

2022 Generic Call for Proposals

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STAGE 1

CLOSURE OF THE SUBMISSION STAGE
FOR PRE-PROPOSALS (PRC, PRCE, PRME, JCJC)
AND REGISTRATION (PRCI)

Thursday 28 October 2021 at 5 pm (Paris time)

STAGE 2

CLOSURE OF THE SUBMISSION STAGE FOR FULL PROPOSALS

The closure of the full proposal submission stage is set for end of March 2022. The exact date and time will be specified if you are invited to submit a full proposal (mid-February 2022).

Prior to submitting a (pre)-proposal for a research project, it is important to carefully read this document in full as well as the 2022 AAPG Guide (which will be available on the ANR website in September 2021) and the regulations concerning the conditions of allocation of ANR funding (<http://www.anr.fr/RF>)

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A. Context and objectives of the 2022 Generic Call for proposals (2022 AAPG)

General context for the implementation of the 2022 Generic Call for Proposals

Mobilising France's scientific communities in response to the Covid-19 post-pandemic and its consequences requires a global approach, and this concerns all the scientific themes of the 2022 Work Programme and its Generic Call for Proposals (2022 AAPG). Consequently, special consideration will be given to research proposals that focus on providing new insights into the environmental, anthropogenic, health, socio-economic and behavioural factors that could contribute to the emergence, spread and impact of pandemics. Proposals to develop all manner of risk assessment and mitigation and impact surveillance methods and that examine and support the potential social, economic, environmental, agricultural and industrial changes that could arise as a result of managing this crisis. This applies equally to mainland France, the overseas territories and the wider world – particularly the most vulnerable regions, with their specific characteristics. Supporting the economic recovery will also be a priority, while limiting the impact of human activity on future global changes and developing processes to increase society's resilience to these global changes. Global inter- and trans-disciplinary approaches will naturally be encouraged.

The 2022 Generic Call for Proposals is the “Research and Innovation” component of ANR’s 2022 Work Programme. It is directed towards all scientific communities and all public and private players involved in French research, including small and medium-sized enterprises (SMEs) and very small enterprises. It is designed to give researchers in various scientific fields access to co-funding in a large number of research themes (applied or not) in addition to their allocated recurrent funding. The AAPG applies to all types of research (basic and industrial research and experimental development, see. [Appendix 1](#)).

The “*Research and Innovation*” component of ANR’s Work Programme 2022, which supports the 2022 AAPG, has been structured into **56 research themes**¹:

- There are **37 research themes** within seven main scientific fields:
 - Environmental Sciences (4 themes)
 - Materials Sciences and Engineering (6 themes)
 - Life Sciences (11 themes)
 - Humanities and Social Sciences (7 themes)
 - Digital Sciences (6 themes)
 - Mathematics and its Interactions (1 theme)
 - Sub-atomic Physics, Earth and Universe Sciences (2 themes)
- **19 research themes** covering cross-disciplinary challenges **and** incorporating issues from various scientific fields organised into 7 inter-disciplinary fields:
 - Science of Sustainability (1 theme of the same name)
 - One Health (3 themes)
 - Ecological and Environmental Transition (3 themes)

¹ The 2022 APGG includes seven additional scientific themes compared to AAPG 2021. Some themes have been created, others reorganised to better respond to all of the expectations of the scientific communities. Applicants are requested to read the details of the themes carefully, as described in §G.

- Energy Transformation (2 themes)
- Technological Transitions (4 themes)
- Digital Transformation (3 themes)
- Transformations of Socio-technical Systems (3 themes)

There is a Scientific Evaluation Panel for each research theme.

When researchers submit a project (pre-proposal or registration), they select the scientific theme – and therefore the Scientific Evaluation Panel – that most closely relates to the scientific purpose of their research. The themes are listed under each broad scientific field or cross-disciplinary field in [§G](#).

Special attention is paid to the research continuum in terms of "disciplinarity" (mono-, multi-, inter- and trans-disciplinarity), mainly in cross-cutting research across several disciplinary fields.

With a view to continuing to improve its assessment processes and serve the whole continuum, the ANR takes into account the inter-disciplinarity or trans-disciplinarity present in the projects through the composition of its committees and the expert assessment procedures.

The 2022 Work Programme also incorporates the strategic priorities² defined by the State and implementation of government plans, such as artificial intelligence, humanities and social sciences, quantum technologies, autism in neurodevelopmental disorders, translational research on rare diseases, production of biopharmaceuticals, etc. These priorities are detailed in the scientific themes and linked, if required, to the "Priority research programmes and equipment" ([PEPR](#)) which are part of the directed strand in the 4th Investments for the Future programme ([PIA4](#)).

B. Submission, evaluation and funding of projects under the 2022 AAPG

The Generic Call for Proposals is open to all post-holding³ researchers belonging to an organisation, institution or public or private⁴ research laboratory eligible for ANR funding⁵.

B.1. Funding instruments

The 2022 AAPG uses a set of instruments to fund:

- individual research projects proposed by young researchers (JCJC),
- single-team research projects (PRME),
- collaborative research projects between public (or assimilated⁴) entities in a national or international context (PRC and PRCI respectively) and public (or assimilated⁴) and private entities with a potential opening to the world of business (PRCE).

The five funding instruments proposed under the Generic Call for Proposals each have specific submission and evaluation procedures. The characteristics and requirements of these funding

² Each priority is divided into one or more themes from the Work Programme and the Generic Call for Proposals (see the Generic Call for Proposals for details of the research themes).

³ In the sense of holders of a current (or future) contract linking them to the supervisory authority. The contract may not have started before the agreement.

⁴ For private entities: with an establishment or branch in France.

⁵ See the funding regulations: <http://www.anr.fr/RF>.

instruments are summarised in Work Programme 2022, outlined in [Appendix 2](#) and explained in detail in the *AAPG 2022 Guide*.⁶

The *AAPG 2022 Guide* is also the authoritative document for researchers intending to submit a proposal, as well as the peer reviewers and panel members reviewing submissions, explaining how proposals are submitted, evaluated, selected and funded.

In view of the notable changes made to AAPG 2022 compared to AAPG 2021 in terms of instruments and scientific themes, applicants are requested to read carefully the AAPG 2022 Guide (available from early September 2021) and the contents of the scientific themes provided in [§G](#).

Researchers will need to select the instrument that best suits the objectives of their project when making their application (pre-proposal or registration). They will also outline their role in the project: coordinator, partner's scientific leader, participant (see [Appendix 1](#)).

- **The project coordinator,⁷ funding instrument and scientific theme** defined when the pre-proposal for a PRC, PRCE or JCJC is submitted or a PRCI is registered with the ANR or a PRCI is registered with a foreign agency acting as a Lead agency cannot be amended during all the evaluation and selection processes (especially between stages 1 and 2 of the process).

B.2. Submission rules for the 2022 AAPG

Failure to comply with the above rules will lead to all the projects involved being declared ineligible. Project coordinators must therefore check with their project partners to ensure they respect these rules.

- **A JCJC project coordinator** whose funding by ANR is in progress **cannot act as the coordinator for another JCJC, PRC, PRCE, PRME or PRCI project** under the Generic Call for Proposals or under the French-German call in Humanities and Social Sciences (FRAL SHS), regardless of the year, **while the initial JCJC project is ongoing**⁸. However, he/she may be involved in a proposal submitted for the 2022 version (PRC, PRCE, PRME, PRCI, FRAL SHS).
- **A researcher submitting a PRME project cannot be involved as a coordinator or scientific lead** in another JCJC, PRC, PRCE or PRCI project submitted to ANR under the 2022 Generic Call for Proposals or under the French-German call in Humanities and Social Sciences (FRAL SHS) outlined in the 2022 Work Programme.
- **A researcher may only submit one PRC, PRCE or PRCI project as coordinator and cannot be involved (as coordinator or project partner's scientific leader) in more than three PRC, PRCE or PRCI projects** submitted to ANR under the 2022 Generic Call for Proposals or under the French-German Call in Humanities and Social Sciences (FRAL SHS) outlined in the 2022 Work Programme.⁹

⁶ Document available from the 2022 AAPG page on the ANR website from September 2021.

⁷ This rule applies except in cases of force majeure. A specific request must then be sent to ANR, explaining the unavoidable reason for changing the coordinator.

⁸ Coordinators may submit a proposal in the final year of a JCJC project providing that the current project will have ended by the date on which the grant for the new project is agreed, i.e. by 31/12/2022.

⁹ For 2022, this exclusion rule does not apply to proposals submitted outside the Generic Call for Proposals and the under the French-German Call in Humanities and Social Sciences (FRAL SHS). However, the scientific objectives of

- **A coordinator of a PRC, PRCE, PRCI or JCJC proposal funded under the 2021 Generic Call for Proposals cannot submit a PRC, PRCE, PRCI, PRME or JCJC proposal as coordinator for the 2022 Generic Call for Proposals.** However, the researcher may act as a partner's scientific and technical leader or be otherwise involved in a PRC, PRCE or PRCI proposal submitted for the 2022 edition.

The afore-mentioned rules apply to phase 1 PRCI registrations and to PRCI where the Lead Agency is a foreign agency. Consequently, the coordinator of a stage 1-registered PRCI project or a project submitted to a foreign Lead agency cannot be a coordinator of a separate PRC, PRCE, PRME or JCJC project submitted under the 2022 AAPG, regardless of the outcome of the stage 1 evaluation for that PRC, PRCE, PRME or JCJC proposal. This also applies to the French-German Call in Humanities and Social Sciences (FRAL SHS) outlined in the 2022 Work Programme

B.3. Eligibility of proposals

ANR assesses proposals for eligibility throughout the submission, evaluation, selection and funding process based on the rules on submission for the 2022 AAPG (see [SB.2](#) above) and the eligibility criteria described in the 2022 AAPG Guide.

Applicants are requested to read carefully these documents and the eligibility rules that apply when submitting a proposal, particularly for instruments JCJC and PRME (Appendix 2 and 2022 AAPG Guide).

B.4. Proposal submission process and commitments

Each scientific coordinator applying for a grant undertakes formally that his or her superiors (in particular the unit director, the competent administrative and financial services and the persons authorised to represent legally the institution managing the grant, or its representatives) have consented to the application procedure in progress and that the information relating to the application has been communicated to them. ANR may send the list of submissions it has registered to the laboratory directors and administrators of the managing institutions for projects that concern them.

During the submission phase, the coordinator and all partners undertake to adhere to the French *National Code of Research Ethics* and to ANR's *Code of Ethics and Scientific Integrity*¹⁰.

The research proposal will thus need to give due consideration to sex and/or gender aspects, irrespective of the research area in question.

An undertaking to comply with the obligations arising from the *Nagoya Protocol* and the ANR's *Open Science* policy (see [§D](#)) will also be requested when submitting a proposal.

Project participants are invited to enter their ORCID¹¹ ID and the RNSR number of their host laboratory online.¹²

the separate proposals must be materially different (see the eligibility rule on the uniqueness of the proposal in the 2022 AAPG Guide).

¹⁰ Document available at the following address: <https://anr.fr/fr/lanr-et-la-recherche/engagements-et-valeurs/lintegrite-scientifique/>

¹¹ ORCID is a non-profit organisation supported by a global community of institutional members, including research organisations, publishers, funders, professional associations and other stakeholders in the research ecosystem. For more information: <https://orcid.org>.

¹² <https://appliweb.dgri.education.fr/rnsr/>. A procedure is indicated if this RNSR (National Directory of Research

The submission form must be completed online and the scientific documents (pre-proposal or full proposal) must be submitted in PDF format via the ANR website before the closing date and time of the call (see page 1).

Refer to the *2022 AAPG Guide* for details of what the scientific document should contain.

The scientific proposal should not exceed four pages (including the bibliography, diagrams and references) for a pre-proposal and 20 pages (including the bibliography,¹³ diagrams and references) for a full proposal.

The administrative and financial section must also be completed online before the closing date and time of the call (see page 1).

Any application that has not been completed before the closing date and time of the call (see page 1) is ineligible.

B.5. Project selection

Project selection at ANR is based on the principle of peer review. ANR's selection process includes the organisation of panels and mobilises experts outside these panels.

The Scientific Evaluation Panels comprise highly qualified French or foreign individuals from the relevant research communities. They are in charge of evaluating pre-proposals or full proposals. External experts are involved in phase 1 exceptionally, and in phase 2 systematically.

Each evaluation panel is chaired by a chair-representative who has undergone ANR selection process and ethics training. He/she heads the board of the Scientific Evaluation Panel, which generally consists of two vice-chairs¹⁴ who help the chair prepare for and carry out the panel's work. A Scientific Project Manager assists the chair and his/her board before and during panel meetings but is not involved in debates or appointing experts. The Scientific Project Manager is responsible for managing conflicts and links of interest.

The experts in the area(s) concerned by the proposals produce written evaluations of one or more pre-proposals or full proposals, but do not attend panel meetings. The experts operate independently and in total confidentiality, without any exchanges with third parties. The only elements at their disposal are the materials in the pre-proposal and/or the full proposal as submitted through the website before the call deadline.

The provisions of the ANR Code of Ethics and Scientific Integrity apply to all persons involved in the project selection process.

The evaluation and selection¹⁵ of projects submitted under the 2022 Generic Call for Proposals follows a two-stage procedure. The draft schedule for the submission, evaluation and selection process can be found on ANR's website (see *2022 AAPG Guide*).

The stage 1 evaluation process (excluding PRCI proposals, which are only registered¹⁶, except

Structures) number is missing.

¹³ Since the 2019 edition, the CVs of coordinators and partners may include preprints (<https://fr.wikipedia.org/wiki/E-print>) that have not yet been published in peer-reviewed scientific journals. Applicants are also encouraged to cite preprints, particularly with reference to preliminary data.

¹⁴ There are between one and three vice-chairs, depending on the panel size.

¹⁵ The Generic Call for Proposals selection process was awarded ISO 9001 certification in May 2018 (renewed in 2019).

¹⁶ For the PRCI instrument, phase 1 of the 2022 Generic Call for Proposals submission process involves registration only. All applicants registering a PRCI with ANR during stage 1 will be invited to submit a proposal during stage 2, unless the project registered is not eligible (particularly under dual coordination, see §B.2). When the PRCI

for PRCI projects where a foreign agency is a Lead Agency) involves the Scientific Evaluation Panel identifying PRC, PRCE, PRME and JCJC pre-proposals for which there is a sound basis for drafting a full proposal based on their quality and scientific ambition (discriminating criteria)¹⁷.

The stage 2 evaluation process (which includes PRCI proposals excluding projects assessed by a foreign agency) aims to select the best proposals by evaluating, in accordance with international competitive project selection principles, the quality and scientific ambition of the proposal, how it is organised and how it will be implemented, and what the impact and consequences of the project described in the full proposal will be¹⁸. This second stage draws on both external peer reviews and the evaluation by members of the panel to which the coordinator submitted the proposal. The second phase also includes the right to respond to outside peer reviews. The coordinator's response to the external peer reviews will be taken into account at the plenary meeting of the scientific evaluation panel.

The scientific evaluation panel is fully responsible for the ranking proposal. The ranking will be reached by consensus of the scientific evaluation panel after a debate on each project examined. ANR does not alter the rankings produced by the panels. It funds the projects under each scientific theme based on the budget allocated to this theme.

The panel's evaluation report will be sent to the project coordinator. This report corresponds to the consensus reached by the scientific evaluation panel during the plenary meeting.

After the call has closed, the composition of the scientific evaluation panel will be published on the ANR website.

B.6. Project funding

At the end of the evaluation and ranking process, the decision on whether or not to select a project is made by ANR based on the rankings established by the scientific evaluation panels and the budgetary guidelines and priorities approved by MESRI. In July 2022, ANR will publish the list of projects selected to receive potential funding starting in October 2022.

The procedures for the allocation of ANR funding are set out in the "*Regulations concerning the conditions of allocation of ANR funding*" (<http://www.anr.fr/RF>). Coordinators and partners are invited to read this document carefully in order to build their projects in compliance with its provisions, particularly with respect to budgetary aspects.

Depending on the consortium type, the selected proposals will be funded by ANR either after a unilateral funding decision or after notification, providing that a funding agreement is signed with each of the beneficiary partners. This might sometimes require additional information and analysis (particularly for companies: financial statements, company registration (Kbis), information on capital relationships). If necessary, ANR will contact the partners in question in order to check their respective beneficiary categories via the form drafted for this purpose.

Companies facing financial difficulties are not eligible for ANR funding.

Rules regarding double-funding or funding by other agencies or foundations

proposal is registered with a foreign agency acting as the Lead Agency, the projects are submitted under the conditions defined by the said agency and are not subject to a stage 1 registration with ANR. However, the rules on submission apply (§B.2).

¹⁷ At the end of the first stage, 2,500 to 3,000 applicants will be invited to submit full proposals.

¹⁸ The evaluation criteria for each stage of the evaluation and selection process are explained in §E.

Coordinators may not simultaneously benefit from funding under both the JCJC instrument and/or another programme of the same type: Inserm ATIP-Avenir, CNRS Momentum, the City of Paris Emergence programme, funding from the European Research Council (ERC) or ANR's ERC Springboard call.

Funding under a PRME is incompatible with funding obtained from the ERC or with the same type of funding obtained by the coordinator.

Public bodies other than ANR, other bodies, agencies, associations or foundations provide project-based funding and organise their own calls, including the National Cancer Institute ([INCa](#)), the National Agency for Research on AIDS and Viral Hepatitis – Emerging Infectious Diseases ([ANRS-MIE](#)) and the Medical Research Foundation ([FRM](#)). For the sake of efficiency, projects covered by these calls for proposals are not intended to be funded by ANR. Thus, the eligibility of projects submitted to the ANR under the 2022 Generic Call and relating to themes likely to be supported by these funding organisations, will be determined by ANR possibly in conjunction with these bodies, associations or foundations (for INCa and ANRS-MIE). Only PRC and PRME proposals are concerned by this procedure; JCJC, PRCE and PRCI proposals are not concerned.

As a general rule, projects funded by other bodies, agencies, foundations or associations under similar instruments and with identical expectations may not benefit from double funding.

ANR may verify double-funding and conclude that either the project is ineligible or will proceed to cancel the funded project.

C. Special mechanisms

C.1. Very large research infrastructure (TGIR)

Projects relying on the resources of very large research infrastructure (TGIR) are asked to make this clear from the time they submit their pre-proposal. The infrastructure in question must be approached to ensure such resources are available, independently of the submission of the proposal to ANR, if the smooth running of the project depends on them. Evidence of this can be provided in the full proposal.

For example, resource requests may be made to GENCI (*Large National Intensive Computing Facility*) for access to computing and storage resources for needs in digital simulation, massive data processing or artificial intelligence.¹⁹

C.2. Competitiveness clusters

Projects wishing to benefit²⁰ from the label of one or more competitiveness clusters (*Pôles de compétitivité*) must declare this in the first stage of the selection process²¹.

The scientific coordinator must have the pre-proposal approved by the other partners (including international partners, where applicable) before submitting a labelling request. The project coordinator is invited to make contact with the competitiveness clusters concerned as early as possible and to be informed as to the commitments they make in case they obtain support from these clusters (including possible membership of the cluster, transmission of mid-term and final project reports). If a proposal successfully obtains a label from a competitiveness cluster, information on the monitoring of the project will also be provided to the competitiveness clusters.

C.3. French co-funding

The ANR establishes partnerships with other funders. The Generic Call for Proposal's list of co-funders is regularly updated on the ANR website's Generic Call for Proposals page. In general, they do not provide additional funding but rather contribute to the grant requested from ANR for a project, except where a specific application may be made directly to the partner co-funder. Co-funding means that the grant attributed to the project includes a financial contribution from ANR and a co-funder partner with an interest in supporting the research work. Coordinators of selected projects may refuse co-funding for their project. Similarly, the coordinator may refuse to allow information about the project to be shared with a co-funder prior to the evaluation procedure.

¹⁹ GENCI can provide computing and storage resources free of charge for use in digital simulation (HPC) at three centres in France (CINES, IDRIS and TGCC) for academic and industrial researchers contributing to open research. Two calls for proposals (January and July) are open to applications for resources allocated for a twelve-month period. Applications are then reviewed by specialist panels to determine their level of scientific and technical excellence. More information on the national computing centres, access conditions and an information handbook for users: <http://www.edari.fr> and <http://www.genci.fr>.

²⁰ It is not compulsory to apply for labelling in order to submit a project to the 2022 generic call for projects.

²¹ Such requests will not be accepted in stage 2. PRCI proposals are not eligible for labelling.

D. Regulatory requirements for applicants

All participants in the proposals submitted and everyone involved in projects funded under the 2022 Generic Call undertake to comply with the values and commitments of ANR.

