

Work Programme 2020

Generic call for proposals 2020

(version 1.1)

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STAGE 1

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

Thursday 24 October 2019 at 5:00 pm (Paris time)

STAGE 2: CLOSURE OF THE SUBMISSION STAGE FOR FULL PROPOSALS

Full proposal submission stage closure is set for the **end of March 2020**, the exact date and time will be specified upon invitation to submit full proposals.

Prior to submitting a (pre)-proposal for a research project, it is important to carefully read this document in full as well as the AAPG Guide 2020 (which will be available late-August 2019 from the ANR website) and the Regulations on ANR funding allocation procedures (<http://www.anr.fr/RF>)

Contents

A.	Context and objectives of the Generic Call for proposals 2020 (AAPG 2020)	5
B.	Submission, evaluation and funding of projects under the Generic Call for Proposals 2020	6
B.1.	Funding instruments	6
B.2.	Submission rules for the AAPG 2020	6
B.3.	Eligibility of proposals	7
B.5.	Project selection	7
B.6.	Project funding	9
C.	Special arrangements and regulatory requirements	9
C.1.	Very large research infrastructures (TGIR)	9
C.2.	Competitiveness clusters	9
C.3.	French co-funding.....	10
C.4.	Scientific publications and research data.....	10
C.5.	Promoting scientific, technical and industrial knowledge	10
C.6.	Access to genetic resources and traditional knowledge associated with genetic resources	10
D.	Evaluation criteria for projects submitted for the Generic Call for Proposals 2020	11
E.	Scientific themes covered by the Generic Call for Proposals 2020	13
	Environmental Sciences	13
	Energy and Materials Sciences	16
	Life Sciences	20
	Social Sciences and Humanities	25
	Digital Sciences	28
	Mathematics and its Interactions	33
	Physics of Matter, High Energy, Planetary and Universe Sciences	34
	Multi-disciplinary fields	35
F.	Provisions on the GDPR and Disclosing results	47

A. Context and objectives of the Generic Call for proposals 2020 (AAPG 2020)

The Generic Call for Proposals 2020 is the “Research and Innovation” component of ANR’s Work Programme 2020.

It is directed towards all scientific communities and all public and private players involved in French research, including small and medium-sized enterprises (SMEs) and very small enterprises. It is designed to give researchers in various scientific fields access to co-funding in a large number of research themes, basic or applied, in addition to their allocated recurrent funding.

The AAPG applies to all types of research (fundamental and industrial research and experimental development).

The “**Research and Innovation**” component of ANR’s Work Programme 2020, which supports AAPG 2020, has been structured into **49 research themes**:

- There are **36 research themes** spanning **7 main scientific fields**:
 - Environmental Sciences
 - Energy and Materials Sciences
 - Life Sciences
 - Social sciences and humanities
 - Digital Sciences
 - Mathematics and its Interactions
 - Physics of Matter, High Energy, Earth and Universe Sciences.
- **13 research themes** covering **cross-disciplinary** challenges and integrating issues from various scientific fields.

There is a Scientific Evaluation Panel for each research theme.

When researchers submit a proposal, they select the scientific theme – and therefore the Scientific Evaluation Panel – that most closely relates to the scientific purpose of their research. Details of this purpose are given for each scientific field in [SE](#).

This choice cannot be changed mid-way through the selection process.

The panels dealing with cross-disciplinary themes involving several scientific fields, and panels dealing with interdisciplinary themes, include members who cover all required disciplines and scientific fields.

