate their ideas, in line with the principles of the San Francisco Declaration. I ensure that the project respects the best scientific practice, but also that our evaluation complies with the Agency's Code of Ethics and Scientific Integrity. Members with conflicts of interest do not take part in or even attend sessions evaluating projects to which they have links. Finally, as chair-representative, I take part in the continuous improvement of ANR's evaluation procedures throughout my term of office: I pass on feedback from coordinators and reviewers, including during the launch and mid-process review sessions, to which I contribute.

••• CONTINUOUS IMPROVEMENT ON BEHALF OF SCIENTIFIC COMMUNITIES

Always aiming to improve the quality of the service it provides to scientific communities, ANR adapts in response to needs and expectations on the basis of annual feedback. This continuous improvement approach, confirmed by the ISO 9001 certification achieved in 2018, enables the Agency both to improve the legibility of its funding opportunities and selection processes and to simplify its procedures.

Developing simplification

ANR continued its simplification programme for reference documents in 2018, aiming to make the Agency's work more legible and to reinforce scientific communities' trust in its activities.

As part of the development plan prepared jointly with the Ministry of Higher Education, Research and Innovation, the main research organisations and the CPU (Conference of University Presidents), major evolutions were introduced in the Work Programme. The main change concerned **the structure of the Generic Call for Proposals, no longer based on societal challenges but on scientific fields**, so that each researcher can submit their proposal

to a scientific evaluation panel whose scientific scope is defined by the area of research.

The documentation relating to the Work Programme has also been simplified. From the 250 pages of the 2017 edition, the document has slimmed down to three documents of about 30 pages each in 2018: a presentation of the different instruments, a brief description of the scientific fields and the Guide to the Generic Call for Proposals.

Finally, to more clearly distinguish the scientific aspects from the operational and administrative factors, **the Guide to the Generic Call for Proposals is now the common reference for project coordinators, panel members and external peer reviewers**. It presents the objectives of the four instruments that make up the AAPG, the role of each player in the evaluation and selection process, the submission and selection conditions and the provisional timetable.

Building on the many discussions that have taken place between ANR and funding recipients, the Agency continued to review its **financial regulations** in 2018, working closely with the funding recipients. The goal is to improve the efficiency of the contracting, funding and administrative follow-up processes.



ANR continued its simplification programme for reference documents in 2018, aiming to make the Agency's work more legible and to reinforce scientific communities' trust in its activities.



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ANR receives ISO 9001 certification

On 12th June 2018, ANR was awarded ISO 9001 certification (2015 version) for all the Generic Call for Proposals processes, including project selection and the associated support functions (human resources, budget, agreeing contracts etc.). Made possible by large-scale preparatory work by the Agency's teams, the certification was an opportunity for ANR to clarify its project selection procedures and confirm its performance.



The last step in the selection process is to establish allocation agreements for the grants awarded by ANR to the selected projects. A programme to simplify and **improve the efficiency of the process to draft these agreements and award funding** had already been launched in 2017. The administrative timetable for disbursing the tranches of grant money was brought into line with the sometimes irregular scientific timetable by which projects are organised.

Other important measures to make the life of projects simpler were also introduced in 2018. In accordance with article L.329 of the French Research Code, part of the grant allocated by ANR is paid to the institutions hosting the research projects. ANR's March 2018 Governing Board meeting established that

the principles and payment terms of this "preciput" would no longer be defined in a Preciput Code but in the financial regulations, which have been revised; it will now be paid without requesting supporting documents or the production of annual accounts on how it is spent.

Finally, over their lifetime, projects may evolve due to external circumstances or their own development. Until 2018, these changes were only possible through amendments to the funding agreements involving all the stakeholders. Changes to projects can now be reported simply to ANR, except where agreements involve partners under private law.

•••



Building on the many discussions that have taken place between ANR and funding recipients, the Agency continued to review its financial regulations in 2018, working closely with the beneficiary institutions.



••• IMPROVED LISTENING AND DIALOGUE

To improve its evaluation, funding and monitoring processes, ANR relies on feedback from scientific evaluation panels, project coordinators and beneficiary institutions. Another source of information is the annual ANR Tour, which provides opportunities for explanation, discussion and collecting observations and suggestions from the research communities.

Satisfaction surveys...

ANR conducts several satisfaction surveys among scientific evaluation panel members and project coordinators in the Generic Call for Proposals. The results of these surveys provide a measurement of user satisfaction and a better understanding of their needs and expectations.

Following the satisfaction audit introduced in 2017, further surveys were conducted in 2018. The results show that satisfaction among project coordinators remains stable (81%), while that of non-selected applicants, naturally lower, rose from 44% in 2017 to 50%. These surveys also help to identify strengths and weaknesses. The responses to questionnaires show clear progress in the legibility of the

Work Programme documentation, with satisfaction rising significantly (88% satisfaction compared with 67% in 2017), suggesting that the simplification work has borne fruit. Explicit expectations relate in particular to the explanations for panels' decisions, especially in the event of rejection. The training for scientific evaluation panel chairs has been updated to improve the quality of the evaluation reports sent to project coordinators.

... and formalised feedback

In addition, targeted surveys of panel chairs and members, external peer reviewers and project coordinators are carried out regularly. This feedback is supplemented by reports from ANR staff who attend scientific evaluation panel meetings as observers and ensure procedures are respected. Since 2018, a summary of these surveys and reports has been presented to scientific evaluation panel chairs at a general meeting¹ in September and as part of their training before each new session of calls for proposals. These exchanges between panel chairs and the Agency help improve both the reference texts for calls for proposals and the evaluation processes.



Since 2018, a summary of these surveys and reports has been presented to scientific evaluation panel chairs at a general meeting in September and as part of their training before each new session of calls for proposals.



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¹ The chair representatives' conference

The ANR Tour

The third ANR Tour took place between 4 September and 4 October 2018, focusing on strengthened dialogue. It involved 28 events, organised thanks to support from regional CNRS delegations, research organisations, universities and other higher education institutions. With over 2,500 attendees, the third tour included more meetings than previous editions, covering all the regions of France, both mainland and overseas (Martinique and Guadeloupe).

The events, organised in 25 cities, including four in Paris, enabled scientific communities, researchers and representatives of the business world responsible for developing

and managing research to meet and communicate with ANR staff. Agency representatives detailed the Work Programme, clarified the conditions for applying to calls for proposals and described how the evaluation panels work.

Better support for funding recipients

To complement the ANR Tour, the Agency has organised an annual series of meetings since 2017 to present its financial regulations and its evolution to the administrative and financial staff of research institutions and companies recei-

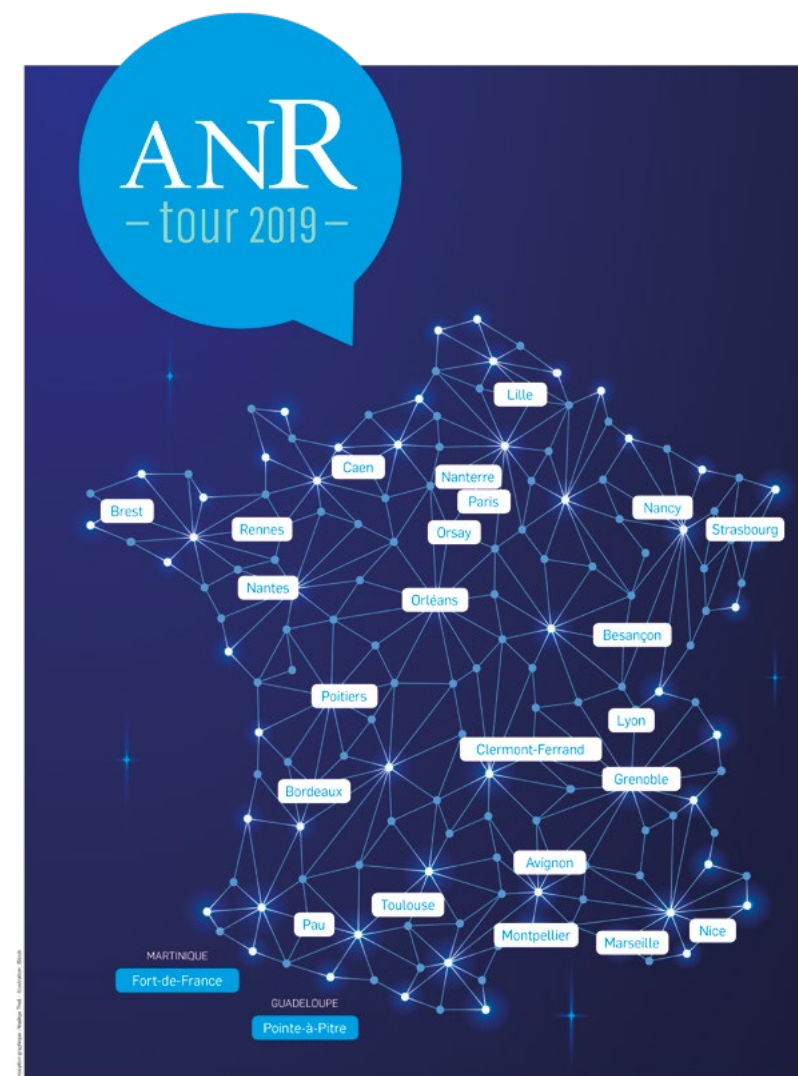
ving funding. Two events in 2018 (June and October) looked back at the 2017 measures to simplify the financial regulations, including admissible cost categories, fungibility of expenses, deliverables and payments, and explained the new improvements and simplifications approved in 2018 relating to the drafting of agreements and the possibility of making changes during the life of a funded project. Emerging from these discussions, a set of frequently asked questions (FAQ) has been prepared and is available on the Agency's website¹.



3rd
TOUR

Over
2,500
PARTICIPANTS

28 EVENTS
in mainland France
and overseas



¹ <https://anr.fr/fr/contact/faq-rt/>

2

Advancing research in all its diversity

1,471
PROJECTS FUNDED
in 2018

16.2%
SELECTION RATE
across all calls in 2018

281
EUROPEAN AND
INTERNATIONAL PROJECTS
co-funded in 2018



Encouraging bottom up research initiatives: the Generic Call for Proposals

The main mechanism of support for basic research, the Generic Call for Proposals (AAPG) encourages collaborative research initiated by researchers and helps young researchers to take responsibility.

MULTIPLE FUNDING INSTRUMENTS

Three instruments in the Generic Call for Proposals (PRC, PRCE and PRCI) reinforce scientific collaboration, while the fourth (JCJC) encourages young researchers to take responsibility.

Collaborative Research Projects (PRC) is the main ANR funding instrument. It supports collaboration between teams on a joint project to boost their creativity, enable them to pool their skills and constitute new academic consortia.


603 PRCs

were selected for funding in 2018, representing 53% of the funding budget devoted to the Agency's calls for proposals.

Collaborative Research Projects Involving Enterprises (PRCE) is dedicated to collaborations between at least one academic laboratory and at least one private company with an R&D activity. The joint approach enables researchers to address new questions, or to approach them from a different angle, and companies to find scope for innovation in the most basic research.



119 PRCEs

were funded in 2018, representing 13% of the funding budget devoted to ANR's calls for proposals.

International Collaborative Research Projects (PRCI) aims to strengthen balanced bilateral international collaboration between French and foreign teams with strong synergies. The funding agencies involved can evaluate the projects submitted in parallel – those recommended for funding by both agencies are then funded. However, they can also agree that a single agency, called the lead agency, will receive, evaluate and select projects. Long-term agreements of this type have been formed thanks to the mutual trust between ANR and the German, Austrian, Brazilian, Luxembourg and Swiss funding agencies.



99 PRCIs

were funded in 2018, representing 5% of the funding budget devoted to ANR's calls for proposals.

The Young Researchers (JCJC) instrument is targeted at young researchers awarded PhDs less than 10 years ago. It enables younger generations to develop their own research topics and put together or consolidate a team, reinforcing their sense of responsibility.



312 JCJCs

were selected for funding in 2018, representing 15% of the funding budget devoted to the Agency's calls for proposals.



1,133
PROJECTS SELECTED
for funding in 2018, a
success rate of
15.1%,
an increase compared
to 2017 (13.2%)

STRUCTURE BASED ON SCIENTIFIC FIELDS

In consultation with research communities, the 2018 Generic Call for Proposals has evolved:

- ▷ the scientific coordinators submit their proposal based on a disciplinary or interdisciplinary field rather than the previous societal challenges;
- ▷ 47 areas have been identified, with 47 dedicated scientific evaluation panels;

This new structure expresses a stronger focus on better disciplinary and cross-disciplinary identification in line with the challenges.

- ▷ referring to the challenges in the National Research Strategy is no longer a criterion for selection;
- ▷ the quality and originality of the proposal, its organisation and the resources used remain the primary evaluation criteria for the Generic Call for Proposals; the scientific excellence of the proposal and the team constitute a further basis for selection.

success story

Sandrine Codis, “Young Researcher” in astrophysics

Three years after obtaining her doctorate, the astrophysicist Sandrine Codis, a CNRS researcher at the Institut d'Astrophysique de Paris, submitted her first research proposal to the **Young Researchers (JCJC)** instrument of the 2018 Generic Call for Proposals. Her project, SPHERES, was selected. Its aim is to model the “cosmic web”, the filaments of gas and dark matter along which galaxies form. The work should help us understand the massive structures of the universe and interpret the images from the European EUCLID space mission, scheduled for 2021, in which France plays an active part. The JCJC funding will give new momentum to the career and work of this graduate of the École Normale Supérieure, who is forging collaborations with researchers of all ages across the world.

“

*My laboratory helped me put the administrative part of the application together,” remembers **Sandrine Codis**. “First of all, the funding enabled me to start recruiting a post-doctoral researcher. I was also able to run a workshop in Japan on my research themes, three-quarters-funded by the SPHERES project as planned in my grant application. What's more, ANR is a springboard: it enables us to carry the responsibility for a project within the scientific community, and perhaps consider applying one day for a large European call for proposals – like the European Research Council, why not!*

”



Find out more:

<https://www.youtube.com/watch?v=e425mc3fuo4&list=PLBGAVVGzrPkE9EB5xj443kKb18iWRKKBq&index=4&t=0s>

••• With 7,520 proposals submitted in 2018, the Generic Call for Proposals accounts for a very high volume of projects. This is why the submission and evaluation process introduced in 2014 takes place in two stages:

▷ In stage one, a summary pre-proposal (four pages) is submitted for review by two members of the evaluation panel (possibly with support from an external peer reviewer in the case of highly interdisciplinary projects), with the final decision taken by the whole panel.

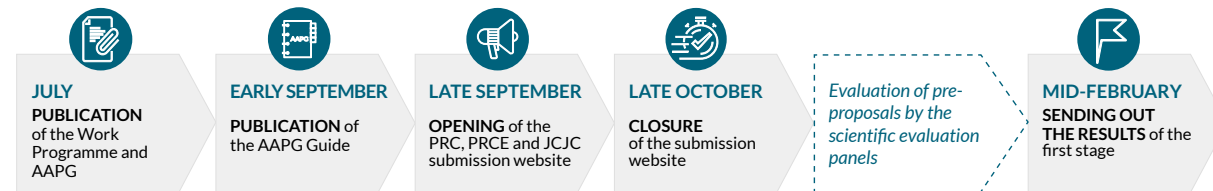
▷ In stage two, the coordinators of the selected projects are invited to submit a full proposal (20 pages). Two panel members are responsible for each application, and call on the expert assessment of at least two external scientists. Researchers now have a right of reply to these assessments. Based on the external reviews and their own assessments on the proposal, the two panel members present a summary to the panel, which ranks the best proposals and makes a

recommendation on funding from the budgets available. Depending on its budget capacity, ANR determines the list of projects finally selected for funding for each panel and each instrument.

Eligible project coordinators receive a summary of the final evaluation and have two months to submit any questions or redress request to the Agency, which examines and responds to them.

THE TWO STAGES OF THE GENERIC CALL FOR PROPOSALS (AAPG)

Stage 1: Submission of pre-proposals



Stage 2: Selection of full proposals



2018 KEY FIGURES AND RESULTS

The 2018 ANR Work Programme emphasised priority fields of research identified by the government for their strategic value.

Within the Generic Call for Proposals, these priorities were supported as follows:

▷ In the area of artificial intelligence (AI), in line with the AI national

plan, an allowance of €9.6 million funded 21 additional projects, of which 44% were interdisciplinary.

▷ The social sciences and humanities (SSH) received additional support of €7.2 million thanks to the national SSH plan. A further 24 projects were thus funded, half of them targeting multidisciplinary research.

▷ Six projects on quantum techno-

logy received an additional budget of €3 million in line with France's participation in the Quantum Flagship launched by the European Union.

Finally, a sum of €11 million arising from an increase in the funding budget enabled over 30 additional cross-disciplinary or interdisciplinary projects to be funded.

The projects selected for the 2018 Generic Call for Proposals break down as follows:

- ▷ 603 Collaborative Research Projects (PRC)
- ▷ 312 Young Researcher projects (JCJC)
- ▷ 119 Collaborative Research Projects involving Enterprises (PRCE)
- ▷ 99 International Collaborative Research Projects (PRCI)

At the end of the year, the Agency funded 57 projects from the reserve lists thanks to budget increases made possible partly by the postponement of international programmes, amounting to the equivalent of €24.2 million in grants being allocated.

The final Generic Call for Proposals selection rate over the two stages thus reached 15.1% (42.2% at stage one and 35.8% at stage two), the highest level recorded since the generic call was introduced in 2014.

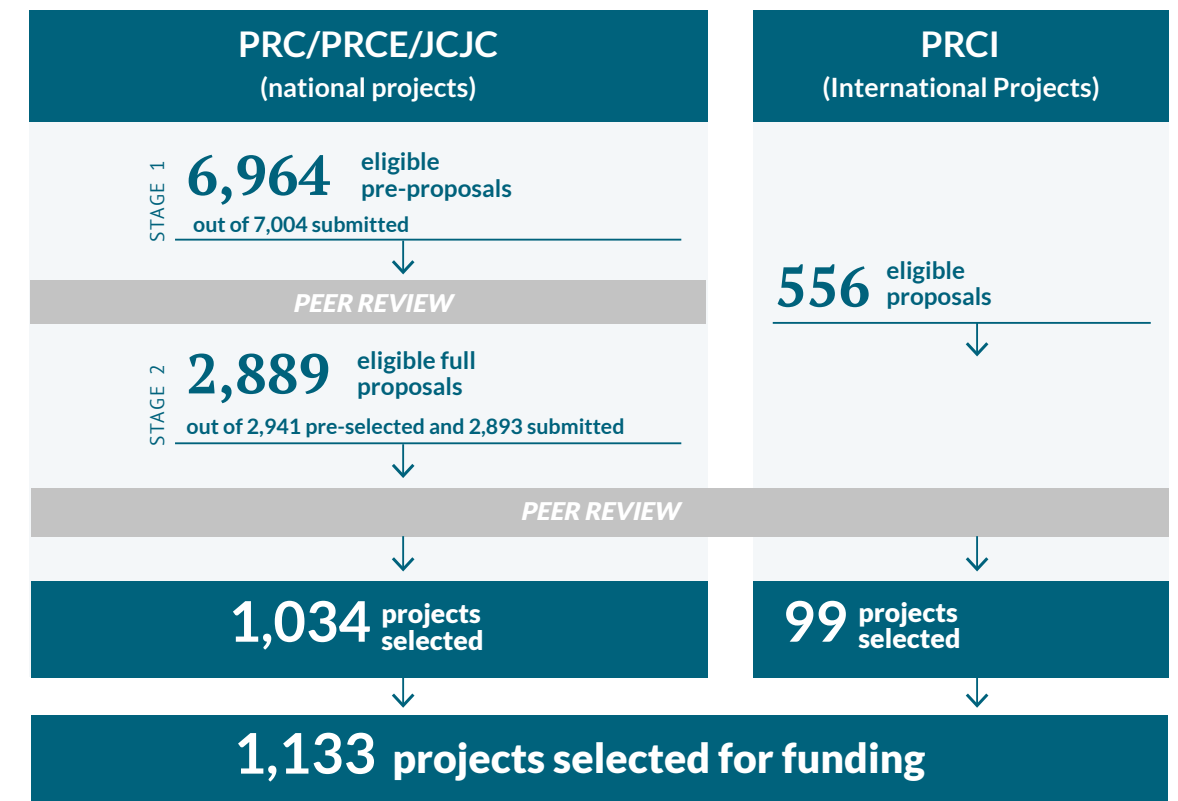
In line with its mission as a project-based research funder, ANR has established a number of institutional partnerships. Within the AAPG, the French Ministry of Armed Forces (the Defence Procurement Agency, DGA) and the General Secretariat for Defence and National Security (SGDSN) contributed €3.3 million to fund projects associated with their areas of interest.