D.1. Ethics and scientific integrity

ANR, as a signatory to the French National Charter for Research Integrity and in accordance with the circular of March 2017²² on the scientific integrity policy, ensures that all initiatives included in Work Programme 2022 comply with the principles of the charter. ANR has reviewed and expanded its own Code of Ethics to include the concept of scientific integrity. The agency ensures that all funding recipients uphold the rules and values that should govern research activities to guarantee their honesty and scientific rigour. Maintaining society's trust in the research community is dependent on it upholding these principles.

This Charter is also backed by the appointment of an ethics and scientific integrity contact who ensures compliance with the fundamental principles, the prevention and proper management of conflicts of interest, and training of staff within and outside the Agency.

In this context, a project coordinator (regardless of the call for proposals) undertakes that all project participants (whether or not they are requesting funding) respect the principles set out in the [National Charter of Ethics of Research Professions²³](#) and the [ANR Charter of Ethics and Scientific Integrity²⁴](#).

D.2. Gender equality

ANR, keen to contribute to the implementation of a policy²⁵ to reduce inequality between men and women higher education and research, has added the principle of equality to its Code of Ethics and Scientific Integrity and embarked on an equality work programme. Its aim is in particular to ensure that scientific communities systematically consider the sex and/or gender aspect in their research, regardless of the field, to produce quality knowledge and to train evaluators on potential gender bias in selection to guarantee projects are considered fairly, whether carried out by women or men.

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, ANR is committed to showcasing women in science who have secured ANR funding or contributed to Scientific Evaluation Panels as chairs or panel members.

In this context, a coordinator of a project undertakes to give equal visibility to the research work produced, whether it is carried out by women or men.

Furthermore, a project coordinator undertakes to take into account the sex and/or gender aspect in his or her research, regardless of the field, to set aside gender bias in producing knowledge and to anticipate the potential consequences of their application.

²² <https://www.legifrance.gouv.fr/download/pdf/circ?id=41955>

²³ https://www.cnrs.fr/comets/IMG/pdf/charte_nationale_deontologie_signe_e_janvier2015.pdf.

²⁴ <https://anr.fr/fr/lanr-et-la-recherche/engagements-et-valeurs/lintegrite-scientifique/>

²⁵ Decree 2020-256 of 13 March 2020 in application of Article 80 of the Public Function Transformation Act.

D.3. Scientific publications and research data

As part of the ANR contribution to the promotion and implementation of open science and in connection with the French National plan for open science (PNZO) and the international Plan S, the ANR beneficiaries undertake to guarantee immediate open access to peer-reviewed scientific publications and to adopt, for research data, an approach known as FAIR (Easy to find, Accessible, Interoperable, Reusable) that complies with the principle "*as open as possible, as closed as necessary*". Thus, all scientific publications emerging from ANR projects funded under the 2022 Generic Call for Proposals will be made available as open access under the licence *Creative Commons CC-BY* or equivalent, by using one of the following three channels:

- publication in a natively open access review;
- publication in a subscription review that is part of a so-called transformative agreement or transformative journal²⁶;
- publication in a subscription review. The publisher version or the manuscript accepted for publication will be lodged in the [HAL](#) national open archive by the authors under a CC-BY licence by implementing the Non-transfer of rights strategy (SNCD), as per the procedures indicated in the special conditions.

When submitting a proposal, the author will use the following wording in the article and/or in the letter addressed to the editor:

"This research has been funded, either in full or in part, by the French National Research Agency (ANR) under project ANR-nn-XXXX-nnnn. With a view to open access publication, the author has applied for an open access CC-BY licence for any manuscript accepted for publication (AAM) as a result of this submission."

To check whether the journal or review of their choice complies with Plan S and regardless of the channel open to them, the authors can use the Journal Checker Tool.²⁷

In addition, the project coordinator undertakes that the full text of these scientific publications (version accepted for publication or publisher version) will be lodged in the HAL national open archive, at the time of publication at the latest, and that the ANR research project reference (e.g.: ANR-22-CE64-0001) from which they are taken will be mentioned.

ANR encourages lodging *pre-prints* in open platforms or open archives and favouring perennial or unique identifiers (OI or HAL Id, for example).

Lastly, the project coordinator undertakes to provide an initial version of the Data Management Plan (PGD) within six months of project start-up and according to the procedures set out in the special terms and conditions.

D.4. Promoting scientific, technical and industrial knowledge

ANR encourages the beneficiaries of ANR funding to carry out and/or participate in actions to transfer knowledge to citizens and decision-makers: publication of articles in the press, carrying out media interviews, public decision-making support, participation in science festivals, arranging public debates, outreach actions, writing articles in a free online encyclopaedia, etc.

²⁶Definition of [so-called transformative agreement](#) or [transformative journal](#): <https://www.coalition-s.org/transformative-journals-faq/>

²⁷ <https://journalcheckertool.org/>

Additional funding can be obtained under the implementation of the [National plan, "Science with and for Society"](#). Specific information on the Agency's actions as part of this national plan are available on the ANR website.

D.5. Access to genetic resources and traditional knowledge associated with genetic resources

The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity was adopted on 29 October 2010. The Protocol aims to promote the conservation of biodiversity and the sustainable use of its components, and to strengthen the contribution of biodiversity to sustainable development and human well-being. The Nagoya Protocol significantly advances the Convention's third objective by providing a strong basis for greater legal certainty and transparency for both providers and users of genetic resources. European Regulation 511/2014 and French Act 2016-1087 determine the application modalities for the Protocol.²⁸ Two control points are defined as follows: i) at the research funding stage, under the control of the French Ministry for Higher Education, Research and Innovation (MESRI), and ii) at the final product development stage, under the control of the French Ministry for the Ecological Transition (MTE).

Under this arrangement, ANR must obtain documentary evidence of Due Diligence Declarations (DDD) for all the research projects it has funded since 2019. Applicants for the 2022 Generic Call for Proposals will be asked to declare any potential use of genetic resources during their projects.

DDDs for research work can be submitted online using the special application on the website of the French Ministry of Higher Education, Research and Innovation. Credentials to access the application can be obtained from the director of the host institution. Full details are available at the following address: <http://www.enseignementsup-recherche.gouv.fr/pid37627/utilisation-ressources-genetiques-associees.html>.

D.6. Scheme to protect the nation's scientific and technical potential (PPST)

The competitiveness, reputation or excellence of an establishment are based primarily on its capacity for innovation as well as the development and maintenance of knowledge and know-how. Each year an increasing number of companies and research laboratories fall victim to attempts to capture strategic or sensitive information that could be misused for malicious purposes.

The goal of the scheme to protect the nation's scientific and technical potential (PPST) is to protect, within public and private establishments right across the country, strategic knowledge and know-how as well as sensitive technologies that contribute to the nation's sovereign interests and whose misappropriation or capture could:

- undermine the nation's economic interests;
- boost foreign military arsenals or weaken the nation's defence capabilities;
- contribute to the proliferation of weapons of mass destruction and their channels;
- be used for terrorist purposes at home or abroad.

²⁸ Act on recovery of biodiversity, nature and landscapes (Act 2016-1087 of 8 August 2016) and its implementation decree pertaining to access to genetic resources and sharing of benefits arising from their utilisation (Implementation Decree No. 2017-848 of 9 May 2017).

Steered by the General Secretariat for Defence and National Security (SGDSN), this interministerial programme, which contributes to the economic safety of all public or private entities, has been in force since 2012. It concerns many ministries including the Ministry of Higher Education, Research and Innovation (CIR No. 3415/SGDSN/AIST/PST of 7 November 2012).

It provides the following:

- legal protection against malicious acts with consequences on the competitiveness of the entity (fraudulent use of information, theft or capture of sensitive data, anti-competitive practices, intrusion into information systems, etc.);
- creation of a trustworthy team;
- government support in an approach to raise the entity's security level;
- the ability to belong to a community of trust conducive to industrial partnerships.

As recommended by the department of the Defence and Security High Official (SHFDS) of MESRI, during this 2022 AAPG, ANR will implement the PPST solely for projects lodged that include in their consortium partners domiciled outside the European Union (EU).

Scientific or technical international cooperation projects identified by ANR and having been selected at the end of stage 1, will be submitted to SHFDS/MESRI for its opinion taking into account national guidelines established by SGDSN.

A negative opinion from SHFDS/MESRI will prevent the project from passing to stage 2 of the AAPG. SHFDS/MESRI will not give the applicant a reason for its opinion.

E. Evaluation criteria for projects submitted to the 2022 Generic Call for Proposals

Panel members and external experts use the same set of criteria to evaluate pre-proposals and full proposals.

The criteria applied in phases 1 and 2 of the selection process are differentiated using the table of sub-criteria below. Details can be found in the *2022 AAPG Guide*.

Evaluation criteria for projects submitted to the 2022 Generic Call for Proposals

Stage 1 (evaluation of pre-proposals)²⁹

➤ Quality and scientific aims

During the phase 1 evaluation process, this criterion is decisive (an A rating must be obtained to access stage 2).

- Clarity of research objectives and hypotheses
- Innovative nature, originality and/or ambitious nature, position in relation to the state of the art
- Relevance of the methodology in terms of disciplinary, interdisciplinary or trans disciplinary aspects
- Ability of the project to address the research issues covered by the chosen theme

➤ Organisation and implementation of the project

- Skills, expertise and involvement of the scientific coordinator
- *For PRC/PRCE proposals:* Quality and complementarity of the consortium, quality of collaboration
- *For PRME proposals:* Quality and expertise of the team that will implement the project
- *For JCJC proposals:* Contribution made by the project to the coordinator's ability to take responsibility and the development of the team

Stage 2 (evaluation of full proposals)

➤ Quality and scientific aims

- Clarity of research objectives and hypotheses
- Innovative nature, originality and/or ambitious nature, position in relation to the state of the art
- Relevance of the methodology in terms of disciplinary, interdisciplinary or transdisciplinary aspects, management of scientific risks and inclusion of gender-related aspects
- *For PRCI proposals only:* Ability of the project to address the research priorities of the chosen theme.

²⁹ PRCI projects are not reviewed during stage 1.

- **Organisation and implementation of the project**
 - Skills, expertise and involvement of the scientific coordinator
 - *For PRC/PRCE proposals*: Quality and complementarity of the consortium, quality of collaboration
 - *For PRCI proposals*: Quality of the consortium, involvement of the partners, complementarity of each country's scientific contributions
 - *For PRME proposals*: Quality and expertise of the team that will implement the project
 - *For JCJC proposals*: Contribution made by the project to the coordinator's ability to take responsibility and the development of the team
 - **Appropriateness of deployed and requested resources to the project's objectives**
- **Impact and consequences of the project**
 - Scientific impact and potential economic, social or cultural impact
 - *For PRC/JCJC/PRME proposals*: Strategy for disseminating and exploiting results; promoting scientific, technical and industrial knowledge
 - *For PRCE proposals*: Action to transfer technology and innovation to the socio-economic world; the promotion of scientific, technical and industrial knowledge
 - *For PRCI proposals*: Strategy for disseminating and exploiting results; promoting scientific, technical and industrial knowledge; value added by European or international cooperation, contribution to the French scientific community

The sub-criteria under the main criteria have a degree of detail suited to the content and the size of the scientific document. The sub-criteria are a guide both for the applicant in compiling their proposal and for the reviewer (panel member or ad hoc peer reviewer) in evaluating the proposal.

F. Provisions relating to GDPR and the dissemination of results

F.1. Personal Data

The ANR uses processed data³⁰ relating to selection, project monitoring and impact studies to carry out its tasks³¹. Personal data³² is collected and processed in accordance with article 6.1 ((c) of the GDPR³³. Such data undergoes processing necessary for the performance of a task carried out in the public interest and/or for compliance with a legal obligation.

The ANR retains personal data concerning non-selected projects for the duration necessary to assess the projects followed by the period allotted for appeal procedures. The retention period

³⁰ Specialist information system (IS), submission and project evaluation sites, Processing to monitor projects, project portfolios and analyses

³¹ Defined in Decree No. 2006-963 of 1 August 2006 on the organisation and operation of the ANR

³² Last name, first name of the researchers, date of birth, professional contact information, degree(s), position (current and previous), fields of activity, place of work, organisation, address(es), curriculum vitae, ORCID number, name and reference of projects, pre-proposals, project proposals (scientific document, administrative and financial appendix).

³³ General Data Protection Regulation (EU) 2016/679

for data pertaining to selected and funded projects runs for the duration necessary for the project to be monitored and verifications to be carried out by authorised bodies³⁴.

The data collected for this purpose can only be disclosed to the relevant departments of the ANR, experts, and evaluation committee members for projects they are involved in; and, where applicable, to regulatory bodies, departments within the ANR and administrations.

People whose personal data is being collected and processed have the right to access and rectify any information concerning them. Consequently, they can access their user profile and personally rectify any of their personal data. Additionally, they are entitled to exercise their rights by contacting the ANR Data Protection representative, Véronique Pauliac, at the following email address: dpd@agencerecherche.fr

For further information, refer to your rights on the [CNIL](https://www.cnil.fr/) (National Commission for Data Protection and Liberties) website at: <https://www.cnil.fr/>.

Details regarding the safeguards taken by the ANR to protect the personal data it collects and processes are notified to data subjects when entering said data in the corresponding data processing systems.

F.2. Communication of Documents

The ANR may be required to communicate certain data and documents to constituents, other French or foreign funding agencies, other administrations (including its supervisory bodies), regulatory bodies, within the framework of collaboration agreements, open public data, access to administrative documents³⁵, interchange between administrations and the reuse of public sector information³⁶. Such communication can include, for example, project characterisation data, expertise, the evaluation committee's summary report, project proposals, contract documents, scientific documents, administrative and financial appendices.

The dissemination and communication of such administrative data and documents are carried out in compliance with applicable regulations and are subject to the protection of personal data, intellectual property and trade secrets. Indeed, certain documents or data collected must not be disclosed or may only be done so in a restricted manner. In the case of collaborations with other funding agencies, or co-funding in particular, document disclosure and confidentiality are regulated by contracts. Document disclosure will be limited to the area of collaboration between ANR and project holding establishments.

³⁴ 10 years from the date of the award of the grant for controls by the European Commission.

³⁵ French Law 78-753 of 17 July 1978 on the communication of administrative documents, Law 79-587 of 11 July 1979 on the motivation of administrative acts, Law 2000-321 of 12 April 2000 relating to the rights of citizens in their dealings with administrative authorities.

³⁶ Order N°2016-307 of 17 March 2016 codifying the provisions relating to the re-use of public sector information in the French code of Relationships between the Public and the Administration, and its implementing decree No. 2016-308 of 17 March 2016.

G. Scientific themes relating to the 2022 Generic Call for Proposals

Every scientific theme corresponds to a scientific evaluation panel (CES)

Mobilising science to implement the 2030³⁷ Agenda of the UN Sustainable Development Goals presents a major challenge for research and innovation for the next decade, particularly in terms of driving coherent digital, energy, social and ecological transitions, without leaving anyone out. In this context, the main "Sustainable Development Goals (SDG)" concerned will be listed for each scientific theme.

"Environmental Sciences" field

Theme A.1: Solid earth and fluid envelopes

This research theme focuses on projects that seek to gain fundamental knowledge on the functioning of all abiotic and biotic compartments (geosphere, hydrosphere including oceans, atmosphere, critical zone and related biosphere, etc.) of the Earth and major cycles. The processes in question are couplings, interactions, interfaces and continuums between these compartments and their impact on major cycles. Its scientific scope includes the following topics in particular:

- atmospheric chemistry (transformation, outcome and dissemination of chemical species, micro-contaminants, aerosols and bioaerosols);
- atmospheric dynamics from the boundary layer to the upper atmosphere, and interactions with the continental and oceanic surface;
- the land-coast--ocean continuum including continental and marine processes in the interface domains (coast, estuaries/deltas);
- the functioning and evolution of climate and major cycles (water, carbon, nitrogen and other substances, nutrients);
- cryosphere climate interactions;
- the interfaces and links between the major compartments, the various dynamics (different functional, spatial and temporal scales, etc.);
- the use of "Earth Archives" to understand the crises and changes in a continuum in the long/short term linked to problems of the Anthropocene;
- knowledge of hazards and extreme hydro meteorological phenomena (linked with climate change in particular) and telluric (microflora);
- knowledge of geological media interacting directly or indirectly with the atmosphere and hydrosphere, including ecosystems and environmental impacts associated with deposits of mineral resources.

Related key words:

Earth System and scale interactions; atmosphere; oceans; humid zones; cryosphere; snowpacks; continental surfaces; interfaces; visible and invisible biosphere for its impact on major cycles; greenhouse gas; aerosols; biogeochemical cycles; carbon cycle; nitrogen cycle; phosphorus cycle; iron cycle; soils; Earth-sea continuum (coast, estuary/delta); erosion process and assessment; hyperheic zone; lithosphere; sea; time series (incl. proxies) et retro-analyses; coupling and coupled approaches (multi-sensor approaches/spatial and temporal multi-scales including remote sensing); modelling; experimentation; observation; climate models; carbon sequestration in the soils; mechanisms and process of erosion;

³⁷ <https://www.agenda-2030.fr/>

reaction by the critical zone to global changes; paleoenvironments similar to those of the Anthropocene; glacial cycles; environmental impacts of mineral resources; optimisation of the exploitation of deposits, underground, the mining environment; fluid-rock interaction; cloud cover; cloud/aerosol/radiation interactions; biocenotic controls; water mass interactions (surface, groundwater, sea); natural hazards; hydro-morpho-sedimentary function from land to sea.

Environmental chemistry, isotopic chemistry, geochemistry, geology, geophysics, sedimentology, stratigraphy, pedogenesis, geodesy, meteorology, micro-meteorology, geomorphology, oceanography, hydrology, hydrogeology, glaciology, climatology, remote sensing, petrology, mineralogy, microbiology

ERC codes associated with the panel: PE04, PE10, LS08.

SDG associated with the panel: 6, 13, 14 and 15

Theme A.2: Living earth

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This research theme concerns projects that seek to gain fundamental knowledge on biodiversity and the (spatial and temporal) dynamics of continental, marine, atmospheric and mixed ecosystems (coast, lagoons, etc.) with little if any anthropised systems, past or present. Its scientific scope covers:

- global description of biodiversity;
- knowledge of functional and population ecology, conservation or restoration ecology;
- the dynamic functioning and resilience of ecosystems, identification of tipping points;
- the origin, characterization, evolution and dynamics of species, populations and communities and their interactions;
- the responses (morphological, physiological, behavioural and evolutionary) responses of organisms, populations, communities (for all species), ecosystems (land, aquatic, marine, atmospheric, mixed) to variations in biotic and abiotic environments;
- all clades in these ecosystems;
- the different levels of organisation, from molecules to ecosystems;
- models and scenarios for the future of biodiversity.

Related key words:

Biodiversity; rare species; invasive species; soils; rhizosphere; forest; terrestrial, freshwater and marine environments (including coastal and lagoon; observation; experiments and system modelling; modelling; connectivity; resilience; systems' integration; trophic networks; migration; adaptation; acclimatisation; protected areas; restoration; conservation.

Ecology; ecophysiology; systematic; phylogeny; ethology; population genetics; evolutionary biology; functional ecology; phylo-geography; microbiology; biogeochemistry; genomics; metagenomics; metatranscriptomics

ERC codes associated with the panel: PE01, PE06, PE10, LS02, LS03, LS06, LS08, LS09

Related SDG: 13, 14 and 15

Theme A.3: Biology of animals, photosynthetic organisms and micro-organisms

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This research theme concerns fundamental biology projects with a cognitive approach towards long or very long-term practical applications on living species and applied biology projects for

livestock animals, food-producing animals, all photosynthetic organisms of interest, their dedicated models and associated organisms (micro-organisms, microbiota, pests, beneficial insects, etc.) and the interactions between these organisms.

All levels of regulation (genomic, transcriptomic, epigenetic, translational, metabolic, physiological, developmental, etc.) are concerned. Proposals are part of a continuum of scale from the gene and/or the molecule, to the cell, the individual and the population.

Related key words:

Algae; micro-organism; photosynthetic organism; animal; bioaggressor; model species; crop species; fungi; aquatic plant or animal; forest plant; fruit plant; weed; holobiont; aquaculture; bio-control; animal behaviour; determinism of animal well-being; development; livestock farming; embryogenesis; organogenesis; parasitism; animal nutrition; plant nutrition; pathogenicity; reproduction; biological networks; symbiosis; allelopathy.

Plant biology; animal biology; developmental biology; microbiology; plant pathology; animal health; biochemistry; ecophysiology; genetic engineering; modelling; physiology; cell biology; signal transduction; virology; molecular genetics; quantitative genetics; epigenetics; genomics; metagenomics; transcriptomics; proteomics; metabolomics; glycomics; bioinformatics; computational biology; biostatistics; systems biology; predictive approaches.