The strategic priorities defined by the French state and the government plans listed in the Work Programme 2020 are clearly included in the “AAPG 2020”. These priorities, which receive additional funding, are listed below:

- Artificial intelligence
- Social sciences and humanities
- Quantum technologies
- Antimicrobial resistance:
- Autism in Neurodevelopmental Disorders
- Translational Research on Rare Diseases.
- Cooperation within French-German research projects (*see appendices to Work Programme 2020*)

B. Submission, evaluation and funding of projects under the Generic Call for Proposals 2020

The Generic Call for Proposals is open to all grant-holding researcher¹ belonging to an organisation, establishment or public or private² research laboratory eligible for ANR funding.³

B.1. Funding instruments

AAPG 2020 uses a set of instruments to fund individual research projects coordinated by young researchers (JCJC), or collaborative research projects between public entities or similar in a national or international context (PRC and PRCI respectively), and public (or similar) and private entities with a potential opening to the world of business (PRCE). The four funding instruments proposed under the Generic Call for Proposals each have specific submission and evaluation procedures. The characteristics and requirements of these funding instrument are briefly outlined in Work Programme 2020 and explained in detail in the *AAPG Guide 2020*.⁴ This Guide is the authoritative document for researchers intending to submit a proposal, as well as the experts reviewing submissions and panel members, explaining how proposals are submitted, evaluated, selected and funded.

Researchers will need to select the instrument that best suits the objectives of their project when making their application.

This choice cannot be changed mid-way through the process.

B.2. Submission rules for the AAPG 2020

- **A researcher may only submit one project as coordinator and cannot be involved (as coordinator or scientific and technical leader for a project partner) in more than three proposals** submitted to ANR under the Generic Call for Proposals, including PRCI,⁵ and under the French-German programme in Social Sciences and Humanities outlined in Work Programme 2020.⁶
- **A coordinator of a PRC, PRCE or JCJC proposal funded under the Generic Call for Proposals 2019 cannot submit a PRC, PRCE or JCJC proposal as coordinator for the Generic Call for Proposals 2020.** However, the researcher may act as a partner's scientific and technical leader or be otherwise involved in a PRC, PRCE or PRCI proposal submitted for the 2020 edition.
- **A JCJC project coordinator cannot act as the coordinator for another JCJC, PRC, PRCE or PRCI for the Generic Call for Proposals, regardless of the year, while the initial JCJC project**

¹ For current (or future) contractors with a binding contract with the managing authority. The contract may not have taken effect prior to awarding.

² For private entities: with an institution or branch in France.

³ See funding rules: <http://www.anr.fr/RF>.

⁴ Published on the ANR website in early September 2019.

⁵ The limit to participation in no more than three projects as coordinator or scientific and technical leader therefore applies equally to stage 1 PRCI registrations. Consequently, the coordinator of a stage 1 registered PRCI proposal or a proposal submitted to a foreign agency acting as the Lead agency (DFG, FWF or FNS) cannot be the coordinator of a separate PRC, PRCE or JCJC proposal under the Generic Call for Proposals, regardless of the outcome of the stage 1 evaluation for that PRC, PRCE or JCJC proposal.

⁶ For 2020, this exclusion rule does not apply to proposals submitted in no relation to the Generic Call for Proposals or to the Fr-Ger programme in Social Sciences and Humanities. However, the scientific objectives of the separate proposals must be materially different (see the eligibility rule which dictates that each proposal must be different in the *AAPG Guide*).

is ongoing.⁷ However, the researcher may be involved in a PRC, PRCE or PRCI proposal submitted for the 2020 edition.

- The project coordinator, funding instrument and Scientific Evaluation Panel indicated when the pre-proposal for a PRC, PRCE or JCJC is submitted or a PRCI is registered cannot be amended mid-way through the Generic Call for Proposals 2020 selection or evaluation process.

All projects which fail to comply with the above rules shall not be eligible.

- Coordinators may not simultaneously benefit from both funding under the JCJC instrument and/or funding under the Inserm ATIP-Avenir, CNRS Momentum or Town of Paris Emergence programmes and/or funding from the European Research Council (ERC) and/or ANR's ERC springboard (Tremplin) project.

B.3. Eligibility of proposals

ANR assesses proposals for eligibility throughout the submission, evaluation, selection and funding process, based on the submission rules described in the AAPG Guide 2020 (see [SB.2](#)) and the eligibility criteria described in the *AAPG guide 2020*.

B.4. Proposal submission process

The submission form must be completed online and the scientific documents (pre-proposal or full proposal) must be submitted in PDF format via the ANR website. Refer to the *AAPG Guide 2020* for details of what the scientific document should contain.