At the end of the budgetary year, the total Generic Call for Proposals budget thus represented €443.1 million, compared with €420.6 million in 2017.



The total Generic Call for Proposals budget represents **€443.1M** compared with €420.6 million in 2017

Results of the 2018 Generic Call for Proposals



Reinforcing competitiveness and technology transfer

With over 18,000 projects funded or co-funded since its foundation, ANR contributes to developing research creativity and meshing science with economics. Through specific funding instruments (outside the Generic Call for Proposals) and programmes dedicated to competitiveness and technology transfer, the Agency encourages researchers, laboratories and companies to open up new scientific perspectives together, develop long-term technological solutions and ensure that applied research has an economic impact.

THE CHALLENGE AND FLASH INSTRUMENTS, RESPONDING TO SPECIFIC RESEARCH NEEDS

At the interface between civil society and research, ANR can respond to requests from institutional or private partners dealing with a precise scientific or technological challenge. The partner defines the objectives with the Agency, which can address its needs through three specific instruments.

Created in 2008, **the Challenge instrument** fosters competition between consortia of laboratories and public or private companies to overcome scientific, technological or methodological obstacles in relation to a specific, identified problem. The work is organised around campaigns of experiments to track, test and compare the approaches taken.

The funding for this original tool varies: it may be provided by ANR, co-funded or supplied entirely by a partner. **Eight Challenges have been launched since its creation.**



At the interface between civil society and research, ANR can respond to requests from institutional or private partners dealing with a precise scientific or technological challenge.



In 2018:

▷ As part of the **MALIN Challenge** to locate people precisely inside buildings not fitted with any special equipment, an initial series of real-life tests was organised at a test centre run by the DGA, a partner in the Challenge. Six teams competed to test the first version of their prototypes and the evaluation protocols.

▷ At the Paris International Agricultural Show, ANR, in partnership with the ministries responsible for research, agriculture and the ecological transition, the French National Metrology and Testing Laboratory (LNE) and the French National Research Institute of Science and Technology for Environment and Agriculture (Irstea), presented the four teams selected for the **ROSE Challenge** on robotics and sensors for the Ecophyto plan. The goal of this Challenge is to stimulate competition between consortia offering innovative weeding solutions (robotic mechanical weeding, electrical weeding) to replace the use of chemicals.

The Flash instrument, meanwhile, responds to emergencies: with an accelerated procedure, the scientific community is mobilised very quickly to tackle urgent research needs. Thanks to the responsiveness of this instrument, call for proposals can be launched, projects selected, agreed and started in just three months, with no compromise on scientific standards and peer review.

The results of the 2017 Flash call **“Disaster, Risk and Resilience”** were published in 2018, three months after its launch, at the request of the French Ministry of Higher Education, Research and Innovation (MESRI). The call followed the series of unprecedentedly powerful hurricanes that devastated the Lesser Antilles and the Gulf of Mexico.

SUPPORT FOR TECHNOLOGY TRANSFER AND COMPETITIVENESS

ANR’s missions include promoting technical innovation and technology transfer. Through multiple partnerships, it encourages researchers, public institutions and entrepreneurs to work together to strengthen the knowledge economy and ensure their competitiveness.

One example is ANR’s funding for Carnot-labelled laboratories. Created in 2006, **the Carnot label** is awarded by the French Ministry of Higher Education, Research and

Innovation (MESRI) to public laboratories or groupings of university and academic teams in France whose research strategy involves a high level of partnership with private companies. ANR allocates a grant to the 29 current Carnot laboratories that is calculated based on the income generated by their contracts with companies and on the licensing revenues arising from the exploitation of their intellectual property.

In 2018, ANR allocated a total of €62 million to these laboratories, amounting to 9.2% of its funding budget, strengthening the attractiveness and performance of French research.



ANR’s missions include promoting technical innovation and technology transfer.

The “Industrial Chairs” call supports partnership-based research conducted with large private companies in France. Occupied by eminent French or foreign researchers working at public research institutions, the chairs are spaces for research and knowledge transmission in the context

of high-level doctoral or post-doctoral education and are targeted at economic and social problems that are priorities for French industry. ANR and the companies involved co-fund the projects equally for 48 months.

In 2018, 44.4% of applications were accepted. **Four Industrial Chair projects were launched** for a total sum of €3.9 million.



Responding to the research needs of the armed forces Ministry: the ASTRID and ASTRID Maturation programmes

To respond to the research needs of the armed forces Ministry, ANR set up the **ASTRID** (French acronym for “specific support for defence research and innovation”) and **ASTRID Maturation** programmes in 2011 and 2013 respectively. They were fully funded by the French Defence Procurement Agency (DGA) and were taken over by the French Defence Innovation Agency (AID) in 2018. ASTRID addresses research projects with a technological maturity of 1 to 4 on the TRL (Technology Readiness Level) scale. ASTRID Maturation supports application projects with a TRL of 3 to 5 or above. Both programmes support dual research projects with potential benefits for the civil and military fields. The projects funded thus contribute to the AID’s activities in anticipating and mastering the evolution of technologies that will be necessary or useful for future defence and security systems. In 2018, 26 ASTRID projects were selected for funding, a selection rate of 27.1%, for a total amount of €7.6 million.

The ASTRID Maturation programme, enables researchers to build on the innovation base of the ASTRID programme and theses funded by the DGA (or other research projects funded by the French Ministry of Armed Forces), transferring technologies to one or more industrial partners¹.

These projects thus have a higher maturity level. Eight out of 16 ASTRID Maturation projects were selected in 2018, representing a budget of €3.9 million.

¹ The consortium must include at least one SME



••• **The programme to support the creation of shared laboratories (LabCom)** is designed for collaborations between research institutions and companies with fewer than 5,000 employees (VSEs, SMEs and MSEs).

139 LabComs were financed between 2013 and 2018, with an average selection rate of 20.93% and two or three selection sessions a year.

ANR funds the public research body to the tune of €300,000 over 36 months. This system was presented

at the first LabCom conference¹, which took place at the Maison de la Chimie in Paris on 27th September 2018.

These three instruments tie the competitiveness of research closely to that of private French companies, encouraging business to invest in public research and research to transfer its knowledge and technologies to the industrial world. //



The first LabCom conference took place at the Maison de la Chimie in Paris on 27th September 2018

success story

The LERAM LabCom, between public and private research

The story of LERAM, the laboratory for the study of the rheology and adhesion of adhesives for medical applications, tells of the long-lasting complementary relationship between a public research team and a mid-sized French company. In 2013, when ANR launched its first LabCom call for proposals, the Urgo group was beginning a collaboration with the polymers team at the IPREM mixed research unit (University of Pau and the Pays de l'Adour/CNRS).



*LabCom makes it possible to unite two cultures, bringing out new ideas," explains **Christophe Derail, the LERAM coordinator.** "The spirit of LabCom is to release each partner's potential. This synergy has generated knowledge, and a patent submitted in 2018 for a technique to measure adhesion that could ultimately be introduced directly to an industrial production line. Urgo is planning to sign an operating licence with our academic sponsors. A new adhesive formulation has also been discovered, which should be patented very soon. The Nouvelle-Aquitaine region is supporting LERAM by co-funding a thesis involving Urgo and LVMH on products that can be used for plasters and cosmetics.*



The team had research expertise in the creation of polymer materials, particularly for adhesion to skin. Identifying many common areas of interest, the two sides conceived LERAM, which was selected for LabCom 2013 and received a LabCom Consolidation extension in 2018. The agreement between Urgo, CNRS and UPPA was renewed until 2022.

¹ <https://www.youtube.com/watch?v=Xb6wdDzqtIg>

interview

Three questions for... Paul-François Fournier



© Bpifrance

ANR and the public investment bank Bpifrance launched a strategic partnership in 2018. Paul-François Fournier, Bpifrance's Executive Director of Innovation, sets out the context and goals of the partnership.

How do you see the role of research in innovation?

We are experiencing a profound change in the dynamics of innovation. The movement of the last ten years, based on the emergence of digital and mobile technology, is reaching maturity – the equipment has been widely adopted and French innovation has been dynamic. In order to extend this wave to new industries, we must



Bpifrance and ANR are natural partners. ANR funds many research projects with potential for innovation.



now return to the research laboratories to identify and support emerging technologies as early as possible – especially Deep Tech start-ups, which will contribute in all fields to resolving the big challenges of the 21st century, such as health and climate. Bpifrance and ANR are natural partners. ANR funds many research projects with potential for innovation.

What makes the partnership strategic?

Bpifrance is represented on ANR's Governing Board, and we realised, along with Thierry Damerval, that we had to go further. For France to take advantage of the paradigm shift driven by disruptive innovations, we have to offer a funding continuum, investing equally in very basic research projects and in particularly innovative young start-ups.

We are leading the thought process together in the form of seminars and shared working groups to highlight avenues for collaboration on innovation funding, and we are preparing a Deep Tech plan that will occupy us in the coming years. Everyone benefits from knowing their colleagues better in order to play their own part. Bpifrance will gain a better understanding of which sectors, trends and priorities ANR supports, and how. ANR will be able to identify the needs, logic and priorities of an investor who wants to bring projects to market.

What will the partnership contribute to research and innovation?

It will open new possibilities. Not all research is immediately likely to penetrate the business world, of course. But some research needs new forms of support. A global approach is under way to provide this, including the PACTE law, for example, which makes it easier for researchers to get involved in business.

Bpifrance is convinced that start-ups, innovative young groups of 10 to 30 people, are the ideal tool for transferring technologies and developing practical applications for research due to their agile operation. In 2018, the government commissioned Bpifrance to oversee the SATTs (technology transfer acceleration companies), which smooth the transition between research and enterprise. Our ambition is to double the creation of start-ups arising from academic research. Together, ANR and Bpifrance will enable the most innovative research to take flight.

Paul-François Fournier
Executive Director of Innovation,
Bpifrance

Promoting scientific cooperation in Europe and worldwide

One of ANR's missions is to "strengthen scientific cooperation across Europe and worldwide by coordinating its Work Programme with European and international initiatives". ANR has continuously developed its transnational activity with specific initiatives and instruments and through its involvement in various discussion and planning bodies. It has thus become a major player in the construction of the European Research Area (ERA) and occupies a growing role on the international stage. ANR has co-funded 2,226 transnational projects with its counterpart agencies in other countries across all scientific fields since 2006. In 2018, it devoted a budget of over €73 million to co-funding French teams on 281 transnational projects, 80% of them arranged through European partnerships.

CONSTRUCTING THE EUROPEAN RESEARCH AREA: A PRIORITY

ANR contributes actively to the construction of the European Research Area (ERA). It works with other European project-based funding agencies to develop actions, programmes and calls for proposals that complete and reinforce the initiatives conducted through the European Framework Programme for Research and Innovation (FPRI) for the best possible coordination with existing funding provision within the European Union.

Often implemented through European public-public partnerships (P2Ps) such as ERA-NET Cofund or Article 185 or joint programming initiatives (JPIs), these programmes and their transnational calls are conceived for the long term, with a multi-year planning approach. In 2018, the Agency launched 24 calls for proposals of this type, covering a wide variety of scientific fields.

Some of these initiatives concern societal challenges of supra-national importance. In line with the United Nations Sustainable Development Goals (SDGs) and the Societal Challenges of the FPRI, they coordinate research efforts to provide joint responses to global challenges that cannot be addressed solely at national level, such as climate, water resource management, sustainable agriculture,

demographic change, neurodegenerative diseases and antibiotic resistance.



2,226
TRANSNATIONAL
PROJECTS CO-FUNDED
with counterpart agencies
in other countries across
all scientific fields
since 2006

In this context, France is involved in ten Joint Programming Initiatives (JPIs). These European networks, led by member states, were established in 2008. Each JPI defines a shared strategic agenda for research and innovation in its area of interest and can launch multilateral calls for proposals. These initiatives are a means of combining and coordinating national research policies with EU policy around major societal challenges and increasing the international visibility of European research. ANR represents the French position on the governing bodies of these JPIs. It chairs and co-chairs the Water and FACCE JPIs respectively.

The Agency contributes to the PRIMA programme, a partnership for research and innovation in the Mediterranean region focusing on the problems of sustainable agriculture, irrigation and water treatment. The programme helps to implement Euro-Mediterranean research policy. It has a budget of €494 million over ten years (including €40 million committed by France), funded equally by national agencies and the European Commission. The first call was launched in 2018.

Other transnational programmes and calls aim to pool technologies and resources, including in emerging or under-developed research areas, to provide a critical mass of data and skills and share research and its costs. These initiatives thus promote and accelerate the development of knowledge and innovation in fields such as quantum technology, graphene, rare diseases, neuroscience, personalised medicine, biotechnology and sustainable urban planning.



Science policies in Europe and the wider world

ANR is involved in international bodies dedicated to science policy such as **Science Europe** and the **Global Research Council (GRC)**. These two groupings of organisations and research funding agencies, one European and the other global, are forums for discussion and for defining common principles for action. They are a means for the European and international funding bodies represented to take joint positions and issue declarations. The agencies can thus collectively influence the direction of science policy, particularly the planning of the European Framework Programme for Research and Innovation, and promote fundamental principles such as freedom of research and scientific review, scientific integrity, open access, open science and diversity.

DRIVING THE EMERGENCE OF TRANSNATIONAL SCIENTIFIC PARTNERSHIPS FOR EXCELLENCE

ANR reinforces the partnership dynamic between high-level French researchers and foreign scientific communities in areas identified as strategic priorities by the French government and its partners.

In Europe, for example, it shares bilateral agreements with Germany, France's leading partner. The calls for proposals launched in 2018 on the themes "Conversion and storage of energy from renewable sources" and "Smart energy grids" represented a total amount of €14 million, with half allocated by each country.

Outside Europe, following the signature of a framework agreement between ANR and the Japanese

science and technology agency (JST) as part of Japan's CREST research programme, collaborations between France and Japan were initiated in 2018 in the form of two specific joint CREST/ANR calls on the themes of Quantum Technologies and Symbiotic Interaction. This collaboration will be renewed every year.

The PRCI instrument of the Generic Call for Proposals (see p. 28) enables long-term bilateral relationships to be formed with scientific communities in Europe and beyond. In 2018, ANR had agreements with ten agencies through this instrument and funded nearly 100 projects with Germany, Austria, Switzerland, Luxembourg, Brazil, Taiwan, Singapore, Hong Kong and Turkey. **A priority in the 2018 Work Programme, the projects**

shared with Germany represented €15.1 million out of a PRCI budget of €26.4 million. Encouraging the emergence of high-level international teams in all scientific fields, these cooperative relationships are ANR's main means of support for the constitution of borderless research areas.

This is also the case for the ORA (Open Research Area) cooperation between Germany, France, the Netherlands and the UK, and the French-German FRAL programme, which issues annual calls open to all areas of the social sciences and humanities. ●●●

- The Agency is also a member of the **Belmont Forum**. This transnational grouping of research funding agencies from all five continents was created in 2009. It relies on international science communities (Future Earth) to promote transdisciplinary research on a global scale, focusing particularly on the environment, climate change and the mitigation of its effects. The members of the Belmont Forum have jointly launched one or two calls for proposals a year since 2012. ANR, which hosted the Belmont Forum secretariat from 2015 to 2018, was a driving force in setting up its activities. **It has taken part in 12 of its calls for proposals**, enabling the funding of over 80 French researchers involved in 37 collaborative research projects for a total of €11 million. In all, the Belmont Forum has enabled collaboration between researchers and stakeholders from 35 countries on five continents.



The ten years of cooperation between ANR and the Taiwanese Ministry of Science and Technology (MOST) were celebrated on 14th September 2018 at the France-Taiwan science festival. This long-term bilateral partnership, covering all areas of research, has led to the co-funding of **69 PRCI projects involving 230 partner teams**. At the same event, the French Academy of Sciences commemorated 20 years of the French-Taiwanese Prize, which it created with MOST. The 2018 winner was a project co-funded by ANR. This cooperation with Taiwan, built on excellence, is part of a broader context of bilateral collaboration agreements signed with Asian countries since 2007, including India, South Korea, Japan, China and Hong Kong



REINFORCING THE PARTICIPATION OF FRENCH TEAMS IN EUROPEAN CALLS FOR PROPOSALS

To strengthen the leadership of French researchers when applying to the European calls as project coordinator and to foster their participation in the Framework Programme for Research and Innovation, ANR has set up two mechanisms, Springboard-ERC and MRSEI.

The Springboard-ERC (T-ERC) instrument encourages young talents to apply for European Research Council (ERC) calls for proposals. A European Union research funding instrument, ERC supports advanced exploratory research based on original, innovative approaches at the initiative of researchers. ANR's T-ERC instrument

offers a budgetary allocation of up to €200,000 for project coordinators attached to French public research institutions who have not been selected by the ERC but have still received an A rating. It helps them start their research project as quickly as possible so they can apply again with a greater chance of success.

The MRSEI (Setting up European or International Scientific Networks) tool aims to support the creation and

French coordination of an international scientific network with recognition in fields that have significant strategic, economic, technological or societal impact with a view to applications for all the collaborative programmes in the European Framework Programme for Research and Innovation, Horizon 2020. In 2018, 45 networks out of 91 were selected for funding, a success rate of 49.5%. Each project receives a grant of up to €30k to help establish a network. //



45
MRSEI NETWORKS
SELECTED
for funding in 2018 out of 91,
a **SUCCESS RATE** of
49.5%

success story

The POLAR project, from MRSEI to H2020

The POLAR project (POLice and ARchaeologists against the trade in cultural artefacts) emerged from the CNRS call for proposals for research on terrorist attacks in 2015. Faced with the growth in pillaging and trading in cultural goods, including the "blood artefacts" exported from the Middle East, archaeologists, the police and players in the art market decided to pool their knowledge and skills. The interdisciplinary network's project was granted an ANR MRSEI funding in 2018, supporting it to grow transnationally and secure an H2020 funding of about €1.5 million over two years in 2019 under the acronym NETCHER (NETwork and digital platform for Cultural Heritage Enhancing and Rebuilding).

“

*ANR's support for this original network was decisive," summarises **Patrick Laclémence, coordinator of the POLAR MRSEI project and director of the research centre at France's National Police College (ENSP)**. ANR helped us identify the best European call for our project. We then received support to consolidate our European consortium involving the police's central cultural heritage office, ENSP and the Maison de l'Orient et de la Méditerranée.*

”

“

*We then had very little time to set up a huge European programme," continues **Véronique Chankowski, professor of Greek history at the University of Lyon 2, director of the HiSoMA laboratory until 2018 and coordinator of the NETCHER project**. "Thanks to the MRSEI grant, we were able to bring our disciplines together, draw on the services of a firm specialising in preparing H2020 projects and deploy the network concept on a European scale.*

”

3

Guaranteeing and reinforcing efficiency

€672.4M
FUNDING BUDGET
in 2018

€34.3M
OPERATING BUDGET
in 2018

294
EMPLOYEES
(on 31/12/2018)



A framework for continuous improvement

ANR has launched a continuous improvement programme to the benefit of all the scientific communities and stakeholders with which it interacts. As part of its risk management policy and its 2016-2019 contract of objectives and performance (COP) signed with the French government, the ANR is strengthening the reliability of its procedures, continuously adapting them to guarantee selection quality, optimise the excellence of the service delivered to its community of users and ensure the organisation and its activities run efficiently.

INTERNAL CONTROL AND QUALITY MANAGEMENT

To guarantee the reliability of its procedures and strengthen its risk management, ANR relies on linked internal control and quality systems.

Internal control aims to ensure that the organisation complies with laws and regulations, follows instructions and guidance from senior management and protects the reliability and integrity of financial and operational information to guarantee and reinforce operational effectiveness and efficiency. It offers a framework for continuous improvement in this direction.

Quality management aims to define the organisational structure, each individual's responsibilities and the procedures and resources necessary to implement an effective quality management policy. It helps to standardise practices, ensure the traceability of operations, capitalise on the organisation's knowledge and increase the understanding of its context and evolution. In 2018, the Agency obtained ISO 9001 certification for its project selection processes, and will continue this approach with the certification of processes to manage relationships with user communities.

A NEW MAPPING OF MAJOR RISKS

ANR has introduced a system to anticipate and manage risks that is regularly updated to take regulatory, legislative and social changes into account. The system is based on a method for identifying and prioritising risks, both internal and external, and addressing them at the relevant operational level to reduce the Agency's exposure.

The first task in 2017 was to produce a mapping of the major risks highlighting their impact, their probability and the Agency's level of control over them, and then to define an action plan relating to its missions. Twelve risks were identified in 2018, four of them classed as major, and divided into three broad risk categories (management/governance; external risks and operational risks) and four families more specific to the Agency's activities (strategic; financial, legal, regulatory; organisational and IT; societal and human).

The measures taken during the year enabled two major risks to be removed from the priority risk zone: insufficient anticipation of evolutions in the Agency relating to changes in the strategic orientations of research, and the difficulty in allocating human, financial and operational resources to ANR processes based on changes in strategic direction or specific evolutions.