ERC codes associated with the panel: LS01, LS02, LS03, LS05, LS06, LS08, LS09

Related SDG: 2, 12, 14, 15

Theme A.4: Food and food systems

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This research theme concerns fundamental or applied research proposals on food, food systems and food security to contribute to healthy and sustainable foods that can be accessed by all. These proposals may address the following themes:

- human nutrition biology, in particular sensitive groups (infants, children, pregnant women, the elderly), provided that the projects do not focus on diseases,
- the evolution of technologies and food processing and traceability processes (heterogeneity of raw materials, authenticity, labelling, etc.),
- food safety,
- determinants and the impact of food transition and changes in consumption behaviour,
- the social and economic organisation of food systems,
- systemic approaches to the quality of foods and diets (farm to table).

The general goal is to propose a food offer that meets the needs of consumers, is accessible to all, favourable to the environment, well-being and health by developing a healthy and sustainable diet based on a resilient economic system that creates jobs, shares value fairly among the players and promotes the development of territories.

Related key words: *Food; food contaminant; packaging; contact materials; pathogen; microbiota-host-food interaction; preservation; health prevention; nutrition prevention; specific population; consumption practices; taste and sensoriality; access to food; governance; markets; distribution; competitiveness; decontamination; nutrition; value chains; clean label; food toxin; food safety.*

Microbiology; food microbiology; predictive microbiology; fermentation; food chemistry; biochemistry; physiology; food biotechnology; cultural and biological anthropology; economics; epidemiology; multi-stakeholder approaches; processes; sociology; physical chemistry.

ERC codes associated with the panel: LS09, PE04, PE05, PE08, LS06, LS07, LS08, SH01, SH02, SH03.

Related SDG: 1, 2, 3, 8, 10, 12.

“Materials Science and Engineering” field

Comprising six additional scientific themes, this field seeks to support basic research in the materials science disciplines: one theme is dedicated to physics of condensed and diluted matter, two themes to material science, one theme to engineering sciences and two themes to chemistry.

These disciplines are also involved in other scientific themes presented in other fields of the Work Programme, particularly in themes aimed to support research in a specific application (energy, micro and nanotechnologies for information and communication, health technologies, biomedical innovation and ecotechnologies, etc.) or themes dedicated to a cross-disciplinary sub-field with several applications (sensors, imagers and instrumentation or nanomaterials, for example).

Theme B.1: Physics of condensed matter and diluted matter

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The scope of this theme covers a broad field of physics, mainly fundamental, corresponding essentially to the ERC PE02 disciplines (with the exception of the sub-disciplines PE02_01 to 07) “*Fundamental constituents of matter: particle, nuclear, plasma, atom, molecule, gas and optical*” and PE03 (with the exception of the sub-disciplines PE03_05 and 07) “*Physics of condensed matter: structure, electronic properties, fluids, nanosciences, biophysics*”.

Soft matter physics, traditionally part of the physics of condensed matter, is covered by this panel. However, proposals concerned with physical chemistry of soft matter must be submitted under theme B.2, “*Polymers, composites, physical chemistry of soft matter*”.

Projects concerning the physics of biological systems, from the sub-cellular scale to that of tissues and/or organs are also considered in the case of innovative physics projects backed by a sufficiently detailed biological question. Similarly, the projects in this field focused on innovations in biology with implications for both cell biology and embryonic development as well as underlying molecular and genetic mechanisms, are to be addressed in theme C.4 “*Cellular biology, developmental biology and evolution*”.

Finally, projects that fall under the generic topic “Quantum Technologies” are to be addressed in theme E.6 “*Quantum Technologies*”.

Related key words: *atomic and molecular physics; ultra-cold atoms and molecules; atomic and molecular collisions; quantum fluids and gases; physics of fundamental quantum processes; strongly correlated fermions; macroscopic quantum phenomena; superfluidity; superconductivity; magnetism and spin electronics³⁸; heterostructures and nano-objects; growth; molecular electronics; mesoscopic physics; statistical physics; optics (nano-optics, non-linear optics, quantum optics, ultrafast optics, etc.); laser physics; photonic and electronic interactions; radiation-matter interaction; electromagnetism; wave*

³⁸ Projects dealing with spintronics devices must be submitted under the topic, “*Micro and nanotechnologies for information processing and communication*”.

propagation in complex media; physics of gases and plasma; confinement fusion; structure of solids and liquids; physics of mechanical behaviour; aggregates; surfaces; structure and dynamics of disordered systems; self-organisation; physics of fluids; physical hydrodynamics; turbulence; instabilities; non-equilibrium phenomena; non-linear physics; physics of biological systems; complex and active systems; morphogenesis; instrumental developments; atomic and molecular spectroscopy.

ERC codes associated with the panel: major PE02 and PE03, other LS03.

Related SDG: 9.

Theme B.2: Polymers, composites, chemical physics of soft matter

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The scope of this research theme covers:

- the design and use of new, non-toxic monomers, oligomers and polymers, the functionalisation of natural and synthetic polymers and precision macromolecular chemistry as well as the development of synthesis pathways of polymer materials resistant to extreme conditions, resins for composite materials with polymerisations controllable at moderate temperatures, or systems for additive manufacturing. Proposals for material synthesis chemistries allowing for effective recycling of polymers will also be appreciated.
- the physical chemistry and engineering of soft matter. Proposals are expected relating to the production of synthons that, through their self-assembling or self-organization properties, enable the construction of supramolecular organisations,
- the study and understanding of structure-property relations and multi-scale modelling of soft matter, polymer and composite materials with the goal of predicting their properties, including ageing,
- the development of polymer-based materials with special properties (thermomechanical, self-healing, etc.) for specific applications (sensors, membranes, smart textiles, etc.),
- organic matrix composite materials concerning various industrial sectors (aviation, automotive, construction, energy, health, etc.) and work aimed at improving their thermal and mechanical properties, improving their recyclability or introducing functional properties.

This community involved will link chemists, physical chemists and physicists. Proposals will be placed under one of four topics:

- chemistry and synthesis of polymers,
- supramolecular chemistry and physical chemistry and molecular assembly,
- functional polymeric and composite materials,
- polymer surfaces and interfaces,
- processes and development of new technologies for synthesis and shaping.

The projects will aim to take into account the challenges of sustainable development.

Projects using or shaping bio-sourced materials must be covered in theme H.7 "*Bioeconomy, from biomass to uses*".

This theme also complements the new theme, B.4 "*Engineering and process sciences*": if the project is aimed primarily at the study of the mechanical behaviour of composite structures (behaviour, damage, etc.), it must be submitted under theme B.4.

Related key words: *supramolecular chemistry and physics; synthesis of supramolecular and macromolecular objects; self-assembly; properties of supramolecular and macromolecular objects; sustainability and life cycle of supra- and macromolecular systems; containment; encapsulation; polymer chemistry; polymerisation processes; photochemistry; additive manufacturing; polymer shaping processes; properties of function polymeric materials (composites, hybrids, biomaterials, membranes. etc.) ; functionalisation; organic matrix composites; structural and mechanical properties of organic biomaterials; structural characterisation; impregnation resins; molecular and hybrid materials; thin films; bio-inspired systems; soft matter; complex fluids; oligomers; liquid polymers; surfactants; liquid crystals; micelles; vesicles; colloids; gels and hydrogels; molecular machines; stimuable systems; molecular recognition; surfaces and interfaces; microreactors; miniaturisation; waste reduction.*

ERC codes associated with the panel: PE03_13 (Structure and dynamics of disordered systems, e.g. soft matter, granular matter, liquids, glasses, defects), PE04, PE05, PE11.

Related SDG: 912.

Theme B.3: Metallic and inorganic materials

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This theme aims to support research projects in the field of metallic and inorganic material science, relying on the disciplines of solid chemistry and condensed matter, solid state physics, metallurgy and the mechanics of solids.

The scope of this research theme covers:

- metal or ionocovalent type materials (metals and alloys, ceramics and glasses, inorganic compounds, hybrids, natural materials, etc.) and surfaces and interfaces that are associated with them:
- the development of new materials and innovative approaches both in terms of the implementation processes and the desired properties,
- surface treatments or thin film coatings conferring new characteristics or functionalities to the solid material,
- recycling and strategic element substitution aspects (scarcity, chemical risk, costs, etc.),
- new materials for use under severe energy, mechanical or chemical stresses.

Proposals will therefore come under the following five topics:

- inorganic functional materials,
- metallurgical science and engineering,
- surface and interface: functionalisation, surface treatment,
- assemblies,
- fabrication of materials.

This theme also complements the new theme, B.4 " *Engineering and process sciences* " with regard to the development and production of materials: projects aimed primarily at studying and understanding the (mechanical) properties of a material obtained by using a specific development process (not necessarily innovative) must be submitted under this theme. However if the main innovation proposed concerns the development or production process, it must be submitted under theme B.4.

The projects will aim to take into account the challenges of sustainable development.

Related key words: *functional properties, multi-scale approaches to characterisation and simulation, multi-physical couplings, metallurgical thermodynamics, preparation and shaping processes, (by*

machining and treatment, additive manufacturing, innovative synthesis, etc.), microstructures, solid-state chemistry, tribology, surfaces, interfaces, damage, fatigue, corrosion, coatings, thin films, recycling, structural materials, structural and mechanical properties of inorganic biomaterials.

ERC codes associated with the panel: PE03, PE04, PE05, PE07, PE08, PE11.

Related SDG: 9 and 12.

Theme B.4: Engineering and process sciences

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This research theme aims to support basic research in the following fields covering engineering sciences and process sciences, to improve the state of the art and knowledge, and to develop innovative methods, tools and technologies in these fields:

- processes and technologies for the development and manufacturing of materials, components, microsystems and structures (plasma processes, deposition, additive manufacturing, extrusion, laminating, assembly, etc.),
- chemical process engineering, bioprocesses, intensified and multifunctional processes, mechanical or thermal processes, eco-efficient methods,
- control and optimisation of processes, flows and transfers, mixtures,
- fluid mechanics (dynamic, fluid/structure interactions, fluid/material reactive interface, etc.), aerodynamics,
- acoustics, aero-acoustics,
- mechanics, structural engineering, geotechnical engineering,
- biomechanics and bio-engineering mechanics,
- bio-inspiration for engineering, biomimetic engineering,
- systems engineering.

This theme is open to a broad spectrum of scientific approaches: modelling and simulation, experiments, etc. and coupled approaches in particular.

This scientific theme does not target specific applications. It is complementary to themes dedicated to a specific application, which may also include projects mobilising engineering sciences from this perspective (for example, energy for H.8 themes, "*Basic energy sciences* " and H.9 "*Sustainable, clean, safe and efficient energy*" or the medical field for theme H.13 "*Health technologies*").

It is also complementary to the themes focused on materials science and which mainly mobilise physics and chemistry but which also target questions of mechanics and behaviour/resistance at the materials level (B.2 "*Polymers, composites, chemical physics of soft matter*" and B.3 "*Metallic and inorganic materials*").

Lastly, it is complementary to theme H.19 "*Industry and factory of the future*", which covers manufacturing issues on a more integrative scale (organisation based on process, automation, production chain, product industrialisation, etc.) than here.

Related key words: *development and manufacturing processes and technologies; process engineering; chemical engineering; bioprocesses; eco-efficient methods; thermodynamics; fluid mechanics; acoustics; structural mechanics; structural engineering; geotechnical engineering; biomechanics; mechanics for bioengineering; bio-inspired engineering; systems engineering*

ERC codes associated with the panel: PE07_03, PE07_04, PE08 (except PE08_06 Energy processes engineering), PE11

Related SDG: 9.

Theme B.5: Molecular chemistry

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This scientific theme is dedicated to supporting research in molecular chemistry. Any fundamental advance or ground-breaking concept in chemical synthesis, the choice of raw materials used, molecules and compounds obtained, processes implemented, etc., for which innovations can subsequently be developed, has a significant potential application for the chemical industry and, more broadly, numerous industrial sectors that use chemical products.

The projects will aim to take into account the challenges of sustainable development.

This theme covers three additional subjects:

- the development of new reaction schemes or new molecules. Proposals on more environmentally friendly synthesis pathways as well as the synthesis of molecules of interest are expected,
- catalysis in general (enzymatic, heterogeneous, homogeneous or multiple, assisted). The stability and recycling of catalysts and the use of non-toxic metals or ligands will be targeted. Combination with activation processes may also be dealt with,
- eco-efficient processes and new reaction media.

The projects submitted under this theme can be experimental, theoretical technological or industrial. They may cover all manufacturing phases, from the selection of raw materials to the development of the reaction pathway.

Projects whose main problem or scientific or technological hurdle concerns chemical process engineering must be submitted under theme B.4 " *Engineering and process sciences* ".

Biological chemistry (organic or inorganic) projects must be submitted under theme C.1 " *Biochemistry and chemistry of living organisms* ".

Projects addressing bio-sourced chemistry must be submitted under theme H.7 " *Bio-economy, from biomass to uses* ".

Projects aimed at the construction of supramolecular or macromolecular objects with a view to their use in the field of polymers and/or materials must be submitted under the B.2 theme " *Polymers, composites, physico-chemistry of soft matter* ". However, supramolecular chemistry projects not aimed at this type of application must be submitted under this theme.

Related key words: *new molecules; substitution of molecules; design of new ligands; structure-property relationship; chirality and asymmetric synthesis; (bond) activation and reaction processes; organocatalysis; organometallic catalysis; electrocatalysis; photocatalysis; multicatalysis (dual, hybrid, tandem); supported nanocatalysts; redox catalysis; biomimetic catalysis; enzymatic catalysis; metallo-enzymes; artificial enzymes; host-guest; innovative activation (ultrasonic, microwave, high-pressure, mechanochemistry, etc.); cascade reactions; tandem reactions; one-pot reactions; flow chemistry; extraction; separation; detection; identification; emerging reaction media; eco-compatible synthesis (solvent-free, waste reduction, catalyst recycling, alternatives to rare and/or toxic metals, etc.)*

ERC codes associated with the panel: PE04, PE05

Related SDG: 9 and 12.

Theme B.6: Analytical chemistry, theoretical chemistry and modelling

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This theme welcomes proposals where the core research mainly targeted fundamental science and techniques in the following chemistry disciplines:

- theoretical chemistry/modelling,
- analytical chemistry,
- spectroscopy and spectrometric techniques,
- innovative instrumentation for chemistry.

It also covers methodological and instrumental developments for spectroscopies and theory.

Related key words: *theoretical chemistry; modelling/simulation (molecular dynamics, ab initio methods, Monte-Carlo, etc.); physical chemistry (photochemistry, electrochemistry, thermodynamics, etc.); chromatography; NMR; EPR; spectroscopies (UV-visible, IR, Raman, X-rays, etc.); electron spectroscopy; mass spectrometry; miniaturisation; imaging; trace detection; structural properties.*

ERC code associated with the panel: PE04.

Related SDG: 9.

"Life Sciences" field

Theme C.1: Biochemistry and chemistry of living organisms

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This research theme seeks to characterise, modulate and model the chemical and biochemical transformations made by the cell. Its scope, at the interface between biology and chemistry, namely bioorganic and bioinorganic chemistry, covers the following topics:

- enzymology, pharmacology, toxicology, medicinal chemistry,
- studies on metabolism and bioenergetics,
- signalling pathways and post-translational changes,
- chemical changes to biomolecules (nucleic acids, proteins, glycans, etc.) and their potential applications,
- analytical and “omics” approaches, including quantitative proteomic, lipodomic, glycomic, metabolomic and multi-omic quantitative analyses,
- Approaches to understanding and acting on living organisms and their applications to the detailed analysis of mechanisms in functional biology and in health and environment (synthesis, screening and molecular engineering, probes, inhibitors, ligands, molecules for diagnostic or therapeutic purposes),
- the design of new biological systems (synthetic biology) and the controlled alteration of metabolic and biological macromolecular production pathways, in an attempt to understand the fundamental mechanisms of living organisms or to develop their biotechnological applications.

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

Related key words: *biochemistry, chemobiology, bio-organic chemistry, bio-inorganic chemistry, metals and living organisms, enzymology, pharmacology, toxicology, medicinal chemistry, bio-energetics, proteomics, lipidomics, glycomics, metabolomics, synthetic biology, molecular engineering, screening, biotechnologies.*

ERC codes associated with the panel: *major LS01, others LS02, LS04, LS07, LS08, LS09, PE4_11 (Physical chemistry of biological systems), PE5_11 (Biological chemistry and chemical biology), PE5_18 (Medicinal chemistry).*

Related SDG: *3, 9, 14 and 15.*

Theme C.2: Characterisation of structures and structure-function relations of biological macromolecules

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This research theme, at the interface of physical chemistry and biophysics, covers the following topics:

- detailed understanding of the molecular mechanisms governing the major functions of living organisms,
- prediction and resolution of biological macromolecule structures and their complexes and the deciphering of their structure-function relationships,
- approaches allowing these structures and their dynamics to be studied in increasingly complex contexts (multimolecular architectures, either isolated or reconstituted in vitro, complex phases, cell),
- technological or methodological developments in structural biology (NMR, crystallography, cryo-electron microscopy, etc.)
- technological or methodological developments in imaging (super-resolution microscopy, correlative microscopy, etc.)
- technological or methodological developments in molecular dynamics,
- structural spectroscopy and single molecule approaches.

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

Related key words: *structural biology, structure-function relationships of biological macromolecules and their complexes, structure-function relationships of membranes, biophysics, methodological developments, systems biology, modelling.*

ERC codes associated with the panel: *major LS01, others, LS02, LS09*

Related SDG: *3, 9, 14 and 15*

Theme C.3: Genetics, genomics and RNA

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This research theme covers the following topics:

- the deciphering of general mechanisms and regulations responsible for the 3D organization of genomes and chromatin and its epigenetic changes (role of gene genetic entities, non-coding DNA, transposable elements, non-coding RNA and RNA-protein interactions, etc.), including links with environmental conditions (exposome);
- the detailed studies of replication processes, repair, transcription, recombination,

maturation, translation and transport of RNA, as well as transcriptional, post-transcriptional and translational regulations/deregulations, including by non-coding RNAs,

- the analysis of mechanisms required to maintain genome integrity and the faithful transmission of genetic information, as well as the mechanisms and major basic principles of genome organisation, variability and evolution,
- the transgenerational heredity of epigenetic changes;
- characterisation of the genotype-phenotype relationship, including the study of genetic diseases and complexes, and the role of exposomes in this relationship.

The research will be conducted at the molecular and cellular scale, on bacterial, archaeobacterial, single-cell and multi-cell eukaryotes, animal or plant models, or on cohorts of patients and control populations, using molecular, cellular, genetic, transcriptomic, proteomic and multidisciplinary approaches including structural biology, biophysics, computer science and/or mathematics. However, the development of one of the last 4 approaches should not be the only objective of the project.

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

Related key words: replication-repair, recombination, structure and dynamics of chromatin and bacterial nucleoid, epigenetics, gene expression, transcriptomics, non-coding RNAs, RNA maturation, ribosomes, genome translation-evolution, genetic diversity, genetic diseases, genotype-phenotype relationships, exposome, genetic tool developments.

ERC codes associated with the panel: major LS02, others, LS01, LS08, LS09.

Related SDG: 3, 9, 14 and 15.

Theme C.4: Cellular biology, developmental biology and evolution

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This research theme covers the following topics:

- an understanding of the basic biochemical and biophysical mechanisms associated with living cells : cell cycle, biogenesis and dynamics of intracellular organelles and the plasma membrane, molecular mechanisms of senescence, ageing and cell death, signal reception and transduction, homeostasis and differentiation of different cell types, maintenance and differentiation of stem cells, , cell adhesion, cell movement and migration,
- an understanding of these mechanisms at the tissue level in the organism or in multicellular systems reconstituted in vitro (organoids, tissue engineering) to decipher the basic principles of cell homeostasis, morphogenesis, the³⁹ embryonic and post-embryonic development of animal and plant tissues, the ageing of eukaryotic tissues and multi-cellular organisms as well as the organisation of prokaryotic cell colonies,
- an understanding of these mechanisms in the context of the evolution of species and the adaptation to environmental conditions.

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

³⁹Bacterial, archaeobacterial, fungal, plant and animal cells.

Related key words: intracellular trafficking, cell cycle, senescence, apoptosis, cellular homeostasis, cell differentiation and function, adherence-cell movement and migration, tissue homeostasis, morphogenesis, stem cells, developmental biology, signalling, evolutionary biology, cell physics.

ERC codes associated with the panel: major LS03, other LS08.

Related SDG: 3, 9, 14 and 15.

