

# Generic call for proposals 2024

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## Step 1

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

**Thursday 19 october 2023 at 5:00 PM (Paris Time)**

## Step 2

CLOSING DATE FOR THE SUBMISSION OF FULL PROPOSALS

The closing date to submit full proposals is set for end of March 2024. The exact date and time will be specified if you are invited to submit a full proposal (end of February 2024).

***In case of any difference of interpretation, the French version of the present document shall prevail.***

*It is important to carefully read this document in full, as well as the 2024 AAPG Guide (which will be available on the ANR's website in September 2023) and the regulations on the conditions of allocation of ANR funding, before submitting a (pre)-proposal for a research project. (<http://www.anr.fr/RF>).*



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## A. Context and objectives of the 2024 Generic Call for Proposals (2024 AAPG)

*The 2024 Generic Call for Proposals represents the "Research and Innovation" component of the ANR's 2024 Work Programme.* It is open to all scientific communities and all public or private stakeholders involved in French research, including small and medium-sized enterprises (SMEs) and very small enterprises (VSEs). It is designed to give researchers in various scientific fields access to co-funding in a large number of research themes, targeted research or not, in addition to their allocated recurrent funding. The AAPG applies to all types of research (fundamental and industrial research, and experimental development <sup>1</sup>, cf. [Appendix 1](#)).

The "*Research and Innovation*" component of the ANR's 2024 Work Programme, covered by the 2024 AAPG, has been structured into **56 research themes**:

- **37 research themes** are introduced in 7 scientific fields:
  - Environmental Sciences (4 themes)
  - Materials and Engineering Sciences (6 themes)
  - Life Sciences (11 themes)
  - Humanities and Social sciences (7 themes)
  - Digital Sciences (6 themes)
  - Mathematics and its interactions (1 theme)
  - Subatomic Physics, Universe and Earth Sciences (2 themes)
- **19 research themes** corresponding to cross-cutting issues integrating the challenges of several scientific fields, divided into 7 cross-cutting areas:
  - Sustainability Science (1 eponymous theme)
  - Digital transformation (3 themes)
  - One Health (3 themes)
  - Ecological and environmental transition (3 themes)
  - Energy transformation (2 themes)
  - Technological transitions (4 themes)
  - Transformations of socio-technical systems (3 themes)

*Each research theme has its own Scientific Evaluation Panel (CES).*

When submitting a project (pre-proposal or registration), researchers must choose their research theme, and, consequently, the scientific evaluation panel that is most in line with the scientific objectives of their project. These are detailed by major scientific field or cross-cutting area in [§ G](#).

Particular attention will be paid to the entire research continuum, in terms of "disciplinarity" (mono-, multi-, inter- and transdisciplinarity), especially within the cross-cutting research themes covered by several disciplinary fields.

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<sup>1</sup> All types of proposals are possible: proposals with unprecedented objectives or concepts, breakthrough or exploratory proposals, proposals aiming to remove scientific obstacles well known to the community, proposals exploiting data generated by research infrastructures, proposals resulting from previous proposals and intended to consider new objectives.

To further improve its evaluation processes and support the entire continuum, the ANR considers the interdisciplinarity or transdisciplinarity in the projects through the composition of its panels and peer review procedures.

The 2024 Work Programme also includes strategic priorities<sup>2</sup> set by the French Government and the implementation of governmental plans such as Artificial Intelligence; Social Sciences and Humanities; Quantum Technologies; Mathematics; Autism in Neurodevelopmental Disorders; Translational research on Rare Diseases, and Scientific exploitation of data generated by OSIs and IRs<sup>3</sup>. These priorities are detailed in the scientific themes and will revolve, if required, around the "France 2030 Investment Plan" and the "Priority Research Programmes and Equipment" (PEPR), under the directed component of the 4th Investments for the Future Programmes (PIA4).

## **B. Submission, evaluation and funding of projects under the 2024 AAPG**

*The Generic Call for Proposals is open to all tenured researchers<sup>4</sup> belonging to a public or private research organisation, institution or laboratory<sup>5</sup> eligible for ANR funding.<sup>6</sup>*

### **B.1. Funding instruments**

The 2024 AAPG uses a set of instruments to fund:

- either individual research projects coordinated by young researchers (**JCJC**),
- or single-team projects (**PRME**),
- or collaborative research projects between public or similar<sup>4</sup> entities in a nationally (**PRC**) or internationally (**PRCI**) and between public (or similar<sup>4</sup>) and private entities that may provide an opening towards the business community (**PRCE**).

Proposed under the Generic Call for Proposals, these five funding instruments each have their own specific characteristics in terms of submission and evaluation procedures. The characteristics and expectations of these various funding instruments are summarised in the 2024 Work Programme, listed in Appendix 2 and detailed in the 2024 AAPG Guide.<sup>7</sup>

The 2024 AAPG Guide also serves as a reference for researchers wishing to submit a proposal, for peer reviewers and panel members, in terms of submission, evaluation and selection or funding of projects.

*When submitting a project (pre-proposal or registration), researchers will have to choose the funding instrument and the scientific theme best suited to the objectives of their project.*

*Applicants are invited to read carefully the 2024 AAPG guide (available in September 2023) and the scientific content of the themes provided in [§C](#).*

*They will also define their role in the project: scientific coordinator, partner's scientific manager, or*

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<sup>2</sup> Each priority is broken down in one of more scientific themes of the Work Programme and its Generic Call for Proposals (see the full description of these scientific themes in the Generic Call for Proposals).

<sup>3</sup> The list of international scientific organisations (OSIs) and research infrastructures\* (IRs\*), previously named very large research infrastructures is provided in Appendix 5.

<sup>4</sup> Insofar as they are currently under contract (or will be) with the managing authority. The contract may have not started before the agreement. The salary of the coordinator and scientific project managers of each partner team are not eligible for ANR funding.

<sup>5</sup> For private entities: with an institution or branch in France.

<sup>6</sup> See Funding Regulations: <https://anr.fr/en/funding-regulations>.

<sup>7</sup> The document will be available on the ANR website and the [2024 AAPG web page](#) in September 2023.

participant (cf. [Appendix 1](#)).

- **The project coordinator<sup>8</sup>, the funding instrument and scientific theme** defined when the pre-proposal for a PRC, PRCE, PRME or JCJC is submitted or a PRCI is registered with the ANR, or a PRCI is registered with a foreign agency acting as the Lead Agency **cannot be changed during the evaluation and selection process** (especially between stages 1 and 2 of the process).

## B.2. Submission rules for the 2024 AAPG

*Failure to comply with the rules listed below will result in all the projects involved being deemed ineligible.* Therefore, project coordinators must check with their project partners that they indeed comply with these rules.

- **A coordinator of a JCJC project** currently funded by the ANR **cannot act as coordinator for another JCJC, PRC, PRCE, PRME or PRCI project** under the Generic Call for Proposals or the French-German call in Social Sciences and Humanities (FRAL SSH), regardless of the edition, while the initial JCJC project is underway<sup>9</sup>. However, he/she may be involved in a proposal submitted for the 2024 version (PRC, PRCE, PRME, PRCI, FRAL SSH).
- **A coordinator of a JCJC project** selected for funding during a previous edition and now closed **cannot act as coordinator for a new JCJC project submitted under the 2024 AAPG**. Coordination of a JCJC project is now limited to once throughout a career.
- **A coordinator or member of a PRME project** currently funded by the ANR **cannot act as coordinator or member of another PRME or JCJC project over the duration of his/her PRME project**.<sup>10</sup>
- **A researcher may submit only one PRME, PRC, PRCE or PRCI project as project coordinator and may not be involved (as coordinator or partner's scientific manager) in more than 3 PRME, PRC, PRCE or PRCI projects** submitted to ANR (including foreign PRCI Lead) under the 2024 Generic Call for Proposals or under the French-German Call in Social Sciences and Humanities (FRAL SHS) outlined in the 2024 Work Programme.<sup>11</sup>
- **A coordinator of a PRC, PRCE, PRCI (including foreign PRCI Lead), PRME or JCJC project funded under the 2023 Generic Call for Proposals may not submit, as coordinator, a PRC, PRCE, PRCI, PRME or JCJC project for the 2024 Generic Call for Proposals.** However, he/she may act as a partner's scientific manager or be otherwise involved in a PRC, PRME, PRCE or PRCI project submitted for the 2024 edition.

*The aforementioned rules apply to phase 1 PRCI registrations and PRCIs 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*

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<sup>8</sup> This rule applies except in the event of *force majeure*. A specific authorisation request must be sent to the ANR and explain the *force majeure* requiring a change of project coordinator.

<sup>9</sup> Submission as project coordinator is authorised in the final year of a JCJC project, provided that the ongoing project is completed by the date on which the new project is agreed, i.e., no later than 31/12/2024.

<sup>10</sup> Submission as project coordinator is authorised in the final year of a PRME project, provided that the ongoing project is completed by the date on which the new project is agreed, i.e., no later than 31/12/2024.

<sup>11</sup> For the 2024 edition, this exclusion rule does not apply to proposals submitted outside the Generic Call for Proposals and outside the French-German Call in Social Sciences and Humanities (FRAL SSH). However, the scientific objectives of the proposals submitted should not be nearly identical. (See the eligibility rule on the uniqueness of the proposal in the 2024 AAPG Guide).



*Lead agency cannot act as coordinator of a separate PRC, PRCE, PRME or JCJC project submitted under the 2024 AAPG, regardless of the outcome of the stage 1 evaluation for that PRC, PRCE, PRME or JCJC project. This also applies to the French-German Call in Social Sciences and Humanities (FRAL SSH) outlined in the 2024 Work Programme.*

### B.3. Eligibility of proposals

The ANR reviews the eligibility of the proposals throughout the submission, evaluation, selection and funding process, based on the submission rules for the 2024 AAPG (see § B.2 above) and the eligibility criteria outlined in the *2024 AAPG Guide* and the ANR's funding regulations.

**Applicants should carefully read these documents and the eligibility rules that apply when submitting a proposal**, particularly for JCJC and PRME instruments (Appendix 2 and 2024 AAPG Guide).

### B.4. Processes and commitments when submitting a proposal

Each scientific coordinator applying for a grant formally declares that his or her superior (namely their unit directors, the relevant administrative and financial departments and persons authorised to legally represent the institution managing the grant, or its representatives) has approved the current submission procedure, and that the information regarding the application has been communicated to him/her. The ANR may send the list of submissions registered to laboratory directors and administrative officers of the managing institutions for projects that concern them.

During the submission phase, the scientific coordinator and all eventual partners undertake to comply with the French National Code for Research Integrity and the ANR's Code of Ethics and Scientific Integrity.<sup>12</sup>

Moreover, particular attention will be paid, where relevant, to considering the sex and/or gender aspect in the research project submitted, regardless of the field, in terms of scientific or methodological approaches.

When submitting a proposal, applicants will be asked to comply with the obligations arising from the Nagoya Protocol and the ANR's Open Science policy (see § D).

Project participants are invited to provide their ORCID ID<sup>13</sup> and the RNSR number of their host laboratory online.<sup>14</sup>

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 submission website before the closing date and time of the call (cf. page 1).

The 2024 AAPG Guide provides details on the elements to be included in the scientific document.

The scientific proposal should not exceed 4 pages (including the bibliography, figures and

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<sup>12</sup> The document is available at <https://anr.fr/en/anrs-role-in-research/commitments/scientific-integrity/>

<sup>13</sup> ORCID is a non-profit organisation supported by a global community consisting of institutional members, including research organisations, editors, funding agencies, professional associations and other stakeholders in the research ecosystem. For more information: <https://orcid.org>.

<sup>14</sup> <https://appliweb.dgri.education.fr/rnsr/>. Please follow the outlined procedure if you do not have a RNSR number.

references) for a pre-proposal, and 20 pages (including the bibliography,<sup>15</sup> figures 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 (cf. page 1).

*Any incomplete application by the closing date and time of the call (cf. page 1) will be ineligible.*

## **B.5. Project selection**

The project selection conducted by the ANR is based on the peer-review principle. The ANR's selection process includes the organisation of panels and mobilises peer-reviewers beyond these panels.

Scientific Evaluation Panels (CES) consist of highly qualified French or foreign scientists from the relevant research communities. They are in charge of evaluating pre-proposals or full proposals, with the help of external peer reviewers, exceptionally in stage 1 and systematically in stage 2.

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-chairs<sup>16</sup> who help the chair prepare for and conduct the panel's work. A scientific project manager assists the chair-representative and his/her board before and during panel meetings, but is not involved in debates or the appointment of peer reviewers. The scientific project manager is responsible for managing conflicts of interest and personal connections.

The experts in the theme(s) covered by the proposal provide written evaluations of one or more pre-proposals or full proposals, but do not attend panel meetings. Experts operate individually and confidentially, without any discussion with third parties and no access, in the event of a re-submission, to any previous evaluation of the project. They are provided only with the elements constituting the pre-proposal or full proposal, as completed and submitted online by the closing date and time of the call.

*The provisions of the ANR's Ethics and Scientific Integrity Charter apply to anyone involved in the project selection process.*

The evaluation and selection process<sup>17</sup> for projects submitted under the 2024 Generic Call for Proposals follows a two-stage procedure. The provisional timetable for the submission, evaluation and selection process can be found on the ANR website (cf. 2024 AAPG Guide).

The stage 1 evaluation process (excluding PRCI proposals, which are only registered<sup>18</sup>, except for PRCI projects where a foreign agency is the Lead Agency) involves the Scientific Evaluation

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<sup>15</sup> Since the 2019 edition, the CVs of the project coordinator and its partners may include preprints (<https://en.wikipedia.org/wiki/Preprint>) yet to be published in peer-reviewed scientific journals. In addition, the ANR encourages the applicant to list preprints, particularly to reference preliminary data.

<sup>16</sup> There are one to three vice-chairs, depending on the size of the panel.

<sup>17</sup> The selection process for the Generic Call for Proposals was ISO 9001 certified in May 2018 (renewed in 2022).

<sup>18</sup> For the PRCI instrument, stage 1 of the 2024 Generic call for proposals submission process is for registration only. All PRCI applications registered by the ANR in stage 1 are invited to submit a proposal for stage 2, except if the project registered was deemed ineligible (particularly under dual coordination, see § B.2). When the PRCI is funded by a foreign agency acting as the Lead agency, project submission must be conducted in accordance with the conditions defined by that agency and are not subject to registration by the ANR in stage 1. However, submission rules still apply (§ B.2).