A new tool to better satisfy user communities

ANR began setting up a new tool to improve the way it manages its relations with its user communities in 2018. In line with the Agency's objectives and processes, it needs to be able to respond to all queries efficiently during the life cycle of a project and to trace operations.

Clearance of past editions: strong progress

The programme to clear the backlog of previous editions relates to projects funded between 2006 and 2010 that have yet to be finalised because documentary evidence is lacking, involving more than 5,300 projects over the period. Thanks to the simplification of administrative processes, the remaining payments for many projects have now been made:

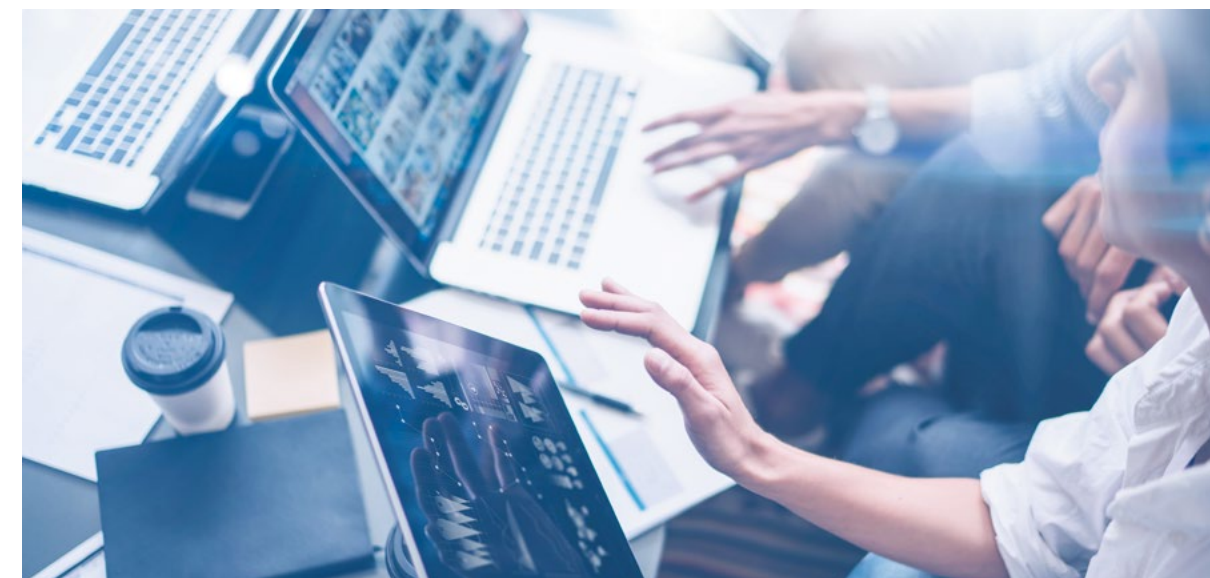
- ▶ **4,600** projects closed since the programme began
- ▶ The **2006** edition closed – The 2005/2007/2008 editions in the process of being closed
- ▶ **€66M** of outstanding amounts paid since the plan began

A SELF-ASSESSMENT PROCESS TO MOBILISE STAFF

In 2018, in preparation for its review by the High Council for Evaluation of Research and Higher Education (Hcéres), ANR launched an internal self-assessment process for the period 2014-2018. Nearly 130 volunteers from among about 300 employees took part in the five working groups set up and led by members of the Executive Board. These groups

In 2018, in preparation for its review by the High Council for Evaluation of Research and Higher Education, ANR launched an internal self-assessment process for the period 2014-2018.

conducted and drafted several SWOT analyses (Strengths, Weaknesses, Opportunities, Threats) of the Agency's operation. The progress of the work was shared at two general meetings. Emerging from these efforts, a self-assessment report was submitted to Hcéres in March 2019. It precedes the drafting of the next Contract of Objectives and Performance, which will follow the current 2016-2019 COP. //



Supporting staff every day

Quality of life in the workplace and support for staff in their careers are priorities for ANR, which aims to contribute to the professional and personal development of its employees. In-depth dialogue between management and staff led to several initiatives being deployed in these areas in 2018.

QUALITY OF LIFE IN THE WORK-PLACE

A working group including voluntary staff representatives cooperating closely with the Health, Safety and Working Conditions Committee (CHSCT) drew on an internal survey to prepare multi-year action plans on psychosocial risks and quality of life at work. Improving quality of life and supporting staff were the objectives of several initiatives in 2018:

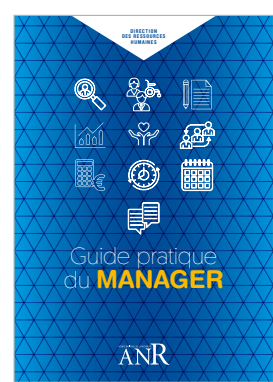
▷ An **agreement on teleworking** signed by ANR's management and staff was introduced in September 2018. The approach has been adopted by 40% of eligible employees, primarily to reduce the time spent commuting. An initial review will be carried out after a year.

▷ As part of the development of its employment policy, ANR has appointed a **social worker** to provide social support for staff.

▷ To support managers, the Agency has drafted a **practical guide to management** aiming to reinforce the consistency of managerial practices, increase team cohesion and motivation and boost staff participation in the decisions that concern them.

▷ The development of **internal communication** was also continued in order to consolidate the circulation of information and foster a shared culture. Information meetings for staff are organised throughout the year. Every week, an internal memo informs staff about the Agency's

news. Internal conferences and working seminars are organised to spread and share a common scientific culture.



BETTER FORECASTING OF CAREER DEVELOPMENT

To anticipate and support ANR's strategic development and its impact on the Agency's staffing, a two-year agreement on **jobs and skills planning** (GPEC) was signed with trade unions on 19 February 2018. An ad hoc GPEC committee was created, consisting of representatives of management and unions. Its role is to draft plans for the evolution of the Agency's activities and staffing needs. In accordance with the GPEC agreement, a classification of the Agency's jobs (stable, evolving and emerging) has been defined for the committee to draw on. The classi-

fication should enable individualised training and support measures to be deployed.

Career interviews were also introduced in 2018. These are an opportunity for everyone to review their career and receive advice on how to manage professional plans on varying time scales. Staff can thus identify their prospects for evolution, both inside and outside the Agency.

In this context, the **computerisation of human resources processes** (HR) moved up a gear with the 2018 campaign of annual appraisal interviews. The computerised HR management system incorporates the recruitment, skills evaluation, training supervision and career follow-up processes.

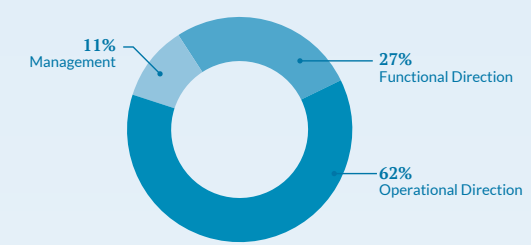


294
EMPLOYEES
(on 31/12/2018)

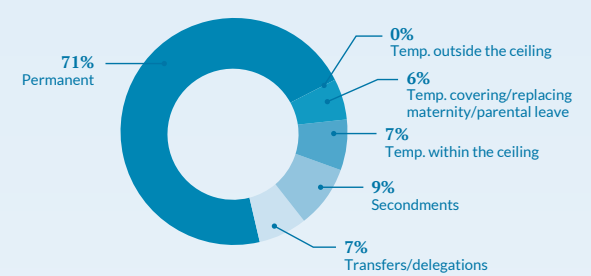
60% WOMEN

40% MEN

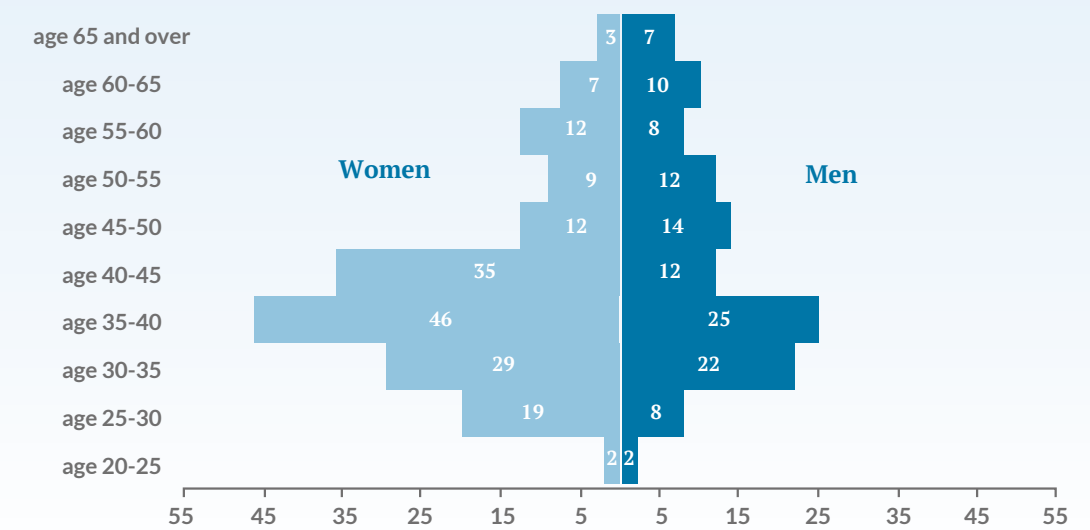
Staff breakdown by role as of 31/12/2018 (FTE)



Staff breakdown by status as of 31/12/2018 (FTE)



Age pyramid by gender



Prize awarded

ANR received the **2018 Gold Trophy** at the *Victoire des Leaders du Capital Humain* HR awards in the public sector category. This prize is awarded by a jury of human resources professionals from the public and private sectors. It recognises the Agency's initiatives developed in consultation with its staff and representatives of management and employees.

© Adobe Stock

The Agency's budget

The ANR budget consists of an operating budget, which enables it to implement all its processes, and a funding budget, which is devoted to funding research projects.

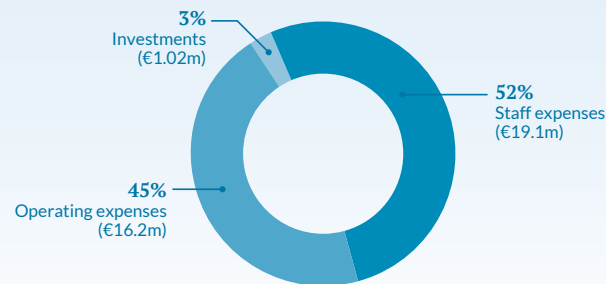
THE OPERATING BUDGET FOR THE AGENCY'S EXPENSES

This represents spending on staff, operations, investment and organising panels and evaluation. In 2018, it amounted to €34.3 million of credit authority and €36.22 million of payment appropriations. It is broken down according to the graph "Operating budget breakdown by payment appropriations".

The operating budget is financed primarily by the public service subsidy of €29.2 million, with other resources including:

- ▷ The management fees received by ANR from organisations co-funding research projects;
- ▷ The SGPI (General Investment Secretariat) payment for ANR's expenses in managing the Investments for the Future programmes.

Operating budget breakdown by payment appropriations



THE RESEARCH FUNDING BUDGET

In 2018, ANR provided funding for research projects amounting to a commitment authority of €672.4 million, i.e. €47.9 million more than in 2017.

The funding budget makes it possible to commit grants for projects selected in 2018 that will run over several years. The resources come mostly from the funding subsidy allocated

by the Ministry for Higher Education, Research and Innovation, representing €654.4 million in 2018 after a transfer to the reserves.

The Agency's funding budget has seen significant increases since 2016:
 + €63.9 million in 2016
 + €29.3 million in 2017
 + €50.5 million in 2018

€34.3M
OPERATING BUDGET
in 2018

Funding for the 2018 Generic Call for Proposals projects rose by €22.5 million compared with 2017, and by €61.4 million compared with 2016.

Co-funding from public bodies and contributions from the European Commission represented €18.1 million in 2018, 2.7% of the total funding budget.

Disbursements in 2018 represented €770.8 million, an increase of €155.2 million relative to 2017.

BREAKDOWN OF THE FUNDING BUDGET

The 2018 funding budget is divided between:

- ▷ The Generic Call for Proposals;
- ▷ Specific calls for proposals;
- ▷ Budget spent outside the calls for proposals.

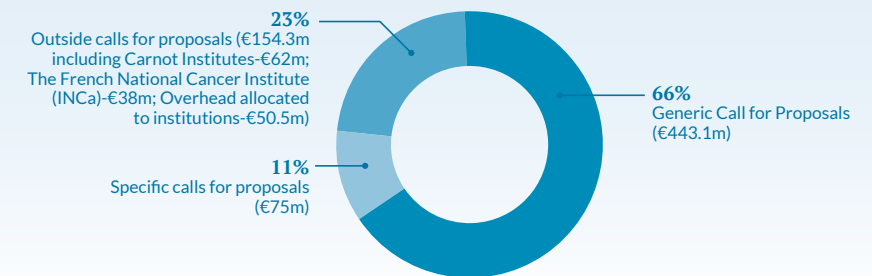
In total, calls for proposals represent €518.1 million, 77% of the funding budget.

Other fundings represent €154.3 million, 23% of the budget.

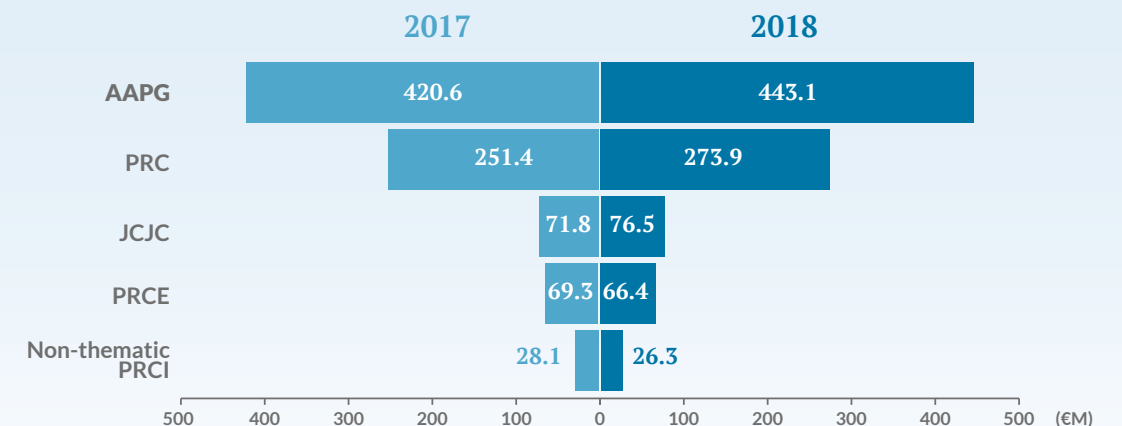


€672.4M
FUNDING BUDGET
in 2018

2018 funding budget

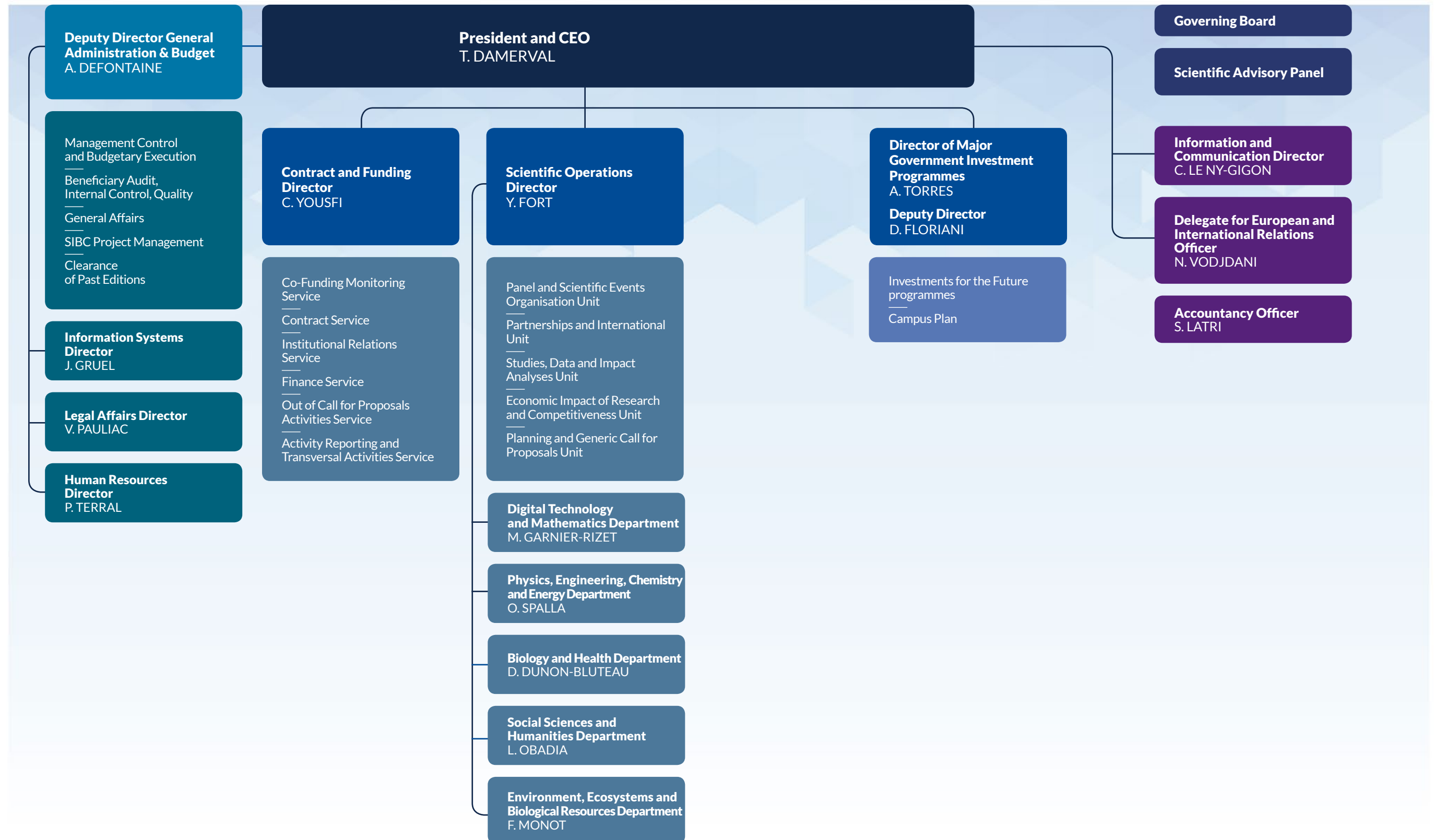


Generic Call for Proposals (AAPG)



Governance of the Agency

Organisation chart as of 30th January 2019



The Governing Board

Instituted by decree no. 2006-963¹ of 1st August 2006, the ANR Governing Board determines the affairs of the institution by its deliberations and decisions. This includes deliberating on the orientations of the Agency's annual Work Programme, the policy for awarding and managing grants, the general organisation of services, the internal regulations and ANR's budget and financial accounts.

The members of the ANR Governing Board were appointed by the Ministry of Higher Education, Research and Innovation decrees of 7th March 2018 and 28th February 2019.

COMPOSITION

In addition to Thierry Damerval, the President and CEO of the Agency, the members are:

As representatives of the Minister of Research:

- ▶ Bernard Larrouturou, full member
- ▶ Damien Rousset, substitute
- ▶ Mélanie Joder, full member
- ▶ Guilhem de Robillard, substitute

As representatives of the Minister of Higher Education:

- ▶ Brigitte Plateau, full member
- ▶ François Couraud, substitute

As representatives of the Minister of Industry:

- ▶ Alain Schmitt, full member
- ▶ Véronique Barry, substitute
- ▶ Benoît Legait, full member
- ▶ Jacques Serris, substitute

As representatives of the Minister of the Budget:

- ▶ Alban Hautier, full member
- ▶ Nicolas Hengy, substitute

As qualified representatives from the major scientific fields, including at least one representative of the Conference of Heads of Higher Education Institutions:

- ▶ Jean-François Balaudé, full member
- ▶ Lise Dumasy, substitute
- ▶ Antoine Petit, full member
- ▶ Stéphanie Thiébault, substitute
- ▶ Christine Cherbut, full member
- ▶ Jean-Paul Moatti, substitute
- ▶ Carine Giovannangeli, full member
- ▶ Gilles Bloch, substitute
- ▶ Bruno Sportisse, full member
- ▶ Bernadette Dorizzi, substitute
- ▶ François Jacq, full member
- ▶ Michèle Rousseau, substitute

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

- ▶ Stéphane Cueille
- ▶ Philippe Tchong
- ▶ Marie-Noëlle Semeria
- ▶ Catherine Truffert

As Vice President of the National Strategic Council for Research:

- ▶ Pascal Colombani

As staff representatives:

- ▶ Jannatul Mia, full member
- ▶ Rémi Grodzki, substitute
- ▶ Angela Samaan, full member
- ▶ Célestin Bakala, substitute

In addition, attending the Board in an advisory status:

- ▶ The Chair of the Governing Board of the public establishment BPI-Groupe or their representative
- ▶ The French General Commissioner for Investment or their representative
- ▶ The Deputy Director General for Administration & Budget
- ▶ The Scientific Operations Director
- ▶ The Budget Controller
- ▶ The Accountancy Officer

Scientific Advisory Panel

The ANR Scientific Advisory Panel's role is to assist the President and CEO in the strategic guidance of the Agency. The President and CEO consults it for:

- ▶ the preparation of the ANR's Work Programme and the report on its implementation;
- ▶ work to evaluate research provision and analyse its impact;
- ▶ the creation or abolition of the Agency's scientific departments, together with their naming and scope;
- ▶ the appointment of the heads of scientific departments and the renewal of their functions.