Theme C.5: Physiology and physiopathology

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This research theme covers the following topics:

- an understanding of the hierarchical assembly of molecular and cellular components of tissues and organs as well as of the underlying signalling pathways (including metabolic), their interactions and the physiological properties generated by these interactions,
- an understanding of these interactions and properties within organisms as a whole, including microbiota and at the interface with the environment,
- an understanding of the mechanisms of alteration in pathological processes including the use of organoids.

Multidisciplinary proposals dealing with all biological, nutritional, behavioural, psychological and social determinants underlying physiological and/or pathological functioning may be evaluated in this theme.

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

Related key words: physiology, pathophysiology, systemic and comparative physiology/pathology, multifactorial chronic diseases, diseases and ageing, metabolism and nutrition, microbiome, reproductive biology.

ERC codes associated with the panel: major LS04, other LS07.

Related SDG: 3, 9, 14 and 15.

Theme C.6: Immunology, infectiology and inflammation

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This theme covers the following topics:

- characterisation of the molecular and cellular mechanisms involved in the defence system of organisms and inflammatory reactions during adaptive and innate immune responses, in order to establish an integrated analysis of the immune system in normal and pathological situations, including immunodeficiency, hypersensitivity, auto-immunity, auto-inflammation and transplantation. This includes mechanistic studies of the effect of hyperactivation of the systemic immune and inflammatory system ,
- the mechanisms used by human and animal pathogens to take advantage of host cellular factors for their survival, dissemination and transmission throughout the body;
- the identification of infection restriction factors in humans and animals;
- the development of new models and mathematical and computer science approaches

to gain a better understanding of the development and homeostasis of the various components of the immune system, inflammation, allergy and host-microbe relations at all levels (cell, organ, organism),

- any work on the fundamental biology of micro-organisms, which could pave the way for the development of new anti-infective approaches .

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

Related key words: *immune defences, infectious diseases, host-pathogen interactions, inflammation, homeostasis and deregulation, microbiology, microbiota, symbiosis/dysbiosis, immune deficiencies, allergies, autoimmunity, inflammatory process, modelling, graft response.*

ERC code associated with the panel: LS06.

Related SDG: 3, 9, 14 and 15.

Theme C.7: Molecular and cellular neuroscience – Developmental neurobiology

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This research theme covers the following topics:

- all studies at the molecular and cellular scale designed to understand the mechanisms governing the establishment, functioning, dynamics and plasticity of the nervous system and sensory organs under normal or pathological conditions (including neurovascular and neuroinflammatory components),
- the logic of the hierarchical structure of the molecular, cellular and tissue components of the nervous system and sensory organs, the relationships between their dynamics and their plasticity and the nervous system's functional properties,
- understanding the mechanisms and identifying the molecular and cellular determinants involved in psychiatric diseases, addiction, neurodevelopmental diseases and autism spectrum disorders, neurodegenerative diseases and rare diseases affecting the nervous system. The neurovascular and neuroinflammatory components of these pathologies are also included, except for non-neuronal aspects, which are evaluated by the "Physiology and physiopathology" theme.

All invertebrate and vertebrate animal models are considered under this theme, together with experimental and technological approaches and their development (imaging, computation and models, artificial intelligence, behaviour, electrophysiology, pharmacology, optogenetics, etc.) relating to these studies.

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

Related key words: *neurogenetics, cellular neurobiology, biophysics, neuropharmacology and neurophysiology, neurodevelopment, neurodegenerative diseases, addictions, psychiatry, mental health.*

ERC codes associated with the panel: major LS05, others, LS03, LS07.

Related SDG: 3, 9, 14 and 15.

Theme C.8: Integrative and cognitive neuroscience

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This research theme covers the following topics:

- all integrative studies intended to understand high-level brain properties and functions,
- the different levels of organization, hierarchy and interactions specific to the functioning of the brain, e.g. those involved in multi-sensory integration, object and action recognition, decision-making, memory, behaviour, cognition and the state of consciousness, the specific aspects of the human brain including its social - e.g. self-awareness, language, relationships with others - and pathological dimensions,
- the mechanisms and biological and social determinants of behaviour and learning, of mental health disorders, , , neurodevelopmental diseases and autism spectrum disorders,, neurodegenerative diseases, addictions and rare diseases affecting the nervous system to prevent and treat them with the objective of promoting complementary aspects and synergies between basic research and preclinical and clinical research in the field of mental health, psychiatry and addictions,
- nervous system pathologies including cerebrovascular diseases and pathologies of the sensory organs with the exception of non-neural aspects that are covered by the “*Physiology and Physiopathology*” theme.

Experimental approaches include in-vivo functional and multi-modal imaging (MRI, fMRI, PET, photonics, ultrasound), electrophysiology, computational analysis, brain-machine interface, artificial intelligence, behaviour, optogenetics and psychophysics, etc.).

An epidemiological approach to health inequalities in the mental health area is covered by the “*Public health*” theme and related technology approaches fall under the “*Healthcare technologies*” theme.

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

Related key words: *cognition, behaviour, computational neurosciences, psychiatry, mental health, neurodegenerative diseases, addictions, physiopathology, clinical approaches, cross-sectional studies.*

ERC codes associated with the panel: *major LS05, others, LS07 SH04.*

Related SDG: *3 and 9.*

Theme C.9: Translational health research

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The goal of this research theme is aimed at funding studies positioned downstream from exploratory research projects carried out in research laboratories and upstream of clinical projects supported by the Hospital Clinical Research Programme (PHRC), managed by the Directorate-General for Healthcare Provision (DGOS).

Proposals, which aim at the formulation of new hypotheses, that can subsequently be tested in a clinical research framework and are therefore located at the interface between basic and clinical research, are reviewed in this research theme

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

Related key words: *new therapeutic approaches, new diagnostic approaches, physiology, physiopathology, personalised medicine, biomarkers, epidemiology, cohorts.*

ERC codes associated with the panel: major LS07, other LS07.

Related SDG: 3.

Theme C.10: Biomedical innovation

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This research theme covers the following topics:

- the study and validation of new therapeutic targets,
- the design and development of chemical or biological therapeutic products (including vaccines and nanomedicines),
- the new biomedicine formats optimised for production processes,
- relevant animal models for the biological and/or pre-clinical assessment of products of therapeutic interest,
- vaccine prevention methods;
- diagnostic and prevention tools and products,
- bio-markers.

PRCE projects are especially well suited for this theme to take into account the applications of the proposed research and their possible development.

Projects concerning medical devices, imaging and health technologies in general, fall under the specific "Health technologies" theme.

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

Related key words: *new therapeutic targets, drug-design, nano-medicine, vaccines, biotechnologies, biomarkers, pharmacology, pharmacochimistry, adjuvants, vectors, antibodies, biopharmaceuticals, bioproduction.*

ERC codes associated with the panel: LS07.

Related SDG: 3 and 9.

Theme C.11: Regenerative medicine

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Regenerative medicine covers all therapeutic strategies aimed at replacing, repairing or regenerating damaged tissues or organs *in situ*. This multi-disciplinary and translational research theme covers the following topics:

- innovative biomaterials: their characteristics and interactions with the living world and their use in therapeutic approaches; pure materials engineering projects are thus excluded,
- medical devices interacting with the biological environment (active devices) to offset or replace dysfunctional tissues or organs;
- research in cell and α -cell therapy for application in regenerative medicine. Immunotherapy and onco-haematology projects are excluded,
- stem cells (embryonic or induced): the study of the mechanisms of trans-differentiation/differentiation and proliferation of stem cells for their use in regenerative medicine. Basic research projects (cell biology, developmental physiology or biology) are excluded;

- multidisciplinary projects on multicellular systems reconstituted *in vitro* (organoids, Organ on Chip, spheroids) for regenerative medicine,
- research on molecular components contributing to the mechanisms of cell and/or tissue regeneration,
- artificial tissues or organs: all projects aimed at developing artificial organs for therapeutic purposes and their integration into the organ. Research on the preservation and/or reconditioning of explanted human organs, transplantation of new organs or tissues, tools to help monitor tissue regeneration. Projects aimed at creating purely technological artificial organs without any biological component are excluded,
- gene therapy research to regenerate tissue or organ functionality,
- research on new tools for the clinical grade production of advanced therapy products and demonstration of proof of concept.

Related key words: *Biomaterials, Medical devices, Cell therapy, Stem cells, Extracellular vesicles, Trophic factors for tissue regeneration, Organoids, Pharmacological approaches, Innovations in organ and tissue transplantation, Transplantation, Gene therapy for regenerative medicine, Personalised medicine, Biomanufacturing processes, Proof of concept, Monitoring of tissue regeneration, Preclinical models, In vivo feasibility and tolerability, Biomaterials related to regenerative medicine.*

ERC codes associated with the panel: LS07, LS09, LS3, PE5_7 Biomaterials, biomaterials synthesis, PE8_8 Materials engineering (biomaterials, metals, ceramics, polymers, composites, etc.)

Related SDG: 3, 9

“Humanities and Social Sciences” field

The seven new areas of the Humanities and Social Sciences field aim to cover the entire domain. This requires an exhaustive approach which has led to the adoption of themed or disciplinary titles, depending on the case. The items selected within each theme are guidelines, not excluding other subjects or issues.

Mono- or multidisciplinary projects are expected within Humanities and Social Sciences, regardless of approach (comparative, multi-scale, systemic, etc.) and their purpose (basic or applied research, academic, economic or societal exploitation).

Collaboration with researchers or teams outside Humanities and Social Sciences fall under cross-cutting themes, with the exception(s) mentioned below in the presentation of themes.

Theme D.1: Individuals, companies, markets, finance, management

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This theme, which covers the topics of markets, finance, management, individuals and households, is intended to welcome projects dealing with the transformation of the economic and financial sphere and of productive systems.

The projects will come under the following three topics:

- individual and collective preferences and behaviour (households, consumers),
- company behaviour and strategies, HR management, marketing,
- industrial organisation, sector dynamics, networks,
- strategic interactions, networks, innovations and new technological trajectories, R&D,

- competition, regulation, financial institutions, financial markets,
- investment decisions, market fluctuations,
- historical and diachronic approaches to the economy, companies and markets,
- RSE, taxation, measurement indicators: performance, productivity, well-being, inequalities,
- international economics, development economics, international trade and commerce, trade policies, international distribution of value chains,
- transitions, indicators, impact measurement and sustainable growth.

Related key words: macroeconomics, microeconomics, econometrics, companies, human resources, management, strategy, finance, banks, markets, trade, households, individuals, social choice, preferences, behaviours, well-being, equilibrium(s), fluctuations, growth, inflation, regulations, employment, organisations, interactions, networks, innovation, investment, competition, risks, accounting, RSE, taxation, pensions, decarbonised economies and finance, digital transformation, sustainability.

ERC codes associated with the panel: SH1

Related SDG: 1, 2, 3, 7, 8, 9, 10 and 13

Theme D.2: Institutions and organisations, legal frameworks and standards, governance, international relations

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This theme welcomes projects relating to the joint transformation of societies and institutions, organisations, legal, normative and political systems, at all scales. It covers the field of public policies, government, infra- and supranational stakeholders and public-private interactions. It encompasses an understanding of political organisations, modes of government and governance, contemporary regulatory and administrative systems and international relations.

The projects will come under the following topics:

- changes in law, legal and normative systems; repertoires of action; applications and socio-political impacts of these transformations; standards; economic approaches to law, law and ethics,
- social and legal regulations pertaining to violence, judicial rules and organisations, public freedoms and security, challenges to the legal order,
- political theory, transformation of political systems (changes in democracies, new forms of collective mobilisation and protest), transformation of modes of government and governance at all levels,
- analysis of public action and policies at international, European, national and territorial levels,
- analysis of national and international state policies,
- globalisation, international relations, global governance, non-government stakeholders, geopolitics and geostrategy, contemporary war and peace processes;
- knowledge, expertise, data (including digital); political, social and legal data issues and protection thereof (e-health, big data, etc.).

Related key words: law, legal theory, legal history, philosophy of law, economic approach to law, comparative law, constitution, human rights, ethics, norms, justice, judiciary, political science, institutions, legislation, regulation, democracy, administrative change, states, non-state stakeholders,

local authorities, decentralisation, transnational logics, federalism, government, governance, public action, practices, measurement, regulation, freedoms and security, international relations, global and transnational governance, diplomacy, wars and peace, conflict resolution, data, big data, knowledge, expertise.

ERC codes associated with the panel: SH2

Related SDG: 5, 10, 13, 16

Theme D.3: Contemporary societies: state of, dynamics and transformations

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This theme welcomes projects relating to social transformations and dynamics, populations and settlements, integration and differentiation processes, education and training, health, work, sport, information and communication.

The projects will come under the following topics:

- demography, families, life pathway, ageing, social trajectories, transformations of social groups,
- human and social health, public health and health care systems, disability, quality of life, health and human sciences,
- social approaches to work, public employment policies, working conditions,
- education, training, educational policies, school organisation, educational innovations and experiments, lifelong learning,
- inequalities, social, economic and environmental, discrimination, inclusion and exclusion logics, access to rights,
- contemporary developments in religion, secularisation and secularism, beliefs and practices, radicalisation,
- citizenship, mobilisation, participation, individual and collective action, social cohesion, conflict, delinquency,
- organisational communication, documentation, communication techniques, information management,
- media and social networks, infodemic, information and big data,
- food: food supply, food practices, food safety,
- sport(s), sport practices, sporting events, sport and health,
- tourism(s), tourist mobility, leisure.

Related key words: *demography, family, gender, age, life pathway, social protection, health, disability, care systems, social approaches to work, employment, education, training, pedagogy, learning, inequalities, poverty, solidarity, inclusion, discrimination, exclusion, religion, secularism, citizenship, participation, conflict, delinquency, communication, information, media, infodemic, food, consumption, sport, tourism.*

ERC codes associated with the panel: SH3

Related SDG: 2,3, 4, 5, 10, 11, 2, 16

Theme D.4: Cognition, behaviour, language

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This theme welcomes projects allowing a better understanding of human cognition and thought (brain aptitudes and capacities; psychology) and their relationship with social, individual or collective behaviour. It encompasses studies on language, considered in its relations with other cognitive functions and through various approaches, if possible crossed (pragmatics, sociolinguistics, linguistic anthropology, etc.).

The projects will come under the following topics:

- social cognition and social interactions, theory of mind, comparative cognition,
- individual behaviours, practices and decision-making; interactions between individual behaviours and collective entities or phenomena (institutions, social influences, public and private policies, etc.) ,
- social perception, social categorisation, non-verbal behaviour,
- cognitive and emotional development throughout life; influence of the environment (emotional, family, social, etc.) ,
- developmental, cognitive, sensory-motor disorders, disabilities,
- decision making, memory, cognition and consciousness, specific aspects of the human brain including its social dimensions,
- the interactions between language (creativity, use, behaviour), other cognitive functions (perception, attention, awareness, emotion, reasoning, memory, motor skills...) and the brain, acquisition and learning processes,
- and socio-linguistics, linguistic anthropology; theoretical linguistics, computational linguistics,
- human-machine interaction, artificial intelligence, verbal and non-verbal communication.

Related key words: *cognition, cognitive sciences, human thought, theory of mind, behaviours, decisions, experiments, risks, uncertainties, language, psychology, social perception, developmental and cognitive disorders, linguistics, discourse analysis, pragmatics, socio-linguistics, linguistic anthropology, artificial intelligence, human-computer relations, information, verbal and non-verbal communication.*

ERC codes associated with the panel: SH4

Related SDG: 2, 3, 4

Theme D.5: Arts, languages, literatures, philosophies

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This theme welcomes projects relating to texts and writing, languages, representations and modes of artistic expression, the production, dissemination and reception of works, whatever their nature and medium; it also encompasses everything relating to theoretical and critical thought.

The projects will come under the following topics:

- literature(s): history, theory, criticism; comparative approaches, poetics, genetics of texts; literature and humanities,
- creative processes and theories; economics, law, politics of creation,
- arts, live performances, images, music,
- architecture, design, fashion, contemporary decorative arts,
- aesthetics, metaphysics, logic, ethics,

- religious texts and traditions, new corpora, exegesis, receptions,
- diachronic and synchronic, descriptive and analytical approaches to languages; language(s), script(s), writing(s); rare languages, new languages; historical and cultural contexts of languages; multilingualism and interculturality,
- constitution and analysis of digital corpora (texts, images, sounds, etc.), digital philology, digital creations.

Related key words: *literature, comparative literature, textual genetics, exegesis, literary criticism, literary history, poetics, philology, humanities, arts, visual arts, performing arts, decorative arts, music, musicology, history of the arts, architecture, design, law and economics of creation, material and immaterial creations, digital corpora, epistemology, aesthetics, ethics, philosophy; languages, linguistic systems, historical linguistics, literatures and languages, languages and cultures.*

ERC codes associated with the panel: SH5

Related SDG: 4, 8

Theme D.6: Studies of the past, heritage, cultures

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This theme welcomes projects relating to past societies, their history and archaeology. The challenge is to understand the diachronic structuring and organisation of these societies, their relationship with their environment and their cultures. This theme also encompasses heritage in all its forms, and heritage issues.

The projects will come under the following topics:

- forms of organisation and structuring of societies, comparative, cross-cutting, connected and global history; anthropology of social and cultural practices (body, food, sexuality, education, medicine, etc.) ,
- political and institutional history (powers, dominations, imperialisms and imperialities); history of conflicts and international relations, colonial and post-colonial history; laws, justice and penal practices,
- environments of the past, environments and landscapes, interactions between human societies and their environment, especially in the face of global change, history of environmental awareness. This topic could be the subject of interdisciplinary projects outside Social Sciences and Humanities;
- cultural, economic, political, legal and technological contexts of material production; history and archaeology of gestures and techniques, skills and trades, exchanges and networks, objects and texts;
- expressions of symbolic thought: arts, value systems, ideas and representations, dynamics of religions, cults, rites, myths and beliefs; creation of identities;
- intellectual history, history of science, technology and literary knowledge;
- databases, documentary corpus, convergence of sources and cross-approach of the sciences of erudition;
- heritage (natural, cultural, tangible, intangible): study, restoration, conservation, legal protection, enhancement, process of patrimonialisation, at the national and international levels.

Related key words: *archaeology, prehistory, protohistory, ancient history, medieval history, modern history, contemporary history, political and institutional history, history of conflicts and international relations, social history and anthropology, paleoenvironments, vulnerabilities, environmental history, history of science, intellectual history, sciences of scholarship, epigraphy, numismatics, papyrology, codicology, palaeography, philology, material production, archaeomaterials, techniques and technologies, exchanges, symbolic thought, beliefs and religions, the creation of identities, documentary corpus, museography, heritage enhancement, safeguarding, protection and conservation of cultural goods, memory practices and policies, heritage sciences, territorial dynamics, landscapes.*

ERC codes associated with the panel: SH5, SH6, PE10_6

Related SDG: 4, 8, 15

Theme D.7: Societies and territories in transition

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This theme welcomes all projects with a geographical or spatial dimension and likely to enrich the understanding of territories (urbanised, urban, peri-urban, rural, productive, etc.) in all their dimensions, dynamics and interactions. A link is expected between spatial and temporal scales as well as levels of socio-political organisation.

The projects will come under the following topics:

- socio-spatial systems, territorial transitions;
- places and non-places, spatial and territorial identities, relationship between societies and territories (including seas and oceans, air and outer space);
- mobilities and migrations, identities, belonging, models and forms of integration;
- rebuilding relations between centres and peripheries; borders, margins, integration, segregation, fragmentation, crime; city policies; housing markets, social, spatial and environmental justice;
- development and urban planning, land use, land, housing market, local taxation, property prices, regulation of real estate platforms;
- territorialisation of public policies, territorialisation of rights, extraterritoriality, law and territory, sovereignty;
- adaptation of socio-ecological systems to global environmental change; development and protection of resources and landscapes; social and territorial vulnerability and resilience; ecological, climate and energy transitions of territories; environmental empowerment, capabilities and agency; environmental conflicts and mobilisations;
- digital revolution and its consequences, smart cities, cyberspace;
- geomatics, geo-referenced data and corpora, databases and interoperability, cartography and critical approaches to maps.

Related key words: *dynamics and territorial trajectories, societies and territories, territories and productive systems, low-density spaces, maritime and air spaces, territorialities, extraterritorialities, region, regionalisation, metropolisation, landscapes, land, rurality, urbanity, city living, peri-urban, centre/periphery, segregation, housing; resources, pollution, nuisances, risks, vulnerability, resilience, ecological, climatic and environmental transition, globalisation, multiculturalism; digital revolution, cyberspace, smart cities; spatial analysis, spatial economy, databases, cartography, geomatics, geo-referencing, modelling.*

ERC codes associated with the panel: SH7

Related SDG: 7, 8, 9, 11, 13

“Digital Sciences” field

Theme E.1: Foundations of digital technology: information technology, automation, signal processing

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This theme concerns fundamental research striving for excellence and breakthroughs in the fields of computer science, automatic control and signal processing.