Panel identifying PRC, PRCE, PRME and JCJC pre-proposals for which drafting a full proposal may be justified by their scientific excellence and ambition (decisive criteria; see § E and the AAPG Guide).<sup>19</sup>

*Note: The 2024 AAPG procedure helps consider the “memory effect” between two AAPG editions, with the approval of the coordinator. Therefore, if the pre-proposal submitted has already been evaluated in 2023, the previous peer review and the pre-proposal (Stage 1 of the 2023 AAPG) will be sent to the panel if the project coordinator agreed with this option when he/she submitted the pre-proposal for the 2024 AAPG. The review will be sent to the panel once individual evaluations are carried out by panel members to assess the development of the project between two call editions. An additional field (3,000 characters) will also be available to describe the changes made between the project submitted and its previous version.*

The stage 2 evaluation process (which includes projects submitted to the PRCI instrument, and excludes projects evaluated by a foreign agency under a Lead agency procedure) aims to select the best proposals by evaluating, in accordance with international competitive project selection principles, the scientific excellence and ambition of the proposal, how it is organised and how it will be implemented, and what impacts and consequences the project described in the full proposal may have (see the 2024 AAPG Guide).<sup>20</sup> This second stage is based on both external peer reviews and the evaluation by members of the panel in which the project coordinator submitted the proposal. The second stage also includes the right to reply to external peer reviews. The project coordinator’s response to external peer reviews will be considered during the plenary session of the Scientific Evaluation Panel.

*Note: The 2024 AAPG procedure helps consider the “memory effect” between two AAPG editions. Therefore, if the full proposal submitted has already been evaluated in 2023, the previous final report and the full proposal (Stage 2 of the 2023 AAPG) will be sent to the panel if the project coordinator agreed with this option when he/she submitted the full proposal for the 2024 AAPG. The review will be sent to the panel: i) after having received external peer reviews; ii) after individual evaluations are carried out by panel members and iii) after having received a right of reply from the project coordinator, after assessing the development of the project between two call editions. An additional field (3,000 characters) will also be available to describe the changes made between the project submitted and its previous version.*

The Scientific Evaluation Panel is fully responsible for ranking the proposals. The ranking will be reached by consensus of the panel after a debate on each project reviewed. The ANR does not alter the rankings provided by the panels and 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 reflects the consensus reached by the scientific evaluation panel during the plenary session, based on all the documents available: proposal, external reports, the project coordinator’s right to reply, individual peer reviews by panel members and, where relevant and if the project coordinator approved it, the full proposal and evaluation conducted the previous year.

After the call has closed, the list of projects selected for funding and the composition of the scientific evaluation panel will be published on the ANR website.

## **B.6. Project funding**

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<sup>19</sup> Following the end of stage 1, around 2,500 to 3,000 applicants are invited to submit a full proposal.

<sup>20</sup> The evaluation criteria for each evaluation and selection stage process are detailed in § E.

Following the evaluation and ranking process, the ANR decides on whether or not to select a project, based on rankings established by Scientific Evaluation Panels and the budgetary guidelines and priorities approved by MESRI. In July 2024, the ANR will publish the list of selected projects for funding for a potential start in October 2024.

The procedures for the allocation of ANR funding are set out in the "Regulation on the allocation of funding" (<https://anr.fr/en/funding-regulations>). Scientific coordinators and partners are invited to carefully read this document to set up their projects in compliance with its provisions, particularly with regard to budgetary aspects.

Depending on the type of consortium, the proposals selected will be funded by the ANR, either after a unilateral funding decision or after notification, provided that each partner receiving funding signs a funding agreement. This may sometimes require the provision and assessment of additional information (particularly for companies: financial statements, certificate of registration, information on capitalistic links). If required, the ANR will contact the relevant partners 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, organisations, local or regional authorities, or foundations***

A project coordinator may not simultaneously receive funding under both the JCJC instrument and/or another similar programme such as Inserm ATIP-Avenir, CNRS Momentum, the City of Paris Emergence programme, funding from the European Research Council (ERC) or the ANR's Tremplin ERC call.

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

Public entities, agencies, associations or foundations, other than the ANR, provide project-based funding and coordinate their own calls, such as the French National Cancer Institute (INCa), French National Agency for Research on AIDS and Viral Hepatitis – Emerging Infectious Diseases (ANRS |MIE) and French Foundation for Medical Research (FRM). To ensure efficiency, projects covered by these calls for proposals are not intended to be funded by the ANR.<sup>21</sup> Thus, the eligibility of the projects submitted to the ANR, under the 2024 Generic Call for Proposals, and falling under themes likely to be supported by these funding agencies, will be jointly evaluated by the ANR and these organisations, agencies, associations or foundations (for INCa and ANRS|MIE).

Generally speaking, projects funded by other organisations, agencies, local and regional authorities, foundations or associations, under similar instruments and with identical expectations, will not be eligible for double funding.

The ANR may check for double-funding (during the evaluation process, the selection or at a later date) and conclude that either the project is ineligible or will proceed to cancel the funded project.

## **C. Specific measures**

### **C.1. Very large research infrastructures (OSIs or IRs\*)**

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<sup>21</sup> This rule applies to PRC and PRME instruments. JCJC, PRCE and PRCI instruments are not affected.

Projects relying on resources from research infrastructures (IRs\*) or very large research infrastructures (OSIs and IRs\*, previously TGIR) are invited to clarify this information when they submit their pre-proposal. A procedure independent from the ANR project submission must be carried out to ensure that such resources are available if they are key to the success of the project. This can be justified as part of the submission of a full proposal.

For instance, requests for resources can be made to GENCI (*Big National Equipment for Intensive Computing*) to access computing and storage resources for digital simulation, massive data processing or artificial intelligence.<sup>22</sup>

## C.2. Competitiveness clusters

Projects wishing to be awarded a label<sup>23</sup> by one or more competitiveness cluster(s) must mention it during the first stage of the selection process<sup>24</sup>.

When applying for a label, the project coordinator must first have the approval of the other partners (including, if required, foreign partners) involved in the pre-proposal. Project coordinators are invited to contact, as soon as possible, the relevant competitiveness clusters and find out about their commitments, should they support these clusters (including any cluster membership, transmission of intermediate and final project reports). If a proposal labelled by a competitiveness cluster is successful, the information on the monitoring of the project will be provided to the competitiveness cluster.

## C.3. French co-funding

The ANR establishes partnerships with other funding agencies. The Generic call for proposal's list of co-funding agencies is regularly updated on its Generic Call for Proposals web page. Generally, this does not constitute additional funding, but a contribution to the funding requested from the ANR for the project, except when a specific request can be made to the co-funding partner. Co-funding means that the grant allocated to the project includes a financial contribution from the ANR and a co-funding partner with an interest in the research he seeks to support. A project coordinator selected may decline the co-funding of his / her project. Similarly, the project coordinator may decline to allow information about the project to be shared with a co-funding agency prior to the evaluation procedure.

## C.4. Additional co-funding opportunities

In addition to ANR funding instruments, additional funding opportunities are provided. The Thematic Annual Programming (TAP) is therefore relevant for the 2024 AAPG, and falls under the SD-WISHEES CSA, Joint Programming Initiatives on Water (Water JPI) and Climate (JPI Climate). The "SD-WISHEES" TAP programme focuses on the theme covering the protection of cultural heritage in response to extreme hydroclimatic events. This tool encourages the internationalisation of national research, development and innovation projects (such as PRC,

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<sup>22</sup> GENCI provides free computing and storage resources for digital simulation (HPC), within three French national centres (CINES, IDRIS and TGCC), for academic and industrial researchers contributing to open research. You can apply to two calls for proposals (in January and July) to receive resources allocated over a year. Applications are then reviewed by Thematic Panels, according to their scientific and technical excellence. For more information on national computing centres, procedures, you can download the information booklet for users at <http://www.edari.fr> and <http://www.genci.fr>.

<sup>23</sup> Applying for labelling is not mandatory to submit a proposal to the 2024 Generic Call for Proposals.

<sup>24</sup> No labelling application will be accepted in stage 2. PRCI projects are excluded from the labelling application procedure.

PRCE, PRME and JCJC), **simultaneously funded by the ANR and other funding agencies involved in the initiative**, through the networking of projects working on a common scientific theme. When submitting their pre-proposals (see details in Appendix 4, particularly the relevant themes), project coordinators are invited to express their interest in taking part in the SD-WISHEES TAP from stage 1 of the 2024 AAPG.

### C.5. PRIMA labelling

France is a member of the international [PRIMA](#) program (Partnership for Research and Innovation in the Mediterranean Area, see text of the [2024 Action Plan](#)). As part of the activities developed with the 19 countries involved in this program, projects funded by the AAPG 2024 with a link to the themes described in [PRIMA's strategic research and innovation agenda](#) are likely to be included in the contributions made by France to Section 3 of PRIMA (Participating States Initiated Activities, PSIA). As such, the coordinators of the projects concerned will be invited to indicate their inclusion in the PRIMA program in any communication made in connection with the valorization of their results.

## D. Regulatory requirements for applicants

*All participants in the proposals submitted and the projects funded under the 2024 Generic Call for Proposals undertake to abide by the ANR's values and commitments.*

### D.1. Ethics and Scientific Integrity

The ANR, who signed the French National Charter for Research Integrity, in accordance with the circular of March 2017<sup>25</sup> on the scientific integrity policy, ensures that the principles of this Charter are respected for all the actions provided for in the 2024 Work Programme. To this end, the ANR has reviewed and expanded its own Code of Ethics to include scientific integrity. The agency ensures that its beneficiaries comply with all the rules and values governing research activity, to guarantee honesty and scientific accuracy. Maintaining society's trust in research stakeholders depends on the compliance to these principles.

This Charter is also backed by the appointment of an Ethics and Scientific Integrity contact responsible for the compliance of these fundamental principles, the prevention and proper management of conflicts of interests, and training of staff internal or external to the agency.

In this context, a scientific coordinator (regardless of the call for proposals) undertakes to ensure that all project participants (seeking funding or not) comply with the principles reflected in the [French National Charter for Scientific Integrity](#)<sup>26</sup> and the [ANR's Ethics and Scientific Integrity Charter](#)<sup>27</sup>.

### D.2. Gender equality

In efforts to contribute to the implementation of a policy<sup>28</sup> aiming to reduce gender inequalities in Higher Education and Research (ESR), the ANR added the principle of equality in its Code of Ethics and Scientific Integrity, and rolled out an action plan for gender equality. The objective is to encourage scientific communities to systematically consider the sex and/or gender aspect in their research, regardless of the field, to produce quality knowledge and train

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<sup>25</sup> <https://www.legifrance.gouv.fr/download/pdf/circ?id=41955>

<sup>26</sup> [https://www.cnrs.fr/comets/IMG/pdf/charte\\_nationale\\_deontologie\\_signe\\_e\\_janvier2015.pdf](https://www.cnrs.fr/comets/IMG/pdf/charte_nationale_deontologie_signe_e_janvier2015.pdf).

<sup>27</sup> <https://anr.fr/en/anrs-role-in-research/commitments/scientific-integrity/>

<sup>28</sup> Decree No. 2020-256 of 13 March 2020 pursuant to Article 80 of the Civil Service Transformation Act.

peer reviewers on the issue of potential gender bias in the selection process, to ensure equal treatment for projects conducted by women or men.

The ANR is also committed to promoting women in Science who received ANR funding, or were involved in scientific evaluation panels as chair or panel member, to give them greater exposure and address an overly masculine representation of science, and encourage young women pursue careers in fields where they are either absent or in a minority.

In this context, the coordinator of an ANR-funded project undertakes to provide equal exposure to all research work produced, whether it is conducted by women or men.

Moreover, a project coordinator undertakes, to consider the sex and/or gender aspect in his or her research, regardless of the field, to set aside gender biases in the production of knowledge and to anticipate the possible consequences of its application.

### D.3. Scientific publications and research data

As part of the ANR's contribution to the promotion and implementation of Open Science, and in line with the French National Plan for Open Science (PNOS) and International Plan S, ANR recipients undertake to ensure immediate open access to peer-reviewed scientific publications and to adopt, for research data, a FAIR (*Findable, Accessible, Interoperable, Reusable*) approach in line with the "as open as possible and as closed as necessary" principle. Thus, all scientific publications stemming from ANR-funded projects under the 2024 Work Programme will be made available in open access under the *Creative Commons CC-BY* license or equivalent, by using one of the three following approaches:

- publication in a natively open access journal;
- publication in a subscription journal that is part of a transformative agreement or transformative journal<sup>29</sup>,
- publication in a subscription journal. The publisher's version or the manuscript accepted for publication will be deposited in the Open archive HAL under a *CC-BY* license, implementing the Rights retention Strategy (RRS)<sup>30</sup>, according to the terms specified in the special conditions of the funding decision or agreement.

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

*"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 its publication in open access, the author has applied for an open access CC-BY licence for any manuscript accepted for publication (AAM) resulting from this submission".*

The authors can use the Journal Checker Tool to check whether their selected journal or review complies with Plan S and which channel is open to them.<sup>31</sup>

Furthermore, the project coordinator undertakes to ensure that the full text of these scientific publications (version approved for publication of publisher's version) is deposited in the national Open archive HAL, no later than the time of publication, and to mention the ANR

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<sup>29</sup> Definition of a [transformative agreement](https://www.coalition-s.org/transformative-journals-faq/) or [transformative journal](https://www.coalition-s.org/transformative-journals-faq/): <https://www.coalition-s.org/transformative-journals-faq/>

<sup>30</sup> <https://www.ouvrirelascience.fr/implementing-the-rights-retention-strategy-for-scientific-publications/>

<sup>31</sup> <https://journalcheckertool.org/>

research project reference (e.g., ANR-22-CE64-0001) from which they result, by associating a permanent identifier (e.g., DOI).