The Scientific Advisory Panel may also be asked to provide an opinion by the Agency's Governing Board or the CEO.

Its composition, the procedure for appointing its members and its rules of procedure are defined by the ministerial order of 10th September 2015.

COMPOSITION

Established on 31st January 2019, the new ANR Scientific Advisory Panel is chaired by **Pierre Corvol, President of the French Academy of Sciences and an honorary director of the Collège de France.**

In addition to the **heads of the Agency's scientific departments**, it includes:

- ▶ Bruno Chaudret, research director of the CNRS and a member of the French Academy of Sciences
- ▶ Yuko Harayama, former executive member of the Japanese Prime Minister's Science and Technology Council
- ▶ Valérie Mazza, science and innovation director at Limagrain group and a member of the French Academy of Technology
- ▶ Nathalie de Noblet-Ducoudré, research director at the CEA and a member of the French Academy of Agriculture
- ▶ Roseann O'Reilly Runte, president and CEO of the Canada Foundation for Innovation
- ▶ Pascal Viginier, president of the French Academy of Technology and advisor to the chairman of Orange

¹ <https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=LEGITEXT000006054155>

4

Supporting project excellence

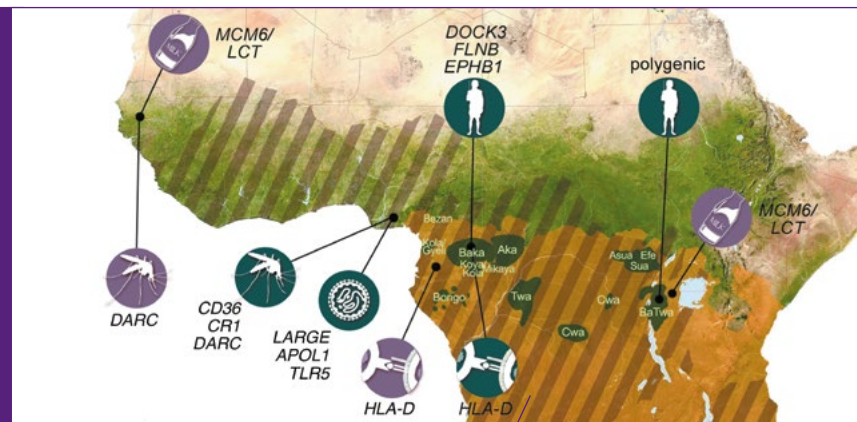
-
- ▷ NATIONAL COLLABORATIVE PROJECTS P. 54
 - ▷ YOUNG RESEARCHERS PROJECTS P. 61
 - ▷ PUBLIC/PRIVATE COLLABORATIVE PROJECTS P. 64
 - ▷ INTERNATIONAL COLLABORATIVE PROJECTS P. 69
 - ▷ INVESTMENTS FOR THE FUTURE P. 73
-



AGRHUM

Human populations, changes in lifestyle, habitat and process of genetic adaptation to the environment

The study of species' adaptation to their environment sheds light on the specific adaptation mechanisms triggered during rapid changes in environmental pressures. However, the extent and speed of adaptation to new environments are not widely known. The AGRHUM project forms part of this perspective and aims to increase understanding of the adaptation processes of human populations whose lifestyles and ecological systems differ.



Groups of hunter-gatherers of central Africa and adaptation to the environment

In order to evaluate the impact of the transition from the hunter-gatherer status to an agriculture-based lifestyle on the mechanisms of selection and adaptation, the AGRHUM project focused on central Africa, a region which is home to both the largest populations of hunter-gatherers and sedentary populations which have practised agriculture for almost 5,000 years. The coding part of the genome of a wide panel of individuals, derived from different populations of hunter-gatherers and farmers, was sequenced. Its analysis helped determine the consequences of the populations' history and lifestyle on the efficacy of purifying selection (elimination of deleterious mutations). In parallel, several approaches were developed to determine the role of different mechanisms of biological adaptation to the environment, such as the classic models of positive selection, or other models like polygenic adaptation or adaptive interbreeding. The joint analysis of these results helped evaluate the way in which rapid changes of environment influence the adaptive value and efficacy of the selection.

These analyses revealed a contrasting demographic history among hunter-gatherer and farming populations in Africa, with major changes in effective size throughout their history. Despite this contrasting past, these population groups maintain the same capacity to purge deleterious mutations and thus share the same efficacy in terms of selection. The project also helped identify biological functions which, by being involved in particular in defending humans against pathogens, contributed to the adaptation and survival of those populations in their environment. The results of this project were the subject of articles published in journals such as *Science*, *Nature Ecology & Evolution*, *Molecular Biology & Evolution*, and *PNAS*.

PERSPECTIVES

The AGRHUM project opens up interesting perspectives on human biodiversity and populations' adaptation to their environment, in particular if it is pathogenic. These now require field work both at anthropological and epidemiological level. This project has also made available new methodological tools for the study of the different forms of genetic adaptation of other species.

AGRHUM

Study of genetic adaptation to rapid environmental changes: agriculture and the human model

ANR programme:
Generic Call for Proposals CE2014

Edition, Project duration:
2014, 48 months

ANR grant:
€493,000

Coordinator:
Lluís Quintana-Murci
quintana@pasteur.fr
research.pasteur.fr/en/heg

Main publication or contribution:
Lopez et al. 2018. *Nature Ecology & Evolution* 2(4): 721-730

Partners:
Institut Pasteur, CNRS, Paris ;
CNRS, Université Joseph Fourier,
Grenoble ;
CNRS, MNHN, Paris

FRIPON

A unique FRANCE-WIDE detection network to observe meteorite falls, find them and determine their origin

Meteorites are samples of the Solar System that allow us to study its formation. The network of 100 cameras in France set up by the ANR FRIPON project aims to increase the number of meteorites found before they are altered (one every two years compared to one every ten years in the 19th century) and to determine their origin. Its ultimate goal is to associate known meteorite families (about a hundred) with asteroids or asteroid families.



FRIPON Camera at Pic du Midi observatory

The FRIPON camera network continuously monitors the sky to detect meteors produced when fragments of extraterrestrial material, a centimetre in size or larger, cross the atmosphere - whether or not they reach the ground. It capitalizes on the price reduction of fisheye video surveillance cameras and laptops. This has made it possible to develop relatively inexpensive observation stations (€1.5k) and to cover the entire French territory. FRIPON is therefore the densest network for such a large area. Measuring the speed of meteors is essential for reconstructing orbits and source regions. FRIPON takes advantage of the emission of a continuous signal by the GRAVES military surveillance radar, a signal that is reflected by the meteor heads and allows their speed to be determined using the Doppler effect. This is a technology that permits detecting and processing data on the fly. It has thus been easy to add foreign cameras whose data are processed in France. FRIPON is now the leading team in Europe on the subject of meteors, at the

same level as the American and Australian teams. Since the gradual commissioning of the FRIPON network, more than 4000 orbits have been observed: it has become possible to scan the source regions, and the first field research test campaigns have been carried out. To support FRIPON, the Vigie-Ciel citizen science programme was implemented on funding from Investissements d'Avenir. Its objective is to involve the public, in particular through field searches for meteorites. Vigie-Ciel (led by the MNHN - www.vigie-ciel.org) relies on a network of regional partners using a set of co-constructed tools to train scientific mediators in their region to raise awareness among citizens and invite them to participate.

PERSPECTIVES

In addition to the implementation of Vigie-Ciel, the FRIPON network is developing in two directions: (a) at the French level, an application was made to become a National Observation Service; (b) it is gradually being extended to Europe, with more than 50 cameras already installed in 9 other countries.

FRIPON

Fireball Recovery and InterPlanetary Observation Network

ANR programme:
Blanc SIMI 5

Edition, Project duration:
2013, 54 months

ANR grant: €543,280

Coordinator:
Jean-François Colas
colas@imcce.fr
www.fripon.org

Main publication or contribution:
Jeanne et al. (2019) Calibration of fish-eye lens and error estimation on fireball trajectories. Application to the FRIPON network.
Sous presse, Astronomy and Astrophysics

Partners:
IMCCE MNHN PSUD/IDES
CNRS_LAM CNRS_CEREGE

Mésomobile, west-central Mesoamerica: a key region to understand the migratory processes linked to the emergence of the Tarascan State

The Mesomobile project focused on the migratory phenomena that lead to the emergence of major Prehispanic cultural entities in the West-central Mesoamerica, such as the Tarascan State. To understand the nature of these processes, four indicators that require a fine chronological control were jointly examined: territorial dynamics, biocultural markers, technical systems and the circulation of goods.



© V. Darras

Lerma Alluvial Plain, Michoacan

In the region studied, the archaeological documentation repeatedly highlights 1) changes in the territorial organization, 2) significant transformations in the material culture (architecture, funeral practices, technical systems, access to resources). To understand the nature of the processes involved, Mesomobile selected a strategic region in northern Michoacan that benefits from more than 30 years of archaeological background. Particular attention was placed on transitional periods perceived as phases of rapid change: the end of the Formative period (100 BC - 250 AD), the beginning of the Early Postclassic period (from 900 AD), and its transition to the Middle Postclassic period (from 1200 AD). In this context, the mechanisms of social and political change linked to the migratory phenomena, and the valuation of the adaptive capacities of populations to organize their habitats and economic activities, were assessed using high-performance tools: archaeological and geophysical surveys, GIS and satellite image systems, LIDAR telemetry, databases, "chaines

opératoires", physico-chemical characteristics of materials (ceramic, obsidian, etc.), isotopic analyses and morphometric variations of teeth and cranial vault. Thanks to Bayesian modeling of 14C dates, the temporal perception of mutations has been refined. The online database, which includes nearly 700 sites discovered through various programmes, allows you to visualize population fluctuations over time and space. Bio-anthropological analyses and studies of material culture converge on the idea of cultural transformations linked to population movements. In particular, they support the hypothesis that foreign populations arrived in the Zacapu region in the 13th century, probably from nearby regions.

PERSPECTIVES

Mesomobile's innovative character lies in its interdisciplinary dimension and the combined use of state-of-the-art technologies, designed to refine the chronological and spatial resolution of ancient mobility. The programme provides a model approach that can be «exportable» to other Mesoamerican contexts and beyond.

Mésomobile

Mobility, Territories and Sociopolitical mutations in West-central Mesoamerica

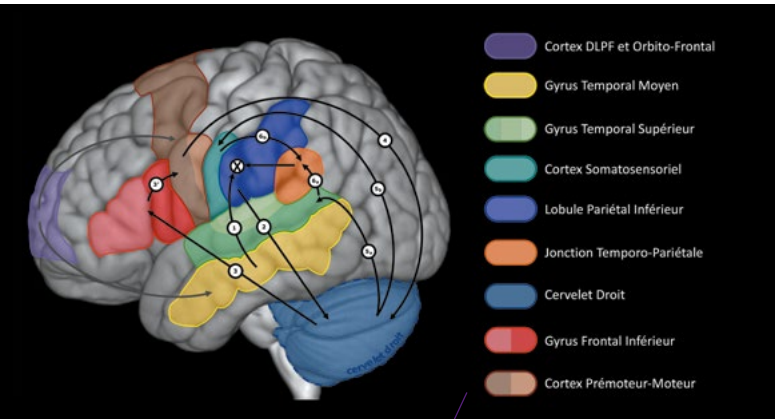
ANR programme: Generic Call for Proposals
Edition, Project duration: 2014, 48 months
ANR grant: €298,203

Coordinator: Véronique Darras
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<https://mesomobile.hypotheses.org/>
Main publication or contribution:
<http://mesomobile.huma-num.fr/index.php>

Partners: Archéologie des Amériques (ArchAm_UMR8096) Centre d'études mexicaines et centraméricaines (CEMCA, Mexico)

InnerSpeech: Cognitive neuroscience tapping inner speech

Can you hear a voice when you read these lines? Is it your own voice or another voice? Can you hear your pitch, your intonation? Can you have imaginary conversations? The aim of the InnerSpeech project is to draw a theoretical model of inner speech – the little voice in our head – by examining varieties of inner speech, such as wilful inner speech, verbal mind wandering or verbal rumination and by confronting introspective descriptions with empirical data (neuroimaging and electrophysiology).



© R. Grandchamp & H. Lœvenbruck

Cerebral network of wilful inner speech

Inner language has long been under the scrutiny of literature and humanities. Through the practice of introspection and reflexion, writers, poets, artists, philosophers and psychologists have provided descriptions of varieties of inner speech and their roles. The use of experimental methods, tools and technology in cognitive neurosciences provides a new window of insight into this internal phenomenon. In the InnerSpeech project, a multi-paradigm approach was implemented, confronting introspective descriptions with empirical data. Subjective data were obtained through questionnaires and introspective interviews. Quantitative objective data include cerebral activation data obtained via functional Magnetic Resonance Imaging (fMRI), brain dynamics obtained via intracranial electroencephalography (iEEG), electromyographic (EMG) recordings of orofacial muscle activity (lips, forehead), cardiac variability and motor interference measurements. Our fMRI data have allowed us to describe the neural networks associated with the production of inner speech with our own voice vs. someone

else's voice (monological varieties) as well as those associated with imaginary vs actual speech perception (dialogical varieties). Taken together with the introspective questionnaires, our fMRI data provide a more detailed description of the networks of wilful inner speech vs. verbal mind wandering. The collection and analysis of iEEG data in implanted patients are still in progress. Our EMG and motor interference data, collected in collaboration with the LIP (Grenoble) and Ghent University (Belgium), suggest that the lip motor system is involved in induced ruminations. They provide promising strategies to reduce rumination via orofacial relaxation or inhibition. The analysis of the detailed introspective data collected in collaboration with the Monologuer Project (CERILAC, Univ. Paris Diderot) is still under way. Collaborations with Durham University (UK) and Basque Country University are considered.

PERSPECTIVES

Theoretically, the InnerSpeech project has contributed to improve our understanding of several varieties of inner speech. On a clinical level, it offers potential outcomes in the field of rumination or auditory verbal hallucination remediation. It also opens up humanist and societal prospects related to the practice of inner language with the goal of improving self awareness or cognitive performance.

InnerSpeech

Neural correlates of inner speech

ANR programme: Blanc SHS2
Edition, Project duration: 2013, 48 months
ANR grant: €262,995
Coordinator: Hélène Lœvenbruck

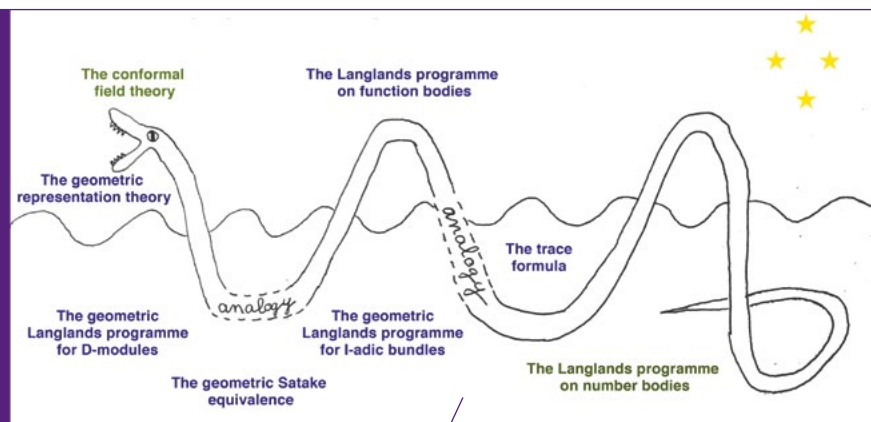
Helene.Loevenbruck@univ-grenoble-alpes.fr
<http://lpnc.univ-grenoble-alpes.fr/Innerspeech>
Main publication or contribution: Condiolint: A neurocognitive model of inner speech along condensation, dialogicality, intentionality

Partners: LPNC, GIPSA-lab, UMS IRMaGe, Laboratoire d'épilepsie, Grenoble Institut des Neurosciences, Inserm U1028, NeuroLab Ferrara University, CNoS University of British Columbia

VARGEN

Varieties of characters and generalisations

VARGEN is a fundamental research project in mathematics, more precisely in representation theory. The Langlands programme is a vast study field ranging from arithmetic to theoretical physics. The members of the project worked on different questions linked to this programme. The objective was to reveal the in-depth relationships between several mathematical entities by studying their underlying geometry.



The Langlands programme seen as a marine monster

As the drawing indicates, the Langlands programme concerns number bodies, such as, for example, that of rational numbers, but also function bodies, which resemble number bodies but are more geometric. There is also an entirely geometric variant of the Langlands programme linked to the conformal field theory. The results of VARGEN were obtained through the collaboration of a dozen French universities and specialists from other countries. During the project, eight workshops were held, including two international conferences. The project gave rise to 96 publications and six articles for the general public. Within the framework of this project, V. Lafforgue showed a major part of the global Langlands correspondence for all the reductive groups on function bodies; the case of the linear group was already known and had afforded L. Lafforgue the Fields medal in 2002. S. Riche, D. Juteau and their collaborators showed the conjecture of Mirkovic-Vilonen on the fibres of spherical bundles on the affine

Grassmannian. G. Laumon and P.-H. Chaudouard showed the support theorem for the Hitchin fibration (a result which had astonishing applications in arithmetic as well as in the proof of the fundamental lemma by Bao Chau Ngo, which won him the Fields medal in 2010). S. Mozgovoy and O. Schiffmann calculated the number of twisted Higgs bundles of a given rank and degree on a curve. Ph. Boalch constructed a new family of Poisson algebraic varieties. E. Vasserot, P. Shan, R. Rouquier and M. Varagnolo described category \mathcal{O} of double affine Hecke algebra representations and the algebras of Kac-Moody. S. Lysenko developed the theory of Eisenstein series in the metaplectic geometric Langlands programme.

PERSPECTIVES

The pioneering work of V. Lafforgue and A. Genestier will lead to a local version of the Langlands correspondence in the direction of “automorphing towards Galois”. The studies of Riche, Juteau et al. open the way to the theory of “modular character-bundles” à la Lusztig. D. Gaitsgory, S. Lysenko will describe the metaplectic Whittaker category in terms of quantum groups.

VARGEN

Varieties of characters and generalisations

ANR programme:
ANR-13-BS01-0001-01

Edition, Project duration:
2013 - 54 months

ANR grant:
€108,000

Coordinator:
Sergey Lysenko

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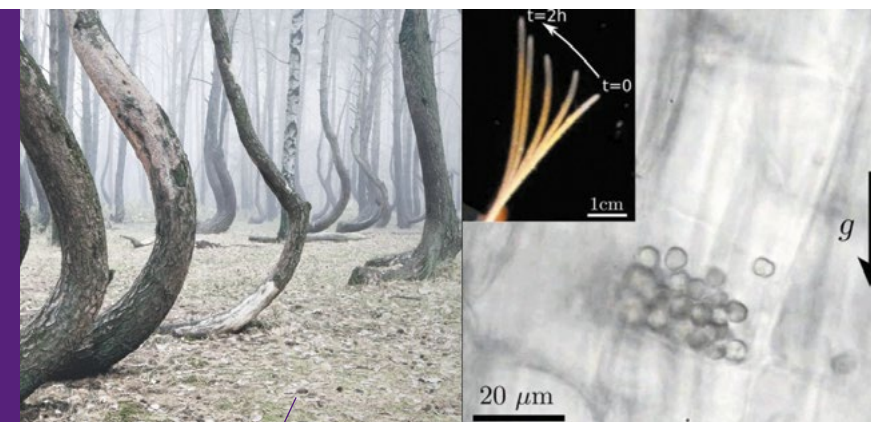
Main publication or contribution:
V. Lafforgue showed the Langlands correspondence in the “automorphing towards Galois” direction.