Projects with components in a biology or health should be addressed in the transversal theme "Interfaces: mathematics, digital sciences – biology, health".

Related key words: logic, computability, decidability, complexity, theoretical computer science, combinatorics, graph theory, software science, formal methods, computational models, competition models, languages and semantics, cryptography, cybersecurity, fundamental, sequential or distributed algorithms, proof theory, computer arithmetic, symbolic computation, game theory, optimisation, statistical signal processing, detection-estimation, analysis and representation, information theory, multimedia data security, corrective codes, compression, control and optimisation, control and observation, estimation and identification, dynamic systems, system theory and modelling.

ERC codes associated with the panel: PE01, PE06, PE07.

Related SDG: 9.

Theme E.2: Artificial intelligence and data science

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The French State priority "Artificial Intelligence" is mainly implemented within this research theme. This priority also covers proposals under disciplinary or interdisciplinary research themes that fall outside this area but involve an AI component.

This research theme expects research in artificial intelligence covering, in a broad sense, machine learning and its mathematical foundations, as well as symbolic approaches, massive data processing and data science, and knowledge management.

The following themes are given as a guide:

- methods and models to manage and exploit large volumes of data, whatever are their variety, mode of production and quality;
- automatic learning: learning theory, optimisation, new paradigms, constitution, annotation and evaluation of corpora;
- methods and models integrating, in a transverse way on its various themes, the scientific stakes linked to the deployment of artificial intelligence in particular in terms of trust and frugality, making it possible to ensure transparency, safety, trust, explanation of learning, decision and reasoning models, preservation of private life, equity;

- methods and models for knowledge extraction and management: representation and reasoning about knowledge, data and knowledge mining, ontology engineering and its use in data enrichment and information retrieval, knowledge graphs, decision theory, multi-agent systems and the semantic web;
- research projects aimed at advancing the state of the art in order to accomplish complex tasks (computer vision, automatic language and speech processing, automatic translation, etc.), autonomous decision-making systems or systems enabling high-level interactions with human users.

Work contributing to research in Human-Machine Interaction and Robotics is to be addressed in the "Interaction, Robotics" theme. Work in the fields of health, transport and safety, or at the interface between AI and Social Sciences and Humanities, should be addressed, respectively, in the transversal axes "Interfaces: *Mathematics, digital sciences - biology, health*", "*Urban societies, territories, constructions and mobility*" and "*Global security, resilience and crisis management, cybersecurity*" or "*Interfaces: Digital sciences – Social sciences and humanities*".

Related key words: *Machine learning (supervised, unsupervised, reinforcement, federative, distributed, decentralised, continuous, real-time...), representation learning and domain transfer, learning from unstructured data, statistical models, optimisation, data mining, text and data mining (CT), computer vision, scene analysis and interpretation, pattern recognition, automatic language and speech processing, multimodal data processing, decision support, game theory, computational social choice, consensus systems, multi-agent systems, planning, heuristic search, constraint satisfaction, knowledge extraction, knowledge representation reasoning, ontologies, semantic web, fusion, uncertainty management, massive data, large-scale distributed computational models on data, distributed artificial intelligence, content indexing, information retrieval, data visualization, data quality, trust systems, confidentiality, privacy, ethics, validation, certification, robustness, imprecision, explicability, causality, reproducibility, paucity of data, rare data, embedded artificial intelligence, computational models, transparency, responsible AI.*

ERC codes associated with the panel: PE01, PE06, PE07.

Related SDG: 9 and 14.

Theme E.3: Software sciences and engineering - Multi-purpose communication networks, high-performance infrastructures

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This research theme deals with proposals aimed at overcoming fundamental or applied research obstacles centred on three main fields that are sometimes combined:

- Communication networks as an object of study covering all its components and facets, taking into account their multiple topologies (ad hoc, peer-to-peer, mesh, edge, etc.), speeds (high-speed communications versus networks of objects) and usages. From the physical layer, including antennas and their interactions with the network, to the exploration of differentiated and mobile usage conditions, justifying analyses in terms of security, availability and reliability, and authorising context-sensitive services. This field of research also relies on progress in terms of standardisation (5G, 5G+), virtualisation and networks of the future (air-ground, satellite, etc.);
- High performance computing and communication infrastructures allowing the development of computing models, algorithms and the exploitation of massive

parallelism, optimisation and dynamic management of resources based on quantitative properties and measurements (performance, robustness, memory, energy efficiency), programming environments and algorithms for the exascale. This field also targets the study of the distribution of computation on various topologies and network architectures ("edge cloud", fog, cloud, cache, etc.) connecting computation resources as well as the various aspects of virtualisation of applications, servers, networks (SDN), etc. without omitting the security aspects;

- Developments in software sciences and technology covering both new programming languages and paradigms, including domain-specific languages (DSL), and associated software design engineering (e.g. model-driven engineering), the exploration of advanced techniques in multi-modelling, variability management and adaptability for product line design, facilitating programme analysis, software verification and certification, as well as the identification and remediation of cyber security vulnerabilities.

This domain also aims at developing software technologies for embedded systems integrating their various aspects and constraints (real-time, mixed, mixed criticality, software dominance, cyber-physics, etc.).

Related key words: *Operating systems, real-time OS, middleware, software engineering, virtualisation, self-adaptive systems, supervision; embedded systems, internet of things, heterogeneous hardware architectures, security of hardware systems; virtual prototyping, service composition, web programming and security, service platforms; optimised compilation to centralised or parallel (multi-core) architectures, computational models for parallelism, distributed systems and algorithms, programming languages, blockchain technology; protocol and service orchestration, metrics, software architectures, program analysis, vulnerability identification and remediation, anti-malware, verification, proof of safety and security properties, testing and debugging methods; optical communications, radio communication, architecture and programmability of communication systems, security, reliability and availability, mobility, scaling, elasticity, energy efficiency, control, management and information plans; hardware accelerators, massive parallelism, cloud, orchestration and optimisation of communication/execution/storage resources, QoS and SLA assurance, data analytical for network optimisation, end-to-end security, cryptographic protocols, management of shared infrastructures, context-sensitive services, service-infrastructure interface, trust solutions, data privacy.*

ERC codes associated with the panel: PE06, PE07.

Related SDG: 8 and 9.

Theme E.4: Interaction, robotics

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The projects expected in this research theme concern, on the one hand, Human-Machine interaction in all its dimensions, including natural dialogue, the creation of multimedia content and cognitive processes and, on the other hand, autonomous and interactive robotics in all its components (service robotics, medical robotics, industrial robotics, robotics for the environment, multi-robot cooperative systems).

This research area also supports interdisciplinary research actions.

If projects raise ethical issues, these should be addressed in the proposal.

Manufacturing robotics projects aiming at industrial performance rather than the development of robotics per se, are to be submitted in the "Industry and factory of the future" theme: Man, organisation, technologies

Related key words: multi-sensorial interfaces (gesture, tactile, face, sound, speech, ...), brain-machine interfaces, wearable computing, augmented reality, virtual reality, immersive environments, user-centred design, participatory design, practice-centred design, conversational agents, adaptable interfaces, collaborative interactions, non-verbal communication, multimedia content creation, multi-source data, interface ergonomics, visualisation, simulation, rendering, computer vision, dialogue, human/data interaction, multimodal interaction, humanoids, aerial robots, terrestrial robots, autonomous vehicles, underwater robots, agricultural robots, adaptable systems, exoskeletons, planning, cognitive architectures, decision-making autonomy, human-robot collaboration, mobility, sensors, robotic mapping, field robotics, multi-robot systems, cognitive psychology, social robotics, companion robot, affective robotics, affective computing, surgical robotics, instrument/organ interactions, soft robotics, computer-assisted medical-surgical gestures, manufacturing robotics, cobots, collaborative robotics and multi-modal rendering, Human-System Interaction, audio perception, ultrasound, touch/pressure, haptic feedback, physiological sensors, processing of particular image modalities (infrared), interaction devices.

ERC codes associated with the panel: PE06, PE07, SH04.

Related SDG: 2, 3, 4, 5, 8, 9, 10, 11 and 12.

Theme E.5: Digital models, simulations, applications

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Multidisciplinary proposals bringing together probabilistic experts, analysts, statisticians, data scientists, experts in experimental modelling, system identification, numerical methods and algorithms, and experts in application domains are encouraged in order to promote disciplinary breakthroughs that will make it possible to develop new models, to substantially improve performance, cost, time, quality, volume, etc.

The obstacles to be overcome include:

- in programming environments in particular linked to future exascale architectures: execution supports, management of architecture heterogeneity and energy consumption, etc.), new models (complex workflows);
- in situ visualisation, fault tolerance ... (Post Moore era framework), new programming languages and paradigms. Particular attention will be paid to the maturity and sustainability of the chosen tools;
- in algorithms and numerical methods by demonstrating, if possible, the potential of supercomputing to advance knowledge and facilitate applications to exploit complex, heterogeneous and massively parallel architectures: the construction and exploitation of surrogate models, time/space parallelism, variable precision algorithms;
- the specific challenges of stochastic simulation, energy consumption, the use of NVM memories, high-performance data analysis and the deployment of data processing chains to take advantage of exascale computer architectures, the development of numerical libraries and new numerical methods that scale up, etc.,

- for the modelling of complex problems: assimilation problems - possibly mixing with "data models" - or even AI, probabilistic, multi-scale and multidisciplinary analyses, optimisation methods (robust, stochastic, etc.), machine learning/deep learning, exploitation of massive data, construction of pipelines for complex models, validation and certification of results (recognition of an image by the algorithm that is different from the eye, quantification of uncertainties, etc.), estimation of impacts (financial, societal, environmental, etc. .), estimation of impacts (financial, societal, environmental);
- The construction of hybrid data-driven models, taking advantage of the performance of heterogeneous data learning and optimisation techniques and integrating physical and symbolic knowledge (ordinary differential equations, partial differential equations, reduced models), with the aim of making simulations more understandable for experts in the field;
- development of models and their optimisation for coupling and interaction between newly accessible hardware and computer systems, virtual representations, simulations and the cyber-physical world: real-time simulations and interactivity, combination of various computational architectures, design of models that evolve according to the exploitation of data, partitioning of calculations between elements of heterogeneous computers, etc.

Particular attention will be paid to the setting up of ambitious, structuring projects by communities combining supercomputing and mastery of an application domain (energy, climate, environment, cosmology, smart cities, industry 4.0, etc.) to take their scientific models to a new scale or dimension, requiring a supercomputer of the exaflopian order. The team will have to highlight the requirements to implement their scientific project in terms of adaptation or even development of all or part of the existing algorithm as well as the implementation of complex work flows.

Related key words: *supercomputing, HPC, exascale, scaling, scalability, performance, resilience / fault tolerance; massive, hierarchical and heterogeneous parallelism, heterogeneous architecture, hybrid, CPU, GPU, FPGA, multi-core, cluster of machines; computational frugality, energy efficiency, optimisation, (quantification) uncertainties, multi-scale, multi-physics, domain decomposition, data assimilation and inversion, data-driven models, modelling and simulation, digital twins, coupling of hardware and computer systems, co-design (software, hardware, application), model reduction, hybrid dynamic systems, validation and verification, scientific computation library, linear algebra, modelling languages, workflows, pre- and post-processing (meshing, visualization, ...), management of large amounts of scientific data.*

ERC codes associated with the panel: PE01, PE06, PE07, PE08.

Related SDG: 9.

Theme E.6: Quantum technologies

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The Government priority, "Quantum Technologies" is outlined in this research theme.

This research area supports research activities related to the fields of "Materials Science and Engineering" and "Digital Sciences".

It covers the technological and scientific projects based on the quantum concepts of superposition and entanglement, in the following areas:

- Quantum communications for cryptographic applications and other uses of entanglement distribution;

- Quantum computing and simulation: quantum processors and architectures based on "qubits" and quantum algorithms, programming models and environment, applications and usage cases of quantum computing and simulation, certification tools, etc.
- Quantum sensors and metrology (imaging - especially medical -, atomic clocks, accelerometers, gyrometers, gravimeters, gradiometers, Lidars, etc.)
- Fundamental research and development of new concepts using quantum mechanics to compute, measure, process or transmit information more efficiently than with classical technologies,

Projects with a multidisciplinary dimension and bringing together complementary skills are encouraged.

Projects relating to quantum sensors and metrology with high disruptive potential (ultra-cold atom quantum gases, impurities in crystals, opto-mechanical resonators, quantum materials, etc.) are prioritarily encouraged.

Related key words: Quantum optics, sources of quantum light, quantum communications, quantum cryptography, memories, repeaters, multipartite communications, protocols, quantum simulation, platforms, control and verification methods, quantum computation, qubits, quantum logic gates and processors, integration, quantum computation and algorithms, models and programming environment for quantum computation, quantum error correction, conventional quantum hybrid computing, quantum metrology, sensors, gravimeters, magnetometers, accelerometers, gyrometers, atomic clocks, quantum imaging, optimal quantum control, quantum feedback, squeezing, non-destructive quantum measurements, quantum systems: trapped atoms and ions, Rydberg atoms, quantum boxes, defects in solids, rare earth ions, 2D materials, graphene, electron and nuclear spins, quantum information science, superposition, entanglement, decoherence, estimation, reconstruction of quantum states, quantum tomography, topological systems, component independent processes.

ERC codes associated with the panel: PE02, PE03, PE06.

Related SDG: 9 and 16.

“Mathematics and its Interactions” field

Theme F.1: Mathematics

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Projects in this theme are expected to contribute the advance of research and knowledge in mathematics. It covers the whole field, from the most fundamental to the most applied aspects.

Projects in effective interaction with other disciplines can be submitted in other scientific themes ("Foundations of digital technologies", "Artificial intelligence and data science"). The cross-cutting theme are focused on multidisciplinary projects oriented towards certain specific applications and aiming at mutual scientific cooperation between the disciplines:

- "Interfaces: mathematics, digital sciences - Earth system and environmental sciences",
- "Interfaces: mathematics, digital sciences - biology, health".

These axes are more suitable for interdisciplinary projects whose consortium includes researchers from the different disciplines involved.

Related key words: algebraic geometry, arithmetic and differential geometry, topology, algebra, number theory, dynamical systems, ordinary differential equations, analysis, functional analysis, partial

differential equations, mathematical physics, probability, statistics, numerical analysis, scientific computing, data processing, logic, discrete and combinatorial mathematics, cryptography, modelling, simulation, optimisation, control, game theory, mathematics for signal and image, history of mathematics.

ERC codes associated with the panel: PE01, PE06.

Related SDG: 9.

“Sub-atomic Physics, Sciences of the universe, and Earth sciences” field

Theme G.1: Planetary science, structure and history of the Earth

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This theme corresponds to research work aimed at acquiring fundamental knowledge and highly innovative developments in instrumentation, networking, data processing and exploitation in the field of planetology, planets of the solar system and exoplanets, exobiology, the structure and history and dynamics of the Earth (including distant palaeo-environments not linked to problems of the Anthropocene).

Key related words: *hazards (telluric hazards, space meteorology and near-Earth objects); chemistry and physics of planetary atmospheres; cosmochemistry; planetology; exoplanets; exobiology; planetary formation; geology; geochemistry; geochronology; geodynamics; geomagnetism; geophysics; gravimetry; geodesy; mineralogy; petrophysics; pre-anthropocene palaeoenvironments; natural mineral resource formation; palaeontology; palaeomagnetism; petrology; sun-Earth relations; sedimentology; seismology; Earth structure; tectonics; early Earth; deep Earth; volcanology.*

ERC codes associated with the panel: PE9_1, PE9_2, PE9_3, PE9_4, PE9_13, PE10

Related SDG: 9.

Theme G.2: Sub-atomic physics and astrophysics

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This theme aims to support research work to develop fundamental knowledge, theories and models and to contribute to innovative developments in instrumentation, measurement, data processing and development in the fields of subatomic and theoretical physics, nuclear physics, astrophysics and cosmology.

Key related words: *physics of fundamental interactions; particle physics; subatomic physics; accelerator physics; nuclear physics; space-time reference systems; astrophysics; astrochemistry; astronomy; high-energy and particle astronomy; astroparticles; multi-messenger astrophysics; galaxy formation and evolution; interstellar medium; star formation and planetary systems; stellar physics; solar physics; cosmology, dark matter and dark energy; gravitational waves; classical and quantum gravitation; theoretical physics; string theory (including its mathematical aspects); mathematical physics; statistical mechanics; non-equilibrium phenomena; non-linear physics; disordered systems; classical and quantum dynamical systems; low-dimensional quantum systems; quantum information; integrable systems; algorithm and complexity; instrumental developments.*

ERC codes associated with the panel: PE02_01 to PE02_07, PE09_05 to PE09_13.

Related SDG: 9.

Cross-cutting themes

Each cross-cutting, transition, transformation area could be defined by an introductory text explaining the transdisciplinarity of the axes included and the expectations in relation to the axes of the disciplinary scientific areas (above).

These cross-cutting areas, transitions, transformations also correspond to specific programming steering committees bringing together members of several disciplinary programming steering committees.

Theme H.1: The Science of sustainability

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The science of sustainability is concerned with the complex interactions between natural and socio-economic systems, and how these interactions affect, over time and space, the planet's life support system and its biodiversity, socio-economic development and human well-being. Its ambition is to provide science-based solutions to the major global societal challenges and to accompany the major transitions in society and the associated risks. In an integrated approach, the science of sustainability favours - at different scales of time and space - the study of the functioning and dynamics of eco- and anthropo-systems, their interactions through their multiple dimensions: environmental, ecological, climatic, physico-chemical, cultural, historical, legal or socio-economic. It allows to break down research around a common object and, in particular, stimulate taking into consideration interactions between the 17 SDGs.

According to the definition of sustainability science, projects are considered to fall under this theme if they include the following components:

- to be focused on transitions requiring adaptation to one or more pressures;
- to present systematic inter- or trans-disciplinarity.

Where appropriate, the research project may be co-constructed with stakeholders and be the subject of a specific partnership. Implemented by a team of researchers, the project should produce new knowledge and lead to the production of decision-making tools and the deployment of sustainable solutions, and then meet the SDGs.

The theme will support projects addressing at least two of the following three aspects:

- Situation analysis (conflicts of uses and management, tensions over resources, antagonisms, risks linked to hazards and extreme events, stakeholder strategies, targets to be reached, obstacles to be overcome, resource finiteness and impacts, etc.);
- solutions (remediation, adaptation, mitigation, trajectories towards the target, organisational solutions, warning systems, etc.);
- deployment modalities (governance, socio-economic models, technological and social innovations, public policies, etc.).

Research questions supported can be of three kinds:

- focused on the science of sustainability as a research object (concepts, approaches and method);
- focused on transformation as a research object,

- built around major nexuses (including biodiversity, climate, water, resources, energy, food, oceans, health, technologies, digital, society) at different scales of time and space (including the city, Southern and Northern countries, etc.).

This new thematic axe is partly based on the "Human-environment interactions" thematic ax of the 2021 action plan. Projects concerning the very long-term evolution of the environment and the study of paleoenvironments are expected in the "Studies of the past, heritages, cultures" thematic axe, including interdisciplinary aspects and/or aspects that shed light on current and future global changes linked to human action.

Key words: *transitions; sustainability, methods of studying transitions; risk-uncertainty and adaptive management of transitions; vulnerabilities and inequalities (spatial, social, economic, educational, intergenerational, environmental); role of technological or social innovations in territories in transition; multi-actor approaches, stakeholder networks and co-constructions at different scales (regions, cities); transition trajectories in territories (characterisation, barriers, leverages, slow/fast transitions, etc.); ecological vulnerability - social vulnerability; economy/society/environment interaction; SD&RS; finiteness of resources; adaptation and mitigation in the face of climate change; conflicts of uses and management for common goods, land and/or natural resources; ecological vulnerability - social vulnerability; economy/society/environment interaction;; risks and disasters; food/water/energy, health/biodiversity/agro-ecology nexus, etc.; dynamic scenarios coupling socio-economy - resources and ecosystem services; exploitation of knowledge, modelling and integrated scenarios to design adaptation solutions and study their impacts on natural resources and socio-ecosystems; dynamic protection of ecosystems and biodiversity in the face of anthropic pressures or global changes; links between ecosystem functioning and epidemiological risks; mediation; co-construction; development of impact pathways; resilience.*

ERC codes associated with the panel: PE08, PE10, LS07, LS08, LS09, SH01, SH02, SH03, SH07

Relates SDG: All

One Health

Theme H.2: Contaminants, ecosystems and health

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The scientific scope of this research theme covers in particular multidisciplinary approaches, which contribute to expanding knowledge on the characterisation and fate of physical, chemical or biological contaminants contributing to the exposome, as well as their effects on human, animal and plant health, as well as on ecosystems, in line with the "Eco Health" concept. Projects are expected to particularly include the following:

- characterisation of the exposome (including cocktail of contaminants, individual and collective behaviours and interactions between different kinds of stresses in humans, animals and plants);
- contaminants, environmental metrology and biological samples, including bioindicators and biomarkers;
- the effects and activation mechanisms of contaminants on living organisms, ecosystems and human health;
- the eco-dynamics of contaminants, their interactions and their trans- and multi-generational impacts;
- adaptive and evolutionary mechanisms in exposed organisms.
- the evaluation of new tools for the governance of risks linked to contamination, in

taking the populations' perceptions into account.