Additionally, the ANR also recommends that peer-reviewed book chapters and scientific publications from ANR projects, be made available in open access under the Creative Commons license or equivalent (the CC-BY license is recommended). The ANR encourages submitting the full scientific text or publication in the national Open archive HAL (version approved for publication of publisher's version) and mention the ANR research project reference (e.g., ANR-22-CE56-0001) by associating a permanent identifier (e.g., DOI).

The ANR also encourages the submission of preprints in open platforms or archives.

Therefore, the project coordinator undertakes to provide, within 6 months after the start of the project, a first version of the Data Management Plan (DMP), under the terms set out in the special conditions.

Finally, pursuant to the 2nd National plan for Open Science, the ANR recommends that any software developed during the project be made available under a free license and that source codes be stored in the Software Heritage archive, by indicating the ANR-funding reference (e.g., ANR-22-CE56-0001).

#### **D.4. Promoting scientific, technical and industrial knowledge**

The ANR encourages its funding beneficiaries to carry out and/or participate in actions to transfer knowledge to citizens and decision-makers, such as publication of articles in the press, media interviews, public decision-making support, involvement in science festivals, organising public debates, scientific outreach efforts, writing articles in a free online encyclopaedia, etc.

The Research Programming Law (LPR) for 2021-2030 introduces a new approach to relationships between science, research and society. In 2021, the ANR launched a call for expressions of interest, in line with MESR, entitled "Science with and for Society (AMI-SAPS)", which resulted in the planning of several calls for proposals under the National "Science with and for Society" Plan to:

- 1) support scientific mediation and communication research
- 2) encourage the development of scientific, technical and industrial culture in research and knowledge dissemination organisations and institutions
- 3) develop and structure participatory research
- 4) increase the expertise to support public policies, with a view to meeting major societal challenges.

Five SAPS calls are planned for 2024, including the recurring "Mobilising researchers for CSTI" call, which provides recipients of the 2022 AAPG with additional funding for scientific communication and mediation initiatives conducted in collaboration with CSTI professionals.

Additional funding may be obtained under the implementation of the [National Plan for "Science with and for society"](#). For more information on the ANR's actions under this national plan, please visit <https://anr.fr/en/latest-news/read/news/2021-09-23-science-avec-et-pour-la-societe-les-appels-a-projets-du-programme-pluriannuel-saps-de-l/>.

#### **D.5. Accessing genetic resources and traditional knowledge associated with genetic resources**

The Nagoya Protocol on the Access to Genetic Resources and the traditional knowledge



associated with 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. It contributes to the conservation of biological diversity, sustainable use of its components, and increasing the contribution of biological diversity to sustainable development and human well-being. The Nagoya Protocol significantly pushes forward the third objective of the Convention by ensuring greater legal certainty and transparency for genetic resources suppliers and users. The European Regulation No. 511/2014 and French Act No. 2016-1087 determined the terms of implementation for this protocol.<sup>32</sup> Therefore, two check points are defined: i) during the funding stage for research efforts under the supervision of the French Ministry of Higher Education, Research and Innovation (MESRI), and ii) during the final product development stage, under the supervision of the French Ministry of Ecological Transition (MTE).

In this context, the ANR must obtain “Due Diligence” Declaration receipts (DDD) for all research projects funded since 2019. Applicants of the 2024 Generic Call for Proposals will be asked to report any possible use of genetic resources throughout their projects.

As part of research, DDDs can be registered online through the dedicated application on the MESRI website. Credentials to access the application can be obtained from the director of the hosting institution. For more information, please visit <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 the 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 may be used for malicious purposes.

The scheme to protect the nation’s scientific and technical potential (PPST) aims to protect the access, within public and private institutions, to the strategic knowledge and know-how, and sensitive technologies that contribute to the nation’s sovereign interests whose misappropriation or capture could:

- harm the nation's economic interests,
- boost foreign military arsenals or weaken the nation's capacity to defend itself,
- contribute to the proliferation of weapons of mass destruction and their vectors,
- be used for terrorist purposes nationally or abroad.

This inter-ministerial programme led by the French General Secretariat for Defence and National Security (SGDSN), which contributes to the economic safety of all public or private entities, has been implemented since 2012. It involves many ministries including the French Ministry of Higher Education, Research and Innovation (CIR No. 3415/SGDSN/AIST/PST of 7 November 2012). It provides:

- 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.);
- the opportunity to build a trustworthy working team;
- government support in an approach to raise the entity's security level;

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<sup>32</sup> Act for the recovery of biodiversity, nature and landscapes (Act No. 2016-1087 of 8 August 2016) and its implementation Decree on the access to genetic resources and sharing of benefits arising from their use (Implementation Decree No. 2017-848 of 9 May 2017).

- the ability to belong to a community of trust approving of industrial partnerships.

As recommended by MESRI's Department of Defence and Security High Official (SHFDS), the ANR will implement the PPST, as part of the 2024 AAPG, for submitted projects that include, within their consortia, foreign companies or partners.

Scientific or technical international cooperation projects identified by the ANR and selected during stage 1, will be submitted to SHFDS/MESRI for an opinion, while considering the national directions established by the SGDSN.

The project will not be selected following the AAPG evaluation process if SHFDS/MESRI provides a negative opinion. SHFDS/MESRI is not required to justify its opinion to the applicant.

**Important note:** Before submitting a project to the ANR (all calls and instruments are involved), applicants are invited to contact the departments in charge of the PPST application within their institution, to check the eligibility of their project.

## E. Evaluation criteria for projects submitted to the 2024 Generic Call for Proposals

The evaluation of pre-proposals and proposals is conducted based on the criteria used by both panel members and external peer reviewers.

The criteria applied in stage 1 and 2 of the selection process are distinguished using the sub-criteria grid below. More details can be found in the *2024 AAPG Guide*.

### *Evaluation criteria for projects submitted to the 2024 Generic Call for Proposals*

#### Stage 1 (evaluation of pre-proposals)<sup>33</sup>

##### ➤ Quality and scientific aim

*During the phase 1 evaluation process, this criterion is decisive ([an A rating is required to access stage 2](#)).*

- Clarity of research objectives and hypotheses
- Scientific ambition of the project and position with respect to the state-of-the-art
- Adequacy and relevance of the methods implemented
- Adequacy of the project with the scientific theme selected

##### ➤ Organisation and implementation of the project

- Skills, expertise and involvement of the project coordinator
- For PRC/PRCE proposals:
  - Quality of the consortium
  - Complementary nature of the contributions
- For PRME proposals:

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<sup>33</sup> PRCI are not evaluated in stage 1.

- Quality and expertise of the team
- For JCJC proposals:
  - Project contribution to the coordinator's empowerment and team development

<b>Stage 2 (evaluation of full proposals)</b>
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- **Quality and scientific aim**
  - Clarity of research objectives and hypotheses
  - Scientific ambition of the project and position with respect to the state-of-the-art
  - Adequacy and relevance of the methods implemented
  - For PRCI proposals:
    - Adequacy of the project with the scientific theme selected
- **Organisation and implementation of the project**
  - Skills, expertise and involvement of the scientific coordinator
  - For PRC/PRCE proposals:
    - Quality of the consortium
    - Complementary nature of the contributions
  - For PRCI proposals:
    - Quality of the consortium
    - Complementarity nature of the scientific contributions from each country
  - For PRME proposals: Quality and expertise of the team
  - For JCJC proposals: Project contribution to the coordinator's empowerment and team development
  - Adequacy of the resources implemented and requested with the objectives of the project
- **Impact and benefits of the project**
  - Scientific impact and possible impact in economic, social and cultural fields
  - For PRC/JCJC/PRME proposals: Strategy for the dissemination and exploitation of results; promotion of scientific, technical and industrial culture
  - For PRCE proposals: *Transfer technology and innovation to the socio-economic world; promotion of scientific, technical and industrial culture*
  - For PRCI proposals: *Strategy for the dissemination and exploitation of results; promotion of scientific, technical and industrial culture; added value of a European or international cooperation, contribution to the French scientific community*

*The sub-criteria related to the main criteria provide a level of detail adapted to the content and size of the scientific document.*

*The sub-criteria serve as a guide to help the applicant prepare his/her application and for the peer reviewer (panel member or external peer reviewer) to conduct the evaluation. The details of what is expected for each criterion or sub-criterion are specified in the 2024 AAPG Guide.*

## **F. Provisions on GDPR and the dissemination of results**

## F.1. Personal Data

The ANR uses data processing<sup>34</sup> for the selection, project monitoring and impact studies to carry out its tasks.<sup>35</sup> Personal data<sup>36</sup> is collected and processed in accordance with Article 6.1 (e) and (c) of the GDPR<sup>37</sup>. This data undergoes processing necessary for the performance of a task carried out in the public interest and/or to comply with a legal obligation.

The ANR keeps personal data regarding non-selected projects for the duration required to evaluate the projects, after all appeal procedures have expired. The retention period for data relating to selected and funded projects runs for the duration required for the project to be monitored and controls to be carried out by authorised bodies<sup>38</sup>.

The data collected for this purpose can only be disclosed to the relevant departments of the ANR, peer reviewers, and evaluation panel members, for projects they are involved in, and, where relevant, to regulators, departments within the ANR and administrations.

People whose personal data is being collected and processed, have the right to access and rectify any information that concerns them. As such, they can access their user profile and personally rectify any of their personal data. In addition, they are entitled to exercise their rights by contacting the ANR Data Protection representative, Véronique Pauliac, at [dpd@agencerecherche.fr](mailto:dpd@agencerecherche.fr)

For more information, refer to your rights on the [CNIL](https://www.cnil.fr/) (French 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. Disclosure of documents

The ANR may be required to communicate a number of data and documents to constituents, other French or foreign funding agencies, other administrations (including its supervising authorities), regulators, under collaboration agreements, open public data, access to administrative documents<sup>39</sup>, exchanges between administrations and the re-use of public sector information<sup>40</sup>. Such communication can include, for example, project characterisation data, expertise, the evaluation panel's summary report, project proposals, contract documents, scientific documents, administrative and financial appendices.

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<sup>34</sup> Business Information System (BIS), project submission and evaluation websites, Processing for project monitoring, portfolios and assessments.

<sup>35</sup> Defined in Decree No.2006-963 of 01 August 2006 on the organisation and operation of the ANR.

<sup>36</sup> Last name, first name of the researchers, date of birth, personal details, degree(s), position (current and previous), areas of work, workplace, parent organisation, address(es), curriculum vitae, ORCID number, project name and reference, pre-proposals, project proposals (scientific document, administrative and financial appendix).

<sup>37</sup> General regulation (EU) No. 2016/679 on the protection of personal data.

<sup>38</sup> 10 years from the date when the grant was awarded for controls by the European Commission.

<sup>39</sup> French Act No. 78-753 of 17 July 1978 on the communication of administrative documents, Act No. 79-587 of 11 July 1979 on the motivation of administrative acts, Act No. 2000-321 of 12 April 2000 on the rights of citizens in their dealings with administrations.

<sup>40</sup> Order No. 2016-307 of 17 March 2016 codifying the provisions on the re-use of public information in the French Code of Relationships between the public and the administration, and its implementing Decree No. 2016-308 of 17 March 2016.

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, a number of 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 especially, document disclosure and confidentiality are regulated by contracts. The disclosure of documents will be limited to the area of collaboration between the ANR and project coordinating institutions.

## **G. Scientific themes of the 2024 Generic Call for Proposals**

Each scientific theme has its own Scientific Evaluation Panel (CES)

*Mobilising science to implement the 2030 Agenda<sup>41</sup> of the United Nations 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 (SDGs)" concerned will be listed for each scientific theme.*

## **H. « Environmental sciences » field**

### **Theme A.1: Solid earth and fluid envelopes**

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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);

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<sup>41</sup> <https://www.agenda-2030.fr>

- 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:***

*Research object:* 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 (nitrogen, carbon, iron, phosphorus, rare earth elements, silicon, etc.) ; soils ; Earth-sea continuum (coast, estuary/delta) ; erosion process and assessment ; lithosphere ; 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 ; reaction by the critical zone to global changes ; paleoenvironments similar to those of the Anthropocene ; glacial cycles ; environmental impacts of mineral resources ; optimization of the exploitation of deposits, underground, the mining environment ; fluid-rock interaction ; cloud cover ; water mass interactions (surface, groundwater, sea) ; natural hazards.

*Research approaches:* Environmental chemistry ; isotopic chemistry ; geochemistry ; geology ; geophysics ; sedimentology ; stratigraphy ; pedogenesis ; geodesy ; meteorology ; geomorphology ; oceanography ; hydrology ; hydrogeology ; glaciology ; climatology ; remote sensing ; petrology ; mineralogy ; microbiology.

***ERC code associated with the panel:*** PE04, PE10, LS08

***Related SDG:*** 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, characterisation, evolution and dynamics of species, populations and communities and their interactions;
- the responses (morphological, physiological, behavioural and evolutionary) of organisms, populations, communities (for all species), ecosystems (terrestrial, 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:***

*Research object:* acclimatisation ; adaptation ; protected areas ; biodiversity ; connectivity ; conservation ; freshwater and marine environments (including coastal and lagoon) ; invasive species ; rare species ;

*experiments and system modelling ; forest ; systems integration ; migration ; terrestrial environments ; modelling ; observation ; trophic networks ; resilience ; restoration ; rhizosphere ; soils.*

Research approaches: *biogeochemistry ; evolutionary biology ; functional ecology ; ecology ; ecophysiology ; ethology ; population genetics ; genomics ; metagenomics ; metatranscriptomics ; microbiology ; phylogeny ; phylo-geography ; systematics.*

**ERC code 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 plant and animal biology with a cognitive approach towards long or very long-term practical applications on living species and applied plant and animal biology projects for livestock, 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:**

Studied organisms: *algae ; animal ; pests ; crop ; fungi ; pollinators ; holobiont ; microorganism ; model species ; photosynthetic organism ; plant ; weeds.*

Research object: *aquaculture ; bio-control ; animal behavior ; determinism of animal welfare ; development ; farming ; embryogenesis ; organogenesis ; parasitism ; animal nutrition ; plant nutrition ; reproduction ; biological networks ; plant health ; animal health ; symbiosis ; allelopathy ; stress ; adaptation ; regulation.*

Discipline: *biochemistry ; bioinformatics ; biostatistics ; ecophysiology ; epigenetics ; genetics ; genetic engineering ; metabolomics ; metagenomics ; microbiology ; modelling and predictive approaches ; physiology ; proteomics ; transcriptomics ; signal transduction ; virology.*

**ERC code 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 is open to fundamental or applied research proposals on food, food systems and sectors that ensure food security, improve nutrition and contribute to healthy and sustainable diets for 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 food technologies and processing, the traceability processes (heterogeneity of raw materials, authenticity, labelling, etc.), the development of low energy and low water processes, robustness, optimal use of resources and waste reduction;

- food safety, (benefit risk analysis of food systems in transition, pathogen dynamics and contaminant flows, etc.);
- the determinants and impact of diet transition and changes in consumption behaviour,
- the social and economic organization of food system actors, from producers to consumers,
- systemic approaches to food and diet quality (from farm to table), including microbial flows along food chains;
- innovations: product, technological, numeric and organizational innovations to support transitions toward healthy and sustainable diets.