Partners:
Université de Lorraine, Nancy

GRAP2

How plants feel gravity? A sedimentation problem still unresolved

Shoots grow up. But how do plants feel gravity? A crucial step in this gravisensing occurs in specific cells, the statocytes, which contain small grains of starch (statoliths), which sediment and give the direction of gravity. Our project at the frontier of biology and physics aims at explaining the remarkable sensitivity of plants to gravity by studying both how plant bend back to vertical and how the statoliths move in the cells.



Sensitivity of trees to gravity. Bending of a wheat coleoptile and observation of the starch grains involved in the gravity sensor

To understand the link between the active bending of the plant and the motion of the starch grains (the statoliths) in the cells, two kinds of experiments have been developed, at the plant scale and at the cell scale. The first goal was to elucidate what the plant is sensitive to and a centrifuge device has been developed, where plants are subjected to different levels of gravity while tilted from the direction of the effective gravity. We have shown that the response is independent of the gravity intensity but depends solely on the inclination angle. The statocytes thus play the role of clinometers and measure the position of the starch grains and not the forces they exert on the wall. A priori, a heap of grains is a lousy clinometer: friction and interparticle locking limit the motion, making the system ineffective below a threshold angle. To solve this paradox, we studied in vivo the movements of statoliths in response to tilting. We discovered that they flow like a liquid in the cell and return to horizontal no matter how the cell is angled, a behavior not expected with a standard granular

medium. The origin of this behavior lies in the agitation induced by the cellular medium, as we have shown by carrying out experiments on inert analogous systems (microbeads in artificial cells sized like real ones). At the end of the project, a new scenario is emerging to describe the detection of gravity in plants, based on “grain clinometers”, the sensitivity of which being ensured by the continuous agitation of the grains by the molecular motors of the cells. Based on these results, a theoretical model has been developed, capable of predicting the response of plants to arbitrary solicitations.

PERSPECTIVES

Our result provides a new framework to better understand the sensitivity of plants to gravity, but open many new questions, a major one being how the plant detects the position of statoliths. These findings also pave the way for bioinspired industrial applications-like robust, miniature clinometers.

GRAP2

GRAvity Perception in Plants: from cell sensing to biomechanical response

ANR programme:
BLANC

Edition, Project duration:
2013, 54 months

ANR grant:
€369,246

Coordinator: Olivier Pouliquen
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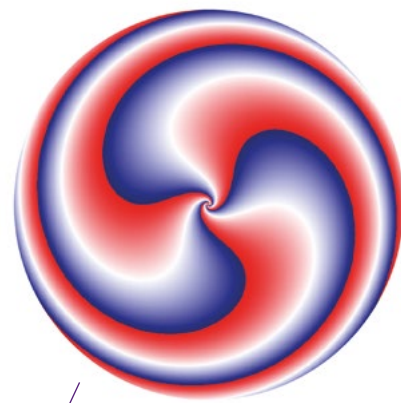
Main publication or contribution:
Chauvet et al, Revealing the hierarchy of processes and time-scales that control the tropic response of shoots to gravistimulations, J. Exp. Bot. (2019).

Partners:
Laboratoire PIAF, Université Clermont Auvergne, INRA, Clermont-Ferrand, Laboratoire IUSTI, Aix Marseille Université, CNRS, Marseille, France

APERRO

Relativistic plasma mirrors: how to reflect and manipulate ultraintense laser light?

Mirrors are the most elementary and most used components in Optics. Ultrashort laser pulses make it possible to investigate their behavior when exposed to considerable light intensities. The objective of the APERO project was to reach a good understanding of the physical mechanisms at play in such interaction conditions, and to exploit these processes to get sources of ultrashort light pulses and of relativistic particles with remarkable properties.



Phase front of a harmonic beam produced from a plasma mirror by a laser beam carrying a phase vortex

© CEA

When an ultrashort laser pulse is focused to a high enough intensity on a solid target, this target gets ionized in the very short time. A plasma -an ensemble of unbound electrons and ions- is thus created at the target surface. Due to the brevity of the laser pulse, this plasma hardly has time to expand into vacuum during the pulse, and the plasma-vacuum interface can remain extremely steep during the interaction. This leads to a dense plasma that behaves like a mirror of high optical quality for the laser pulse. Being strongly ionized, such a 'plasma mirror' can be exposed to ultraintense laser fields, up to a regime where the motion of the mirror surface under the effect of the laser field becomes relativistic -i.e. the plasma surface moves at a velocity approaching the velocity of light. Such a 'relativistic oscillating mirror' induces a periodic Doppler effect on the reflected laser field, leading to the generation of many harmonics of the incidence laser frequency. Electrons can also be expelled from the plasma into vacuum, resulting in beams of relativistic electrons. The pro-

perties of these beams of particles and photons can be exploited to decipher the physical processes at play in these plasma mirrors. Besides, these beams have remarkable and unique properties (especially their very short duration), which make them very attractive for scientific applications. The APERO project has led to a much better understanding of the physical processes involved in the interaction of ultraintense lasers with plasma mirrors, in particular those leading to the emission of beams of relativistic electrons. New and original methods have been developed to control and characterize the properties of the produced harmonic beams, enabling the investigation of these properties in different interaction conditions. Thanks to these results, detailed models of the dynamics of plasma mirrors driven by laser fields have been validated.

PERSPECTIVES

The advances enabled by the APERO project open the way to the use of plasma mirrors in scientific applications, for instance to obtain ultracompact particle accelerators, and, from a more fundamental point of view, to reach extreme light intensities, never achieved so far in a laboratory, so high that particles could be created into vacuum starting from light only.

APERRO

Attosecond Plasma Electronics and Relativistic Optics

ANR programme:
Défi de tous les savoirs

Edition, Project duration:
2014, 36 months

ANR grant:
€499,401

Coordinator:
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Main publication or contribution:
Thevenet et al, Nature Physics 12, 355-360 (2016)

Partners:
Laboratoire d'optique Appliquée (PCO and APPLI groups)

AUTOCHTOM, Colonial Legacies in France's Overseas Territories: indigenous populations in the face of justice and school (Guyana, New Caledonia, French Polynesia)

This project examines the relationship to the colonial and postcolonial state of populations claiming to be «indigenous» in France's Overseas Territories: Amerindians and Noirs-Marrons of Guyana, Kanak of New Caledonia and Mā'ohi of Polynesia. In concrete terms, this involves conducting historical and contemporary investigations into the scope and limits of the colonial heritage within two key institutions of the French Republic: schools and justice.



Nuku Hiva Courthouse, Marquesas Islands, French Polynesia, February 2016

© N. Gagné

Six local investigations are launched at the crossroads of ethnographic fieldwork and archival research. They form the basis for a two-fold comparative analysis (of two institutions in three territories) focusing on the "points of contact" between institutions and individuals, from two perspectives:

- Government policies and institutional mechanisms ("from the top down"): changing representations and practices of the government administration of the education and judicial systems with respect to indigenous groups; contemporary policies aiming at taking into account indigenous particularities within schools and the justice system; tensions and issues related to the local "adaptation" of the school and justice systems.
- Experiences of individuals confronted by these institutional apparatuses ("from the bottom up"): strategies and agency of indigenous people confronted

by school and the justice system through time; various forms of indigenous reception, appropriation, and the contemporary uses of educational and judicial mechanisms; alternative indigenous ways of dealing with conflict resolution (justice) and the transfer of knowledge (education) outside of institutional frameworks.

Justice and education experts generally tackle the issue of colonial legacies only in terms of the contemporary "adaptation" of these institutions to indigenous cultures. However, the recognition of indigenous cultures within the justice systems is extremely variable in these three territories, and it raises serious issues and tensions between culturalism and assimilationism. As for the colonial education systems established in the three territories, they were in fact based on the differentiation of groups, and were consequently fully "adapted" to "native culture" (and subordination). This contradicts the

contemporary assertions of those promoting "alternative" schools and education for indigenous peoples today, and calls the broader notion of the "postcolonial" into question.

PERSPECTIVES

This project has fuelled public and societal debate on the concrete forms of colonial heritage in French overseas territories, both in the three territories and in metropolitan France. Our research team has often appeared in the media, at public conferences, or at the request of central state institutions (Prison Administration, Consultative Commission on Human Rights, etc.).

AUTOCHTOM

Colonial Legacies and Indigeneity in France's Overseas Territories: Amerindians of Guyana, Kanaks of New Caledonia and Mā'ohi of French Polynesia in the Face of Two institutions of the French Republic (Justice, School)

ANR programme:
Young researchers JCJC SSH1

Edition, Project duration:
2013, 54 months

ANR grant:
€166,998

Coordinator:
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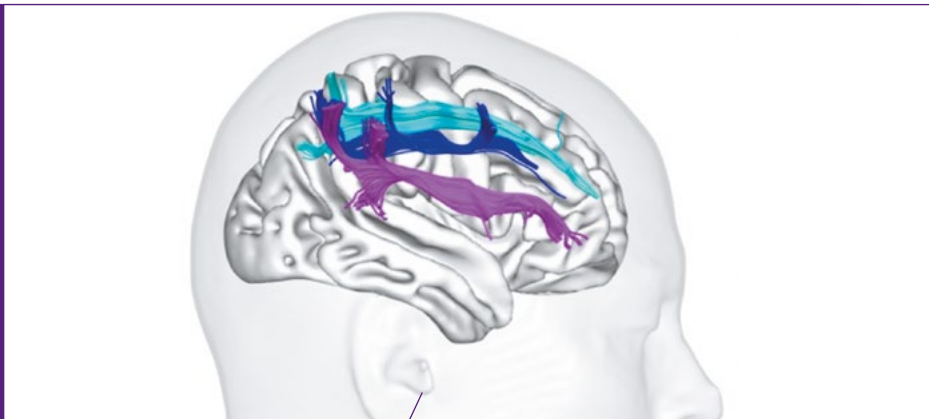
Main publication or contribution:
Special Issue «Justices ultramarines», Ethnologie Française, No 169, 2018

Partners:
Institut de recherche interdisciplinaire sur les enjeux sociaux (IRIS, UMR 8156)

PHENOTYPES

The multiple facets of consciousness in healthy and brain damaged humans

Everything we hear, feel, smell or see is an illusion reconstructed by our brain, an interpretation of our surrounding. This virtual reality streamed in our mind is what we understand as consciousness in its simplest definition. In the current study, we hypothesised that consciousness is not located in a brain area but emerge from the exchange between brain areas.



© Michel Thiebaut de Schotten

The fronto-parietal circuits of the human brain, hypothetically supporting the stream of consciousness

In the first part of the project, we used advanced neuroimaging approaches to separate large networks of areas dedicated to the conscious support of the representation of our environment. By re-analysing the work of 20 years of functional magnetic resonance imaging applied to controls to show areas activated during specific tasks, we successfully demonstrated that the anterior and posterior part of the brain associate their function to produce various representation and actions and are separated according to whether they involve spatial material or non-spatial material. Accordingly, dorsal areas will be related to the consciousness of spatial material and the ventral regions to the consciousness of non-spatial material. Additionally, we found that these two networks of brain areas partially overlap on a middle circuit which might well be essential to the stream of consciousness. In the second part of the project, we explored how lesions into this system might alter conscious representations. Results indicated that disconnection between the

early visual processing in the brain and the fronto-parietal circuits lead to an absence of awareness for the left visual field opposite associated with confabulations. In the absence of visual input the fronto-parietal circuits, hypothetically supporting the stream of consciousness, invent or imagine the missing information. This work was further extended to a group of stroke patients not aware of their motor impairment (i.e. hemiplegia). These patients act as if they were not hemiplegic and reported their paralysed limb as moving correctly. Our methods applied to a large population of 95 stroke patients presenting with this disorder revealed, a disconnection between the fronto-parietal, the premotor and the memory circuits. Hypothetically, this complex syndrome would emerge from the integration of the activity between these three systems.



PERSPECTIVES

This research allowed us to develop and make available to the community a software for the estimation of cerebral disconnection. Its application to brain damaged patients is limitless and will make it possible to test the hypothesis that certain function emerge from the interaction between different regions of the brain and not from their activity alone.

PHENOTYPES

Fractioning the biology of the visual conscious network

ANR programme:

Young researchers JCJC

Edition, Project duration:

2013, 48 months

ANR grant:

€240,000

Coordinator:

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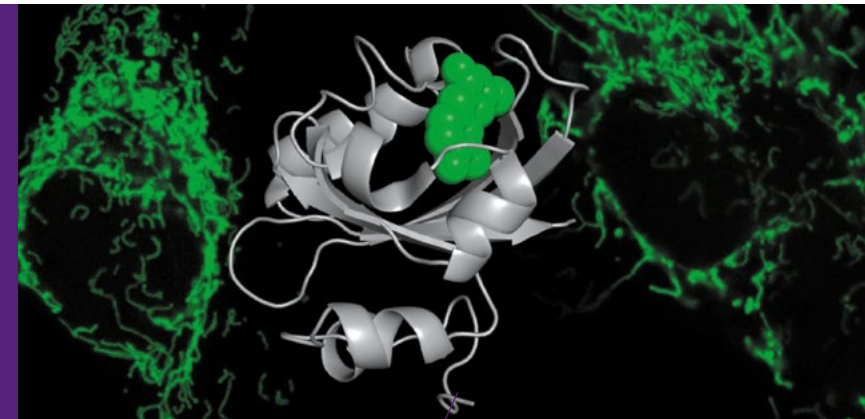
Main publication or contribution:

Functional segregation and integration within fronto-parietal networks

Tag-Light

A new generation of chemical-genetic fluorescent probes for exploring living systems

Cells are complex machines regulated by a set of dynamic processes. Understanding how they work requires observing how their constituents organize themselves and interact. Despite spectacular advances in biological imaging, many molecules and processes remain invisible. The Tag-Light project allowed the creation of new tools to observe the dynamics of biomolecules and biochemical events within cells.



© Arnaud Gautier

Chemo-genetic fluorescent probes reveal the invisible

Arnaud Gautier and his collaborators combine organic chemistry, molecular biology and protein engineering techniques to create tools for exploring life in new ways. These tools are composed of two parts: a protein module and a small synthetic molecule. The advantage of using a protein module is that instructions for its manufacture can be easily and specifically introduced into cells in the form of DNA. In addition, its properties can be adjusted using molecular evolution techniques. The interest of using a small synthetic molecule is to be able to use molecular engineering to refine its properties, and thus benefit from the power of modern chemistry to explore the living. This original approach has led to the creation of FAST, a fluorescent marker offering new perspectives for biological imaging. FAST is derived from a photoreceptor found in *Halorhodospira halophila*, an extremophilic bacterium living in hypersaline environments. This protein has been redesigned to selectively and reversibly bind synthetic fluorogenic ligands called fluorogens. These fluorogens fluoresce

only when bound to FAST, allowing the observation of cells expressing FAST or proteins selectively fused to FAST. This technology is distinguished by the reversibility of the labeling, which offers the possibility of controlling fluorescence on demand. This unique property offers unprecedented experimental flexibility and allows the development of many applications, including the design of biosensors in which fluorogen complexation is dependent on the presence of an analyte, interaction or cellular signal for applications in the diagnosis and screening of therapeutic molecules. This innovation led to the creation of a start-up The Twinkle Factory.



PERSPECTIVES

The FAST technology developed thanks to the Tag-Light project makes it possible to observe processes that were previously invisible. This novel technology can enable biologists to address issues ranging from fundamental mechanisms to the causes of disease and the development of new therapies.

Tag-Light

Next-generation chemical-genetic fluorescent markers for advanced biological imaging

ANR programme:

Young researchers JCJC

Edition, Project duration:

2015, 36 months

ANR grant:

€ 200,000

Coordinator:

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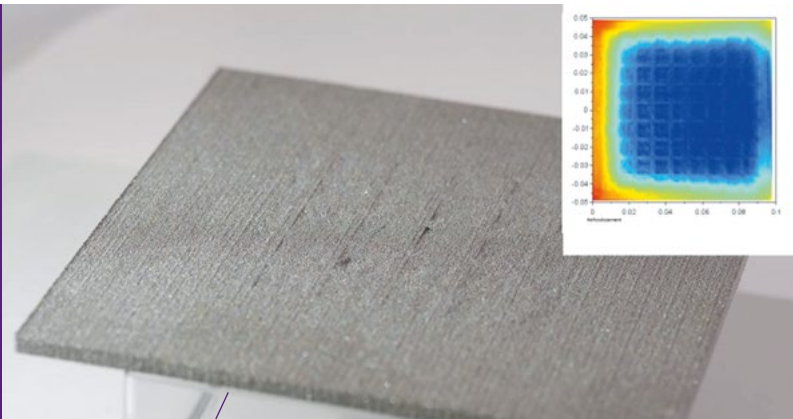
Main publication or contribution:

A small fluorescence-activating and absorption-shifting tag for tunable protein imaging in vivo. PNAS 113 (3), 497-502 (2016).

MOSART

Metallic porous materials for enhanced cooling capabilities

A porous material can be protected from heat by flowing through cold fluid, such as air, which regulates its temperature by internal convection. An additional benefit is obtained by forming a film cooling onto the surface. This is called transpiration cooling. The capability of a material for transpiration cooling is related to its internal porosity, which should be interconnected and open to the surface. One of the targeted applications is to improve the cooling efficiency of inner walls of aeronautical combustion chambers.



Material for transpiration cooling with porous zones 1x1cm²; on the right, temperature map showing cooling

© ONERA - The French Aerospace Lab

The approach was to design, to make and to test some materials for transpiration cooling by metallic 3D printing. First of all, a process allowing the melting of metallic powders (EBM or Electron Beam Melting) was used to obtain the finest porosities, and thus the largest surfaces for heat exchange. With this process, powders can be partially sintered with limited fusion thus leaving an internal porosity, and allowing transpiration cooling. The scan speed as well as the electron beam power were found to be relevant parameters for the achievement of an effective porous material. Architected supports have also been achieved by EBM and then covered by a finishing porous layer made by a conventional sintering process. All the architected materials have been tested on aero-thermal benches and an enhanced cooling efficiency was established thanks to transpiration cooling. Indeed, experimental tests have shown that the temperatures within the materials and

onto their surface were close to the air temperature flowing through them. By this way, multi-layer systems with more or less complex design can be created for enhanced transpiration cooling, taking advantage of the design flexibility of 3D printing processes. The geometry can therefore be adjusted for the application. In the case of protective walls for aeronautical combustion chambers, the design was made by considering mass, dimensions, permeability and structural strength criteria. Numerical simulations have enriched the experimental approach. This enabled us to gain a better understanding of the phenomenon of transpiration cooling, and to appropriately size the thicknesses of the studied systems in order to ensure the correct air flow and thus offer the best cooling.

PERSPECTIVES

Design custom geometry is a reality thanks to 3D printing. It is now possible to tune the properties of the material itself, as here its internal porosity, to design increasingly complex systems. These new tools offer opportunities for designing «patches» for combustion chamber repair.

MOSART

Implementation of architected structures for transpiration cooling

ANR programme:
Astrid



Fully funded by the Direction générale de l'Armement

Edition, Project duration:
2014, 36 months

ANR grant: €300,000

Coordinator:
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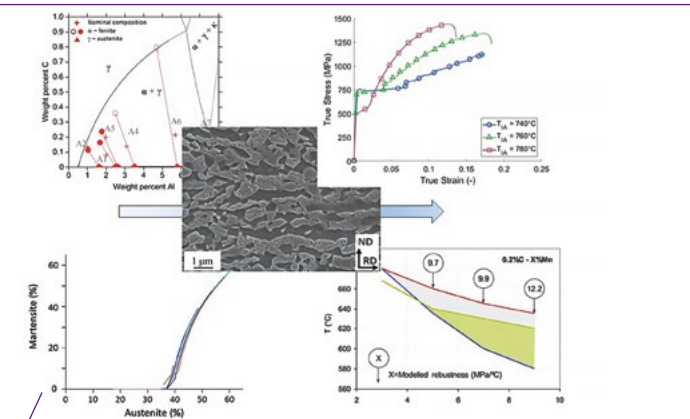
Main publication or contribution:
O. Lambert, Thèse, 2017 &
S. Pinson, Thèse, 2016 sous
la direction de R. Dendievel,
Grenoble Alpes

Partners:
Onera - The French Aerospace
Lab, Materials and Structures
Department, Université Paris-
Saclay;
SIMaP - Science and Engineering
of Materials and Processes,
Grenoble
SafranTech, Magny-les-Hameaux;
SinterTech (PORAL®),
Veurey-Voroize

MeMnAl Steels

A new generation of steels with optimized mechanical properties for automotive parts

The European regulation on CO₂ emissions below 130 g/km lead the automotive industry to lighten vehicles. The development of new very high strength steel grades, decreasing the weight of the body-in-white by almost 20%, requires knowledge and tools to speed up industrialization of a 3rd steel generation. Thanks to additions of medium amounts of Mn and Al, a duplex microstructure is obtained which gives these steels mechanical strength and formability.