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

Related key words: *adaptability, allergen, biocides, biodiversity, bioindicators, biomarkers, legal and regulatory frameworks, contaminant cocktail, chemical contaminants, physical contaminants, biological contaminants, controversies, eco-dynamics, health ecology, ecosystems, ecotoxicology, environment, epidemiology, epigenetics, exposome, drugs, metals, metrology, microbiome, micro- and nanoplastics, modelling, nanomaterials, organometallics, perception by society, endocrine disruptors, pesticides, mineral pollutants, persistent organic pollutants, persistent and mobile pollutants, animal health, human health, plant health, strategies of economic actors, environmental toxicology, toxins.*

ERC codes associated with the panel: LS02, LS04, LS07, LS08, LS09, PE01, PE02, PE03, PE04, PE05, PE07, PE06, PE 08, SH01, SH02, SH03.

Related SDG: 2, 3, 6, 9, 11, 14 and 15

Theme H.3: Infectious diseases and environment

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This theme concerns pathogens, emerging and re-emerging infectious diseases and/or adaptations and resistance to antimicrobials in relation to the environment. The projects submitted will be based on integrated, multi- and interdisciplinary approaches combining disciplines from the ecological and environmental sciences, biology and health, social sciences and humanities.

This research theme covers the following topics:

- all human, animal and plant pathogens, irrespective of their nature (bacteria, viruses, parasites, fungi, algae and non-conventional agents), considering in particular their biology and ecology.
- the ways in which pathogens spread (including in water, air, soil, etc.); the processes of evolution and adaptation to environmental changes of pathogens and their hosts and vectors; the genetic and non-genetic determinants of transmission.
- the mechanisms of emergence of infectious diseases (human, plant or animal, including zoonoses) in relation to environmental and anthropic factors (behaviour, education, social status, etc.).
-
- methods of control, surveillance and prevention, identification of populations and areas at risk, limitation of pathogen spread and of preparation for epidemic or even pandemic risk (including the development of diagnostic tools).
-
- the mechanisms of emergence of infectious diseases (human, plant or animal, including zoonoses) in relation to environmental and anthropic factors (behaviour, education, social status, etc.).
- modelling emergence, dissemination, exposure or elimination parameters, retrospective analyses as well as the constitution of databases that can help define indicators for a predictive approach to the evolution of epidemics as part of health monitoring,
- the development and application of massive data analysis methods, including artificial intelligence, in the context of emerging or re-emerging infectious diseases.

- resistance to antimicrobial, antiparasitic, antifungal, insecticide and biocide treatments and their dynamics of emergence and diffusion.
- the analysis of the social and economic characteristics of epidemic management systems.
- the impact of individual and collective behaviour and practices on transmission.
- the organization and resilience of human and animal health care systems facing the risks of emerging and re-emerging infectious diseases.

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

Projects eligible for ANRS-MIE funding cannot be submitted within the framework of this theme (see page 13).

Related key words: *"One Health" or "Eco-Health" approaches, database, conditions for prevention and management of emerging diseases, determinants of infectious diseases (biological, medical, environmental, social, etc.), epidemics, exposure/infections, wildlife, modelling, niches, pandemics, emerging and re-emerging pathogens, persistence, prediction, management, reservoirs, antimicrobial resistance, risks, global health, transfer and species barrier, vectors, virulence, zoonoses.*

ERC codes associated with the panel: LS01, LS02, LS06, LS07, LS08, PE06, PE10, SH02, SH03.

Related SDG: 1, 3, 4, 9, 10, 13, 14, 15, 16 and 17

Theme H.4: Public health, health and societies

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This theme relates to research in public health. The aim is to:

- describe, analyse and understand the different factors and determinants of health, whether they are socio-economic, behavioural, environmental, demographic, geographical, organisational, linked to life trajectories or to public policies, on the health of populations and health inequalities;
- contribute to the elucidation of disease mechanisms through approaches integrating population data and biomarkers;
- propose work relating to the surveillance, anticipation, prevention and preparation, in ordinary or crisis contexts (epidemic, conflict, etc.),
- encourage cross-disciplinary analysis and approaches with veterinary public health stakeholders in terms of prevention (biosecurity, vaccination) and crisis management, particularly in terms of population-based approaches (modelling, surveillance, etc.),
- carry out, propose or validate intervention studies, as well as preventive actions and health promotion, from the neighbourhood level (community health) to the global level;
- carry out health, economic and societal impact studies of preventive measures aimed at improving health or at adapting to, or preventing, societal or environmental threats, such as epidemics or climate change, and in general to evaluate public policies;
- propose work on the organisation of the health system (effectiveness, efficiency, access, equity, balance between prevention and therapy, etc.) and analyses of the consequences of technological and medical innovations on the health system (digital health, genomic, predictive, personalised medicine, etc.),
- analyse the interactions between the different actors, institutions or groups that contribute to the management of public health issues at different levels of the territory;
- analyse the way in which health systems and society integrate the knowledge acquired

on the exposome, the issues linked to the idea of global health, climate change and biodiversity loss.

The consideration of multiple health-related determinants and factors, their interactions and their combined effects is encouraged. All dimensions and fields of health, as well as questions regarding quality of life, autonomy and disability, will be considered, throughout life and in the different areas of life (residential, school, professional, leisure activities, etc.). Particular attention will be paid to conceptual and methodological research to analyse the effects of health determinants and factors.

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

Related key words: health; populations; determinants of social inequalities in health and vulnerability, knowledge of populations at risk, cohorts; case-control studies; epidemiological and biostatistical methodology; big data in health; exploitation of existing health data; individual and collective behaviour, relationship to risk and perception of risk, health norms; screening, early diagnosis; chronic diseases; access to care and functioning of the health system; evaluation of public policies; performance and financing of health care provision; relations between professionals and users; experiences of users of the health system; risk management, surveillance, prevention, protection; policies, organisations, regulations, actors; health promotion; health practices; veterinary public health.

ERC codes associated with the panel: LS02, LS07, SH01, SH02, SH03, SH04, SH06.

Related SDG: 1, 3, 4, 5, 10, 12, 16 and 17.

Ecological and Environmental Transition

This cross-cutting area, at the interface of environmental sciences, humanities and social sciences and material sciences, is made up of three research areas that were already included in the 2021 Work Programme. In the 2021 Work Programme, two of them, namely "Methodologies, instrumentations, sensors and solutions for the ecological transition" (formerly entitled "Scientific and technological innovations to accompany the ecological transition") and "Dynamics of socio-ecosystems and their components" (formerly entitled "Dynamics of socio-ecosystems and their components with a view to their sustainable management"), were attached to the Environmental Sciences domain. The third theme, "Bioeconomy, from biomass to uses: chemistry, materials, processes and system approaches" (formerly entitled "Bioeconomy: chemistry, biotechnology, processes and system approaches, from biomass to uses") was attached to the cross-cutting areas. The perimeters covered are more or less identical to those of the 2021 generic call for projects, with the exception of the "bioeconomy" theme, as bioenergy has been integrated into the scope of the "Sustainable, clean, safe and efficient energy" theme.

These three axes contribute to the ecological and environmental transition with a clear objective of sustainability. Projects of an inter- and trans-disciplinary nature are mainly expected.

Theme H.5: Methodologies, instrumentations, sensors and solutions for the ecological transition

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This research area concerns research projects on innovative technologies and methodologies to support ecological transitions and in particular:

- the development of methods, tools and sensors for 1) environmental observation and monitoring (smart monitoring, monitoring of forcing, implementation of participatory science or crowd sourcing), and for 2) operational services for diagnosis, warning and environmental crisis (including natural hazards);
- the development of high-tech/high-precision instruments to document the status and dynamic of various environmental compartments;
- methods, processes and tools for sustainable remediation, ecological engineering and hybrid approaches (technologies and solutions based on nature), new approaches aimed at reducing environmental impact, the emergence of new services or economic sectors, while preserving the quality of the environment (water, air, soil, subsoil);
- the development of technologies for extracting contaminants with a view to genuine remediation of environments (water, air, soil, subsoil);
- the characterisation of the ecological footprint, the development of one or more integrative indicators of this footprint;
- advanced data acquisition and analysis techniques, including sensor metrology.

Projects on the development of autonomous vehicles for sample collection should be submitted under theme E.4 "Interaction, robotics".

Related key words: *Natural hazards and cascade effects; pollutant, effluent and waste treatment; pollutant source reduction; long-term and/or high-frequency environmental monitoring; development of in situ measurements; eco-design; nature-based solutions; ecological compensation; telemetry; sampling; measurement; sustainable remediation technologies; sensors/biosensors for the environment; sensor networks; technology trains; measurement of GHGs and air pollutants; GHG sequestration; pollution of the atmosphere, water, soil and subsoil; air quality.*

Environmental chemistry; ecological engineering; ecological engineering (incl. phytoremediation and bio-remediation); metrology; microfluids; civil engineering; process engineering; environmental biotechnology.

ERC codes associated with the panel: LS08, LS09, PE02, PE03, PE04, PE05, PE06, PE07, PE08, PE10

Related SDG: 6, 7, 9, 11, 12, 13, 14, and 15

Theme H.6: Dynamics of socio-ecosystems and of their components

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This theme concerns fundamental or applied research projects seeking to understand the dynamics of productive socio-ecosystems, to propose innovations for their sustainable management (from an economic, social and environmental point of view), and to contribute to the development of trajectories and scenarios to support ecological and digital transitions. Projects will address the following themes in particular:

- exploration of biodiversity and the adaptation capacities and dynamics of socio-ecosystems;
- the role of biodiversity and associated ecosystem services in socio-ecosystems (economic, social, environmental services);
- the origin, characterisation and development of exploited species, including their potential to form sub-populations;
- sustainable and/or integrative livestock practices that promote animal welfare;

- understanding the functioning and identifying solutions to define adaptive management strategies (restoration, conservation, etc.) for anthropised marine or continental (or mixed) ecosystems, at different scales of space, time and levels of organisation (from the individual to the populations);
- the interfaces and interactions between productive or exploited ecosystems and their environment;
- the impact of agro-ecosystem practices on environmental changes,
- the redesign, at relevant spatial, temporal and/or organisational scales, of productive ecosystems (agricultural, aquaculture, fisheries or forest ecosystems in particular) on the scientific basis of agroecology;
- experimentation with transitions coupled with analysis of the economic, social and environmental dynamics of socio-ecosystems.

Related key words:

Agriculture; livestock; forestry; fisheries; aquaculture; landscape; biodiversity; biomonitoring; biocontrol; agricultural system and/or policy design; animal and plant health management; soil management; biogeochemical cycles; ecosystem service; animal welfare; integrated management; public policy; territory.

Agronomy; animal science; plant science; functional ecology; microbiology; ecophysiology; genetics; sociology; economics; geography; management science; political science; modelling; environmental law.

ERC codes associated with the panel: LS02, LS06, LS08, LS09, PE06, PE08, PE10, SH01, SH02, SH03, SH07

Related SGG: 1, 2, 8, 12, 13, 14 and 15

Theme H.7: Bio-economy, from biomass to uses: chemistry, materials, systematic approaches and processes

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This research theme deals with fundamental and applied research projects concerning the "bio-economy", in particular the cascading uses of biomass, the closing of cycles and their social, economic and environmental impacts. It is open to cross-disciplinary and/or systemic approaches specific to the challenges of bio-economics, as well as the methods and technologies linked to the transformation of the biomass for various uses via biotechnologies and chemical and/or physical transformation processes. All bioresources (cultivated, harvested, livestock, forestry, waste, etc.) in continental and marine systems are affected.

The scope of the theme covers topics linked to the following amongst others:

- biomass production, land use conflicts, mobilisation and sustainable management of bio-resources, regardless of origin;
- the pre-processing and transformation of bio-resources by different processes and their coupling (biotechnology, chemistry, catalysis, related processes), in particular in an integrated and systemic approach allowing the optimisation of the various flows involved (biorefinery concept);
- the eco-design and shaping of non-energy bio-sourced materials and molecules;
- the modelling and staging of flows (connecting material, water, energy and monetary cycles), at different scales, particularly territorial;
- analysis of value chains depending on environmental, economic and social criteria.

The requested disciplines fall within life, engineering and chemical sciences and social sciences and humanities. Integrative, interdisciplinary approaches are strongly encouraged.

Projects dealing with food issues must be submitted under the theme "*Food and food systems*". Projects dealing specifically with the transformation of biomass into energy carriers and fuels (biofuels, biogas, etc.) must be submitted under the theme "*Sustainable, clean, safe and efficient energy*".

Related key words: *Land use, terrestrial and marine biomass (quality, availability, management, sustainability of the sector), waste, co-products - by-products ... from biomass or its transformation; identification of new bioresources.*

Biorefineries; biological, thermochemical and/or catalytic biomass conversion processes (fermentation, anaerobic digestion, biocatalysis, chemical catalysis, hybrid catalysis, assisted catalysis...); sustainable chemistry; modelling and associated processes; synthetic biology; metabolic engineering; biotechnologies; micro-organisms; new technologies

Bio-sourced synthons; bio-sourced polymers; platform molecules; bio-sourced industrial products (lubricants, solvents, detergents, inks, adhesives, pigments, paints, cosmetics, etc.); co-products

Life cycle analysis; multi-criteria analysis; impact modelling (economic, environmental including GHG, societal); indicators, public policies, environmental economics, environmental services, logistical modelling and optimisation, representations and social realities, staging, value chain, risk-benefit approaches, etc.

ERC codes associated with the panel: *LS02, LS08, LS09, PE04, PE05, PE08, SH02, SH03, SH07*

Related SDG: *7, 8, 9, 12, 13, 14, 15.*

Energy transition

The ANR 2022 Work Programme and its Generic Call include two scientific themes dedicated to supporting research in the field of energy.

These two complementary areas contribute to the National Energy Research Strategy (SNRE) and help meet the challenges of energy transition challenged set by the Law of August 18, 2015.

The major changes compared to the 2021 call for proposals are, on the one hand, that these two themes are no longer specifically connected to the science of matter field but they are located at the interface of all the scientific fields. On the other hand, bioenergies have been explicitly reintegrated into the scope of theme H.9 "*A sustainable, clean, safe and efficient energy*" (instead of the theme H.7 "*Bioeconomy, from biomass to uses*").

Theme H.8: Basic energy science

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The "basic energy science" theme seeks to support upstream research, to explore new ideas and methods and to study breakthrough concepts. With long-term application perspectives, in particular beyond a 15-year horizon, the aim of this theme is to mobilise and transpose fundamental knowledge, methods and tools from the disciplines of matter, engineering and digital sciences to the field of energy⁴⁰, and to encourage research projects bringing together

⁴⁰ The energy sector includes: sources, conversion, storage, distribution and efficient use.

skills from a wide range of scientific communities, some of which do not necessarily focus on energy at present.

The following subjects can be addressed. The list is not exhaustive.

Innovative materials & environments: understanding, development and advanced characterisation:

- innovative materials and processes for energy: understanding of phenomena and behaviours related to microscopic or macroscopic physical, chemical or physico-chemical microscopic or macroscopic properties of functional materials or surfaces (transport/transfer/storage of heat and/or matter, optics, etc.), substitution of critical materials, activation of chemical reactions, interfacial phenomena, nano-structuring (surface, interface, volume), bio-inspired or geo-inspired processes, complex and reactive assemblies, etc. ,
- advanced characterizations for energy processes: innovative experimental methods and instrumentation (spatial and temporal multi-scales) for complex systems, multi-physical couplings, multi-scale in-operando characterisations, methods for extrapolation of data or measurements over prolonged periods, etc.

Multi-scale and multi-physical modelling and simulations of energy systems:

- modelling/simulation-assisted design: modelling and simulation (including predictive) from the atomic scale to molecules, materials, media, interfaces and processes and devices (quantum, thermodynamic or kinetic methods, up-scaling, machine-learning, data-mining, artificial intelligence, etc.) aimed at discovering new materials, components or devices for energy, multi-scale simulation of functional properties, ageing mechanisms, corrosion, etc. ,
- multi-scale simulations of mechanisms, reactions, processes, devices or systems: multiphase and/or turbulent and/or reactive flows, fluid (reactive) - material interactions, ageing, self-healing systems, modelling of agile or versatile systems and processes, methodological approaches for modelling complex systems, including the assembly of several systems.

Given the upstream and exploratory nature of the expected research, the projects must clearly specify which problems they propose to solve, in relation to an application in the energy field, without it being necessary to provide a quantitative analysis of the impact on the energy field.

Related key words: sustainable materials; nanostructuring; bio-inspiration; geo-inspiration; interfacial processes; self-healing systems; chemical reactivity; catalysts (electrocatalysts, photocatalysts); energy conversion and transfer; thermal; multi-scale approaches (spatial, temporal); in-operando; upscaling; ageing; mathematics and numerical sciences for energy; models of systems; metrology and instrumentation.

ERC codes associated with the panel: LS09, PE01, PE02, PE03, PE04, PE05, PE06, PE07, PE08, PE11

Related SDG: 7, 9, 12 and 13

Theme H.9: Sustainable, clean, safe and efficient energy

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The objective of this scientific theme is to accelerate research aimed at improving energy technologies (in a medium-term perspective) on the one hand, and, on the other hand, to

support research projects involving social sciences and humanities, in the diversity of their disciplines, either in cooperation with other disciplines or in projects specific to social sciences and humanities. The submission of projects with highly interdisciplinary approaches is also encouraged.

Projects on this theme will have to present the extent to which the expected results would increase knowledge, in the perspective of improving performance or of competing with or of complementing existing or developing technologies or processes, while taking into account life cycle issues. They will also have to comply to the SDG goals (resource saving, eco-design, responsible consumption and production, reduction of inequalities, etc.). The presence of these elements will be taken into account when assessing the projects.

The targeted fields are:

- capture of renewable energies (solar, geothermal, wind, marine, etc.),
- energy harvesting, waste energy,
- circular energy, energy recycling: use of biomass (including waste), recycled products as a resource, recycling of heat in processes, recycling of materials that can be used as a base for energy carriers (including CO₂);
- energy storage (mechanical, chemical, electrochemical, thermal, etc.),
- hydrogen energy: production without carbon emissions, storage, transport and distribution in gas or dedicated networks, fuel cells,
- energy grids, including multi-sources, multi-vectors: power electronics, dynamic, smart energy management, grid-storage interactions;
- sustainable uses of the underground from an energy perspective, including massive temporary energy storage with low environmental impact, natural hydrogen;
- energy-efficient industrial equipment and processes (including intensified processes, etc.);
- CO₂ capture and storage;
- production of synthetic hydrocarbons (possibly coupled with platform molecules) from CO₂, N₂ (e.g. ammonia production) or recycled products;
- bioenergy (biofuels, biogas, etc.) obtained by biological, enzymatic and/or chemical, thermochemical means from biomass, with the development of (bio)catalysts and related processes;
- energy efficiency and the reduction of emissions from transport vehicles (combustion, hybridisation, global optimization of energy on board, etc.);
- energy in digital technologies ⁴¹ : components for energy efficiency, reduction/optimisation of system and network consumption;
- approaches to energy transition by social sciences and humanities, which may be interdisciplinary or intersectoral: social, economic, technical, territorial and environmental justice issues;
- analysis of energy consumption patterns, including the challenges of energy sobriety and their implementation dynamics;
- analysis of the socio-technical and economic conditions for the development of the various energy sectors and the strategic choices employed;

⁴¹ Projects aiming to take into account reduced energy in software development should be submitted in the appropriate areas of the Digital Sciences field.

- the links between energy policies and climate objectives for mitigation and adaptation (international comparisons, processes for developing low-carbon and carbon-neutral scenarios, new energy representations and practices).

Interdisciplinary approaches to the systemic challenges of energy transition, in relation with other dimensions of global transitions (ecological, health, digital, societal), are strongly encouraged. If appropriate, the meaning of "interdisciplinary focus" should be defined with details of how this is to be implemented and its expected contributions in scientific terms (new approaches, methodologies, results) or impacts.

PRCE projects are well suited for this theme, to take into account the applications for the research proposed and their possible translation into innovative solutions.