The scientific proposal (to be written in French or English) should not exceed 4 pages (including a bibliography, diagrams and references) for a pre-proposal and 20 pages (including a bibliography,⁸ diagrams and references) for a full proposal.

Project participants are invited to enter their ORCID ID online.⁹

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

The research proposal will need to give due consideration to sex and/or gender aspects, irrespective of the research area in question. *Moreover, an undertaking to comply with the obligations arising from the Nayoga Protocol and the French plan for open science (see [§C](#))* will also be required when the proposal is submitted.

B.5. Project selection

Project selection at ANR is based on the principle of peer review. ANR's selection process includes panels and external experts (i.e. outside these panels).

⁷ Coordinators may submit a proposal in the final year of a JCJC project providing that the current project will have ended on the date on which the new project is awarded, i.e. by 01/10/2020.

⁸ Since the 2019 edition, the CVs of coordinators and partners may include preprints (<https://fr.wikipedia.org/wiki/E-print>) which have not yet been published in peer-reviewed scientific journals. Applicants are also encouraged to cite preprints with reference to preliminary data.

⁹ ORCID is a non-profit organisation supported by a global community of organisational members, including research organisations, publishers, funders, professional associations, and other stakeholders in the research ecosystem. For more information, go to: <https://orcid.org>.

¹⁰ This document can be found at: <https://anr.fr/fr/lanr-et-la-recherche/engagements-et-valeurs/lintegrite-scientifique/>

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

Each evaluation panel is chaired by a referral manager who has undergone ANR selection process and ethics training. The referral manager heads the Scientific Evaluation Panels bureau, generally consisting of two vice-chairs¹¹ who help the chair prepare for and carry out the panel's work.

The panel to evaluate the proposal is selected by the project coordinator in the first submission stage and cannot be altered mid-way through the selection process.

The experts in the area(s) concerned by the proposals produce written evaluations of one or more pre-proposals or full proposals without participating in panel meetings. The external peer reviewers operate independently and in total confidentiality, without any exchanges with third parties. The only elements at their disposal are the materials in the pre-proposal and/or the full proposal as submitted through the website before the call deadline.

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

The *Generic Call for Proposals 2020* involves a two-stage proposal evaluation and selection process.¹² The draft submission, evaluation and funding schedule can be found on the ANR website. The process is described in detail in the *AAPG Guide 2020*. The stage-1 evaluation process (excluding PRCI proposals, which are only registered^{13,14}) involves the Scientific Evaluation Panel identifying PRC, PRCE and JCJC pre-proposals for which there is a sound basis to draft a full proposal based on their quality and scientific aims (selection criteria).¹⁵ The stage-2 evaluation process (which includes PRCI proposals) aims to select the best proposals by evaluating, in accordance with international competitive project selection principles, the quality and scientific aims of the proposal, how it is organised and how it will be implemented, and what the impact and consequences of the project described in the full proposal will be.¹⁶

This second stage draws on both external experts and the evaluation by members of the panel to which the coordinator submitted the proposal.

This second stage also includes the right to respond to outside expert evaluations. The coordinator's response to external experts will be taken into account at the plenary meeting of the Scientific Evaluation Panel. The Scientific Evaluation Panel will rank the proposals on a consensus basis after discussing each proposal. The panel's evaluation report will be sent to the project coordinator, reflecting the consensus reached at the meeting.

¹¹ There are between one and three vice-chairs, depending on the panel size.

¹² The Generic Call for Proposals selection process was awarded ISO 9001 certification in May 2018 (this certification was renewed in 2019).

¹³ For the PRCI instrument, registration is step one of submission for the Generic Call for Proposals 2020, except for PRCIs involving collaboration with Germany (DFG), Austria (FWF) and Switzerland (FNS), for which submissions must be made to these agencies, acting as the Lead Agency. ANR must be provided with administrative information and a copy of the project proposal in accordance with the procedures described in the appendix specific to the agreement in question (available on the ANR website) for these projects

All applicants registering a PRCI with ANR during stage 1 will be invited to submit a proposal during stage 2, unless the project registered is not eligible (particularly under dual coordination, see § B.3).