Understanding and modeling microstructures and mechanical behavior of advanced high strength steels for a reliable industrial process

© ArcelorMittalResearch-SiMaP-IM2NP-MSSMat

Physical metallurgy and mechanical metallurgy are combined to investigate the final properties of these steels: (i) modelling of microstructure genesis, and (ii) modelling of the relations between resulting microstructures and mechanical properties. This knowledge defines the composition range and the optimum thermomechanical schedules to reach the mechanical targets, while accelerating steel developments and reducing efforts for industrialization. Microstructure prediction: Investigation at the atomic scale allows a first prediction of the equilibrium domains of the Fe-Mn-Al-C system. Mesoscopic experiments and modelings inform about the nature of the equilibrium phases, their relative volume fractions, and their compositions. Some DICTRA simulations quantify transformation kinetics during annealing. Mechanical behavior: Deformation mechanisms were investigated thanks to transmission electron microscopy in-situ experiments. In-situ characterization of the strain fields and magnetic measure of the austenite volume fraction evidenced

strain localizations linked to martensitic transformation. The ductile-to-brittle transition was related to the different microstructures which were studied. The results gathered during the project open many ways to improve the 3rd generation steels for automotive:

- Mn/Al/C interactions within ferrite, and the conditions for stability and nucleation of kappa carbide were specified.
- The elastoplastic behavior closely depends on the austenite stability and its transformation kinetics.
- At room temperature, strain instabilities result from displacement of intense strain bands linked to a local transformation of austenite.
- Ductile-to-brittle transitions were characterized for the fine-grained domains (interface fracture) and the delta phase (cleavage, also specified by the atomic calculations).

PERSPECTIVES

The project allows the production requirements to be specified to reach the mechanical properties and define the critical domains (risk of strain localization, cleavage fracture). The experimental methodologies and the models help ArcelorMittal to develop the 3rd high strength steel generation by accelerating the process parameter identifications to obtain the targeted in-service properties.

MeMnAl Steels

Development of a 3rd duplex steel generation for automotive applications

ANR programme:
MATETPRO

Edition, Project duration:
2013, 48 months

ANR grant:
€1,199,501

Coordinator:
Jean-Hubert Schmitt

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Main publication or contribution: A. Perlade et al. - Development of 3rd generation Medium Mn duplex steels for automotive applications, Mater Sci Technol 35 (2019) 204.

Partners:
MSSMat (CentraleSupélec-CNRS); ArcelorMittal Maizières Research; UMET (Univ. Lille 1-CNRS); SIMAP (Grenoble INP-CNRS); IM2NP (Univ. Aix Marseille-CNRS); CEMES (CNRS); ARMINES (Mines ParisTech)

JEMImE, the first serious game that teaches children with autism to produce facial expressions adapted to the social context

Children with autism experience great difficulty in understanding and producing socio-emotional signals such as facial expressions. The objective of the game developed within the framework of the JEMImE project was to teach them to imitate and mime facial emotions in order to reproduce the appropriate expression in a given context. The technological core of the project was therefore to design new artificial intelligence algorithms capable of evaluating the quality of the emotional expressions produced by the children.



Screen captures of the serious game and visualisation of the processing done by the facial expression recognition algorithm

In order to complete this multidisciplinary research project successfully, complementary skills in the fields of automatic emotion analysis, serious game design and clinical treatment of autism were brought into play. The consortium's research studies concentrated on two aspects: designing a serious game and producing a facial expression analysis module.

The game's creation involved designing scenarios adapted to clinical requirements and technical constraints, creating a graphic environment, as well as developing the game itself. Designing the facial expression recognition module called for the implementation of innovative automatic learning algorithms which would obtain a robust and precise analysis of facial emotions in real time. To achieve such artificial intelligence algorithms, the consortium collected and entered data of typical children and data of children with autism. The latter were also used in a clinical perspective in order to better understand the specificities of the emotional productions of children with autism.

The project gave rise to a demonstrator combining the expertise of all the partners in the project. A preliminary version of the facial expression recognition module won the Facial Expression Recognition and Analysis Challenge 2015. The project also led to abundant scientific production: 12 articles in international journals (of which 2 multipartner publications), 11 international communications (of which 3 multipartner communications) and numerous outreach and enhancement programmes at congresses, thematic days and seminars.

PERSPECTIVES

The JEMImE project demonstrated the feasibility of a serious game focussing on automatic analysis of the emotional productions of children with autism. The next phase of the project will consist in showing the clinical contribution of this game by means of a wide-ranging study which will eventually enable it to be disseminated to therapists and families via the Curapy.com platform.

JEMImE

Educational Multimodal Emotional Imitation Game

ANR programme:
Digital Contents and Interactions (CONTINT)

Edition, Project duration:
2013, 54 months

ANR grant: €615,513

Coordinator:
Kévin Bailly

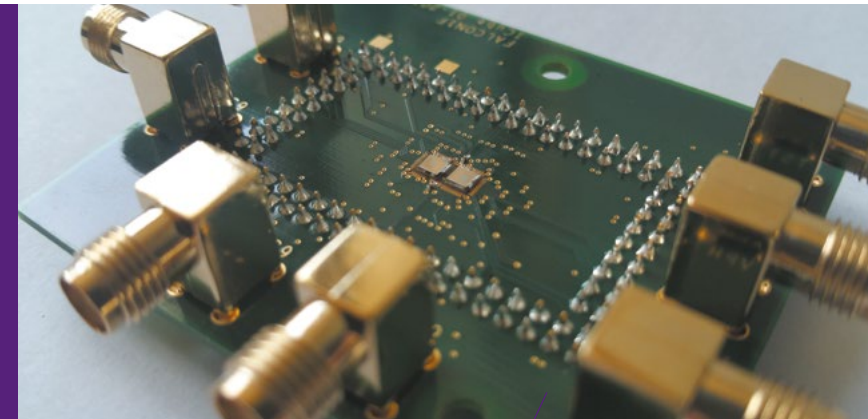
kevin.bailly@sorbonne-universite.fr
<http://jemime.isir.upmc.fr>

Main publication or contribution:
Emotion recognition algorithms (First prize, FERA Facial Expression Recognition and Analysis Challenge 2015)

Partners:
Sorbonne Université (ISIR)
GENIOUS Systems
École Central de Lyon (LIRIS),
Université de Nice (CoBTek)

FALCON, the very first ultrafast burst video sensor with digital storage achieving 10 up to 100 millions frames per second

In the field of high-speed imaging, the fastest cameras use the concept of burst imaging to bypass the bottleneck of the IO speed to achieve an acquisition speed of more than 1 Tera pixels per second. The Falcon sensor takes benefits of the 3D microelectronic technology process to push the performance well beyond the state of the art by gathering more than 1000 images at a speed of 10 up to 100 million frames per seconds.



Photograph of the prototype demonstrating the FALCON sensor

A key to go beyond the Moore's law is the 3D microelectronic which consists to stack several chips in order to increase the integration density. This technic allows splitting the functionalities of a system on the different tiers while offering a potentially gigantic data rate. Thus, this technology is ideal to design an ultrahigh speed video sensor in which the bottleneck is mainly the bandwidth of the data transmission. Moreover, as the electronic is merged on several tiers, the pixel can embed a more complex function. So, the analog to digital conversion (ADC) is integrated within the architecture of the system. Additionally, to the image integrity improvement, this feature allows increasing the number of stored images in the pixel by one order of magnitude with respect to the state of the art.

The Falcon sensor is the very first architecture of ultrafast burst image sensor with a digital storage. The measurements carried out on the realized demonstrator have validated the complete operation of the

system. The maximal speed of 100 million frames per second and the number of 1200 images stored are both 5 times beyond the commercial products at the current state of the art. All the design technological bricks of the systems also show some performances above the state of the art and can be used for the design of another image sensor or sensor for the Internet of Thing. For instance, the designed SRAM architecture is in agreement with all the targeted quality and performance criteria, more specifically in terms of power consumption that makes it possible to use it in the Internet of Thing applications. Finally, the obtain progress on the ADC have contributed to the emergence of a new generation of converters dedicated to the CMOS image sensors exploited by the startup XDIGIT.

PERSPECTIVES

With this new type of imager, ultrafast imaging has made a technological leap forward and now makes it possible to film more than 1,000 images with a complex physical phenomenon. The different technological bricks designed by the consortium partners are state of the art and can also be used within the framework of other imaging applications or IoT.

FALCON

Fast Acquisition Lattice Camera Owing to Nanotechnology

ANR programme:
CE26-0024-01

Edition, Project duration:
2014, 48 months

ANR grant:
€648,378

Coordinator:
Wilfried Uhring
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Main publication or contribution:
W. Uhring et al., « A Scalable Architecture for Multi Millions Frames per Second CMOS Sensor With Digital Storage, » IEEE NEWCAS 2018

Partners:
ICube Laboratory, UMR 7357,
Strasbourg, project initiator
Tima, UMR5158 Grenoble
CEA Ieti, Grenoble
Dolphin Intégration, Grenoble

BAKERY

Farmers' and artisanal bakery practices at the heart of biodiversity

Although bread is a food of historic, cultural and nutritional importance in France, the advantages of its low-input bakery sector for the development of a sustainable food supply are not widely known. The purpose of the BAKERY was to increase awareness of the variety of bakery practices, the diversity of microbial species present in yeasts, and their effects on the nutritional and organoleptic quality of bread as well as on consumers' perceptions.



Wheat, flour and yeast

The BAKERY project adopted an interdisciplinary participatory research approach, involving bakers, psychosociologists, biomathematicians, agronomists and microbiologists, to analyse current practices in sourdough bread production, microbial diversity and bread quality.

Sourdough is a mixture of flour and water fermented naturally by yeasts and lactic bacteria. It helps the dough to rise and produces lactic and acetic acids as well as aromas. The project revealed that breaking with the dominant model of white bread production by means of commercial yeast led to a greater diversity of bread-making practices, beneficial for the preservation of microbial diversity. The well-known baker's yeast species *Saccharomyces cerevisiae*, is not in the majority. Other species of yeast, of the *Kazachstania* genus, are frequent and some had never been described until now. Bakery practices can be differentiated as farmers' and artisanal practices,

which maintain different microbial species and thus contribute to the preservation of biodiversity. An experiment was carried out whereby farmers cultivated ancient wheat populations and modern varieties which the bakers used to obtain and propagate new yeasts. These were then used to bake experimental loaves.

The project showed that the bakehouse environment and the baker are the main drivers of yeast microbiota. There is thus a "bakery terroir" effect. Organoleptic and sensory analysis of the loaves revealed that their aromatic profiles differed not only according to the "bakery terroir" of the yeasts but also depending on the terroir where the wheat was cultivated. Moreover, interviews with consumers showed that as well as health concerns, they seek a social connection by choosing to eat sourdough bread.

PERSPECTIVES

At scientific level, the results of the BAKERY project allowed for the emergence of the yeast microbiota and the bakery industry as a model applicable to ecology, evolution and participatory research. At societal level, they show that the development of local industries based on farmers' and artisanal practices helps promote biodiversity and diversity of tastes. It is now important to follow the rapid development of these industries, and its impact on the dynamic of bakery practices and biodiversity.

BAKERY

Diversity and interactions of a low-input agrofood ecosystem "Wheat/Man/Yeast": towards a better understanding of the sustainability of the bakery industry

ANR programme:
ALID

Edition, Project duration:
2013, 54 months

ANR grant:
€669,694

Coordinator:
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Main publication or contribution:
Carbonetto, et al. (2018) Bakery yeasts, a new model for studies in ecology and evolution.
doi:10.1002/yea.3350

Partners:
UMR SPO, UMR GQE-Le Moulon, CIRM-Levures, CIRM-BIA, ONIRIS, UBO, ITAB, Réseau semence paysanne, Association Triptolème, 40 bakers/farmer-bakers

VinoBodies

Nanobodies: camel cures for ailing grapevines

Grapevine is a genuine reservoir for viruses! With more than 70 known viruses, grapevine harbors the largest number of viruses of any cultivated plant. This viral burden threatens the sustainability of our vineyards. The objective of VinoBodies was to develop diagnostic reagents derived from camelid antibodies (nanobodies) for use in disease control and to evaluate their potential as antiviral molecules. This work made it possible to demonstrate the effectiveness of nanobodies in controlling grapevine diseases.



Plot in the Chablis vineyards with fanleaf diseased grapevines

Diseases such as fanleaf degeneration, rugose wood complex and leafroll disease are the most widespread and most damaging viral diseases in grapevine. Their extreme prevalence is a serious threat to the viability of many vineyards, especially those assigned high value for their continuous cultivation and local heritage. Without effective resistance genes or antiviral molecules, the only means of combating these diseases are sanitary control measures. Although necessary, these methods remain largely insufficient to keep these diseases under control.

The goal of VinoBodies was to evaluate both the potential of nanobodies as molecular probes for virus immunodetection but also as antiviral molecules. Discovered in the 1990s, nanobodies are derived from immunoglobulins unique to camelid species (e.g., camel, llama, or alpaca). They are the smallest antibody-like molecules known, attracting much interest in biomedical research, but their use in agricultural biotechnology remains limited.

In collaboration with our partners at INRA Colmar and Vrije Universiteit Brussel, we isolated nanobodies against a broad spectrum of grapevine viruses. We demonstrated the superiority of nanobodies compared to conventional antibodies for immunoenzymatic detection of different viruses. We also discovered that the expression of some nanobodies in planta conferred resistance to viruses in both herbaceous hosts and grapevine. In particular, we generated plants resistant to both grapevine fanleaf virus (GFLV) and Arabis mosaic virus (ArMV), the two principal agents of the fanleaf degeneration disease of grapevine.

PERSPECTIVES

Our work opens up new perspectives for agricultural pathogen detection, which we intend to develop in the framework of a start-up. The use of nanobodies to confer resistance to grapevine viruses is a longer-term perspective that fits perfectly into a LabCom-type industrial partnership.

VinoBodies

Nanobodies: the swiss army knife of grapevine virology

ANR programme:
AAPG

Edition, Project duration:
2014, 48 months

ANR grant:
€394,592

Coordinator:
Christophe Ritzenthaler
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www.ibmp.cnrs.fr/equipes/biologie-et-biotechnologie-des-virus-de-la-vigne

Main publication or contribution:
Hemmer et al. (2018). Plant Biotech. J. 16, 660-671.
Brevet : Virus-like particles and the uses thereof (EP17305265)

Partners:
INRA Colmar, France
VUB, Bruxelles, Belgique

DEMOCRITE

Demonstration of a risk-analysis and risk-coverage engine on a territory

DEMOCRITE is a geographic-based software platform created from scratch during the project in order to answer operational needs. It allows first responders from the Paris firefighters brigade (BSPP) to compute in a few seconds the effects of an urban explosion or the consequences of a fire. Interactive maps show the intrinsic vulnerabilities of the territory as well as the risk coverage and remaining risks. Beyond the software, important legal issues concerning the rights of victims and the organization of rescue have also been studied.



Danger zones from an explosion in a city (fast-running code FLASH) compared to «free-field» circular zones

DEMOCRITE maps two types of interventions for rescue services: high-probability ones (accident, health problems...) and major ones such as explosions or fires (either accidental or intentional). Considering fire modelling, the tradeoff between precision and speed has been solved by coupling local and global models. The local scale results came from preliminary 3D numerical simulations used to derive parameter for the large-scale fast-running code based on cellular automata AI. Previous empirical methods to deal with explosions were not sufficient to compute effects in urban configurations, so a new approach beyond the international state-of-the-art has been developed for DEMOCRITE and validated on numerical simulations, experiments and bombing forensics. Rescue services also want to know the human and functional vulnerabilities on their territory, for instance in order to optimize the location of their vehicles. It has been done through a spatio-temporal analysis for both results: using activity and transport fluxes to map human vulnerability, and through a multi-criteria study of

the hierarchy of stakes for functional vulnerability. During the project a new need has been expressed by rescue services: analysis of the risk coverage of their territory at any moment, and assessing remaining risks. Through the study of several years of interventions history, such coverage maps have been generated. Due to the operational importance of this last requirement, it has been added to the project with no additional costs.



PERSPECTIVES

Several organisms, even beyond rescue services, have already expressed their interest in DEMOCRITE. Urban explosion modelling, innovative and of great significance considering current threats, will be developed as a specific project. Several other development axis have been identified and prioritized by DEMOCRITE partners and external experts. The main objective is to turn DEMOCRITE into a multi-purpose and operational risk management tool, also relying on reliable data.

DEMOCRITE

Demonstration of a risk-analysis and risk-coverage engine on a territory

ANR programme:
CSOSG 2013

Edition, Project duration:
2014, 55 months

ANR grant:
€995,426

Coordinator:
Emmanuel Lapébie

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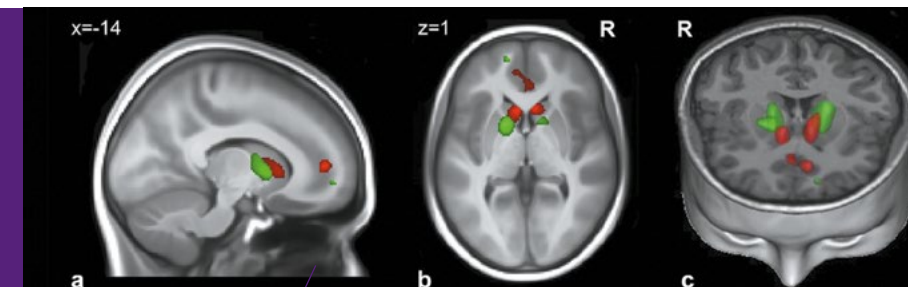
Main publication or contribution:
20 communications,
2 publications, 2 workshops,
1 special journal RISEO, 1 software,
1 potential company creation

Partners:
CEA – French Atomic Energy and Alternative Energies Commission (coordinator), Paris Fire Brigade, Institut P', Société IT Link, Société Systel, IMT-Alès, CERDACC, Maxplus Team INRIA/X

WM2NA

White matter imaging, microstructure, and negative affects: translational study in humans and mice

Do changes in connectivity in the brain in depressed patients, as measured by diffusion tensor imaging (DTI), reflect changes in white matter maturation?



Pre-clinical depression in adolescents: reduction in volumes of grey matter (red) and white matter (green)

The affective disorders have been related to deviations of brain white matter connectivity as evidenced by diffusion tensor imaging (DTI) studies in patients.

It is not clear what the changes seen through DTI refer to at the tissue and molecular levels. This limits the potential value of monitoring white matter alterations with DTI as a clinical tool. To which extent DTI alterations in adolescents with negative affects reflect changes in white matter maturation in adolescence, and what are the molecular factors related with these changes cannot be tested in humans by non-invasive techniques.

This multidisciplinary project combined DTI imaging in adolescent humans and mice, as well as ex-vivo studies in rodents and post-mortem analyses in humans. Results: Partner 1 analyzed brain morphology and white matter microstructure throughout adolescence. The findings highlight a restricted brain network that indicates high vulnerability to develop anxiety and depression symptoms in adolescence, and ultimately major depression disorder. Regional variations involved in resilience capacity, anhedonia, and

sleep habits were delineated. Partner 2 provided convergent morphological, transcriptional, and epigenetic evidence that a history of child abuse and subsequent suicide in adulthood associates with impaired myelination in the anterior cingulate cortex. Partner 3 validated a robust mouse model of depression at adolescence, encompassing dimensions of the disorder. Mice subjected to early life stress and showing signs of adolescent depression showed magnetic resonance imaging changes in cortical areas and white matter fiber tracts as detected by partner 4, suggesting altered myelin integrity. Partner 3 reported a molecular transcription factor that might be relevant for antidepressant response. Using cellular imaging and histochemistry methods, Partner 5 further showed that white matter cells and myelin compaction quality are affected in the cortex and white matter tracts.



PERSPECTIVES

Histological and molecular markers of myelin alteration related to stress during brain development have been validated. This suggests that the variations detected in the brains of adolescents with depressive symptoms, as well as in patients with early childhood abuse, are related with these histological and molecular changes in white matter development. Present findings support the rationale for prevention in adolescents with negative affect symptoms, as well as in children with a history of childhood abuse. In addition, a transcription factor was identified as a promising basis for drug research on negative affect reversibility. The information gathered in the present project on white matter development relation to negative affect was presented to an ad hoc committee in a French Ministry (spring 2018) in order to foster targeted prevention; this information fueled the rationale to stratify the age of protection in adolescence in a project of law presented to the French parliament.