The general goal is to propose a food offer that meets the objectives of sustainable development (<https://www.un.org/sustainabledevelopment/fr/>) and the needs of consumers, respecting their well-being and health. This offer should be accessible to all, favorable to the environment and promotes the economic and social development of territories.

*Related key words:* access to food ; biochemistry ; "clean label" ; competitiveness ; consumption practices ; contact material ; cultural and biologic anthropology ; decontamination ; diet ; economics ; fermentation ; food and nutritional security ; food ; food biotechnology ; food chemistry ; food contaminant ; food microbiology ; food supply ; food toxin ; food sectors ; formulation ; governance ; health prevention ; ingredient ; market ; microbiology ; microbiota-host-food interaction ; multi-actor approaches ; nutrition ; packaging ; participative research ; pathogens ; physical chemistry ; physiology ; predictive microbiology ; preservation ; preventive nutrition ; processes ; regulations ; sociology ; specific populations ; supply chain ; taste and sensoriality.

*ERC code 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 physics, 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; quantum materials; topological materials; macroscopic quantum phenomena; superfluidity; superconductivity; magnetism and spin electronics<sup>42</sup>; 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 propagation in complex media; physics of gases and plasma; laser-plasma interaction; 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 code 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,

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<sup>42</sup> Projects dealing with spintronics devices must be submitted under the topic, *“Micro and nanotechnologies for information processing and communication”*.

- 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 code 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:** 9 and 12.

### 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 code 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,
- electrical engineering, provided that the project does not have an energy purpose (for example in microelectronics or in the field of health or sensors). On the other hand, if the

project aims to contribute to the transformation, distribution or use of electricity (electrical machines, electrical transformers, power electronics, electrical networks, etc.), it must be submitted in the most relevant themes of the energy domain (*i.e.* H.8 "Basic energy sciences" or H.9 "Sustainable, clean, safe and efficient energy"),

- 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; additive manufacturing; process engineering; chemical engineering; bioprocesses; eco-efficient methods; thermodynamics; fluid mechanics; acoustics; electrical engineering; structural mechanics; structural engineering; geotechnical engineering; biomechanics; mechanics for bioengineering; bio-inspired engineering; systems engineering.*

**ERC code 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* ".

Projects at the chemistry-biology interface whose object and/or scientific challenge essentially concern synthetic chemistry must be submitted in this axis (Theme B.5). On the other hand, interface projects oriented towards an application, an object or a scientific challenge mainly related to biology 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 theme B.2 " *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 families of molecules; synthesis methodology; design of new ligands; structure-property relationship; chirality and asymmetric synthesis; bond activation and reaction processes; heterocyclics; hetero-element chemistry; organometallic catalysis; electrocatalysis; photocatalysis; multicatalysis (dual, hybrid, tandem); supported catalysts; redox catalysis; bio-mimetic catalysis; enzymatic catalysis; artificial enzymes; total synthesis; mechanistic studies; physical methods of activation (ultrasound, microwave, high pressure, mechanochemistry...); cascade reactions; tandem reactions; tandem synthesis. ); cascade reactions; tandem reactions; one-pot reactions; flow synthesis; extraction and separation; innovative reaction media; eco-compatible and sustainable synthesis (solvent-free, waste reduction, catalyst recycling, alternatives to rare and/or toxic metals...).*

**ERC code 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, covers the following topics:

- enzymology, pharmacology, toxicology, medicinal chemistry, chemobiology, bioorganic chemistry, bioinorganic chemistry
- studies on metabolism and bioenergetics,
- signalling pathways and post-translational changes,
- chemical changes to biomolecules, natural or not (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 understand and act on living organisms and their applications to the detailed analysis of mechanisms in functional biology (including functional studies of the Human proteome) 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 code associated with the panel:** LS01, 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: Characterization of structures and structure-function relationships of biological macromolecules

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This research theme aims at studying the molecular mechanisms of living functions through structural biology, advanced imaging, physico-chemistry and biophysics approaches. It covers the following topics:

- the study of biological mechanisms both in vitro (isolated, reconstituted or native multimolecular architectures) and in their natural environment, at the sub-cellular and cellular scales (isolated cells, multicellular systems up to the organ);
- structural biology approaches aimed at predicting and solving the structures of biological macromolecules and their complexes (including endogenous native complexes) and deciphering their structure-function relationships;
- biophysical approaches for the study of macromolecules, their functions, interactions and dynamics, in isolation and in the cellular context;
- the association of the most efficient cellular imaging techniques with data acquired through omics techniques;
- the characterization, modelling and reconstruction of networks of interactions involving supramolecular complexes and their disruption, for example during a pathological process;
- technological or methodological developments: in structural biology (NMR, crystallography, cryo-electron microscopy, cryo-electron tomography, etc.); in structural spectroscopy (IR, EPR, etc.); in imaging (super-resolution microscopy, correlative microscopies, image analysis, etc.); in molecular dynamics.

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; cell structural biology; integrative structural biology; correlative approaches; structure-function relationships of biological macromolecules and their complexes; structure-function relationships of membranes; compartments without membranes; biophysics; single molecules; methodological developments; systems biology; modelling; interaction networks.

**ERC code associated with the panel:** LS01, LS02, LS09, PE03

**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 the exposome 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 code associated with the panel:** LS02, 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, the 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.

*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 code associated with the panel:** LS03, LS08.

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



## Theme C.5: Physiology and pathophysiology

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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, behavioral, 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 code associated with the panel:* LS04, 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:

- characterization of the molecular and cellular mechanisms involved in the immune 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 defenses, infectious diseases, host-pathogen interactions, Pathogenicity of bacteria, viruses and parasites, inflammation, homeostasis and deregulation, microbiology, microbiota, symbiosis/dysbiosis, immune deficiencies, allergies, autoimmunity, inflammatory process, modelling, graft response, immunotherapy approaches; biomarkers.*

**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 and sensory organs. 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, behavior, 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, sensory organs, neurodegenerative diseases, addictions, psychiatry, mental health.*

**ERC code associated with the panel:** LS05, 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 except for 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 NIRS, MEG, EEG, surface/intracranial/mobile EEG et neurostimulation (tACS, tDCS, (r)TMS)), 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, behavior, computational neurosciences, psychiatry, mental health, neurodegenerative diseases, addictions, physiopathology and clinical approaches, cross-sectional studies, diseases affecting sensory organs.*

*ERC code associated with the panel: LS05, 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.

Tissue engineering and regenerative medicine projects are supported under the specific axis C.11 "Regenerative Medicine".

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; pathophysiology; personalized medicine; biomarkers; epidemiology; cohorts.*

*ERC code associated with the panel: LS07, LS04.*

*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 nanomedicine),
- the new biomedicine formats optimised for production processes not related to regenerative medicine,
- 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,
- biomarkers.

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.

Tissue engineering and regenerative medicine projects fall under the specific axis C.11 "Regenerative Medicine".

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 ; biodrugs ; bioproduction.*

**ERC code 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 tissue engineering 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 cell-free 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;

- in vitro physiological and/or pathological cell models (organoids, organ-on-a-chip, spheroids, etc.), including for therapeutic target identification and screening;
- research on molecular components contributing to the mechanisms of cell and/or tissue regeneration. Basic research projects (cell biology, developmental physiology or biology) are excluded;
- 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.

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:** *Biomaterials, Medical devices, Cell therapy, Gene therapy, Stem cells, Tissue Engineering, Extracellular vesicles, Trophic factors for tissue regeneration, Organoids, Organ-on-a-chip, Pharmacological approaches, Innovations in organ and tissue transplantation, Transplantation, Personalised medicine, Biomanufacturing processes, Proof of concept, Monitoring of tissue regeneration, Preclinical models, In vivo feasibility and tolerability.*

**ERC code associated with the panel:** LS07, LS09, LS3, PE5\_7 Biomaterials, biomaterials synthesis, PE8\_8 Materials engineering (biomaterials, metals, ceramics, polymers, composites,...).

**Related SDG:** 3 and 9

## **“Humanities and Social Sciences” field**

The seven themes 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 topics or issues.

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

Collaboration with researchers or teams outside the Humanities and Social Sciences field 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 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 topics (non-exhaustive list):

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

**ERC code 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 (non-exhaustive list):

- 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 : administrative change, data and big data, comparative law, conflict resolution, constitution, decentralisation, democracy, diplomacy, economic approach to law, ethics, expertise, federalism, freedoms and security, global and transnational governance, governance, government, human rights, institutions, international relations, judiciary, justice, law, knowledge, legal history, legal theory, legislation, local authorities, measurement, non-state stakeholders, norms, philosophy of law, political science, practices, public action, regulations, states, transnational logics, wars and peace.*

**ERC code 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 (non-exhaustive list):

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

**ERC code associated with the panel:** SH3

**Related SDG:** 2, 3, 4, 5, 10, 11, 12, 16

## **Theme D.4: Cognition, behavior, 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 (non-exhaustive list):

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

**ERC code 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, literatures, languages, representations and 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 (non-exhaustive list):

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

*ERC code associated with the panels:* SH5, SH8-5, SH8-6, SH8-7, SH8-8, SH8-9

*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 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 (non-exhaustive list):

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

**ERC code associated with the panel:** SH5, SH6, SH8-1, SH8-2, SH8-3, SH8-4, 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 (non-exhaustive list):

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

**ERC code associated with the panel:** SH7

**Related SDG:** 7, 8, 9, 11, 133

## “Digital Sciences” field

### Theme E.1: Foundations of digital sciences: computer science, automatic control, signal and image 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 and image processing.

Multidisciplinary projects oriented towards specific application domains and aiming for mutual scientific benefits between disciplines can also be submitted in the following axes:

- “Interfaces: mathematics, digital sciences – biology, health”;
- “Interfaces: mathematics, digital sciences – earth system and environmental sciences”;
- “Interfaces: mathematics, digital sciences – human and social sciences”.

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

*Related key words: algorithmic; signal analysis and representation; computer arithmetic; symbolic computation; calculability and decidability; correction codes; combinatorics; automation and control; control and observation; complexity; compression; cryptography; cybersecurity; detection-estimation; estimation and identification; fundamentals of databases; algorithmic geometry; theoretical computer science; languages and semantics; logic; ; formal methods; computational models; competition models; optimisation; operations research; software science; dynamic systems; graph theory; information theory; game theory; proof theory; systems theory and modelling; geometrical data processing; signal processing; image processing*

**ERC code 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 (AI)" 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;
- machine learning: learning theory, optimisation, new paradigms, constitution, annotation and corpus evaluation;
- 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 activities based on data and AI methods aiming at advancing the state of the art in order to complete 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.
- 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;

Work contributing to research in Human-Machine Interaction and Robotics is to be addressed in the "Interaction, Robotics" theme. Work combining digital sciences with other disciplines falls under this theme as multidisciplinary proposals, with the exception of work pertaining to the fields of health, transport and safety, or at the interface between AI and Social Sciences and Humanities and AI and environmental sciences. These 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*", "*Interfaces: mathematics and digital sciences – Social sciences and humanities*" or "*Interfaces: mathematics and digital sciences – Earth system and environmental sciences*".

**Related key words:** *decision support; scene analysis and interpretation; machine learning (supervised, unsupervised, reinforcement, federative, distributed, decentralized, continuous, real-time ...); representation learning and domain transfer; learning from unstructured data; neuro-symbolic approaches; causality; certification; computational social choice; confidentiality; consensus and synchronisation; massive data; rare data; ethics; explicability; text and data mining (CT); knowledge mining; data mining; paucity of data; fusion; uncertainty management; imprecision; content indexing; distributed artificial intelligence; embedded artificial intelligence; hybrid artificial intelligence; responsible artificial intelligence; computational models; large-scale distributed computational models on data; dynamic models; statistical models; ontologies; optimization; planning; privacy; experimental*

*protocol; validation protocol; data quality; reasoning; heuristic search; information retrieval; operations research; pattern recognition; knowledge representation; reproducibility; robustness; constraint satisfaction; stability; trusted systems; consensus systems; multi-agent systems; hybrid systems; model compression technics; game theory; automatic language and speech processing; multimodal data processing; transparency; validation; computer vision; data visualization; semantic web; scientific workflows.*

**ERC code associated with the panel:** PE01, PE06, PE07.

**Related SDG:** 9 and 14.

### **Theme E.3: Software sciences and engineering - Multi-purpose communication networks, digital infrastructure**

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This research theme deals with proposals aimed at overcoming fundamental or applied research obstacles in three main fields, sometimes combined or not:

- 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, core networks, wireless and cellular networks, etc.), speeds (high-speed communications versus networks of objects) and usages. All the links go 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+, 6G), 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;
- Software development, as an object of study on the entire software life-cycle, covering new programming languages, requirements engineering, design and production software engineering, including model-driven engineering, variability and adaptability management across all layers, program analysis, testing, validation, verification and software certification, etc. This area also aims at taking into account resources, safety, security and trust in software: eco-responsible software, compilation and optimization of, for example, AI-Embedded models, identification and correction of vulnerabilities in cybersecurity, dynamic adaptation and self-adaptive systems, ... This area also concerns the study of software production processes: infrastructure and integration into cyber-physical systems. Finally, the set up approaches are formal and/or empirical approaches, they support analysis of software and production practices. It also targets the design of

software technologies for embedded systems integrating their various aspects and constraints (real-time, mixed criticalities, predominant software, cyber-physics, non-functional constraints, etc.).