¹⁴ For these collaborative projects organised with Germany (DFG), Austria (FWF) and Switzerland (FNS), dual -coordination (see § B.2.) is not authorised and eligibility will be considered on the basis of the list of projects submitted to these partner agencies and to ANR.

¹⁵ Between 2,500 and 3,000 applicants will be invited to submit full proposals at the end of stage 1.

¹⁶ The evaluation criteria for each stage of the selection and evaluation process are explained in [SD](#).

B.6. Project funding

At the end of the evaluation and ranking process, the decision on whether or not to select a project is made by ANR based on the rankings established by the Scientific Evaluation Panels¹⁷ and budgetary guidelines and priorities approved by MESRI. In July 2020, ANR will publish the list of projects selected to receive potential funding commencing in October 2020.

The selected proposals will be funded by ANR, based on the type of consortium, either after a unilateral funding decision or after notification providing that a funding agreement is signed with each of the benefiting partners. This might sometimes require additional information and analysis (particularly for companies: i.e. financial statements, company registration (Kbis), information on capital-based relationships). Reminder: companies facing difficulties are not eligible for ANR funding.

The procedures for the allocation of ANR funding are set out in the “*Regulations concerning the conditions of allocation of ANR funding*” (<http://www.anr.fr/RE>). Partners are invited to read this document carefully in order to build their projects in compliance with the provisions therein in particular with respect to budget aspects. ANR will contact the partners in question in order to check their respective beneficiary categories via the form drafted for this purpose.

C. Special arrangements and regulatory requirements

C.1. Very large research infrastructures (TGIR)

Projects relying on resources from very large research infrastructures (TGIR) are invited to make that clear at the time they submit their pre-proposal. An approach independent of the submission of the proposal to the ANR must be undertaken to ensure such resources are obtained if the smooth running of the project depends on them. Evidence of this can be provided in the full proposal.

Requests for resources can, for example, be submitted to GENCI (*French programme for “Big national equipment for intensive computing”* - www.genci.fr/en) in order to obtain computing and storage resources for the purposes of digital simulation, big data processing or artificial intelligence.¹⁸

C.2. Competitiveness clusters

Projects wishing to be labelled by one or more competitiveness clusters must declare this intention in stage 1 of the selection process.¹⁹

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

¹⁷ ANR does not alter the rankings produced by the panels and funds the projects under each scientific theme based on the budget allocated to the panel.

¹⁸ GENCI can provide computing and storage hardware free of charge, for use in digital simulation and high-performance computing (HPC), at three centres in France (CINES, IDRIS and TGCC) for academic and industrial researchers contributing to open research. Two calls for proposals (January and July) provide openings for applying to obtain resources allocated for a twelve-month period. Applications are then reviewed by Specialist Panels to determine their level of scientific and technical excellence. More information on national computing centres, access terms and conditions and an information handbook for users can be obtained from: <http://www.edari.fr> and <http://www.genci.fr>.

¹⁹ Such requests will not be accepted in stage 2. PRCI proposals are not eligible for labelling.

successfully obtains a label from a competitiveness cluster, information on the monitoring of the project will also be provided to the competitiveness clusters. The labelling timetable is set out in the *AAPG Guide 2020*.

C.3. French co-funding

The ANR establishes partnerships with other funders. The Generic Call for Proposal's list of co-funders is regularly updated on the ANR website's Generic Call for Proposals page. In general, co-funders do not provide additional funding but rather contribute to the grant requested from ANR for a project, except where a specific application is made directly to the partner co-funder. Co-funding means that the grant attributed to the project includes a financial contribution from ANR and a co-funder partner with an interest in supporting the research work.

A selected project coordinator may refuse co-funding for his/her project. Similarly, the coordinator may refuse to allow information about the project to be shared with a co-funder prior to the evaluation procedure.