WM2NA

White matter imaging, microstructure, and negative affects: translational study in humans and mice

ANR programme:
ERANET NEURON II

Edition, Project duration:
2012, 48 months

ANR grant:
€340,860

Coordinator:
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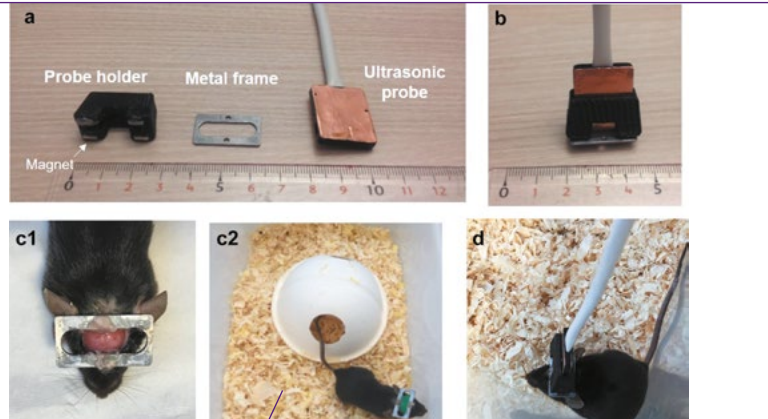
Main publication:
Early Variations in White Matter Microstructure and Depression Outcome in Adolescents With Subthreshold Depression. American Journal of Psychiatry 2018 Dec 1;175(12):1255-1264. doi: 10.1176/appi.ajp.2018.17070825. (IF: 13.39)

Partners:
INSERM U.1000 ;
Douglas Mental Health University Institute ;
INSERM U-952 ;
Albert-Ludwigs-Universität Freiburg ;
CNRS UMR8194, University Paris Descartes

FUSIMICE

New miniaturized ultrasound probe shows the brain activity of mice in action

Classical brain imaging techniques, namely magnetic resonance imaging (MRI) and positron-emission tomography (PET), involve constraints and are expensive. A new functional ultrasound (fUS) imaging technique, invented in 2009 at ESPCI in an INSERM research unit, yields images of equivalent or higher quality with a much simpler device, and is particularly suitable to study the brain activity of awake mice.



(a,b) Ultrasound probe and support, (c1) chronically fixed frame, (c2) protective cover (in green), (d) probe on the mouse

Functional Ultrasound (fUS) imaging uses an innovative ultrafast ultrasound sweeping and exploits the high-performance computing capabilities of graphics processing units to perform a computer reconstruction of the image of blood circulation and thus of brain activity. Knowing that ultrasounds are attenuated by the skull thickness, the technique is particularly suitable for studying the brain activity in mice, where this thickness is negligible, but it required to miniaturize the ultrasound probe. This was achieved by manufacturing a probe of only 4 grams, instead of 12 for the previous version. This probe has first been tested on anesthetized mice to avoid any issue related to the movements of the animals. The experiment was then extended to awake and freely-moving mice. As illustrated above, this was achieved by fixing on the mouse skull a frame on which the probe can be placed with magnets and adjusted. Another setup whereby the head is restrained and only the environment moves is also being developed, and enables more varied

experiments. Furthermore, by optimising the ultrasonic acquisition sequence to limit movement-related artifacts, a continuous monitoring of brain activity in the form of videos has been made possible. Besides, experiments with controlled stimulations of the mouse whiskers have confirmed that the technique shows the specific brain activity in response to these stimuli. Finally, a comparison with functional magnetic resonance has confirmed the benefits of fUS. In summary, the FUSIMICE project has developed and validated the fUS technique to image the brain activity of freely-moving mice in real time with few constraints, achieving a high sensitivity and spatiotemporal resolution with a portable and cheap equipment.

PERSPECTIVES

fUS imaging opens access to previously unexplored aspects of mouse brain function, and in particular creates new perspectives for understanding brain diseases. The project results have led to create a start-up, Iconeus, and to a first product planned to be commercially released at the end of 2019. Additionally, fUS starts to be used in clinical applications, in situations where the skull does not prevent ultrasound imaging, namely during neurosurgery or through the fontanel window for babies.

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IVICA

The Institute Villebon-Georges Charpak (IVICA): pedagogical innovation for the promotion of equal opportunities

The Institute Villebon-Georges Charpak was built to fulfil two missions:

- Allow young undergraduates from underprivileged backgrounds -70% of whom receive grants- who are interested in the sciences but ill at ease with traditional teaching methods to fully reach their potential during the higher education.
- Offer teachers an innovative teaching structure that allows them to imagine or discover new pedagogical practices, to prototype and to test them.



Institute Villebon-Georges Charpak students

Since its creation in September 2013, the Institute Villebon - Georges Charpak has successfully endeavored to reach its objectives. This year, it has welcomed its 6th intake of students whose backgrounds are as diverse as ever and some of whom are characterized by their fragile academic results. In 2018, 84% of our students obtained their degree and more than 95% of them are continuing their studies, mostly in masters or engineering schools. These results which were satisfactory with regards to the objectives set were made possible due to the multidisciplinary teaching units, the projects, the experimentation, the methodology, the flexibility of the courses, the active pedagogy, as well as all the other means put in place to guide the students to success. Generally speaking, the institute works continually to develop practices that are transferable to other training programmes. This year, our Mathematics teachers tested «at your own pace» learning, which allows struggling students to take the time they need to understand

while more advanced students are free to explore other concepts. Practical work in the physical sciences has also been redesigned so that it can take place outside the teaching rooms, the aim being to develop students' creativity and autonomy. The most promising pedagogical practices have already been tested in partner institutions on a wider scale. On a research level, collaboration with the National University of Singapore has been put in place to evaluate the impact of certain pedagogical practices on the rhythm and quality of students' sleep. A protocol for the evaluation of the pedagogical practices has been put in place with a researcher from the Université du Québec in Montréal. As simple as it is efficient, this protocol allows each teacher to evolve their pedagogical practices in an enlightened manner and in complete autonomy.

PERSPECTIVES

The Institute Villebon - Georges Charpak has become a locus for the design and testing of educational activities for a public with a fragile educational background. Its training which is fully in line with the new license decree (flexibility of courses, mechanisms to encourage success, a skills approach, etc.) makes it a valuable demonstrator at this time of the renewal of undergraduate courses.

FUSIMICE

Ultrafast Functional Ultrasound (fUS) Imaging for Highly-Resolved Targeted Mapping of Functional Connectivity in the Awake Mouse Brain

ANR programme:
FLAG-ERA

Edition, Project duration:
2015, 36 months

ANR grant:
€380,000

Coordinator:
Zsolt Lenkei
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Publication or main contribution: E. Tiran et al., « Transcranial functional ultrasound imaging in freely moving awake mice and anesthetized young rats without contrast agent », *Ultrasound in medicine & biology*, 43.8 (2017): 1679-1689

Partners:
École Supérieure de Physique et de Chimie Industrielles (Coordinator, France);
Institut National de la Santé et de la Recherche Médicale (France);
Institute of Experimental Medicine of the Hungarian Academy of Sciences, Hungary;
University of Antwerp, Belgium

IVICA

Institute Villebon - Georges Charpak

Action:
Initiatives of excellence in innovative training (IDEFI) in IDEX IPS

Project region: Île-de-France

Start and end dates of the project:
From 01/07/2013 to 31/07/2020

PIA grant:
€2,500,000

Coordinating institution:
Université Paris-Saclay

Contact:
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Main publication:
<http://www.villebon-charpak.fr/laboratoire-pedagogique/les-pratiques-pedagogiques>

Partners:
Université de Paris V (Descartes),
Université de Paris XI (Paris Sud Orsay),
Fondation ParisTech,
COMUE ParisTech,
Institute Villebon - Georges Charpak

IDEALG

Consolidate and increase knowledge to develop the seaweed sector in France

Faced with a growing worldwide demand for biomass, the French seaweed sector is a global leader in Europe and is developing mainly by exploiting wild and imported resources. The IDEALG project is conducting genomic and post-genomic research to develop new tools and methods for selecting local resources in mariculture and to meet the challenges of sustainable and quality industrial production using biotechnologies and green chemistry.



© Guillaume Gesret @C-Weed aquaculture

Cultures of the sugar kelp *Saccharina latissima* in the Rance river near Saint Malo by C-Weed Aquaculture

The IDEALG project is based on both fundamental and applied research on marine macroalgae and their associated microbes. It is implemented through three axes:

1. Genome sequencing research, to obtain the required data on the potential of algae in terms of genetic diversity, metabolic pathways and interactions with other organisms or their environment. This knowledge is particularly useful for the discovery of enzymes and access to molecules in the second axis, and for selective breeding in the third.
2. The development of analytical and biotechnological tools and chemical studies to exploit and / or control the metabolism of algae for industrial purposes.
3. The development of seaweed cultivation and the conservation of genetic resources. This axis requires adopting new perspectives on genetic breeding and conducting research on new aquaculture practices and domestication

processes. This axis also includes studies of environmental and socio-economic impacts on the algae sector, as well as prospective analyzes.

IDEALG, through more than 130 publications, 10 patents and numerous collaborative projects involving 30 companies, offers tool kits for the processing of genomic, genetic, biological and chemical information. Placed at the service of the community within the EMBRC-Fr national research infrastructure, the results of this work provide a better understanding of the physiology, reproduction, metabolism and interactions of algae with their environment. The integration of mathematics and bioinformatics in the reconstruction of metabolic pathways reverses the idea that an alga can not live without exchanges with the microorganisms that inhabit it. The development of this research involves the use of the model of brown alga *Ectocarpus*, its improvement by genetic approaches, and the analysis of the different biosynthetic

pathways of the compounds of interest, transposable to species of commercial interest, such as the sugar kelp *Saccharina latissima*.

PERSPECTIVES

Securing supplies requires controlling algae cultivation and conducting dynamic management of the genetic diversity of populations. The new extraction processes will also refine all algae fractions. IDEALG's biorefinery and enzyme biotechnology concept will be transferred on an industrial scale to new products and materials.

IDEALG

Seaweed Biotechnologies and Bioresources

Action:

Biotechnologies and Bioresources (BTBR)

Project region:

Bretagne

Start and end dates of the project:

From 01/09/2011 to 31/12/2020

PIA grant:

€10,027,502

Coordinating institution:

COMUE Université de Bretagne Loire

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Philippe Potin
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<https://idealg.u-bretagne-loire.fr/>

Main publication:

https://idealg.u-bretagne-loire.fr/sites/default/files/documents/rapport_idealg_2011-2017.pdf

Partners:

CNRS, IFREMER, Univ. Bretagne Occidentale, Univ. Bretagne Sud, AgroCampus Ouest, ENS Chimie Rennes, CEVA – Algae technology & innovation centre, Univ. Nantes, INRA, SCEA France Haliotis

CAMI, a national network of scientific and medical experts for safer and more efficient diagnostic and therapeutic patient specific interventions

Computer Assisted Medical Intervention has already begun to modify medical practice by offering software for image analysis, simulation and intervention planning, and robotic or navigation assistance devices. The Labex CAMI was created to go further, at the edge of present technological and medical revolutions, by coordinating efforts and stimulating the collaborations of 6 leading French actors in this field.



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3D ultrasound image-guided robot for prostate cancer treatment (brachytherapy). Development of a clinical version of the system

The work carried out by the Labex CAMI combines the medical need and scientific and technological innovations. It ranges from basic research to industrial transfer. This integrative approach also covers educational aspects, as well as the demonstration of the clinical benefits obtained in public health. Indeed, demonstrating the clinical benefits and guaranteeing the quality of the performed interventions are major application objectives of the project.

Based on a shared vision about cross-disciplinary translational research, significant progress has been made in five generic research axes (augmented perception, decision, action and training, and demonstration of clinical benefit). Six collaborative projects targeting application challenges were developed to provide: (1) a control tower in the operating room to monitor the intervention, (2) miniature bio-robotic devices for gastrointestinal interventions, (3) focal and adaptive brachytherapy of the prostate, (4) enhanced endoscopy by multimodal information

fusion, (5) simulation of positioning of medical devices in interventional radiology cardiovascular and (6) a surgical cockpit aimed at improving user-system interaction. Some of these integrated projects have already resulted in industrial collaborations and in new research directions explored and funded via other collaborative projects.

A real «CAMI spirit» has emerged, especially through the Labex doctoral program, with 35 PhD students recruited since 2012, co-supervised by CAMI's partners. CAMI achievements result in nearly 300 scientific and clinical publications, many awards and clinical trials having included more than 1,200 patients. CAMI has also directly contributed to the creation or development of 15 start-ups.

PERSPECTIVES

The objective of CAMI is to enable, for each patient, the most appropriate and effective interventions using statistics obtained from data acquired on populations. Two challenges will structure the future activity of CAMI. One aims to benefit from the latest advances in artificial intelligence; the other targets endoluminal interventions, which raise major scientific and technological challenges.

CAMI

Computer Assisted Medical Interventions

Action:

Laboratories of excellence (LABEX) in IDEX UGA

Project region:

Auvergne-Rhône-Alpes

Start and end dates of the project:

From 01/03/2012 to 31/12/2024

PIA grant:

€8,440,592

Coordinating institution:

COMUE Université Grenoble Alpes

Contact:

Jocelyne Troccaz
Jocelyne.Troccaz@univ-grenoble-alpes.fr
<http://cami-labex.fr/>

Partners:

Université Bretagne Occidentale Brest, Université de Strasbourg, Université de Montpellier, Université de Rennes I, Sorbonne Université, Institut Mines Télécom, CNRS Alpes, INSERM Grand-Ouest, Université Grenoble Alpes, CNRS Paris B, CNRS Alsace, CNRS Languedoc-Roussillon

EVEREST

Training platform and simulations of new-generation minimally invasive surgery

The EVEREST project was born out of the ambition to develop medical and surgical training in line with the technological opportunities of our time. The aim of the project is to democratize the learning of knowledge and techniques of modern minimally invasive surgery by offering high quality digital content. The digitalization of teaching allows for the development of an international and multidisciplinary course adapted to the student profile and his/her practical and theoretical progression.



Learning the manipulation of the endoscope in a fun universe

The EVEREST project is considered as a solution to the rapid development of surgical discipline, teaching practices and new generations of students. Its aim is to break down barriers in the physical workspace, connect people and ensure cross-fertilization between medico-surgical disciplines, technological innovation and business and managerial aspects. This project is enhanced by a network of partners sharing our vision of innovation and is supported by scientific societies both nationally and internationally. EVEREST pursues various objectives:

- High quality, multidisciplinary content based on a unique network of international experts.
- A platform allowing both the integration and the rapid dissemination of educational content, as well as a recognized process of evaluating learners' skills and knowledge leading to a diploma.
- A new range of innovative digital simulators adapted to the needs of a large-scale, low-cost and remotely accessible education for a majority of users.

At the crossroads of these objectives, the « EVE - evolving education » platform was created. This evolutive and dynamic platform brings together all the players in the business in an incubator of innovative ideas. EVE is a unique space for theoretical training, practice, sharing and networking. This year, in collaboration with the University of Strasbourg, the EVE platform will be launched in September 2019 with three international Master's courses: Surgical Endoscopy, Image Guided Therapy and Business Engineering and Surgical Transfer Technologies (BESTT). Driven by an entrepreneurial spirit, the aim of this project is to create a real French sector in the field of medical-surgical training and innovation.

PERSPECTIVES

To complement the training offer initiated this year, simulators will be provided at the start of the 2019/2020 academic year. The aim is to offer low-cost digital simulators for remote and on-demand training, while maintaining high quality learning. Students will have access to an unprecedented theoretical and hands-on learning experience.

EVEREST

European e-Learning in Surgical Education through Simulation and Web Technologies

Action:
Initiatives of Excellence in Innovative Digital Training (IDEFI-N)

Project region:
Grand Est

Start and end dates of the project:
From 01/04/2016 to 31/12/2020

PIA grant:
€1,190,000

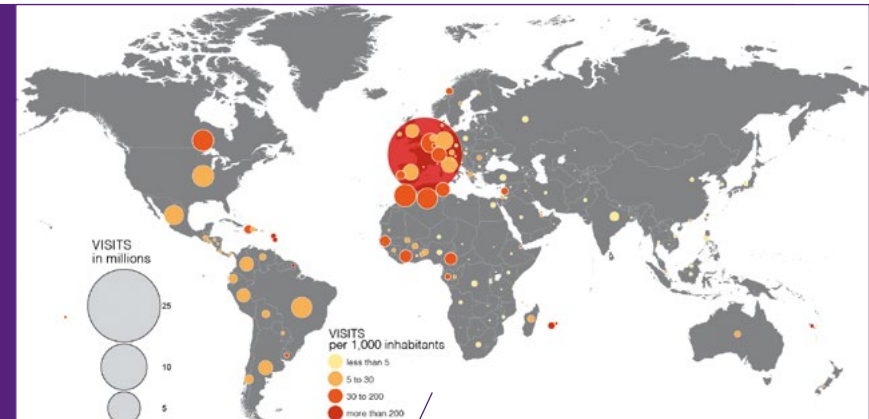
Coordinating institution:
IHU Mix-Surg

Contact:
Silvana Perretta
Silvana.Perretta@ircad.fr

Partners:
IRCAD,
INRIA Nancy Grand Est,
Université de Strasbourg,
Karl Storz France

DILOH is developing an international library for the social sciences and the humanities, offering several thousand documents in open access

The aim is to provide humanities and social science research with a system that serves the different stages of scientific communication. This system is distinguished by the quality of the published content but also by the innovation it offers by connecting texts (published books) to preparatory debates (scientific blogs). As a system that is accessible to everyone, no matter where they are in the world, it also increases the visibility of the humanities and social sciences.



Worldwide visitor numbers to all OpenEdition platforms

DILOH is leading an ambitious digitization and online dissemination programme for humanities and social science publications and building a global digital environment for the production and dissemination of knowledge integrating different types of documents: books, journals, blogs and scientific programmes. The project is part of the open access and open science movement. It is developing a new economic model for publishers: freemium. Most of the content is open access while specialized services are marketed as premium services. 100% of the income generated by the commercialization of these services is reinvested in knowledge dissemination: 66.6% goes to publishers and 33.4% goes to OpenEdition, to ensure the development of new services for users. DILOH is based on digital publishing software developments that meet the needs of the academic community:

- Bilbo: a robot that automatically extracts bibliographic references

- Opentext: a document conversion server that structures texts in rich XML-TEI
- Lodel: open source digital publishing software

In 2018, OpenEdition, the DILOH showcase, received more than 64 million visits and published over 80,000 documents. DILOH is therefore a key mechanism for disseminating and greatly increasing the visibility of research results. It enjoys the trust of almost 100 university presses and the entire research community in the humanities and social sciences through Hypotheses. In addition, 169 libraries and institutions around the world supported the development of DILOH and open access by subscribing to the freemium offer.

DILOH has set up several international partnerships with major institutions: MWS (Germany), Uned (Spain), ISCTE (Portugal), University of Turin (Italy) and the DOAB Foundation (Netherlands).

PERSPECTIVES

DILOH is supporting the social sciences and the humanities (SSH) community from open access to the paradigm of open science. It has taken an EU infrastructure project, OPERAS, to the European level. OPERAS aims to coordinate the actions of all players in order to build collective competence, increase the visibility of content and training, and pool innovations.

DILOH

Digital Library for Open Humanities

Action:
Equipment of Excellence (EQUIPEX)

Project region:
PACA and Ile de France

Start and end dates of the project:
From 01/01/2012 to 31/12/2021

PIA grant:
€7,000,000

Coordinating institution:
Aix Marseille Université

Contact:
Marin Dacos
marin.dacos@openedition.org
https://www.openedition.org/

Partners:
Université d'Avignon et Pays du Vaucluse, École des Hautes Études en Sciences Sociales, Université de Toulon et du Var, École nationale supérieure des Arts et Métiers (Arts et Métiers ParisTech), CNRS Rhône Auvergne, CNRS Provence Corse

ELORPrintTec, a unique equipment facility dedicated to innovation in printed and flexible electronics, open to academics and industrials

Organic semiconductors are a new class of functional materials and represent an alternative to conventional silicon-based technologies. Due to its unique properties, organic electronics is an emerging technology that can bring breakthrough innovations. ELORPrintTec addresses these challenges in the areas of energy, health, digital and the environment.



© ELORPrintTec

Nano-imprint of cavities for flexible displays

This platform, unique in France and in the world, covers both the knowledge and value chains – including new materials, formulations, implementations, innovation, engineering, industrialization, production and marketing - opening up to many potential markets:

- ▶ in the Energy field, photovoltaics can be used to provide alternative energy sources and economical lighting that can reduce the carbon footprint. Thermoelectric and electrocaloric energy recovery systems can also be developed;
- ▶ in the Health sector, we can design sensors, actuators, ion pumps for the targeted delivery of active principles;
- ▶ in the Digital area, radio-identification is developing, as well as connected objects, displays and the flexible e-book technology, which will revolutionize e-documents;
- ▶ for the Environment, the new generation of electronics will rely on manufacturing processes that are energy-efficient and require less strategic raw materials, which will preferably be non-fossil;

▶ in terms of Security, identity documents, anti-counterfeiting systems, or allowing traceability, can be developed.