**Related key words:** hardware accelerators; programme and production practice analysis; active antenna; model-driven approaches; software architectures; heterogeneous hardware architectures; architecture and programmability of communication systems; cloud computing; optical communications; radio communication; optimised compilation to centralised or parallel (multi-core) architectures; service composition; design and development of languages and models; formal development of software and systems; energy efficiency: from measures to solutions; elasticity; reliability and availability; digital frugality; management of shared infrastructures; interference management; vulnerability identification and remediation; service-infrastructure interface; middleware; internet of things; programming languages; anti-malware; testing and debugging methods; metrics; mobility; computational models for parallelism; distributed computing models; channel model; modulation; connected objects; network optimisation; orchestration of protocols and services; orchestration and optimisation of communication/execution/storage resources; real-time OS; massive parallelism; scaling; software stack; control, management and information plans; service platforms; proof of safety and security properties; software development process; cryptographic protocols; programming and web security; data privacy; virtual prototyping; QoS; security; end-to-end security; security of hardware systems; sciences and software engineering; context-sensitive services; trusted solutions; self-adaptive systems; distributed systems and algorithms; embedded systems; Operating systems; supervision; access techniques; blockchain technology; traceability; verification and validation; virtualisation.

**ERC code 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 the various cognitive processes from perception to cognition 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 theme H.19 "Industry and factory of the future: Man, organisation, technologies". Projects on Robotics for health that do not include robotics development should be submitted under the theme H.13 "Health Technologies". Projects with applications in Interaction or Robotics but whose field of study is artificial intelligence should be submitted under the theme E.2 "Artificial intelligence and data science".

**Related key words:** conversational agents; 3D animation; cognitive architectures; decision-making autonomy; sensors; physiological sensors; robotic mapping; cobots; human-robot collaboration; non-verbal communication; practice-centred design; user-centred design; participatory design; co-design; multimedia content creation; immersive environments; dialogue; multi-source data; interface ergonomics; exoskeletons; field robotics; computer-assisted medical-surgical gestures; humanoids; affective computing;

*collaborative interactions; device-technique interaction; human-system interaction; human-data interaction; instrument-organ interaction; adaptable interfaces; multimodal interaction; multi-sensory interfaces (gesture, touch, face, sound, speech, ... ); brain-machine interface; mobility; planning; audio perception; cognitive psychology; augmented reality; mixed reality; virtual reality; rendering; haptic feedback; affective robotics; collaborative robotics and multi-modal rendering; surgical robotics; handling robotics; manufacturing robotics; social robotics; agricultural robots; aerial robots; companion robot; soft robotics; underwater robots; terrestrial robots; simulation; adaptable systems; multi-robot systems; ultrasound; touch-pressure; processing of particular image modalities (infrared); autonomous vehicles; interactive data visualisation; computer vision; wearable computing.*

**ERC code associated with the panel:** PE06, PE07, SH04.

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

## **Theme E.5 : High-performance computing, digital models, simulation, applications**

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Multidisciplinary proposals bringing together probabilistic experts, analysts, statisticians, data scientists, experts in experimental modelling, system identification, numerical methods, algorithms and high-performance computing (HPC), 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, adaptive discretisations;
- the specific challenges of stochastic simulation, energy consumption, the use of NVM memories, efficient random number generation, 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 by quantification of uncertainties or by confrontation with test data (eyeball metric), 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). The development of explainable models for business experts or post-hoc analysis methods to aid applicability is also expected.
- 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 (including control), 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: linear algebra; heterogeneous architectures, hybrid, CPU, GPU, FPGA, multi-core; data assimilation and inversion ; scientific computation library; supercomputing; cluster of machines; co-design (software, hardware, application); control and observation; coupling of hardware and computer systems; domain decomposition; energy efficiency; exascale; computational frugality; management of large amounts of scientific data; HPC; digital twins; modelling languages; meshing; data-driven models; modelling and simulation; optimisation; massive, hierarchical and heterogeneous parallelism; scalability; performance; (quantification) uncertainties, multi-scale, multi-physics; model reduction; spatial and temporal data representations and structures; resilience/fault tolerance; heterogeneous and/or hybrid dynamic systems; operating systems ; hardware abstraction techniques; validation and verification; scientific visualisation; workflows.*

**ERC code 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 represented in this research theme.*

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

It covers the technological and scientific projects exploiting quantum mechanical concepts such as superposition and entanglement, in the following areas:

- Quantum communications targeting, e.g. cryptographic applications and the development of quantum networks as well as other usages of entanglement and quantum information distribution;



- Quantum computing: quantum devices, processors and architectures based on "qubits" or "qudits" or other quantum resources for massively parallel computing, quantum algorithms, programming models and environment, applications and usage cases of quantum computing and simulation, certification and verification tools, quantum error correction tools, noisy intermediate-scale quantum (NISQ) integration, architectures;
- Quantum simulation: quantum devices made specifically for simulating materials, chemical compounds, or other physical phenomena, and for solving problems in other fields (high energy physics, astrophysics, biology, etc.);
- Quantum sensors and metrology (imaging - especially medical -, atomic clocks, accelerometers, gyrometers, gravimeters, gradiometers, Lidars, magnetometers, electrometers, imaging – in particular biological and medical, 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 related to quantum sensors and metrology with high disruptive potential (ultra-cold atom quantum gases, impurities in crystals, opto-mechanical resonators, quantum materials, etc.) are encouraged as a priority.

- **Related key words:** *accelerometers; amplifiers at the quantum limit ; Rydberg atoms; quantum dots; quantum computation and algorithms; hybrid quantum-classical computing; sensors; quantum circuits; quantum gas; multipartite communications; quantum communications; optimal quantum control; quantum error correction; quantum cryptography; decoherence; defects in solids; estimation; quantum feedback; graphene; gravimeters; gyrometers; atomic clocks; quantum imaging; integration; entanglement; rare earth ions; standard quantum limit; magnetometers; 2D materials; memories; control and verification methods; quantum metrology; non-destructive quantum measurements; models and programming environment for quantum computation; NISQ; non-locality; quantum optics; quantum computer; photonics; platforms; protocols; quantum logic gates and processors; component independent processes; qubits; reconstruction of quantum states; repeaters; quantum networks; opto-mechanical resonators; quantum information science; quantum simulation; sources of quantum light; electron and nuclear spins; squeezing; superposition; superconductors; quantum systems: trapped atoms and ions; hybrid quantum systems; topological systems; quantum tomography.*

**ERC code 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".
- "Interfaces: mathematics, digital sciences – human and social sciences".

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

*Related key words:* commutative and non-commutative algebra; analysis; functional analysis; harmonic analysis; numerical analysis; real and complex analysis; statistical learning; arithmetic and differential; astrophysics; scientific computing; control theory; cryptography; partial differential equations (deterministic and stochastic); ordinary differential equations (deterministic or stochastic); algebraic geometry; arithmetic geometry; differential geometry; history of mathematics; homogenisation; logic; discrete and combinatoric mathematics; mathematics for astrophysics; mathematics for biology and health; mathematics for economy and society; mathematics for the environment, earth-sciences and earth-system; mathematics for fluid and solid mechanics; mathematics for signal and image processing; mathematics for quantum mechanics; statistical mechanics; modelling; optimisation; mathematical physics; probability; inverse problems; stochastic processes; simulation; statistics; classical and quantum dynamic systems; category theory; ergodic theory; game theory; number theory; operator theory; representations theory; topology; data processing.

**ERC code 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).

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

**ERC code 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.

**Related key 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; physics beyond the Standard Model; field theory; 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; simulation, calculation and data exploitation ; instrumental developments.*

**ERC code associated with the panel:** PE02\_01 à PE02\_07, PE09\_05 to PE09\_13.

**Related SDG:** 9.

### Cross-cutting themes

Each cross-cutting area, transition, transformation area could be defined by an introductory text explaining the transdisciplinarity of the themes included and the expectations in relation to the themes of the disciplinary scientific areas (see 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, socio-economic and political systems, and how these interactions affect, over time and space, the planet's life support system (biodiversity as a whole), socio-economic development and human well-being. Its ambition is to provide science-based solutions to the major global environmental and societal challenges and to accompany the major transitions in society including 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 and retroactions through their multiple dimensions: environmental, ecological, climatic, physico-chemical, cultural, historical, legal, political or socio-economic, but also how societies are and are becoming stakeholders of their sustainability. 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 the dynamics of transformation and transition towards greater sustainability in a context of environmental, climatic and societal changes ;
- to present systematic inter- or trans-disciplinarity.

Where appropriate, the research project and its implementation may be co-constructed with stakeholders (participatory research). Implemented by the research consortium, 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, new relationships with living beings and the environment, 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, practices, collectives and methods);
- 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 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.

***Related key words:***

Research topics: *adaptation and mitigation in the face of climate change ; multi-actor approaches ; stakeholder networks ; conflicts of uses and management for common goods ; land and/or natural resources ; sustainability ; SD&RS ; development of impact pathways ; resilience ; study impacts on natural resources and socio-ecosystems ; finiteness of resources ; economy/society/environment interaction ; links between ecosystem functioning and epidemiological risks ; mediation ; methods of studying transitions ; risks and disasters ; reference environment ; food/water/energy ; health/biodiversity/agro-ecology nexus, etc. ; dynamic and protection of ecosystems and biodiversity in the face of anthropic pressures or global changes ; risk-uncertainty and adaptive management of transitions ; nature-based solutions ; role of technological or social innovations in territories in transition ; transition trajectories in territories ; dynamic scenarios coupling socio-economy - resources and ecosystem services ; transitions ; vulnerabilities and inequalities ; ecological vulnerability - social vulnerability.*

Research approaches: *co-construction ; modelling and integrated scenarios to design adaptation solutions ; participatory research.*

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

*Related 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 expand 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 “One Health” and “Eco Health” concepts. 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:** « One Health » ; « Eco Health » ; *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 (including pollinators) ; human health ; plant health ; strategies of economic actors ; environmental toxicology ; toxins.*

**ERC code associated with the panel:** LS02, LS04, LS07, LS08, LS09, PE01, PE02, PE03, PE04, PE05, PE07, PE06, PE 08, SH01, SH02, SH03, SH06, SH07.

**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.).
- the modelling of 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.

Basic research on avian influenza and HPAI (Avian Influenza viruses highly pathogenic) are supported in this axis" (see recommendations of COVARs of 8 June 2023).

**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 code 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 various factors and determinants affecting the health of populations and health inequalities, whether socio-economic, behavioural,

environmental, demographic, geographical, organisational, linked to life trajectories or to public policies;

- contribute to the understanding of disease mechanisms through approaches integrating population data and biomarkers;
- propose work relating to the watchfulness, anticipation, prevention and preparation, in ordinary or crisis contexts (epidemic, conflict, etc.),
- encourage cross-disciplinary analysis and approaches with veterinary public health stakeholders regarding prevention (biosecurity, vaccination) and crisis management, particularly in 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 various actors, institutions or groups which 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 aiming 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 including a health and 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 operation 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 code 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, social sciences and humanities, and material sciences, consists of three research areas 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 socioecosystems and their components with a view to their sustainable management*"), were attached to the "Environmental Sciences" field. The third theme, "*Bioeconomy, from biomass to uses: chemistry, materials, systemic processes and approaches*" (formerly entitled "*Bioeconomy: chemistry, biotechnology, processes and systems approaches, from biomass to uses*") was attached to cross-cutting areas. The scopes covered are more or less identical to those of the 2021 Generic Call for Proposals, with the exception of the "*Bioeconomy, from biomass to uses: chemistry, materials, systemic processes and approaches*" theme, as bioenergy has been integrated into the scope of the "*Sustainable, clean, safe and efficient energy*" theme.

These three themes 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 nature of the expected sensors, tools and methods is wide and varied (sentinels, biosensors, biosourcing, etc.) ;
- 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:***

Research object: *Natural hazards and cascade effects ; pollution of the atmosphere, water, soil and subsoil; air quality ; pollutant source reduction ; GHG sequestration; measurement of GHGs and air pollutants ; pollutant, effluent and waste treatment.*

Research approaches: *environmental biotechnology ; sensors/biosensors for the environment ; environmental chemistry ; development of in situ measurements ; nature-based solutions ; civil engineering ; process engineering ; ecological engineering (incl. phytoremediation and bio-remediation) ;*



*ecological engineering ; metrology ; microfluidics ; long-term and/or high-frequency environmental monitoring ; sensor networks ; sustainable remediation technologies.*

**ERC code 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 changes in 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;
- the experimentation with transitions coupled with analysis of the economic, social and environmental dynamics of socio-ecosystems.

**Related key words:** *agriculture ; agronomy ; aquaculture ; animal welfare ; biocontrol ; biodiversity ; biomonitoring ; agricultural policies and/or agricultural systems design ; biogeochemical cycles ; environmental law ; functional ecology ; economics ; ecophysiology ; breeding ; forestry ; genetics ; geography ; animal and plant health management ; soil management ; integrated management ; halieutic ; microbiology ; modelling ; landscape ; fisheries ; public policy ; resilience and adaptation to global environmental changes ; animal science ; management science ; political science ; plant science ; pollination ; ecosystem service ; sociology ; territory ; zootechnics.*

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

**Related SDG:** 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:**

Resources and territories: *land use, terrestrial and marine biomass (production, quality, availability, management, sustainability of the sector); waste, co-products - by-products, etc. from biomass or its transformation; identification of new bioresources.*

Transformation technologies: *biorefineries; biotechnologies; sustainable chemistry; metabolic engineering; micro-organisms; modelling and associated processes; platform molecules; new technologies; bio-sourced polymers; biological, thermochemical and/or catalytic biomass conversion processes; synthetic biology; bio-sourced industrial products (including those related to paper).*

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

**ERC code associated with the panel:** LS02, LS08, LS09, PE04, PE05, PE08, SH01, SH02, SH03, SH07.

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

## Energy transition

The ANR 2024 Work Program 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 set by the French Law of 18 August 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 materials science but they are located at the interface of all scientific fields. On the other hand, bioenergy has been explicitly reintegrated into the scope of theme H.9 "*Sustainable, clean, safe and efficient energy*" (instead of 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 energy<sup>43</sup>, and to encourage research projects bringing together 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. ,

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<sup>43</sup> The energy sector includes: sources, conversion, storage, distribution and efficient use.