C.4. 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 national plan for open science, if funding is granted, the project partners undertake to:

- submit their scientific publications (full texts) resulting from the research, development or innovation project to an open archive (either directly in HAL or via a local institutional archive) in accordance with the conditions of article 30 of the French law '*For a Digital Republic*';^{20,21}
- provide a Data Management Plan (DMP)²² within six months of the project start-up, in accordance with the requirements outlined in the Special Conditions and ANR funding rules.

In addition, ANR recommends giving preference to publication in open access journals and books.²³

C.5. Promoting scientific, technical and industrial knowledge

ANR encourages ANR grant beneficiaries and any partners of these beneficiaries to lead and/or participate in knowledge transfer programmes targeting the general public and decision-makers: publishing articles in the media, talking to the media, assisting with public decision-making, participating in science festivals, organising debates with the general public, vulgarisation operations, drafting articles in an open on-line encyclopaedia, etc.

C.6. Access to genetic resources and traditional knowledge associated with genetic resources

Pursuant to the Nagoya Protocol, ANR must obtain documentary evidence of Due Diligence Declarations (DDD) for all research projects that it funds. This rule applies to projects funded in 2018 and to applicants for calls in 2019 and subsequent years, who are asked to declare any potential use of generic resources when submitting their proposal, and within 6 months of the date of effect of the grant allocation agreement at the latest.

DDDs for research work can be submitted online using the special application on the MESRI website.

²⁰ In this first case, in accordance with article 30 of the "For a digital republic" law (article L533-4 of the French Research Code), the authors have exercised their right to make the final version of their manuscript accepted for publication available free of charge in an open digital format by submitting the proposal to ANR.

²¹ Making monographs freely accessible is also encouraged.

²² One data management plan for each project funded

²³ The DOAJ site (<https://doaj.org/>) lists scientific journals with peer-reviewed open access articles. The DOAB site (<https://www.doabooks.org/>) does the same with monographs.

Credentials to access the application can be obtained from the director of the host institution. For comprehensive helpful details, go to:

<http://www.enseignementsup-recherche.gouv.fr/pid37627/utilisation-ressources-genetiques-associees.html>

D. Evaluation criteria for projects submitted for the Generic Call for Proposals 2020

Panel members and external experts use the same set of criteria to evaluate pre-proposals and full proposals. The criteria applied in stages 1 and 2 of the selection process are differentiated using the table of sub-criteria below. Details can be found in the *AAPG Guide 2020*.

Evaluation criteria for projects submitted to the Generic Call for Proposals 2020

Stage 1 (evaluation of pre-proposals)²⁴

- **Quality and scientific aims** *During the stage 1 evaluation process, this criterion is decisive (an A rating or higher must be obtained to move to stage 2).*
 - Clear research objectives and hypotheses
 - Innovative or original position in relation to current practices
 - Appropriate methodology
 - Ability of the project to address the research issues covered by the chosen scientific theme
- **Organisation and implementation of the project**
 - Skills, expertise and involvement of the scientific coordinator and the partners
 - *For PRC/PRCE proposals:* Quality and complementarity of the consortium, quality of collaboration
 - *For JCJC proposals:* Contribution made by the project to the coordinator's level of responsibility and team development

Stage 2 (evaluation of full proposals)

- **Quality and scientific aims**
 - Clear research objectives and hypotheses
 - Innovative or original position in relation to current practices
 - Appropriate methodology, management of scientific risks
 - *For PRCI proposals only:* Ability of the project to address the research issues covered by the chosen scientific theme.
- **Organisation and implementation of the project**
 - Skills, expertise and involvement of the scientific coordinator and the partners
 - *For PRC/PRCE/PRCI proposals:* Quality and complementarity of the consortium, quality of collaboration,

²⁴ PRCI are not reviewed during stage 1.