One of the first results in the digital field has been the development of new advanced materials for printed electronics for use in the semiconductor industry. This innovation was made possible thanks to the infrastructure of ELORPrintTec. The ELORPrintTec facility has also contributed to consolidating the local and national ecosystem (Major Groups, SMEs, ETIs and start-ups) through the use and integration of materials into existing products, as well as the invention and design of new products based on this emerging technology of printable organic electronic materials. Finally, partnerships have emerged with startups, SMEs and major industrial groups which have perceived the full potential of the platform for their Research & Development activities.



PERSPECTIVES

The market for printable electronics is estimated at € 240 billion by 2027 in areas such as energy, health, digital and the environment. On the one hand, ELORPrintTec will enable tomorrow's engineers to be trained through high-level research, and on the other hand, it will enable the companies to be competitive in this sector maintaining a high-tech level and creating many jobs in Europe.

ELORPrintTec

Bordeaux University
Facility for the Printed
Organic Electronics: from
Molecules to Devices and
System Architectures
as well as their
Commercialization

Action:
Equipment of Excellence
(EQUIPEX)

Project region:
Nouvelle-Aquitaine

**Start and end dates
of the project:**
From 22/02/2011 to 31/12/2019

PIA grant:
€8,994,243

Coordinating institution:
Université de Bordeaux

Contact:
Georges Hadziioannou
georges.hadziioannou@u-
bordeaux.fr
elorprinttec.u-bordeaux.fr

Partners:
CNRS,
Bordeaux INP,
Arkema

Appendices

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| Review of 2018 calls for proposals

	Projects peer reviewed in stage 2 or single stage	Projects funded	Success rate relative to number of eligible proposals (stage 1 review)	Success rate relative to number of eligible proposals (stage 2 review or single-stage call)	Overall ANR funding (€M)	Percentage of ANR funding
Generic Call for Proposals	3,452	1,133	35.8%	32.8%	443.0	85.5%
PRC	1,801	603	42.6%	33.5%	273.9	52.9%
JCJC	782	312	42.1%	39.9%	76.5	14.8%
PRCE	313	119	40.5%	38.0%	66.4	12.8%
PRCI	556	99	-	17.8%	26.3	5.1%
International and competitiveness	1,536	338	-	22.0%	75.1	14.5%
Flash	12	4	-	33.3%	1.8	0.4%
Bilateral French-German exc. PRCI	58	11	-	19.0%	3.1	0.6%
Bilateral and multilateral exc. PRCI	103	9	-	8.7%	3.5	0.7%
ERANET, JPI etc.	999	167	-	16.7%	40.5	7.8%
ERC programme	16	16	-	100.0%	2.3	0.5%
MRSEI	146	72	-	49.3%	2.0	0.4%
ASTRID including Maturation	112	34	-	30.4%	11.5	2.2%
LabCom	81	21	-	25.9%	6.3	1.2%
Industrial Chairs	9	4	-	44.4%	3.9	0.8%
TOTAL calls for proposals	4,988	1,471	-	29.5%	518.1	100%

Review of 2018 calls for proposals

Credit breakdown by beneficiary type (value)

	TOTAL COMMITMENTS (€)	CNRS	INSERM	INRIA	INRA	IRD	CEA	OTHER RESEARCH BODIES	RESEARCH BODIES SUBTOTAL	UNIVERSITIES	OTHER HIGHER EDUCATION INSTITUTIONS	HOSPITALS/ HEALTHCARE	OTHER PUBLIC SECTOR	PUBLIC SECTOR SUBTOTAL	FOUNDATIONS	NON-PROFIT ORGANISATIONS	VSEs	SMEs	BUSINESSES OTHER THAN SMEs	OTHER PRIVATE SECTOR	PRIVATE SECTOR SUBTOTAL
Generic Call for Proposals	443,050,000	153,423,131	41,327,547	7,910,839	17,346,220	4,053,170	17,235,423	12,806,265	254,102,595	110,237,806	40,622,261	337,341	3,137,839	408,437,843	14,332,154	3,790,887	2,194,286	5,890,566	6,362,124	2,042,141	34,612,157
PRC	273,855,732	105,385,709	31,920,497	3,648,359	11,305,325	2,453,294	10,485,169	7,489,252	172,687,604	62,433,052	23,889,254	321,248	1,388,772	260,719,930	10,877,545	1,517,380	87,091	116,692	-	537,094	13,135,802
JCJC	76,477,403	25,457,722	6,332,571	2,295,200	2,689,244	1,357,691	917,119	1,198,852	40,248,398	25,041,109	7,869,394	-	367,621	73,526,522	1,905,785	502,534	-	-	-	542,561	2,950,881
PRCE	66,378,575	11,001,415	1,988,899	1,382,770	1,988,640	-	3,892,932	3,403,806	23,658,461	18,135,323	6,988,642	16,093	1,095,039	49,893,559	143,467	1,770,973	2,090,784	5,773,874	5,958,822	747,095	16,485,016
PRCI	26,338,291	11,578,286	1,085,580	584,511	1,363,012	242,185	1,940,203	714,355	17,508,132	4,628,322	1,874,971	-	286,406	24,297,832	1,405,356	-	16,411	-	403,301	215,391	2,040,459
International and competitiveness	75,010,049	16,411,449	6,858,453	632,564	4,147,051	1,223,217	2,176,267	4,613,992	36,062,993	19,698,252	8,264,291	30,621	1,068,340	65,124,497	3,016,135	622,053	542,314	2,915,482	1,990,549	799,020	9,885,552
Flash	1,800,000	219,629	-	-	-	-	-	161,950	381,579	710,285	169,665	-	427,196	1,688,725	-	33,140	61,569	-	-	16,567	111,275
Bilateral French-German exc. PRCI	3,099,912	1,227,554	-	-	-	-	-	-	1,227,554	1,497,058	375,300	-	-	3,099,912	-	-	-	-	-	-	-
Bilateral and multilateral exc. PRCI	3,530,210	1,533,418	-	-	-	-	172,902	-	1,706,320	462,113	923,047	-	-	3,091,481	144,943	-	-	-	-	293,787	438,730
ERANET, JPI etc.	40,491,395	7,623,557	6,446,260	458,868	3,400,483	1,070,814	753,902	3,435,290	23,189,175	8,737,348	2,889,988	-	35,860	34,852,371	2,344,281	354,727	359,261	1,513,413	740,432	326,910	5,639,024
ERC programme	2,344,000	758,662	-	-	-	-	318,828	91,800	1,169,290	696,821	277,888	-	-	2,144,000	200,000	-	-	-	-	-	200,000
MRSEI	2,033,836	521,002	112,192	-	146,568	152,402	149,187	206,153	1,287,505	514,746	139,730	30,621	30,621	2,003,223	30,613	-	-	-	-	-	30,613
ASTRID including Maturation	11,510,696	2,727,627	300,000	173,696	-	-	481,448	418,799	4,101,569	2,556,794	1,111,761	-	274,662	8,044,786	296,298	234,186	121,485	1,402,069	1,250,117	161,756	3,465,911
LabCom	6,300,000	1,800,000	-	-	600,000	-	300,000	300,000	3,000,000	2,400,000	600,000	-	300,000	6,300,000	-	-	-	-	-	-	-
Industrial Chairs	3,900,000	-	-	-	-	-	-	-	-	2,123,088	1,776,912	-	-	3,900,000	-	-	-	-	-	-	-
TOTAL calls for proposals	518,060,049	169,834,580	48,186,000	8,543,403	21,493,271	5,276,386	19,411,690	17,420,257	290,165,589	129,936,059	48,886,552	367,962	4,206,179	473,562,340	17,348,289	4,412,939	2,736,600	8,806,048	8,352,672	2,841,161	44,497,709
Outside calls for proposals	154,342,000	9,718,596	1,564,732	2,228,053	7,696,172	542,004	18,058,922	55,563,347	95,371,826	24,877,504	16,436,287	151,921	930,296	137,767,834	6,307,207	8,406,959	-	1,860,000	-	-	16,574,166
Carnot Institutes	62,000,000	2,210,000	-	1,140,000	6,360,000	-	14,750,000	14,440,000	38,900,000	1,800,000	7,540,000	-	-	48,240,000	3,680,000	8,220,000	-	1,860,000	-	-	13,760,000
Basic Technological Research (RTB)	3,800,000	2,052,000	-	-	-	-	1,748,000	-	3,800,000	-	-	-	-	3,800,000	-	-	-	-	-	-	-
INCA	38,000,000	-	-	-	-	-	-	38,000,000	38,000,000	-	-	-	-	38,000,000	-	-	-	-	-	-	-
Preciput	50,542,000	5,456,596	1,564,732	1,088,053	1,336,172	542,004	1,560,922	3,123,347	14,671,826	23,077,504	8,896,287	151,921	930,296	47,727,834	2,627,207	186,959	-	-	-	-	2,814,166
TOTAL outside calls for proposals	154,342,000																				
TOTAL ANR budget in commitment authorities	672,402,049																				

Review of 2018 calls for proposals Credit breakdown by beneficiary type

	TOTAL COMMITMENTS (€)	CNRS	INSERM	INRIA	INRA	IRD	CEA	OTHER RESEARCH BODIES	RESEARCH BODIES SUBTOTAL	UNIVERSITIES	OTHER HIGHER EDUCATION INSTITUTIONS	HOSPITALS/ HEALTHCARE	OTHER PUBLIC SECTOR	PUBLIC SECTOR SUBTOTAL	FOUNDATIONS	NON-PROFIT ORGANISATIONS	VSEs	SMEs	BUSINESSES OTHER THAN VSEs/SMEs	OTHER PRIVATE SECTOR	PRIVATE SECTOR SUBTOTAL
Generic Call for Proposals	443,050,000	34.6%	9.3%	1.8%	3.9%	0.9%	3.9%	2.9%	57.4%	24.9%	9.2%	0.1%	0.7%	92.2%	3.2%	0.9%	0.5%	1.3%	1.4%	0.5%	7.8%
PRC	273,855,732	38.5%	11.7%	1.3%	4.1%	0.9%	3.8%	2.7%	63.1%	22.8%	8.7%	0.1%	0.5%	95.2%	4.0%	0.6%	0.0%	0.0%	-	0.2%	4.8%
JCJC	76,477,403	33.3%	8.3%	3.0%	3.5%	1.8%	1.2%	1.6%	52.6%	32.7%	10.3%	-	0.5%	96.1%	2.5%	0.7%	-	-	-	0.7%	3.9%
PRCE	66,378,575	16.6%	3.0%	2.1%	3.0%	-	5.9%	5.1%	35.6%	27.3%	10.5%	0.0%	1.6%	75.2%	0.2%	2.7%	3.1%	8.7%	9.0%	1.1%	24.8%
PRCI	26,338,291	44.0%	4.1%	2.2%	5.2%	0.9%	7.4%	2.7%	66.5%	17.6%	7.1%	-	1.1%	92.3%	5.3%	-	0.1%	-	1.5%	0.8%	7.7%
International and competitiveness	75,010,049	21.9%	9.1%	0.8%	5.5%	1.6%	2.9%	6.2%	48.1%	26.3%	11.0%	0.0%	1.4%	86.8%	4.0%	0.8%	0.7%	3.9%	2.7%	1.1%	13.2%
Flash	1,800,000	12.2%	-	-	-	-	-	9.0%	21.2%	39.5%	9.4%	-	23.7%	93.8%	-	1.8%	3.4%	-	-	0.9%	6.2%
Bilateral French-German exc. PRCI	3,099,912	39.6%	-	-	-	-	-	-	39.6%	48.3%	12.1%	-	-	100.0%	-	-	-	-	-	-	-
Bilateral and multilateral exc. PRCI	3,530,210	43.4%	-	-	-	-	4.9%	-	48.3%	13.1%	26.1%	-	-	87.6%	4.1%	-	-	-	-	8.3%	12.4%
ERANET, JPI etc.	40,491,395	18.8%	15.9%	1.1%	8.4%	2.6%	1.9%	8.5%	57.3%	21.6%	7.1%	-	0.1%	86.1%	5.8%	0.9%	0.9%	3.7%	1.8%	0.8%	13.9%
ERC programme	2,344,000	32.4%	-	-	-	-	13.6%	3.9%	49.9%	29.7%	11.9%	-	-	91.5%	8.5%	-	-	-	-	-	8.5%
MRSEI	2,033,836	25.6%	5.5%	-	7.2%	7.5%	7.3%	10.1%	63.3%	25.3%	6.9%	1.5%	1.5%	98.5%	1.5%	-	-	-	-	-	1.5%
ASTRID including Maturation	11,510,696	23.7%	2.6%	1.5%	-	-	4.2%	3.6%	35.6%	22.2%	9.7%	-	2.4%	69.9%	2.6%	2.0%	1.1%	12.2%	10.9%	1.4%	30.1%
LabCom	6,300,000	28.6%	-	-	9.5%	-	4.8%	4.8%	47.6%	38.1%	9.5%	-	4.8%	100.0%	-	-	-	-	-	-	-
Industrial Chairs	3,900,000	-	-	-	-	-	-	-	-	54.4%	45.6%	-	-	100.0%	-	-	-	-	-	-	-
TOTAL calls for proposals	518,060,049	32.8%	9.3%	1.6%	4.1%	1.0%	3.7%	3.4%	56.0%	25.1%	9.4%	0.1%	0.8%	91.4%	3.3%	0.9%	0.5%	1.7%	1.6%	0.5%	8.6%
Outside calls for proposals	154,342,000	6.3%	1.0%	1.4%	5.0%	0.4%	11.7%	36.0%	61.8%	16.1%	10.6%	0.1%	0.6%	89.3%	4.1%	5.4%	-	1.2%	-	-	10.7%
Carnot Institutes	62,000,000	3.6%	-	1.8%	10.3%	-	23.8%	23.3%	62.7%	2.9%	12.2%	-	-	77.8%	5.9%	13.3%	-	3.0%	-	-	22.2%
Basic Technological Research (RTB)	3,800,000	54.0%	-	-	-	-	46.0%	-	100.0%	-	-	-	-	100.0%	-	-	-	-	-	-	-
INCA	38,000,000	-	-	-	-	-	-	100.0%	100.0%	-	-	-	-	100.0%	-	-	-	-	-	-	-
Preciput	50,542,000	10.8%	3.1%	2.2%	2.6%	1.1%	3.1%	6.2%	29.0%	45.7%	17.6%	0.3%	1.8%	94.4%	5.2%	0.4%	-	-	-	-	5.6%
TOTAL outside calls for proposals	154,342,000																				
TOTAL ANR budget in commitment authorities	672,402,049																				

ANR support for projects backed by competitive clusters through its 2018 calls for proposals

Cluster name	Number of projects funded	Funding granted to the project (€)
Advancity, Sustainable Cities and Mobility	1	686,222.08
Aerospace Valley	9	5,172,194.71
Agri Sud-Ouest Innovation	5	1,725,522.38
ALPHA-RLH	6	2,168,712.37
Alsace BioValley	1	665,126.85
ASTECH	2	961,188.56
Atlanpole Biothérapies	1	663,493.86
AVENIA	1	397,636.53
AXELERA	14	5,207,118.92
Cancer-Bio-Santé	1	279,990.00
Cap Digital Paris-Région	2	1,050,000.00
CAPENERGIES	1	389,112.12
Cereal Valley	3	962,899.92
DERBI (Renewable Energy in Construction and Industry)	1	358,560.00
ELASTOPOLE	2	696,453.39
EMC2 (Metal Assemblies and Complex Composites)	3	905,520.21
Eurobiomed	4	1,919,811.21
Former EAU (water) cluster	1	759,671.28
Former PNB Nuclear Valley cluster	1	661,188.56
FIBRES-ENERGIVIE	1	379,900.80
HYDREOS	1	687,110.77
Images & Networks	7	3,318,649.50
IMAGINOVE	1	230,748.48
IAR (Industry and Agro-Resources)	3	962,899.92
LUTB Transport & Mobility Systems	2	238,788.00

Cluster name	Number of projects funded	Funding granted to the project (€)
LYON BIOPOLE	12	5,716,152.60
Materialia	4	439,657.20
MATIKEM	5	2,309,900.32
Medicen	9	3,707,278.57
Mer Bretagne Atlantique	9	1,591,454.28
Mer Méditerranée	1	417,649.61
Microtechniques	1	500,177.34
MINALOGIC	12	4,309,736.33
MOV'EO	2	452,758.02
Nutrition Health Longevity	1	510,868.00
OPTITEC	4	1,872,727.04
PLASTIPOLIS	3	300,000.00
European Ceramics Cluster	1	455,760.00
S2E2 (Smart Electricity Cluster)	2	963,039.05
SAFE	4	699,650.22
SCS (Secured Communicating Solutions)	1	649,998.67
SYSTEMATIC Paris region	7	2,250,956.59
TECHTERA (Textiles and Functional Materials)	1	549,190.76
TENERRDIS	5	693,455.04
TERRALIA	4	2,104,552.77
UP-TEX	1	435,706.88
VEGEPOLYS	4	672,368.88
Véhicule du futur	1	623,863.54
VIAMECA	4	984,680.13
VITAGORA	1	590,034.24
TOTAL GRANTS (EXCLUDING DUPLICATES)	133	65,250,136.50



Investments for the Future PIA financial elements*

Total amount authorised (€)	11,525,383,457
Total amount agreed (€)	11,346,720,652
Total amount disbursed (€)	8,562,578,527

Excluding Campus and Saclay

(*) Including the non-consumable grants for the 4 fully certified IDEX projects.



Investments for the Future Breakdown of project funding by region as of 31/12/2018

Main region of project	Number of projects	Total authorised* (€)	Disbursements (€)
Auvergne-Rhône-Alpes	113	1,449,568,029	840,893,378
Bourgogne-Franche-Comté	11	156,325,921	78,209,317
Brittany	21	351,133,524	215,187,333
Centre-Val de Loire	8	58,250,805	31,761,313
Overseas	1	6,000,000	-
Grand-Est	41	1,395,006,264	1,236,446,296
Hauts-de-France	33	476,375,158	256,227,830
Paris Region	272	4,004,724,637	3,059,829,402
Normandy	12	83,017,039	55,088,202
Nouvelle-Aquitaine	40	1,156,948,910	1,024,168,842
Occitanie	63	813,101,017	520,016,783
Pays de la Loire	14	222,601,465	119,847,326
Provence-Alpes-Côte d'Azur	44	1,302,930,687	1,103,202,505
TOTAL	673	11,475,983,457	8,540,878,527

Excluding Campus and Saclay / excluding CVT

(*) Including the non-consumable grants for the 4 fully certified IDEX projects.



Investments for the Future Breakdown of project funding by action as of 31/12/2018

Action name	Number of projects	Total authorised* (€)	Disbursements (€)
Bioinformatics	12	17,130,082	16,329,542
Biotechnology - Bioresources	13	88,213,364	68,751,776
Cohorts	10	74,467,076	57,247,956
Thematic development consortia (CVT)	6	49,400,000	21,700,000
Demonstrators	4	77,993,735	60,697,474
Development of Experimental Digital Universities	5	8,000,000	4,800,000
Graduate schools of research	11	154,671,509	11,100,748
Equipment of excellence	93	591,902,706	539,214,247
Equipment of excellence 2	4	131,200,000	56,429,448
Additional experimentation by SATTs	2	5,000,000	2,800,000
IDEX / I-SITE** (PIA2)	86	1,039,407,419	534,542,670
National Biology and Health Infrastructure	23	509,237,699	408,083,099
Initiatives of Excellence** (PIA1)	88	4,635,361,584	4,357,134,219
Initiatives of Excellence in Digital Education	12	12,290,000	10,349,258
Initiatives of Excellence in Innovative Education	22	114,300,000	90,430,086
Carnot Institutes	55	136,216,771	87,545,259
Convergence Institutes	10	103,136,000	19,081,282
Technology Research Institutes	8	949,954,825	486,297,124
Institutes of Excellence in Low-Carbon Energy	9	367,325,393	208,174,724
University Hospital Institutes (IHU)	6	349,329,163	284,969,011
University Hospital Institutes 2 (IHU)	1	50,000,000	-
University Hospital Institutes B (IHU)	6	35,000,000	32,788,139
Boarding Schools of Excellence and Equality of Opportunity	1	900,000	720,000
Laboratories of Excellence (excluding IDEX/Isite)	55	541,058,056	471,154,881
Make Our Planet Great Again	31	19,697,161	2,694,327
Nanobiotechnology	8	18,842,529	17,137,265
New University Curriculum (NCU)	36	325,900,000	13,043,880
University Hospital Cancer Centre (PHUC)	2	20,000,000	18,813,478
University-Hospital Research in Health	24	185,423,340	82,466,603
Technology Transfer Acceleration Companies (SATT)	14	846,548,603	545,838,273
Nuclear Safety	22	67,476,441	52,243,758
TOTAL	679	11,525,383,457	8,562,578,527

Excluding Campus and Saclay

(*) Including the non-consumable grants for the 4 fully certified IDEX projects.

(**) Including Labex and Idefi projects within the scope of the projects concerned



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