Key words: *circular energy economy; renewable energy; wind energy; marine energy; geothermal energy; hydroelectricity; solar thermal; solar photovoltaic; solar fuels; energy harvesting; hydrogen energy; electrolysis; fuel cells; power-to-X; energy storage; electrochemical storage; batteries; supercapacitors; electrical energy management (power electronics, cables, etc.); smart energy grids; energy efficiency of digital technologies; thermal and thermodynamic systems; energy-efficient industrial processes; turbines; motors; HVAC; heating; refrigeration; energy and greenhouse gas efficient transport vehicles; CO2 capture/transport/storage; bio-energies; bio-fuels; bio-combustibles; synthetic fuels; underground use for energy; renewable or recovered heat; SSH & energy; socio-technical approaches; LCA; multi-criteria analysis; energy forecasting; energy consumption control; energy security and risk.*

ERC codes associated with the panel: LS09, PE01, PE02, PE03, PE04, PE05, PE06, PE07, PE08, PE11, SH01, SH02, SH03, SH04, SH06, SH07

Related SDG: 7, 9, 10, 12 and 13

Technological transitions

This cross-cutting field is made up of four themes, the common denominator being to contribute to the development of innovative technologies for various applications, relying in particular on materials science and engineering and on developments in digital science (simulation/modelling, massive data processing and artificial intelligence, etc.).

Two themes are dedicated to specific applications: for the medical sector (theme H.13 "Health Technologies") and for digital society (axe H.12 "Micro and nanotechnologies for information processing and communication").

It also includes a theme dedicated to innovative developments in the field of sensors, imaging and instrumentation, regardless of application (biology, physics, astrophysics, environmental sciences, etc.), as well as a theme aimed at supporting further generic research in nanosciences and nanomaterials, focusing on the properties of materials or objects induced by the nano dimension or on specific phenomena linked to the nano scale, for potential future technological developments.

Theme H.10: Nano-objects and functional nanomaterials, interfaces

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This theme welcomes proposals addressing the contributions of the nanometric dimension in the design and production of materials. The presence of specific nanometric scale objects or phenomena in the final outcome of the project should be the main criterion prompting

submission of the proposal on this theme. The simple association of nano-objects with known properties, without new ones emerging, does not fall under this heading.

Proposals will come under the following four topics:

- synthesis, manufacture and characterisation of nano-objects and nano-materials of functional complexes. Applied to the field of health, the projects will have to present the development and physico-chemical study of new and preferably multifunctional families as the main challenge;
- management of interfaces at the nano scale, functionalisation and interactions between interfaces,
- nano-object assemblies and 2D and 3D nanostructuring of the material,
- new properties resulting from the coupling of interactions at the nano scale.

The projects will seek to take into consideration sustainable development issues as well as life cycle and safety issues (for example, *safety-by-design*).

Proposals concerning the study of the contribution of the nanoscale dimension to the field of sensors (to improve performance, for example) as well as the instrumentation dedicated to nanomaterials must be submitted under theme H.12, "Sensors, imagers and instrumentation".

Projects dealing with digital technology devices must be submitted under theme H.13, "Micro and nanotechnologies for information processing and communication".

Projects focusing on the delivery of active ingredients for health are outside the scope of the panel and should be submitted under the appropriate theme.

Related key words: *nanoparticles (nanowires, nanotubes, nanocubes, nanoplatelets, etc.); 2D nanomaterials; 3D nanomaterials; metamaterials; nanoporous materials; thin and/or nanostructured films; formation and stability mechanism; control of properties (mechanical, electronic, optical, thermal, magnetic, etc.); composite-interfaces in composite materials; surface and/or nano-object functionalisation; interaction between surfaces and interfaces; reactivity control; simulation, modelling; assembly; nanofluidics; interactions with the environment; synergy of properties (optoelectronic, photo-magnetic, etc.); near-field properties; synthesis processes and elaboration methods (bottom-up, top-down, self-assembly, growth, additive methods, confined environments, etc.).*

ERC codes associated with the panel: LS07, PE03, PE04, PE05.

Related SDG: 3 and 9.

Theme H.11: Sensors, imagers and instrumentation

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This theme is intended to welcome projects whose main objective is the development of new sensors or innovative characterisation instrumentation, at different scales. Projects are expected to address as best as possible the problems of the "instrumentation - measurement - data processing" analysis chain, specifying the instrumental, experimental, numerical or algorithmic aspects required.

The theme comprises three main topics:

- the development of measurement and instrumentation methods for *in situ* characterisation and *on-line operando* monitoring, in order to characterise materials, devices or systems;

- characterisation at the nanometric scale and characterisation of nanomaterials: development of instrumentation and protocols dedicated to characterisation at the nanometric scale, meeting the needs of observation and detection metrology, including in complex media, whether fluid or solid, diluted or not;
- innovation, particularly breakthrough innovation, in the field of sensors and detectors in order to improve their performance (sensitivity, resolution, data acquisition and management and optimisation of their processing, etc.). Proposals should extend beyond the simple manufacture of materials and the characterisation of their sensitivity to a parameter (physical, chemical, biological, etc.) and envisage integration for instrumentation purposes.

Projects aiming at applications in the fields of physics, biology, health or the environment can be proposed under this theme provided that they address the problems of the experimental and instrumental analysis chain as a matter of priority.

Projects that primarily fall under the generic topic “Quantum Technologies” are to be submitted under the corresponding theme.

Similarly, projects dealing more specifically with the application/use rather than the development of the measuring instrument *per se* should be directed towards the relevant themes.

Related key words: sensors (thermal, mechanical, magnetic, chemical, electrochemical, biochemical, biological, optical, piezoelectric, inertial, acoustic, terahertz, etc.); in situ/in operando characterisation; chemical and biological reactivity monitoring; on-line control; imagers (optical, X-ray, terahertz, spintronics, etc.); wave-matter interactions (nanophotonics, photodetection); microscopies (optical, electronic, acoustic, near-field, terahertz, ionic, correlative, etc.); spectroscopies; measurements of physical properties (mechanical, optical, thermal, electrical, magnetic, etc.); metrology; micro and nanofluidics; advanced data processing techniques; multimodal techniques; tomography; non-destructive testing; development of measurement and characterisation methods.

ERC codes associated with the panel: majors PE02, PE03, PE04, PE05, PE07, PE08, other LS01.

Related SDG: 9.

Theme H.12: Micro- and nanotechnologies for information and communication technology

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This theme aims to support, for applications in the field of information and communication sciences, key technologies such as electronics and photonics, the integration of devices in systems or the exploration of new paradigms for the next generations of components (neuromorphic, bio-inspired, etc.). All projects should address well-identified scientific and technological hurdles and seek to demonstrate either improvements in quantifiable performances or breakthroughs compared with existing knowledge.

Projects targeting theoretical or digital approaches (simulation and/or design of components, circuits, materials, processes, complex systems) but also generic methodologies (design, testing, metrology), or the study of reliability, the advanced characterisation of materials or of performances of nanodevices/basic components, are fully incorporated under this theme.

At the relevant dimensional scales (micro and nano), the theme covers the following three areas:

- materials for components and devices: design, development, etc.
- elementary components and devices: characterisation, integration, application, etc.
- circuits, architectures and systems: design, simulation, test, etc.

Projects concerning quantum technologies should be submitted under theme E.6 "Quantum Technologies".

Related key words: *semiconductors; micro and nanoelectronics; electronics (organic, flexible); spintronics, memories; passive components; metamaterials; artificial materials; devices for optics; non-linear optics; optical near-field; optical sources; optical fibres; (micro) displays; millimetre components; THz; micro and nanophotonics; plasmonics, components (alternative, neuromorphic, computational accelerators, etc.); components for AI; integrated circuits and systems; 3D integration; heterogeneous integration; dense interconnections; photodetectors; imagers and sensors for ICT; new architecture paradigms; RF; micro-nanosystems; simulation (materials, components, circuits); characterisation; instrumentation; technological processes; design; life cycle.*

ERC codes associated with the panel: PE02, PE03, PE05, PE07.

Related SDG: 9.

Theme H.13: Healthcare technologies

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This research theme supports interdisciplinary research in the fields of engineering and systems sciences applied to new concepts, tools and health technology methods in the following areas:

- Instrumentation, detection systems and anatomical, functional, cellular and molecular imaging agents of medical interest and their integration in multiple systems;
- technologies associated with devices to improve the efficiency of screening, drug vectorisation, or bioproduction processes;
- the implementation of diagnostic and analytical systems (on-board sensors) and therapy in (or on) living organisms;
- biomaterials not related to regenerative medicine;
- the manufacturing processes and devices associated with organoids;
- in vitro diagnostic and analytical technologies, their implementation in living organisms, biomaterial aspects related to regenerative medicine;
- surgical technologies including remote surgery, related materials and devices, implantable devices, functional replacement devices and prostheses: advances may target the reliability, biocompatibility and performance of these technologies, miniaturisation, remote operability and increased energy autonomy. The development of these technologies may include modelling, simulation or implementation;
- technologies for e-health and in particular for measuring the exposome;
- disability compensation and autonomy.

PRCE projects taking into account the applications of the proposed research and their possible development are suitable for this theme.

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

Related key words: *medical devices, biosensors and monitoring instruments, medical imaging, stimulation tools, signal and image processing, biomaterials/biomechanics, home automation, home equipment, disability, e-health, medical IT, bioprinting, exposome, bioprocessing.*

ERC code associated with the panel: LS07.

Related SDG: 3, 9 10 and 12.

Digital Transformation

Theme H.14: Interfaces: mathematics, digital sciences – biology, health

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This theme supports interdisciplinary research projects between two major scientific fields, namely mathematics and digital sciences on the one hand, and biology and health on the other hand. The aim is to strengthen the cross-fertilisation of these two fields in order to highlight new concepts, models or methods in mathematics and digital sciences to accelerate research in the field of biology and health.

The projects submitted may focus on the following:

- the development of methods for the collection, extraction, management, securing, matching and exploitation - aid in decision-making - of extensive or heterogeneous data from various sources ranging from biology to medico-administrative health data bases (National Health Data System) and health data registries or any other source of personal health data for preclinical, clinical, population or epidemiological research, or for use in decision-making;
- analysis and modelling of data from omics approaches (transcriptomics, proteomics, etc.), structural biology, cell and tissue microscopy, imaging or e-health, and the virtual and augmented visualisation of these complex multi-modal, multi-scale, high-content data;
- signal processing and medical images for segmentation, extraction and characterization of the information contained, as well as the merger of multimodal, multiscale, morpho-functional information in order to increase biological knowledge and/or develop new approaches of medical interest.
- the modelling of biological and physiological processes and the simulation of simplified models allowing the development of predictive approaches to the quantitative and qualitative behaviour of the systems studied, as well as methods facilitating comparison with experimental data, in particular, data assimilation and automated learning approaches;
- the simulation of complex biological systems using scientific calculations, supercomputing and associated optimisation, immersive simulation (virtual and augmented).

A co-funding request by DGOS (General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.

Related key words: *big data in biology, large-scale automated learning and artificial intelligence for life sciences, aid in decision-making, predictive analysis, signal and image analysis and processing, modelling of biological processes, simulation in biology, emerging properties of biological systems, computational biology, bioinformatics, biomathematics, e-health, medical IT, bioproduction.*

ERC codes associated with the panel: LS01, LS02, LS03, LS05, LS07, PE01, PE06, PE07.

Related SDG: 3 and 9.

Theme H.15: Interfaces: digital sciences – Humanities and social sciences

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This theme supports interdisciplinary or transdisciplinary research actions related to the two main areas of "Digital Sciences" and "Humanities and Social Sciences".

This theme concerns both the application of digital concepts, methods and technologies in fields relevant for Humanities and Social Sciences (linguistics, culture, education, economics, psychology, sociology, geography, anthropology, history, literature, art, etc.) and, conversely, the study by Humanities and Social Sciences of digital objects (infrastructures, social networks, algorithms, artificial intelligence, software, etc.) but only where the cross-study benefits both fields.

The projects may relate to digital humanities or computational social sciences, or reflect on the challenges of digital objects, networks and devices provided that both disciplines seek to create significant spin-offs for Humanities and Social Sciences as well as digital sciences through strong, mutual interaction. Targeted progress may be more marked in one of the two fields (Humanities and Social Sciences or Digital sciences) provided that they mobilise concepts or tools from recent advances in the other field. Work that simply mobilises digital engineering or is limited to impact studies is therefore excluded along with research involving two types of disjointed tasks. On the contrary, the selected projects will have to mobilise an upstream, interdisciplinary approach in terms of research questions asked and research methods employed. The projects will be supported by an interdisciplinary partnership, bringing together researchers in digital science and technology and in humanities and social sciences.

Related key words: Educational staging, serious games and gamification, personalisation and adaptation to the learner, training in digital technologies, digital literacy, distance learning, co-learning, co-teaching, digital school and connected territory, immersive environment (school, classroom, tool), computer environments for human learning, cognitive approaches, sociological and anthropological approaches to learning from/through the digital, pedagogical innovation, digital and transformation of research and knowledge practices, access to publications and research data, credibility and verification of online information, media literacy, discourse and controversy analysis, cultural analysis, use of massive data and new analytical capacities, annotations and data enrichment, personal quantification, behavioural sciences, digital humanities, open data and linked data, digital approaches to heritage, natively digital heritage, knowledge modelling, access to information, cultural and digital mediations, virtual collections, immersive and nomadic devices, digital approach to artistic creation, digital/algorithmic governmentality, democracy and citizen debates in the digital context, public policy analysis via open data, computational social sciences, mathematical modelling of social systems, acceptability and appropriation of digital technologies, ethical digital, eco-design of digital technologies and services.

ERC codes associated with the panel: PE06, PE07, SH01, SH02, SH03, SH04, SH05, SH06, SH07.

Related SDG: 1, 4, 5, 8, 9, 10, 11, 16 and 17.

Theme H.16: Interfaces: mathematics, digital sciences – Earth system and environmental sciences

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The aim of this theme is to support innovative interdisciplinary research projects in the scientific context of the Earth system and the environment, aimed at developing new mathematical, physical and/or digital concepts and methods, up to and including their implementation on computing and data infrastructures, for: the modelling, theoretical analysis and simulation of multi-physical and multi-scale natural systems; the processing and analysis of large volumes of diverse data from observational or experimental systems and digital simulations.

The projects submitted may focus on the following themes in particular:

- FAIR services for the management, curation, security, access, interoperability and cross-fertilisation of distributed, heterogeneous and multi-sourced data (e.g. soil, sea, air, space, biodiversity, collection, experimentation, digital simulations), including scaling up and Cloud virtualisation.
- innovative methods, software architectures and workflows for processing, "smart" reduction and statistical analysis of massive data flows and volumes, in particular multi-source data, using artificial intelligence-type approaches in particular, and data processing logistics (in-situ and in-transit analysis)
- modelling, theoretical analysis and digital simulation in deterministic or stochastic frameworks, for the understanding and quantification of the development - using different time and space scales - of coupled systems (e.g. climate, solid earth-fluid envelope couplings, global change impacts, anthropisation and urbanised environments, hazards and risks) out of equilibrium, multi-physics and multi-scale, and their interactions, exploiting new physics-based artificial intelligence approaches in particular (e.g. parameterisation, emulation and surrogate models) and new supercomputing.
- assimilation, inferences, probabilistic inversions of multi-source and multi-resolution data (observation, experimentation, simulation) associated with complex and model spaces with large dimensions to understand the structures, composition and dynamics of the components of the Earth system and the environment, and their interactions, as well as the theoretical analyses used to qualify and justify their application.
- characterisation and quantification of extreme events and uncertainties in a probabilistic framework, and their integration through the different sources and scales of time and space involved in analytical methods, inference and data assimilation, multi-physics digital modelling/simulation, or artificial intelligence-type approaches.
- innovative methods and their theoretical analysis - e.g. combining data analysis, digital simulations and artificial intelligence - to improve the monitoring and assessment of telluric hazards (e.g. earthquakes, volcanic eruptions, landslides, tsunamis) along with climatic, environmental, anthropogenic events and space meteorology-related hazards, in isolation or in interaction;
- design of digital twins for the Earth system and the environment orchestrating digital modelling/simulation, analysis and assimilation of multi-source and multi-type data flows, as well as the logistics of these data through a continuum of digital infrastructures including the major national supercomputing centres;
- methods and services to integrate and present scientific information (data and model products) in forms that facilitate their use for decision-making by different stakeholders (e.g. agriculture, risk prevention and management, infrastructure, energy and health).

Expected projects should be innovative and address well-identified fundamental and methodological issues beyond a single discipline, and demonstrate the benefits of the proposed interdependent strategy of collaboration and cooperation between different disciplines.

Related key words: big Data, statistical data processing and analysis, theoretical modelling/analysis/numerical simulation of coupled, multi-physical and multi-scale systems, multi-source data assimilation and inversion, probabilistic and stochastic approaches, workflows and simulation packages, quantification of uncertainties and extreme events, large-scale automated learning, aid in decision-making, predictive analysis, monitoring and forecasting methods, data crossing and fusion, data management, data curation and FAIR services, database, visualisation and visual exploration of large datasets, data clusters, infrastructures, overall approaches.

ERC codes associated with the panel: PE06, PE07, PE10

Related SDG: 1, 4.

The transformation of socio-technical systems

Theme H.17: Global security, resilience and crisis management, cybersecurity.

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Thinking about the "global security" of societies implies embarking on the broadest disciplinary collaboration possible, from the understanding social and environmental phenomena through to prospective reflection on the changes in societies, threats and risks, and new applications via new technological devices (AI, blockchain, virtualisation, IOT, etc.).

In this perspective, this theme concerns research projects whose objectives are to characterise new forms of threats and risks, vulnerabilities, potential consequences on systems and therefore the risks inherent in societies (protection of the nation's vital interests, resilience, logistics, treatment of consequences); working on the prevention and protection of goods and people; developing the protection of infrastructures and networks as well as the protection of objects, data, content and software; managing crises and contributing to resilience; analysing the instruments, including legal and economic instruments, involved in the exercise of people's rights and freedoms.

The theme is open to any fundamental or targeted research, uni-disciplinary, multi-disciplinary or inter-disciplinary, leading to social, scientific or technological developments in terms of safety and security (prevention/anticipation/supervision/detection/reaction/remediation). Participatory research involving users (main/end users, other private security forces or contributors, municipal police, fire service, civil security, etc., NGOs, local authorities, vital stakeholders, etc.) is encouraged.

Proposals must be positioned with respect to four topics:

- the resilience of the nation and society, which includes risk identification, crisis management and remediation, regardless of origin: resilience of systems and methods, resilience of territories, training and educational approach, etc.
- the fight against terrorism and organised crime: analysis of the logic and mechanisms of action (violent radicalisation for example) and conduct research into new operational resources;
- the security of society and its individuals, in the areas where they live or move, consider public action perspectives to deal with crime and trafficking, respond to the phenomena

of urban violence, ensure events are held peacefully and monitor gatherings of a festive or democratic nature, etc.

- cybersecurity: freedom and security in cyberspace, coding and cryptography, formal methods for security, privacy protection, security of information systems, software and networks, security and multimedia data, security of hardware systems, secure collaborative work tools, secure digital identity, combating cybercrime (ransomware, malware analysis, etc.), human factors and cybersecurity;
- protection of critical infrastructure and societal resilience against physical and digital threats to sensitive sites, critical equipment and networks and the correct functioning of society; protection of public spaces; surveillance of sovereign spaces.

Associated keywords :

Cybersecurity: *cybersecurity of networks, information systems, data, software and embedded systems, intrusion detection, detection and mitigation of vulnerabilities, protection against attacks, secure communications, protection of personal data, system engineering for physical and digital protection;*

Global security: *hybrid threats, security forces equipment, evidence management, rescue to people, security of establishments and places open to the public, transport, protection of public spaces, surveillance of maritime, land and air spaces, resilience of systems, protection of activities of vital importance, fight against the Nuclear-Radiological-Biological-Chemical-Explosive (NRBCE) threat, activity continuation plan (digital physics, logistics flows, information flows, etc.)*

Social Sciences and Humanities: *ethical and legal security by design, exercise of the protection of freedom, disinformation detection, public and international policies, sociology of organisations, social and cultural modelling, national security, global security, secure/non-secure societal transitions.*

ERC codes associated with the panel: LS07, LS09, PE01, PE02, PE03, PE04, PE05, PE06, PE07, PE08, SH01, SH02, SH03, SH04, SH06, LS2.

Related SDG: 9, 16 and 17.

Theme H.18: Transport and mobility, constructions in urban and peri-urban areas

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The research expected in this area must explore the solutions by which urban territories, considered on all scales - from buildings to urban systems - transport, housing, and users, will be able to face environmental challenges through sustainable development.