- *For JCJC proposals:* Contribution to the coordinator's level of responsibility and team development
- Appropriate deployed and requested resources for the project's objectives
- **Impact and consequences of the project**
 - Scientific impact and potential economic, social or cultural impact
 - *For PRC/JCJC proposals:* Strategy adopted to disseminate and highlight the results of the research, including promoting scientific culture,
 - *For PRCE proposals:* Initiatives to transfer technology and innovation to the world of business,
 - *For PRCI proposals:* Balance and complementariness between the scientific contributions of the respective partners in each country and the **added value/benefit for France of European or international cooperation.**

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

E. Scientific themes covered by the Generic Call for Proposals 2020

Each scientific theme corresponds to a Scientific Evaluation Panel (CES).

Using scientific input to deploy the United Nations sustainable development programme - Agenda 2030²⁵ is a key priority for research and development programmes over the next decade, particularly to drive consistent digital, energy, social and ecological transitions without forgetting anybody. In this context, the main "Sustainable Development Goals (SDG)" in question are mentioned for each scientific theme.

Environmental Sciences

Theme 1.1: Fluid and solid Earth

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This research theme covers projects aiming to improve fundamental knowledge of the functioning of all Earth system compartments (lithosphere, hydrosphere, atmosphere, biosphere, etc.). This theme covers the following topics in scope:

- the functioning of and changes in climate and major Earth cycles,
- the characterisation, dynamics and workings of the critical zone and the associated biosphere,
- knowledge of mineral resources (non-energy applications only): deposits and environmental impacts.

Anthropic disturbance is considered under this theme providing that the impact is global

Associated keywords: Earth system and interactions of scales, atmosphere, ocean, wetlands, cryosphere, snowpack, continental surfaces, interfaces, climate change, climate models, visible and invisible biospheric impacts on major Earth cycles, greenhouse gases, aerosols, deep sea regions, marine chemistry, geochemistry, extreme hydrometeorological events, biogeochemical cycles, soil properties, erosion processes and mechanisms, sedimentology, pedogenesis, critical zone responses to global changes, hydrosphere, hydrology, carbon cycle, nitrogen cycle, time series (incl. proxies) and analyses of past environments, couplings, assimilations and databases produced using analysis results, paleoenvironments similar to those of the Anthropocene era, geodesy, genesis and potential for primary mineral resource deposits, optimized exploitation of deposits, sub-surface resources and the mining environment.

Associated ERC codes: PE10, LS08.

Associated SDG: 6, 13, 14 and 15.

Theme 1.2: Living earth

Contacts: antoine.morisot@agencerecherche.fr; anne.lieutaud@agencerecherche.fr

This research theme covers projects aiming to improve fundamental knowledge of biodiversity and the dynamics of continental and marine ecosystems with little, if any, past or current human influence. Its scientific scope covers:

- global exploration of biodiversity,
- the origin, characterisation and evolution of species,
- the dynamics of species, populations and communities and their interactions,
- the responses (morphological, physiological, behavioural) of species, communities of populations and organisms to biotic and abiotic environments,

²⁵ <https://www.agenda-2030.fr/>

- all clades in these ecosystems,
- the different levels of organisations, from molecules to colonies.

Associated keywords: *biodiversity, observations, rare species, invasive species, connectivity, soil ecosystems, forests, aquatic environments, resilience, systems integration, systems modelling and testing, food webs, ecology, systematics, phylogeny, ethology, population genetics, biology, functional ecology, animal and plant sciences, phylo-geography, modelling, microbiology, bio-geochemistry.*

Associated ERC codes: SH02, PE01, PE04, PE05, PE06, PE10, LS02, LS03, LS06, LS08, LS09.

Associated SDG: 14 and 15.

Theme 1.3: Scientific and technological innovations to support the ecological transition

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This research theme covers research projects focusing on environmental technologies as part of ecological and digital transitions, particularly including:

- the development of methods and sensors for monitoring all environment components (smart monitoring),
- methods and tools for operational diagnosis, alert and environmental crisis services (including natural risks),
- methods and tools for sustainable remediation, ecological engineering, climate engineering, new approaches aiming to manage the environmental effects of new economic sectors or services.