- 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 code 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 CO<sub>2</sub>);
- 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;

- electrical engineering<sup>44</sup>, power electronics, power transmission, actuators, converters and electrical machines;
- 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.);
- CO<sub>2</sub> capture and storage;
- production of synthetic hydrocarbons (possibly coupled with platform molecules) from CO<sub>2</sub>, N<sub>2</sub> (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, electrification, global optimization of energy on board, etc.);
- energy in digital technologies <sup>45</sup> : 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 individual and collective behaviour, including the challenges of energy sobriety and the dynamics of their implementation
- analysis of the socio-technical and economic conditions for the development of the various energy sectors and the strategic choices employed;
- energy policies and in particular their links with climate mitigation and adaptation objectives (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.*

**Related 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 engineering (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; CO<sub>2</sub> capture/transport/storage; bio-energies; bio-fuels; bio-combustibles; synthetic fuels; nuclear energy; underground use for energy; renewable or recovered heat; techno-economic approaches; life-cycle analysis; multi-criteria analysis; energy dependence; cross-border operations; network infrastructure;

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<sup>44</sup> Projects dealing with electrical engineering but not aiming at an energy purpose can be submitted under axis B.4 "Engineering and process sciences".

<sup>45</sup> Projects aiming to take into account reduced energy in software development should be submitted in the appropriate areas of the Digital Sciences field.

*energy markets; energy forecasting; behaviour; demand management; fuel poverty, energy security and risk; energy sobriety.*

**ERC code 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 consists 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 Sciences (simulation/modelling, massive data processing and artificial intelligence, etc.).

Two themes are dedicated to specific applications: for the medical sector (theme H.13 "Healthcare Technologies") and digital society (theme 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 aiming to support further generic research in nanoscience and nanomaterials, focusing on the properties of materials or objects induced by the nano dimension, or on specific phenomena related to the nanoscale, 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,
- management of interfaces at the nano scale, functionalisation and interactions between interfaces at the nano scale,
- 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*).

In the field of sensors, only projects that are mainly dedicated to a nanofabrication or nanostructuring stage should be submitted in H10. Projects concerning the study of the contribution of a nanometric dimension to the field of sensors (to improve performance, for example), as well as instrumentation dedicated to nanomaterials, should be submitted under theme H.11, "Sensors, imagers and instrumentation".

Projects whose aim is to design devices for digital technologies must be submitted under theme H.12, "Micro and nanotechnologies for information processing and communication".

Applied to the field of health or biology, the projects on synthesis submitted in this H.10 theme must present as a main lock the synthesis and the physico-chemical study of families of innovative and preferably multifunctional nano-objects. Projects interested in the study of therapeutic, pharmacological and/or biological properties, without demonstrating a strong originality at the level of nanostructuring and multifunctionality of the systems, must be submitted to the corresponding axis of the "Life Sciences" domain. In addition, *in vivo* studies are excluded from this H.10. 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 code 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 code associated with the panel:** majors PE02, PE03, PE04, PE05, PE07, PE08, other LS01.

**Related SDG:** 9.

## **Theme H.12: Micro and nanotechnologies for information processing and communication**

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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 (more Moore / more than Moore). Depending on the expected degree of breakthrough or the assumed level of risk, the 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 will assess their impact on technological transition by referring, for example, to ADEME<sup>46</sup> scenarios, the 2030<sup>47</sup> Agenda, etc., or on the question of technological sovereignty (France 2030, European Chips Act, etc.).

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 nano devices / basic components, are fully incorporated under this theme.

At the relevant dimensional scales (micro and nano), from basic materials towards systems on chips, 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 aiming at the development of devices and components for digital technology based on nano- objects or functional nanomaterials can be submitted under this theme.

Projects concerning quantum technologies whose objective is the development of technological building blocks and/or generic components which are also of interest in classical

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<sup>46</sup> <https://www.ademe.fr/les-futurs-en-transition/les-scenarios/>

<sup>47</sup> <https://www.agenda-2030.fr/17-objectifs-de-developpement-durable>



communication systems can be submitted in this theme provided these systems are clearly identified. The other projects should be submitted under theme E.6 "Quantum Technologies".

Projects concerning the sensors, imaging and instrumentation targeting applications in information processing and communication that are clearly identified and have priority over potential applications in other fields can be submitted in this theme. The other projects should be submitted under theme H.11 "Sensors, imagers and instrumentation"

**Related key words:** *characterisation; optical near-field; integrated circuits and systems; components (alternative, neuromorphic, computational accelerators, etc.); millimetric components; passive components; components for AI; design; life cycle; electronics (organic, flexible); (micro) displays; optical fibres; imagers and sensors for ICT; 3D integration; heterogeneous integration; dense interconnections; instrumentation; artificial materials; devices for optics; memories; metamaterials; metasurfaces; micro and nanoelectronics; micro and nanophotonics; micro-nanosystems; new architecture paradigms; non-linear optics; packaging; photodetectors; plasmonics, technological processes; neural networks; RF; semiconductors; optical sources; simulation (materials, components, circuits); spintronics; System-in-package; chiplet-type modular systems; system-on-chip; resilient/frugal technology; THz.*

**ERC code 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;
- in vitro diagnostic and analytical technologies, their implementation in living organisms;
- 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.

Tissue engineering and regenerative medicine projects fall under the specific axis C.11 "Regenerative medicine".

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, PE02, PE03, PE07

**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 foster the emergence of new concepts, models or methods in mathematics and digital sciences with a view to accelerating research in the fields of life sciences and health. The impact of the projects will be assessed in particular on the proposed methodological innovations and their validation through proof of concept.

*The projects submitted may focus on the following:*

- methods for the analysis, integration, modelling and visualisation of complex data (multimodal, multiscale, high-content) such as data from omics approaches (genomics, transcriptomics, proteomics, etc.), structural biology, cell and tissue microscopy, imaging or e-health;
- the modelling of biological and physiological processes, enabling the development of predictive approaches to the quantitative and qualitative behaviour of the systems studied, the numerical simulation of these models using scientific and high-performance computing and the related optimisation as well as the methods for comparing them with experimental data, in particular data assimilation and automatic learning approaches;
- medical signal and image processing for the segmentation, extraction and characterization of the information they contain, as well as the fusion of multimodal, multiscale, morpho-functional information with the aim of deepening biological knowledge and/or developing new approaches of medical interest;
- immersive (virtual and augmented) visualisation and simulation of data and models;
- the development of methods for the collection, extraction, management, securing, matching and exploitation - aid in decision-making - of massive or heterogeneous data from a variety of sources ranging from omics biology to medico-administrative health data bases (National Health Data System) and health datawarehouses or any other source of personal health data for preclinical, clinical, population or epidemiological research, or as decision-making aid;

*A co-funding request by DGOS (Direction générale de l'offre de soin/General Directorate for Healthcare Provision) may be made for projects that include a partner health care facility.*

**Related key words:** *large-scale machine learning and artificial intelligence for life sciences; assistance in decision-making; algorithmic; predictive analysis; signal and image analysis and processing; big data in*

*biology; biomathematics; bioinformatics; computational biology; bioproduction; e-health; medical information technology; modelling of biological processes; emerging properties of biological systems; simulation in biology.*

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

**Related SDG:** 3 and 9.

## **Theme H.15 : Interfaces: mathematics, digital sciences – humanities and social sciences**

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

This theme concerns both the application of concepts, methods from mathematics, computer sciences and digital 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.) insofar as the cross-disciplinary study benefits both fields.

The projects may relate to digital humanities or computational humanities and social sciences as well as reflection on the challenges of digital objects, networks and devices as long as, by bringing disciplines into close and mutual interaction, they aim to achieve significant scientific spin-offs in both humanities and social sciences and digital sciences or mathematics. The targeted progress may be more significant in one of the two fields (humanities and social sciences or digital sciences or mathematics) provided that the projects mobilise concepts or tools from recent advances in the other field. Research proposals that simply mobilise digital engineering or are limited to impact studies are 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 mathematics or digital science and technology, and in humanities and social sciences.

**Related key words:** *acceptability and appropriation of digital technologies; access to information; access to publications and research data; analysis of culture; analysis of discourses and controversies; analysis of digital media; analysis of graphics traces; analysis of public policies through open data; annotations and enrichment of data; cognitive, sociological and anthropological approaches to learning from/through the digital; digital approach to artistic creation; digital approaches to heritage; co-learning; co-teaching; virtual collections; credibility and verification of online information; democracy and citizen debates in the digital context; immersive and nomadic devices; open data and linked data; eco-design of digital technologies and services; digital school and connected territory; economy and digital markets; media literacy; e-learning; digital enterprise; immersive environment (school, classroom, tool); computing environments for human learning; digital exposure; digital technology training; digital governmentality/algorithms; history of mathematics; digital humanities; cultural and creative industries; pedagogical innovation; serious games and gamification; digital literacy; cultural and digital mediations; knowledge modelling; mathematical modelling of social or socio-economic systems; computer-assisted music; digital ethics; digital and transformation of research and knowledge practices; natively digital heritage; personalisation and adaptation to the learner; content personalisation; self-quantification; use of*

*big data and new analysis capacities; reduction of the digital divide; 3D restitution; educational scripting; behavioural sciences; computational humanities and social sciences; digital society and innovation; uses and digital social practices; uses and regulation of Artificial Intelligence.*

**ERC code associated with the panel:** PE01, 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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This theme aims at supporting innovative interdisciplinary research projects in the scientific context of the Earth system and the environment (in the sense of all the physical, chemical and biological processes taking place on the planet, including the interactions between humans and the environment, and between the different compartments of the Earth - ocean, atmosphere, biosphere, cryosphere, and land). These projects are expected to develop new mathematical, physics and/or numerical based concepts and methods to be implemented on computing and data-based infrastructures. The objective is to enable modelling, theoretical or statistical analysis, and simulation of multi-compartment systems on different spatio-temporal scales; processing and analysing data produced by observational systems, or experiments, or results of numerical simulations. The expected projects should address the challenges raised by the large volumes and diversity of these data.

The submitted projects may, in particular, address the following topics:

- digital methods and services - conforming to FAIR principles - for managing, curating, securing, accessing, interoperating, and cross-referencing distributed, heterogeneous, and multi-source data (e.g., land, sea, air, space, biodiversity, collection, experimentation, numerical simulations), including scaling and virtualization in the cloud;
- innovative methods, software architectures and workflows for the processing, "intelligent" reduction and statistical analysis of massive data flows and volumes, especially multi-source data, exploiting in particular artificial intelligence and data processing logistics (in-situ and in-transit analyses) based approaches;
- modelling, theoretical analysis and numerical simulation in deterministic or stochastic frameworks, at different time and space scales. In particular, these models would be able to integrate new artificial intelligence approaches (e.g., parametrization, emulation, surrogate models, digital twins) and new high-performance computing capabilities for the understanding and quantification of the evolution of integrated multi-compartment and multi-scale systems (e.g., climate, interactions between solid Earth and fluid envelope, global change impacts, anthropized and urban environments, hazards and risks), and their interactions;
- assimilation, inferences, probabilistic inversions of data, in particular multi-source and multi-resolution data (observation, experimentation, simulation) associated with complex and high-dimensional model spaces for the understanding of the structures, composition and dynamics of Earth system components and of the environment and their interactions, as well as the theoretical analyses allowing to qualify and explain their uses;

- characterization, quantification and predictability of extreme events including associated uncertainties in a probabilistic framework, and their integration through the different sources and scales of time and space involved in the analysis and inference methods, data assimilation, numerical modelling/simulation of complex systems, and/or artificial intelligence approaches;
- innovative methods (together with their theoretical analysis) to improve the monitoring, assessment and predictability of all natural and/or man-made hazards: earthquakes, climate hazards (earth, climate, environmental, pollution) as well as those associated with space weather, all considered 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, management of these data relying on a series of digital infrastructures including the major national high-performance computing centres;
- innovative methods for modelling the cross interactions between anthropic or natural changes on the one hand and populations, communities and ecosystems on the other hand, to identify and characterise, in particular, resilience, adaptation or evolution phenomena;
- methods and services to disseminate scientific information under a form that eases their use (decision making) by different stakeholders (e.g. agriculture, risk prevention and management, infrastructure, energy, health).

The foreseen projects must be innovative, interdisciplinary and examine well identified fundamental and methodological questions. The benefits for the different disciplines of the proposed collaboration and cooperation strategy must be clearly explained.

*Related key words: adaptation and resilience of populations, communities and ecosystems; decision support; predictive analysis; large-scale automatic learning; set-based approaches; probabilistic and stochastic approaches; assimilation and inversion of multi-source data; database; big Data; natural and anthropogenic environmental changes; data crossing and fusion; species and population evolution; data management, curation and FAIR services; infrastructures; digital twins; monitoring and forecasting methods; theoretical/simulation modelling/analysis of coupled systems, multi-physical, and multi-scale; data hubs; predictability; numerical forecasting; quantification of uncertainties and extreme events; climate simulation; earth system; statistical data processing and analysis; visualization and exploration of large data sets; workflows and simulation ensembles.*

**ERC code associated with the panel:** PE01, PE6, PE7, PE10, LS08, LS09, SHS 6, SHS7.

**Related SDG:** 6, 7, 11, 13, 14, 15.

## Transformation of socio-technical systems

This cross-cutting area is made up of three axes that share several points in common. First of all, each of these axes is focused on a major issue of development of societies and living well together, whether in relation to the global challenge related to security (axis H.17), the challenges of sustainable development of cities, buildings and transport (axis H.18) or the mutation of productive systems (axis H.19).

Another common point is that these axes call on a very wide range of scientific disciplines to address these issues, ranging from material sciences and engineering to human and social

sciences, including mathematics, digital sciences, and even environmental or life sciences where appropriate. At the same time, some of the issues identified in these axes call for multidisciplinary, even interdisciplinary and systemic approaches.

Finally, collaborative (or even participatory) research projects involving actors from the different fields treated, including companies but also, depending on the subject, civil society (NGOs, etc.) and public actors (local authorities, law enforcement, public transport service, etc.) are welcome in these areas.