This research should help to evaluate and improve the performance of buildings, transport and territories, and to develop sustainable alternatives. This research must be conducted with a view to reducing pressures on the environment and adapting to future disruptive or incremental changes, including climate change, but also demographic or territorial transitions, for instance. Particular attention is paid to advances in digital science and technology to support and promote this transition, based on modelling, data exploitation and the development of digital solutions. Questions of governance and the development of public policies, legislation and new economic models, which will be involved in the management and transformation of urban systems, can also be integrated into the projects, by mobilising the relevant expertise in social sciences and humanities.

It will essentially involve participating, through the implementation of integrated multi, inter or transdisciplinary integrated approaches to the development of methodological or technological

solutions. It will provide, in particular, the knowledge and understanding needed to analyse, measure, diagnose, help design, build, rehabilitate or renew urban systems, intra- and extra-urban transport systems and the existing built environment. International comparisons are welcome. Particular interest may be shown in systemic approaches, which facilitate the integration of societal, environmental and technical processes and promote understanding in terms of their interactions, complexity and dynamics.

In addition to companies, the participation of stakeholders such as local and regional authorities is encouraged.

The scope of this theme covers the following three areas:

- sustainable urban systems and their components: equipment, infrastructure, uses and practices, access and practices; quality of the urban environment, reasoned and integrated use of the urban soil and subsoil, integrated approach to energy in the city, urban climate (heat island, etc.), nature in the city, urban agriculture, ecosystem services, urban flows and metabolism and the circular economy (the city as a resource), industrial ecology and synergies between urban and industrial territories, access to resources (water, energy, food), mutualisation of energy and material flows, reuse and recycling of waste, reconversion of urban wasteland and fight against artificialisation.
- sustainable construction: buildings (new and old), low-carbon area or districts, healthy and with low environmental impact (use of materials with less impact on natural resources, in particular, and that are easily recyclable), energy renovation, sustainable construction and management of heritage buildings and infrastructures;
- transport and mobility: transport safety and security, mobility and driving aids, autonomous vehicles, smart and interconnected transport systems, multi-modality.

and with interdisciplinary topics:

- networks and services: passenger and freight transport networks and services, digital networks and services, urban (e)services, urban engineering (water, sanitation, waste, energy, etc.);
- vulnerabilities and resilience, change and adaptation to change and to 'shocks' or crises;
- town planning, urban morphologies, in relation to mobility or accessibility to services.

Related key words: *quality of the urban environment (air, water, soil, subsoil, landscapes, noise, pollution, etc.); rational and integrated use of urban soil and subsoil; integrated approach to energy in the city; fight against artificialisation; ecosystem services in the city; urban metabolism; urban climate; vulnerabilities and resilience of socio-technical systems; low-carbon and low environmental impact buildings, blocks, districts, city; energy and environmental renovation; civil engineering; construction; management and rehabilitation of existing heritage; infrastructure; urban engineering; port areas; sustainable mobility; inter- and multi-modality; transport safety and security; driving aids; autonomous vehicle; connected vehicle; passenger transport networks and services; urban logistics, IoT (Internet Of Things); urban services; e-services; urban data; smart cities; smart transport systems.*

ERC codes associated with the panel: LS08, LS09, PE01, PE02, PE03, PE06, PE07, PE08, PE10, SH01, SH02, SH03, SH04, SH06, SH07.

Related SDG: 1, 3, 4, 6, 7, 9, 10, 11, 12, 13, 14, 15, and 16.

Theme H.19: Industry and factory of the future: People, organisations, technologies

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This research theme is open to fundamental research projects and to projects with an industrial purpose to design and implement the factory of the future. The expected projects must help remove scientific and/or technological obstacles in one of the following three break-through themes:

- supporting, understanding and boosting the development of new digital or manufacturing technologies to meet the demand for innovative personalised and optimised products,
- promoting a systemic vision and organisation of the factory for a development process that considers the whole product life cycle and value chain dimensions.
- focus the factory on people who stay at the centre of operations whereas the work organisation becomes more flexible. It is also necessary to address production challenges while reducing the cognitive and physical workloads of operators.

These disruption themes are divided into seven topics:

- people in new productive organisations,
- smart, connected, controlled factories,
- virtual factories,
- flexible and agile factories,
- green and socially responsible factories,
- robotics for industrial performance, human-robot collaboration in production systems (technological, organisational and legal aspects),
- new production and control technologies.

The expected projects must come under these topics. They can be from different communities including engineering sciences, information and communication sciences and technologies, system sciences, human and social sciences etc.

Cross-disciplinary proposals taking technological and human aspects into account are strongly encouraged, as they are likely to lead to a significant breakthrough in the design of future production systems. Finally, exploratory research proposals for the factory of the future are especially welcome in this panel.

Related key words: *adaptation-resistance and change support, decision aids, operator assistance, logistics chain and networks, cobots, rapid configuration, diagnostics, eco-design, eco-efficiency, industrial ecology, circular economy, economy of functionality, local eco-system, cognitive ergonomics, fab-lab, cognitive engineering, management and evaluation of the life cycle of product-service systems, systems engineering, frugal innovation, industrial innovations, innovative measurement and control instrumentation, integration of additive manufacturing, human-machine interaction, internet of things, predictive and anticipatory maintenance, optimisation and operational research, work organisation, customisation of products and services, sustainable processes and services, energy and resource efficient production, products, augmented reality, virtual reality, recycling, regulation of individual or collective activity, manufacturing robotics, cyber-physical systems, control command learning techniques, innovative manufacturing technologies, theory of industrial innovations, manual labor.*

ERC codes associated with the panel: LS05, LS06, LS07, PE01, PE02, PE06, PE07, PE08, SH01, SH02, SH03, SH04.

Related SDG: 8, 9, 10 and 12.

H. Appendices

Appendix 1: Reminder of the definitions

Project: Project: fundamental or applied research work and/or feasibility study(s) as defined by the European Regulations, which are the subject of the Assistance and carried out by the Beneficiary and the possible Partner(s). The Project is described in the scientific document (in its latest version) communicated to the ANR.

Grant: sum granted by the ANR to a Beneficiary in the form of a subsidy for the implementation of a research and development Project.

Beneficiary: Legal entity recipient of the Grant Co-contracting partner of the ANR, Research Organisation or Company, as defined below, identified in the special terms and conditions.

Partner: Research organisation and/or Company (as defined in the European Regulation), legal entities, contributing to the realisation of the Project.

Coordinator Partner (when a Project is carried out in collaboration with several Partners) or coordinator: Partner responsible for the scientific and technical coordination of the Project, for setting up and formalising the cooperation between the Partners, for producing some of the Project Deliverables, for holding progress meetings and for communicating the results. He/she is named in the special terms and conditions together with the scientific leader.

Scientific leader(s) or partner's scientific leader: the natural person responsible for the scientific implementation of the Project on behalf of the Partner(s) and named in the special terms and conditions.

Research organisation and dissemination of knowledge: the term "Research organisations" should be understood in the sense of the definition in point 1.3 ee), d) of European Commission Framework No. 2014/C 198/01 of 27 June 2014. This is an entity, such as a university, research institute, technology transfer agency, innovation intermediary or any real or virtual collaborative entity focused on research, regardless of its legal status (public or private organisation) or its mode of financing, whose objective is to carry out basic or applied research activities or to disseminate widely the results of these activities by means of teaching, publications or knowledge transfer. Where such an entity also carries out economic activities, the funding, costs and revenues of those economic activities should be recognised separately. Undertakings that may have influence over such an entity, for example as a shareholder or member, do not have privileged access to its research capabilities or results.

Enterprise: the term "enterprise" includes large enterprises, small and medium-sized enterprises (SME). The definition of small and medium-sized enterprises (SMEs) is that given in Article 1 of Annex 1 of European Commission Regulation (EC) No 651/2014 of 17 June 2014 and is contained in European Commission Recommendation 2003/ 361/EC of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises and any successor Community texts. According to the European Regulation, a company is any entity, regardless of its legal form, carrying out an economic activity. The following are considered to be companies: corporations, commercial companies, civil companies, entities carrying out a craft activity or

other activities on an individual or family basis, partnerships or associations that regularly carry out an economic activity within the meaning of the European Regulation.

Fundamental research: experimental or theoretical work undertaken primarily to acquire new knowledge about the basis of phenomena or observable facts, with no direct practical application or use in view.

Industrial research: Planned research or critical investigations aimed at acquiring new knowledge and skills with a view to developing new products, processes or services or to bring about a significant improvement in existing products, processes or services. It includes the creation of components of complex systems necessary for industrial research, in particular for the validation of generic technologies, excluding prototypes referred to in the definition of experimental development below.

Experimental development: the acquisition, combination, shaping and use of relevant scientific, technological, commercial and other knowledge and techniques to develop new or improved products, processes or services. This may include other activities aimed at conceptualising, planning and documenting new products, processes and services. Experimental development may include prototyping, demonstration, pilot development, testing and validation of new or improved products, processes or services in environments representative of real-life conditions, where the primary objective is to provide additional technical improvements to products, processes or services that are not substantially "fixed". The creation of commercially viable prototypes and Pilot Projects is experimental development when the prototype is necessarily the final commercial product and when it is too expensive to produce for demonstration and validation purposes only. In the event of subsequent commercial use of Demonstration or Pilot Projects, any revenue from such use must be deducted from the eligible costs.

Experimental development does not include routine or periodic changes to existing products, production lines, manufacturing processes, services and other ongoing operations, even though these changes may represent improvements.

Appendix 2: Summary of the principal characteristics of the funding instruments of the 2022 Generic Call for Proposals.

This appendix does not replace the AAPG 2022 Guide which describes in detail the expectations and rules governing eligibility for various funding instruments, the main characteristics of which are presented below. Applicants are requested to read this guide carefully.

1. Young Researchers Instrument (JCJC)

The goal of the JCJC funding instrument is to prepare the new generation of talented young researchers destined to become the future leaders or directors of French scientific research. This involves encouraging young researchers to take responsibility by tackling scientific or technological barriers using innovative approaches.

The instrument thus aims to enable the young researcher to acquire scientific autonomy, to develop his or her own research theme, to set up or consolidate his or her own team within or outside the laboratory, to acquire a project-based research culture and to express rapidly his or her capacity for innovation. It is also a springboard for young researchers who, thanks to initial support from the ANR, will find it easier to consider submitting a proposal in response to calls from the European Research Council (ERC), with a better chance of success.

Targeting the individual, this instrument provides funding for the young researcher's team only.⁴² This instrument is open solely to researchers from research and knowledge dissemination organisations or institutions eligible for ANR funding.⁴³ It is not open to non-holders and cannot be used to fund the coordinator's salary.⁴⁴

To be classified as “Young Researchers” applicants **must have defended their doctoral thesis** (or obtained any degree or qualification equivalent to an international PhD) **less than 10 years ago** (i.e. after 1st January 2011).⁴⁵

*For the 2022 version, researchers are eligible for the “young researcher” instrument only for a period of 5 years after taking up a position in a knowledge spillover and research organisation or facility laboratory eligible for ANR funding.*⁴⁶

As from the 2022 AAPG, funding under the “Young Researchers” (JCJC) instrument can only be obtained once in one’s career.

It is not possible to combine JCJC funding with a similar type of funding⁴⁶:

2. Single-team research projects (PRME)

The “single-team research project” (PRME) funding instrument is intended specifically to fund a single team or a single laboratory (if the latter is not organised in teams) from research and

⁴² Changing the coordinator is not allowed during the project.

⁴³ Young researchers eligible for the JCJC instrument (who have defended their theses and taken up their position within the set time frames) are not obliged to submit this instrument and may submit them under the PRC, PRCE or PRCI instruments if the composition and size of the projects justify this.

⁴⁴ In the sense of holders of a current (or future) contract linking them to the supervisory authority. The contract may not have started before the agreement. See the new eligibility rules in the 2022 AAPG Guide.

⁴⁵ Conditions apply for exceptions [maternity/paternity leave, parental leave, long-term sick leave (more than 90 days), national service, etc.]. The limit can also be extended for women by one year per dependent child. Where appropriate, supporting documents must be provided when the pre-proposal is submitted.

⁴⁶ Inserm ATIP-Avenir, CNRS Momentum, the City of Emergence programme, funding from the European Research Council (ERC) or other funding such as JCJC etc.

knowledge dissemination organisations or institutions eligible for ANR funding. Only the coordinator's team or the laboratory is funded under a single-team research project.

A PRME project corresponds to research targeting scientific objectives with outstanding ambition and ground-breaking dimensions. The PRME is coordinated by a leader of a team already formed or a laboratory that offers all the skills and know-how necessary to achieve these ambitious and innovative objectives. The applicant team or laboratory must justify its sustainability over the duration of the project in its application package.

In the framework of a PRME, strong commitment from the coordinator is expected (*at least 40% FTRP*). The team will also have to provide evidence that *at least 2* of the participants identified in a PRME project have FTRP.

In this context, funding under a PRME by the ANR is not compatible:

- with funding obtained from the ERC by the coordinator submitting the PRME;
- with funding from another agency or other funding body, foundation or association (e.g. "FRM Team" funding from the Foundation for Medical Research (FRM)).

A change of coordinator will not be authorised during a PRME.

Therefore, given these expectations and rules, as part of 2022 APGG, a PRME coordinator cannot:

- submit a JCJC, PRC, PRCE, PRME or PRCI project as a coordinator during the two first years of the PRME project;
- be involved as a scientific and technical leader for a PRC, PRCE or PRCI partner in the framework of the 2022 AAPG.

Moreover, throughout the duration of the PRME, participants in a PRME project cannot submit another PRME or participate in another PRME.

Applicants should make sure in particular not to lodge a project that could be considered a collaborative project. As such, a project lodged by several teams from the same laboratory must be considered as a collaborative research project (PRC) and not a PRME.

Researchers who wish to submit a PRME are requested to comply with these eligibility and project construction rules which are also in the 2022 AAPG Guide.

3. Funding instruments dedicated to collaborative research (PRC, PRCE, PRCI)

Collaborative projects set out to achieve scientific or technological results by pooling the skills and resources of various public or private, national or international research teams or groups.

By facilitating collaboration, the grants expedite proposed research. These instruments encourage research teams to work on projects for which collaboration provides added scientific value, either by making research possible, or by paving the way for more ambitious or higher quality results. Interdisciplinary or multidisciplinary research is encouraged under these collaborative instruments.

A collaborative project is coordinated by a coordinator partner (also called coordinator) who acts on behalf of all partners (at least two) making up the consortium. A scientific manager is appointed for each partner.⁴⁷

⁴⁷ See: Appendix 1 - Definitions (page 19 and 20) in the ANR Financial Regulation. <https://anr.fr/fr/rf/>

3.1. Collaborative Research Projects (PRC)

The "Collaborative Research Project" (PRC) funding instrument is the ANR's main funding instrument. This instrument includes all forms of multi-partner research projects other than those covered by the PRCI and PRCE instruments.

It involves at least two partners⁴⁸ from research and knowledge dissemination organisations and institutions eligible for ANR funding. Collaborations using own funds are possible, particularly in the case of foreign team(s) from countries not eligible for the PRCI (§C.3-2), in which case the consortium must contain at least one team from research and knowledge dissemination organisations or institutions eligible for ANR funding.

3.2. International Collaborative Research Projects (PRCI):

ANR works in collaboration with research funding agencies in other countries and proposes agreements to its supervisory ministry designed to facilitate collaboration between the teams in these different countries. These bilateral agreements, which may cover targeted themes or be open to all research themes funded by the ANR, are focused on priority objectives or geographical areas for limited periods of time, with the exception of the special case of Franco-German cooperation (Elysée Treaty, revised in 2019 in Aix-La-Chapelle).

Depending on circumstances, the objectives of these agreements are to:

- accelerate and develop the collaboration of French researchers with the best international teams on key themes;
- promote partnerships with emerging countries based on themes of mutual interest and shared benefit;
- foster the emergence of transnational teams of excellence by enabling research to be conducted and shared at the optimum global level.

For agreements targeted on specific themes, ANR and its partner agencies aim to renew the theme over two to three years in order to strengthen collaborations and encourage the emergence of quality projects.

The "International Collaborative Research Projects" (PRCI) funding instrument is specific to those bilateral collaborations that are established between at least one French partner (a laboratory of a research and knowledge dissemination organisation or institution eligible for ANR funding) and at least one foreign partner (eligible for funding from a foreign funding agency which has signed a bilateral agreement with ANR).

Strong synergy is expected between the two partners submitting their proposals and should result in complementarity of scientific contributions from each country and a precise identification of real scientific coordinators of projects in each country. For the 2022 Work Programme, the countries involved in these bilateral agreements will be (subject to confirmation):

- *In Europe: Germany, Austria, Luxembourg and Switzerland.*
- *Worldwide: Brazil, Quebec, the United States, Hong-Kong, Russia, and Taiwan.*

Appendix 3 (below) gives details of the research issues and themes covered by these

⁴⁸ A PRC can involve two teams from a same laboratory, with each one then considered to be a partner in the collaborative project. This is not a PRME in this case ([§C.2](#)).

collaborations.⁴⁹ In addition to the agreements linked to the PRCI instrument of the Generic Call for Proposals, bilateral agreements that are strategic for the State are subject to specific calls for proposals. These calls, which reflect a shared ambition with partner agencies, have their own budget and, in most cases, special evaluation and selection criteria.

Information on these specific international collaborations is available on the ANR website and update regularly as negotiations progress.

3.3. Collaborative Research Projects involving Enterprises (PRCE)

The “Collaborative Research Projects involving Enterprises” (PRCE) funding instrument is specific to collaborations that are established between at least one laboratory of a research and knowledge dissemination organisation or institution eligible for ANR funding) and at least one business or commercial company involved in R&D.⁵⁰ The project may be coordinated by the public partner or the private partner.

These projects aim to achieve jointly research results that will benefit both parties, by allowing public or private laboratories of research or knowledge dissemination institutions to address new research questions, or to approach them differently, and by giving companies access to better public research in order to improve their capacity for innovation in various ways.

⁴⁹ List drawn up on the date of publication of the 2022 WP and likely to be completed or amended: applicants are invited to consult the ANR website regularly. Country-specific appendices (available on the ANR web page on the Generic Call for Proposals) describe the eligible themes and the special procedures for submission and selection. They describe additional conditions for eligibility for the Generic Call for Proposals and must therefore be consulted before any submission to the ANR or to the foreign partner.

⁵⁰ For the definition of a business or commercial company, see: Appendix 1 - Definitions (page 19 and 20) in the ANR Financial Regulation. <https://anr.fr/fr/rf/>

Appendix 3: Evaluation Panels in conjunction with bilateral collaborations within the Generic Call for Proposals 2022: International Collaborative Research Project - (PRCI)

Country (agency)	Collaboration themes	Lead Agency	Scientific areas concerned
Brazil (FACEPE)	<ul style="list-style-type: none"> • Mathematics and digital sciences • Humanities and social sciences • Materials • Engineering, chemistry, physics • Environment and biological resources 	-	Themes A.1 to A.4; B.1 to B.6; D.1 to D.7; E.1 to E.6; F.1; G.1 and G.2; H.1 and H.2 ; H.4 to H.7; H.11; H.12; H.14 to H.16; H.19
Brazil (FAPESP)	<ul style="list-style-type: none"> • Mathematics and digital sciences • Humanities and social sciences • Materials • Engineering, chemistry, physics • Environment and biological resources 	ANR	Themes A.1 to A.4; B.1 to B.6; D.1 to D.7; E.1 to E.6; F.1 ; G.1 and G.2; H.1 and H.2; H.4 to H.7 ; H.11 and H.12; H.14 to H.16; H. 19
Canada–Quebec (FRQSC)	Being updated	ANR	Themes D.3 and D.4
United States (NSF)	<ul style="list-style-type: none"> • Biophysics • Digital sciences • Mathematics and its interactions 	(NSF)	Themes B.1; C.2 to C.4; H.14
Hong Kong (RGC)	All disciplinary fields funded by ANR and RGC	-	Themes E.1 to E.6; F.1 ; H.12 and H.14
Russia (RSF)	Being updated	-	All except theme H.17
Singapore (NRF)	Suspended in 2022	-	Themes A.1; D.6 and H.3
Taiwan (MOST)	All disciplinary fields funded by ANR and MOST	-	-
Germany (DFG)	All disciplinary fields funded by ANR and DFG, except Humanities and social sciences**	DFG	All except HSS scientific themes
Austria (FWF)	All disciplinary fields funded by ANR and FWF	FWF	All
Luxembourg (FNR)	All disciplinary fields funded by ANR and FNR	ANR	All
Switzerland (FNS)	All disciplinary fields funded by ANR and FNS	FNS	All

*Scientific themes relating to the 2022 Generic Call for Proposals.

** Humanities and social sciences are subject to a specific call for proposals outside the AAPG.