Associated keywords: *alert services and alarms for natural and technological risks (domino effect), sustainable remediation technologies, ecological engineering (incl. phytoremediation and bioremediation), climate engineering, environmental sensors, sensor arrays, technological systems, treatment of pollutants, effluents and waste, measuring GHG and atmospheric pollutants, GHG removal, ecodesign, environmental chemistry, atmospheric, water and soil pollution, agrosystems, biomimetism, indoor air quality, reduced sources of pollutants, imaging, signal processing.*

Associated ERC codes: LS08, LS09, PE02, PE03, PE04, PE05, PE06, PE07, PE08, PE09, PE10.

Associated SDG: 2, 6, 7, 9, 11, 12, 13, 14 and 15.

Theme 1.4: Biology of animals, photosynthetic organisms and micro-organisms

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This research theme covers purely fundamental biological research projects with cognitive aims targeting, in the long term or very long term, practical applications for exploited species, and applied biology projects for livestock or exploited species, all photosynthetic organisms, including models, and associated organisms (microorganisms, microbiota, pests, pathogens, auxiliaries, etc.) and interactions between these organisms.

All levels of regulation (genomic, transcriptomic, epigenetic, translational, post-translational, metabolic, physiological, developmental, etc.) are involved. Proposals are part of a continuum of scale from the gene, to molecules to the population.

Associated keywords: *symbiosis, parasitism, allelopathy, synergy, pathogenicity, model, cultivated, weed, aquatic, forest, marine, fruit, livestock, fisheries, fish farming, terrestrial, microbiology, biology, genetics, physiology, genomics, proteomics, metabolomics, epigenetics, biochemistry, bioinformatics, ecophysiology, genetic engineering, transgenesis, modelling, bio-control, animal behaviour, determining animal well-being, holobiont.*

Associated ERC codes: LS02, LS03, LS06, LS08, LS09.

Associated SDG: 2, 14 and 15.

Theme 1.5: Food and food systems

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This research theme covers fundamental or applied research projects focusing on food, food systems and global food security. These proposals may address the following topics:

- the biology of human nutrition, notably for vulnerable groups (babies, children, the elderly), provided that the projects do not deal with pathologies,
- technological developments and improvements to food tracking and processing (mixed types of raw materials, authenticity, labelling, etc.)
- food safety,
- determinants and the impacts of changes to the food sector and consumer habits,
- the social and economic organisation of food systems.

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

Associated keywords: multi-party approaches, hygiene programmes, nutritional programmes, specific groups, consumer practices, taste and sensory practices, access to food, governance, markets, distribution, competitiveness, conservation, packaging, contact materials, pathogens, decontamination, microbiota-host-food interaction, food-based microbiology, processes, nutrition, proteins, epidemiology, physiology, microbiology, economics, sociology, cultural and biological anthropology, sectors, "clean label", food contaminants, fermentation, breast milk.

Associated ERC codes: LS09, PE01, PE04, PE05, PE06, PE07, PE08, SH01, SH02, SH03.

Associated SDG: 1, 2, 3, 8, 10 and 12.

Theme 1.6: Dynamics of ecosystems and their components for their sustainable management

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This research theme covers fundamental or applied research projects aiming to understand the dynamics of production ecosystems with a view to their sustainable management, proposing innovations for the integrated and sustainable management of exploited ecosystems, contributing to the development of paths and scenarios to support ecological and digital transitions, in particular projects dealing with the following topics:

- exploring biodiversity and the adaptation capacities and dynamics of socio-ecosystems,
- the role of biodiversity and related ecosystemic services in socio-ecosystems,
- interfaces and interactions between productive or exploited ecosystems and their environment,
- the impact of agro-ecosystem practices on environmental changes,
- the origin, characterisation and evolution of exploited species,
- alterations to productive aquatic ecosystems (marine or continental),
- sustainable and/or integrative livestock practices promoting animal well-being.

Multidisciplinary approaches are welcome.

Associated keywords: biodiversity, bio-monitoring, bio-control, agricultural policy and/or system design, animal and plant health management, soil management, major cycles, biology, functional ecology, agronomics, animal sciences, sociology, economics, geography, political sciences, modelling, genetics, physico-chemistry, microbiology, practices, environmental law, ecosystemic service, landscaping, multi-party approach, agriculture, livestock, forestry, marine fisheries, animal well-being.