### **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, cloud computing, IOT, etc.).

In this perspective, this theme concerns research projects whose objectives are to characterize, prevent and respond to 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; supporting decision-makers and 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 applied research, uni-disciplinary, multi-disciplinary or inter-disciplinary, leading to social, scientific or technological developments in terms of safety, security and cybersecurity (prevention/ anticipation/ supervision/ detection/ reaction/ remediation).

Participatory research involving users (internal security forces, private security and cybersecurity operators, municipal police, civil security, operators of vital importance or of establishments open to the public, local authorities, NGOs, 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, citizen and territorial resilience, training and educational approach, decision support, 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.
- security and democracy, against a backdrop of ever-increasing demands for transparency, the reshaping of democratic balances, the need to respect individual and fundamental freedoms, greater protection for personal data, and the development of

new uses brought about by the development of new technologies (social networks, artificial intelligence, 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.), security of cloud computing and its uses, hardware and software security of connected objects, 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.

**Related key words:** *cybersecurity of networks, information systems, data, software and embedded systems ; cloud computing security ; Internet of Things security ; communication security ; intrusion detection ; detection and mitigation of vulnerabilities ; protection against attacks ; protection of personal data ; system engineering for physical and digital protection ; national security ; global security ; hybrid threats ; security forces equipment ; evidence management ; rescue to people ; security of transport, establishments and places open to the public ; 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.) ;\_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 ; secure/non-secure societal transition.*

**ERC code 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: Cities, buildings and construction, transport and mobility: transition to sustainability**

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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 artificialization ; 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 code 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 theme is open to fundamental research projects and industrial research projects to help design and implement the industrial production systems of the future. The expected projects will have to contribute to lifting scientific and/or organisational barriers in one of the three following areas:

- 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 industrial system for a development process that considers the whole product life cycle and value chain dimensions.
- focus the factory on people who should 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,
- robotics for industrial performance, human-robot collaboration in production systems (technological, organisational and legal aspects),
- digital production methods and technologies, the connected factory, connected industrial ecosystems,
- the virtual industry and factory,
- flexibility and agility of new management modes and production systems,
- new production and control technologies.
- eco-production, the green and socially responsible factory,

The expected projects must come under these topics; they can mobilise different scientific disciplines, in engineering sciences, information and communication sciences and technologies, systems sciences, humanities, social sciences, epistemology of science and technology, 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 industrial systems and factory of the future are especially welcome in this panel.

Lastly, the projects are expected to take account of the need for resilience in the face of potential future disruptions (climatic issues, geopolitical uncertainties, pressure on both human and natural resources, etc.), leading in particular to the need to rethink the economic and organisational models (functionality economy, systems approach, Open Source, etc.) of an industry of the future based on the principles of sustainable development.

**Related key words:** *adaptation-resistance and change support ; decision aids, operator assistance ; logistics chain and networks ; cobotics ; rapid configuration ; diagnostics ; eco-design ; eco-efficiency ; industrial ecology, circular economy, economy of functionality, eco-production ; local ecosystem ; cognitive ergonomics ; fab-lab ; cognitive engineering ; management and evaluation of the life cycle of product-service systems ; industry of the future ; 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 ; management ; optimisation and operational research ; work organization ; 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 ; manuel labor.*

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

**Related SDG:** 8, 9, 10 and 12.

## Strategic priorities

The strategic priorities defined by the French Government focus on the following themes of the 2024 AAPG:

- Scientific exploitation of data generated by OSIs and IRs<sup>\*48</sup>: all AAPG themes (new priority in 2024)
- Artificial intelligence: mainly theme E.2 and projects in other themes, but including a major AI component
- Mathematics: theme F.1 (new 2024 priority)
- Quantum Technologies: theme E.6
- Social Sciences and Humanities: themes D.1, D.2, D.3, D.4, D.5, D.6, D.7, H.1, H.4, H.15, and H.18
- Autism in neurodevelopmental disorders: themes C.3, C.4, C.7, C.8 C.9, C.10, D.4 and H.13
- Translational research on rare diseases: theme C.9

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<sup>48</sup> The need identified, which justifies this national priority, is the strengthening of France's position in international scientific cooperation involved in campaigns to exploit data from these research infrastructures. The list of international scientific organisations (OSIs) and research infrastructures\* (IRs\*), previously named very large research infrastructures, is provided in Appendix 5.

## I. Appendices

### Appendix 1: Definitions from the ANR's funding regulations

**Project:** fundamental or applied Research work and/or feasibility Study(s) as defined by European Regulations, which are the subject of the Grant and carried out by the Beneficiary and potential 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, to conduct 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 Conditions.

**Partner:** Research organisation and/or Enterprise (within the meaning of the European Regulation), legal entities, contributing to the implementation of the Project.

**Coordinating Partner** (when a Project is carried out in collaboration between several Partners) or **Project coordinator:** Partner responsible for the scientific and technical coordination of the Project, for setting up and formalising cooperation between the Partners, for producing some of the Project Deliverables, for holding progress meetings and for disseminating the results. He is designated in the Special Conditions together with his Scientific Manager.

**Scientific Manager(s) or Partner's Scientific Manager:** natural person responsible for the scientific implementation of the Project on behalf of the Partner(s) and designated in the Special Conditions.

**Research and Knowledge Dissemination Organisation:** the term "Research Organisations" must be understood within the meaning of the definition in point 1.3 ee), d) of the European Commission Framework No. 2014/C 198/01 of 27 June 2014. It 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 Law Body) or its funding mode, whose objective is to conduct basic or applied Research activities or to widely disseminate the results of these activities by means of education, publications or knowledge transfer. Where such an entity also carries out economic activities, the funding, costs and revenues of these economic activities should be accounted for separately. Enterprises that may have influence over such an entity, i.e., as shareholders or members, do not enjoy a privileged access to its research capabilities or to the results it produces.

**Enterprises/Companies:** the term "Enterprise/Company" includes large enterprises, small and medium-sized enterprises (SMEs). The definition of small and medium-sized enterprises (SMEs) is that of Article 1 of Appendix 1 of Regulation (EC) No. 651/2014 of the European Commission of 17 June 2014 and is contained in Recommendation 2003/361/EC of the European Commission of 6 May 2003 on the definition of micro, small and medium-sized enterprises and any Community text replacing it. According to the European Regulation, an Enterprise is any entity, regardless of its legal form, carrying out an economic activity. The following are considered to be Enterprises: companies known as corporations, commercial companies, civil companies,

entities carrying out a craft activity or other activities on an individual or family basis, partnerships or associations which 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, without any direct practical application or use being foreseen.

**Industrial research:** Planned research or critical investigation aimed at acquiring new knowledge and skills to develop new products, processes or services or to bring about a significant improvement in existing products, processes or services. It includes the creation of component parts of complex systems required for industrial research, particularly for generic technology validation, but excludes prototypes as defined 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. These may also include, for instance, other activities aiming at the conceptual definition, planning and documentation of new products, processes, or services. Experimental development may include prototyping, demonstration, pilot Project 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 make further technical improvements to products, processes or services that are not substantially "fixed". The creation of commercially exploitable prototypes and pilot projects is experimental development when the prototype is necessarily the commercial end product and when it is too expensive to produce to be used solely for demonstration and validation purposes. 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 modifications to existing products, production lines, manufacturing processes, services and other ongoing operations, even though such modifications may represent improvements.

## Appendix 2: Summary of the principal characteristics of the 2024 Generic Call for Proposals' funding instruments.

*This appendix does not replace the 2024 AAPG Guide, which fully describes the expectations and rules governing eligibility for various funding instruments, the main characteristics of which are presented below. Applicants are asked to carefully read this guide.*

*Regardless of the AAPG funding instrument, all types of proposals are possible: proposals with unprecedented objectives or concepts, breakthrough or exploratory proposals, proposals aiming to remove scientific obstacles that are well known to the community, proposals exploiting data generated by research infrastructures<sup>49</sup>, or proposals resulting from previous proposals and intended to consider new objectives.*

### 1. Young Researchers Instrument (JCJC)

The JCJC funding instrument aims to prepare the new generation of talented young researchers destined to become the future leaders or directors of French scientific research by encouraging them to tackle scientific or technological obstacles using original approaches.

Therefore, the instrument aims to help young researchers acquire scientific autonomy, develop their own research theme, set up or strengthen their own team around this theme, within and beyond their laboratory, acquire project-based culture and quickly demonstrate their capacity for innovation. It is also a springboard for young researchers who, thanks to initial support from the ANR, will be more willing to consider submitting a proposal in response to the calls launched by the European Research Council (ERC).

This instrument, which focuses on the individual, provides funding solely for the young researcher's team.<sup>50</sup> This instrument is open solely for researchers from research and knowledge dissemination organisations and institutions eligible for ANR funding.<sup>51</sup> It is not open to non-tenured staff<sup>52</sup> and cannot be used to fund the coordinator's salary.

To be classified as "Young researcher", **applicants must have defended their doctoral thesis** (or having obtained a degree or qualification equal to the international PhD standard) **less than 10 years ago** (i.e., after 01 January 2013).<sup>53</sup>

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<sup>49</sup> In 2022 and 2023, the ANR implemented a pilot call on the scientific exploitation of research infrastructure data (ESDIR). As of 2024, this call is replaced by (1) the opportunity to submit projects requiring the scientific exploitation of data from research infrastructures to the AAPG and (2) a priority for the "scientific exploitation of data generated by ISOs and RIs\*" (see appendix 5).

<sup>50</sup> No change of project coordinator is accepted during the implementation of a JCJC project.

<sup>51</sup> A researcher eligible to the JCJC instrument (respecting the deadline for the defence of a thesis and the deadline to take up his position) is however not required to apply to the instrument, and therefore may apply to a PRC, PRCE or PRCI instrument if the composition and size of his/her project justify such a choice.

<sup>52</sup> Insofar as they are currently under contract (or will be) with the managing authority. The contract could have not started before the agreement. See the new eligibility rules listed in the 2024 AAPG Guide.

<sup>53</sup> Exemptions may be granted (maternity/paternity leave, parental leave, leave for parental presence, long-term sick leave (more than 90 days), national service, integrated dual degrees, etc.) In addition, for women, the limit is extended by one year per dependent child. In addition, for women, the limit is extended by one year per dependent child. Where relevant, supporting documents must be provided when the pre-proposal is submitted.

**Reminder:** Since 2022, eligibility to the "young researcher" instrument is limited to 5 years after taking up a position within a research and knowledge dissemination organisation or institution eligible for ANR funding<sup>54</sup>. Moreover, it should be noted that funding under the "young researcher" instrument can only be allocated once throughout a career.

It is not possible to combine JCJC funding with a similar type of funding.<sup>55</sup>

## 2. Single-team Research Project (PRME)

The "Single-team research project" (PRME) funding instrument is intended to fund a single team or laboratory from a research and knowledge dissemination organisation or institution eligible for ANR funding. Only the project coordinator's team or laboratory is funded under the single-team research project.

A PRME project corresponds to research directed towards outstandingly ambitious and innovative scientific objectives. A PRME project is coordinated by a team or laboratory manager with all the skills and know-how required to achieve these ambitious and innovative objectives. Various types of teams are accepted, provided that they are approved by the laboratory director. The team or laboratory must prove, in their application, their sustainability over the duration of the project. To this end, upon submission of its pre-proposal, the coordinator must provide a certificate signed by the laboratory director (under the model to be posted on the 2024 AAPG web page).

Under a PRME, a project coordinator is expected to be heavily involved (*at least 40% FTREs*). The team will also have to provide evidence that all participants identified in a PRME project are involved in at least 1.5 FTREs (*see the list of people eligible in the 2024 AAPG Guide*).

In this context, funding under a PRME instrument by the ANR is incompatible with:

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

A change of coordinator will not be authorised during the implementation of a PRME project<sup>56</sup>.

Throughout the duration of the PRME, participants in a PRME project cannot submit another PRME or take part in another PRME.

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

Researchers seeking to submit a PRME project must comply with these eligibility and project development rules which are also in the 2024 AAPG guide.

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

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<sup>54</sup> A researcher eligible to the JCJC instrument (respecting the deadline for the defence of a thesis and the deadline to take up his position) is however not required to apply to the instrument, and therefore may apply to a PRC, PRCE or PRCI instrument if the composition and size of his/her project justify such a choice.

<sup>55</sup> Inserm ATIP-Avenir, CNRS Momentum, the City of Paris Emergence programme, funding from the European Research Council (ERC), regional authorities or any other funding such as the JCJC instrument, etc.

<sup>56</sup> This rule applies except in the event of *force majeure*. A specific authorisation request must be sent to the ANR and explain the *force majeure* requiring a change of project coordinator.

Collaborative projects aim to achieve scientific or technological objectives by sharing knowledge and resources stemming from various national or international public or private research teams or groups.

Therefore, the funding granted helps fast-track the research proposed through collaborative efforts. These instruments encourage research team to carry out research for which a collaboration provides a scientific added value, either because research can be conducted or because it makes it possible to consider results of greater ambition or quality. Inter-disciplinary or multidisciplinary research is encouraged as part of these collaborative instruments.

A collaborative project is led by a coordinating partner (also referred to as coordinator), acting on behalf of all partners (at least two) and making up the consortium. A scientific manager is appointed for each partner.<sup>57</sup>

### **3.1. Collaborative Research Projects (PRC)**

The “Collaborative Research Project” (PRC) instrument is the ANR’s main funding instrument. It includes all types of multi-partner research projects other than those covered by PRCI and PRCE instruments.

This collaboration involves at least two partners<sup>58</sup>, including at least one laboratory from a research and knowledge dissemination organisation or institution eligible for ANR funding. Collaborations using own funds are possible, particularly for foreign team(s) from countries that are not eligible for the PRCI (cf. Appendix 2 § C.3-2), in which case the consortium must include at least one team from research and knowledge dissemination organisations or institutions eligible for ANR funding.

### **3.2. International Collaborative Research Projects (PRCI):**

The ANR is working in collaboration with research funding agencies from other countries and provides agreements facilitating collaborations between teams from these various countries to its supervisory ministry. These bilateral agreements, which may cover targeted themes or be open to all research themes funded by the ANR, focus on priority objectives or geographical areas for limited periods of time, except for the special case of the Franco-German collaboration (Elysée Treaty, revised in 2019 in Aix-La-Chapelle).

Depending on the case, these agreements aim to:

- accelerate and develop collaborations between French researchers and the best international teams on key themes,
- promote partnerships with emerging countries based on themes of mutual interest and shared benefits,
- enable the development of transnational teams of excellence to conduct and share research worldwide.

For agreements targeting specific themes, the ANR and its partner agencies aim to renew the theme over two to three years to strengthen collaborations and foster the emergence of quality projects.

The “International Collaborative Research Projects” (PRCI) funding instrument is devoted to

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<sup>57</sup> See: Appendix 1 – Definitions (pages 19 and 20) of the ANR’s Funding Regulations. <https://anr.fr/en/funding-regulations/>

<sup>58</sup> A PRC may involve two teams from the same laboratory, with each being considered a partner in the collaborative project. In this case, it is not a PRME (§ C.2).

these bilateral collaborations, which are established between at least a French partner (a laboratory from a research and knowledge dissemination organisation or institution eligible for ANR funding) and a foreign partner (eligible for funding from a foreign funding agency, which has signed a bilateral agreement with the ANR).

A strong synergy is expected between the two partners submitting their proposal and must be reflected in the complementarity of each country's scientific contributions and clear identification of real scientific project coordinators for each country. For the 2024 Work Programme, the countries involved in these bilateral agreements would be:

- *In Europe: Germany, Austria, Luxembourg and Switzerland.*
- *Internationally: Brazil, Canada, Quebec, United States, Hong Kong, Singapore and Taiwan.*

Appendix 3 (below) provides details on the research issues and themes covered by these collaborations.<sup>59</sup> In addition to the agreements linked to the PRCI instrument of the Generic Call for Proposals, bilateral agreements that are strategic for the French State are subject to specific calls for proposals. Following a common desire with partner agencies, these calls are subject to a specific budget and, most often, to specific evaluation and selection conditions.

Information on these specific international collaborations is available on the ANR website and is regularly updated according to the progress of negotiations.

### **3.3. Collaborative Research Projects involving Enterprises (PRCE)**

The “Collaborative Research Project involving Enterprises” (PRCE) funding instrument is dedicated to collaborations established between at least one laboratory from a research and knowledge dissemination organisation or institution eligible for ANR funding, and at least one company or trading company involved in R&D.<sup>60</sup> The project may be coordinated by the public partner or the private partner.

These projects aim to jointly reach research results which will be beneficial to both parties, by allowing public or private laboratories from research or knowledge dissemination institutions to address new research issues, or to approach them differently, and by giving companies access to the best public research so they can improve their capacity for innovation in various ways.

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<sup>59</sup> Appendices specific to each country (available on the 2024 Generic Call for Proposals web page) describe the themes eligible and specific submission and selection procedures. They describe the additional eligibility provisions for the Generic Call for Proposals, and must absolutely be consulted before any application is submitted to the ANR or a foreign partner.

<sup>60</sup> For the definition of a company or trading company, see: Appendix 1 – Definitions (pages 19 and 20) in the ANR's Financial Regulation. <https://anr.fr/en/funding-regulations/>



## Appendix 3: List of bilateral collaborations and research themes of the 2024 Generic Call for Proposals: International Collaborative Research Project (PRCI)

Countries (agencies)	Themes for collaboration	Lead Agency	Relevant scientific themes*
<b>Brazil</b> (FACEPE)	<ul style="list-style-type: none"> <li>• Mathematics and Digital Sciences</li> <li>• Social Sciences and Humanities</li> <li>• Materials</li> <li>• Engineering, chemistry, physics</li> <li>• Environment, ecosystems and biological resources</li> <li>• Biology &amp; Health</li> </ul>	-	Themes A.1 to A.4; Themes B.1 to B.6; Themes C.6 to C.8; Themes D.1 to D.7; Themes E.1 to E.6; Theme F.1; Themes G.1 and G.2; Themes H.1 to H.7; H.11 and H.12, H.14 to H.16 and Theme H.19
<b>Brazil</b> (FAPESP)	<ul style="list-style-type: none"> <li>• Mathematics and Digital Sciences</li> <li>• Social Sciences and Humanities</li> <li>• Materials</li> <li>• Engineering, chemistry, physics</li> <li>• Environment, ecosystems and biological resources</li> <li>• Biology &amp; Health</li> </ul>	ANR	Themes A.1 to A.4; Themes B.1 to B.6; Themes C.6 to C.8; Themes D.1 to D.7; Themes E.1 to E.6; Theme F.1; Themes G.1 and G.2; Themes H.1 to H.7; H.11 and H.12, H.14 to H.16 and Theme H.19
<b>Canada</b> (CRSNG)	<ul style="list-style-type: none"> <li>• Hardware and software for quantum computing</li> </ul>	CRSNG	Themes E.6 and B.1
<b>Canada – Quebec</b> (FRQSC)	<ul style="list-style-type: none"> <li>• Arts, languages, literatures, philosophies</li> </ul>	ANR	Theme D.5
<b>United States</b> (NSF)	<ul style="list-style-type: none"> <li>• Physics of living organisms</li> </ul>	NSF	Themes C.2 to C.4; Theme B.1; Theme H.14
	<ul style="list-style-type: none"> <li>• Quantum technologies</li> </ul>	NSF	Theme B.1; Themes C.1 to C.3, C.7 and C.10; Themes E.1 to E.6; Theme F.1; Themes H.3, H.11 and H.13
	<ul style="list-style-type: none"> <li>• Molecular chemistry (precious metal-free catalyst)</li> </ul>	ANR	Theme B.5
	<ul style="list-style-type: none"> <li>• Digital sciences, mathematics and their interactions</li> <li>• Mathematics and its interactions</li> </ul>	ANR	Themes E.1 to E.6; Theme F.1; Themes H.12 and H.14
<b>Hong Kong</b> (RGC)	All disciplinary fields funded by the ANR and RGC	-	All themes except H.17
<b>Singapore</b> (NRF)	Circular economy	-	Theme A.4; Theme B.4; Themes D.1 to D.7; Themes H.1, H.6 and H.7, H.18 and H.19

Countries (agencies)	Themes for collaboration	Lead Agency	Relevant scientific themes*
<b>Taiwan</b> (NSTC)	All disciplinary fields funded by the ANR and NSTC	-	All themes except H.17
<b>Germany</b> (DFG)	All disciplinary fields funded by the ANR and DFG, except Social Sciences and Humanities**	DFG	All themes except D.1 to D.7 and H.4
<b>Austria</b> (FWF)	All disciplinary fields funded by the ANR and FWF	FWF	All scientific fields
<b>Luxembourg</b> (FNR)	All disciplinary fields funded by the ANR and FNR	ANR	All scientific fields
<b>Switzerland</b> (FNS)	All disciplinary fields funded by the ANR and FNS	FNS	All scientific fields

\*Cf. § G “Scientific themes covered by the 2024 Generic Call for Proposals” in the 2024 AAPG. Each scientific theme has its own a Scientific Evaluation Panel (CES).

\*\* Humanities and social sciences are subject to a specific ANR-DFG call, beyond the AAPG.

## Appendix 4: Thematic Annual Programming on the protection of cultural heritage in response to extreme hydroclimatic events (TAP SD-WISHEES)

In addition to ANR funding instruments, the Thematic Annual Programming (TAP) scheme was implemented to ensure the compatibility and coordination of national research programmes and facilitate international cooperation by creating a network of projects addressing the same scientific theme.

As part of the SD-WISHEES CSA , Joint Programming Initiatives on Water (Water JPI) and Climate (JPI Climate), joined forces to launch a joint Thematic Annual Programming call on the protection of cultural heritage in response to extreme hydroclimatic events, “TAP SD-WISHEES”.

This tool **encourages the internationalisation of national** research, development and innovation **projects** (such as PRC, PRCE, PRME and JCJC), **simultaneously funded by the ANR and other funding agencies involved in the initiative**, through the networking of projects working on a common scientific theme.

Scientific project coordinators will be responsible for submitting a project in the following scientific themes: A.1 “*Solid earth and fluid envelopes*”, A.2 “*Living earth*”, D.5: “*Arts, languages, literatures, philosophies*”, D.6; “*Studies of the past, heritage, cultures*”, D.7 “*Societies and territories in transition*”, H.1 “*Sustainability Science*”, H.5 “*Methodologies, instrumentations, sensors and solutions for the ecological transition*”, H.6 “*Dynamics of socio-ecosystems and their components*”, H.15 “*Interfaces: Mathematics, Digital Sciences - Social Sciences and Humanities*”, H.16 “*Interfaces: Mathematics, Digital Sciences - Earth system and Environmental Sciences*” and H.18 “*Transport and mobility, constructions in urban and peri-urban areas*” to express their interest, when submitting their pre-proposal (stage 1 of the 2024 AAPG), in taking part in the TAP. Confirming<sup>61</sup> the interest to take part in the TAP will be requested when submitting the full proposal (stage 2 of the 2024 AAPG).

Inter- and trans-disciplinary approaches are encouraged, as well as innovative disciplinary approaches contributing to expand and share knowledge to monitor and characterise the impact of hydroclimatic extreme events on the cultural heritage, and develop adaptation and mitigation strategies for cultural heritage preservation.

The projects expected in the TAP SD-WISHEES must cover at least one of the following fields or themes<sup>62</sup>:

- Monitor and assess the impacts of extreme hydroclimatic events on cultural heritage. Interdisciplinary approaches combining quantitative and qualitative methods, and in various geographic areas, are encouraged.
- Characterise the most critical hydroclimatic parameters for cultural heritage.

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<sup>61</sup> Confirming the interest in stage 2 of the 2024 AAPG is required to qualify for the TAP scheme. The expression of interest in stage 1 is optional and without obligation.

<sup>62</sup> The list of sub-themes may be subject to minor changes, with a view to harmonising research themes in the various countries involved. A possible update will be published on the ANR website.

- Model and protect changes in cultural heritage at high spatial and temporal resolution to better understand the impact of hydroclimatic extreme climate events on cultural heritage and anticipate new or unknown risks.
- Assess the vulnerability and resilience of cultural heritage.
- Develop tools to manage cultural heritage in a changing hydroclimatic context. Tools should meet the needs of communities and its users. Inclusive and participatory approaches must be implemented in the development and adoption processes of these tools.
- Prevent the damage to cultural heritage through the elaboration of long-term adaptation and mitigation strategies, based on lessons from the past and good practices.
- Governance, efficient training, sharing of knowledge and expertise, and educational activities for the protection of cultural heritage.

The objective, for projects networked within the “TAP SD-WISHEES” **international cluster**, is to **discuss their approaches, methods, data and results, while fostering knowledge transfer towards citizens and decision-makers.**

**The activities of the cluster created will last 2 years, from 2025 to 2026, and include at least two meetings a year,** to exchange with other researchers and/or project coordinators involved in this international network.

**The projects interested in taking part in this initiative will receive additional €25k to €30k funding for “TAP SD-WISHEES” networking activities.**

Following the 2024 AAPG evaluation process, the ANR will check that the themes chosen by the eligible projects and proposed for funding are suitable to those of the TAP. Three projects per country involved maximum will take part in “TAP SD-WISHEES”. The ANR will allocate funding based on the ranking conducted by the scientific evaluation panels involved. The list of selected projects for each country will be announced in late 2024.

*For any question regarding the TAP SD-WISHEES, please contact:*

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*More information on this Thematic Annual Programming call, the countries involved, its implementation, the work and results expected, will soon be published on the “SD-WISHEES TAP Action” web page of the joint programming initiatives involved in this call.*

## Appendix 5: List of International scientific organisations and Research infrastructures IRs\* (previously TGIR) eligible to the “scientific exploitation of data generated by OSIs and IRs\*” priority

Scientific field	Acronym	Name of the infrastructure	Type
<b>Astronomy and astrophysics</b>	ESO	European Southern Observatory	OSIs
	SKAO	SKA Observatory	OSIs
	CFHT	Canada-France-Hawaii Observatory	IRs*
	CTA	Cherenkov Telescope Array	IRs*
	IRAM	Institute for Millimetre Radio Astronomy	IRs*
<b>Biology &amp; Health</b>	EMBL	European Molecular Biology Laboratory	OSIs
	OEBM	European Molecular Biology Organisation	OSIs
<b>High-energy nuclear physics</b>	CERN	European Organisation for Nuclear Research	OSIs
	CERN LHC	Large Hadron Collider	IRs*
	DUNE PIP-II	Deep Underground Neutrino Experiment	IRs*
	EGO-Virgo	European Gravitational Observatory – Virgo	IRs*
	FAIR	Facility for Antiproton and Ion Research	IRs*
	GANIL-SPIRAL2	National Large Heavy Ion Accelerator (GAMI) - 2nd generation heavy ion online production system	IRs*
<b>Social Sciences and Humanities</b>	HUMA NUM	Very Large Research Infrastructure in the Digital Humanities	IRs*
	PROGEDO	PROGEDO (Production and Management of Data)	IRs*
<b>Materials and Engineering Sciences</b>	Apollon	Apollon Laser	IRs*
	ESRF	European Synchrotron Radiation Facility	IRs*
	ESS	European Spallation Source	IRs*
	E-XFEL	European X-Ray Free Electron Laser	IRs*
	ILL	Max von Laue – Paul Langevin Institute	IRs*
	SOLEIL	SOLEIL Synchrotron	IRs*
	CRG ILL	Collaboration Research Group – ILL	IRs*
	CRG ESRF	Collaboration Research Group- ESRF	IRs*
<b>Earth System And Environmental Sciences</b>	CEPMMT	European Centre for Medium-Range Weather Forecasts	OSIs
	CONCORDIA	CONCORDIA Franco-Italian research base in Antarctica	IRs*
	ECORD/IODP	European Consortium for Ocean Research Drilling	IRs*
	EURO-ARGO	Global ocean in-situ observation network /	
	France	European contribution to Argo program	IRs*
	FOF	French Oceanographic Fleet	IRs*
	ICOS France	Integrated Carbon Observation System	IRs*
<b>Digital Services</b>	GENCI	Big National Equipment for Intensive Computing	IRs*
	RENATER	National Telecommunications Network for Technology, Education and Research	IRs*
	IDRIS	Institute for Development and Resources in Intensive Scientific Computing	IRs*
	TGCC	CEA Very Large Computing Center	IRs*