Associated ERC codes: LS02, LS06, LS08, LS09, PE01, PE06, PE07, PE08, PE10, SH01, SH02, SH03.

Associated SDG: 2, 12, 13, 14 and 15.

Energy and Materials Sciences

2.1. Sustainable, clean, safe and efficient energy

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This research theme aims to invest all research resources available in France in meeting the challenges of the energy transition targeting green growth, as defined in the French law of 18 August 2015 and as per the scientific obstacles defined in the French Energy Research Strategy (SNRE). Proposals are expected for all of these obstacles (reducing energy consumption, greenhouse gases, etc.) and should promote systemic and integrative approaches, the design of new materials, methods and processes and the role of digital techniques, social sciences and humanities. In addition, this theme is fully open to fundamental Sciences focusing on mainly frontier-level energy research. In fact, the aim is to involve all scientific disciplines (chemistry, Earth sciences, physics, mathematics, etc.) which are not traditionally filed under the "Energy" heading in order to generate both fundamental and frontier knowledge, which will assist with the energy transition and prepare for the emergence of radical new ideas and ground-breaking concepts.

- the following sciences are fundamental for the energy sector: fundamental and frontier research, ground-breaking concepts aiming to meet long-term energy priorities,
- capture of renewable energies, energy harvesting from the environment,
- clean hydrogen generation,
- production of synthetic hydrocarbons and platform molecules from CO₂; activation of stable small molecules (CO₂, CH₄, N₂, etc.),
- hydrogen storage, fuel cells,
- electrochemical storage: batteries and supercapacitors,
- dynamic management of energy systems: storage and networks,
- sustainable uses of the sub-surface targeting future sources of energy, including temporary energy storage with a low impact on the environment,
- low-energy industrial facilities and processes, CO₂ capture and use
- energy efficiency and the reduction of emissions from transport vehicles (combustion, hybridisation, global optimization of energy on board vehicles, etc.).
- efficient components and infrastructures laying down the road to a digital society,
- the energy transition, social sciences and humanities: integrative approaches to energy-related priorities (political, societal, economic, environmental, territorial, technological, etc.), links to climate mitigation and adaptation policies, representations and new energy practices, etc.

Projects concerned with the production of biomass and how to transform biomass into bioenergy must be managed under the "Bioeconomy" theme.

Associated keywords: wind energy, marine energies, geothermal systems, hydropower, solar heating systems, CSP, photovoltaic, hydrogen energy, electrolysis, fuel cells, hydrogen-energy systems, fuel cell systems, chemical compression, electrochemical compression, gas separation/purification, solar fuels, bio-inspired energy production, biofuel cells, energy harvesting, CO₂ recovery, carbon cycle, power-to-X, energy storage, electrochemical storage, batteries, supercapacitors, electrical engineering, power electronics, smart energy networks, thermal and thermodynamic systems, energy efficiency, turbines, motors, HVAC equipment, heating, cooling, clean fuels, low-energy transportation vehicles and industrial processes with greenhouse gas emissions, CO₂ capture/transport/storage, sub-surface evaluation and exploration methods, free heat recovery and re-use, nuclear, social sciences, humanities & energy, digital technologies & energy, basic sciences for energy, Earth sciences.

Associated ERC codes: LS09, PE01, PE02, PE03, PE04, PE05, PE06, PE07, PE08, PE10, SH01, SH02, SH03, SH06.

Associated SDG: 7, 9, 12 and 13.

2.2. Polymers, composites, soft matter physics and chemistry, processes

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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 macromolecular chemistry as well as the development of means of synthesising polymer materials able to resist extreme conditions, resins for composite materials with polymerisations which can be controlled at moderate temperatures, or additive manufacturing systems. Proposals for material synthesis chemistries allowing for effective recycling of polymers will also be appreciated.
- the physics and engineering of soft matter, where the properties are the result of interactions, structuring and dynamics at different spatial and temporal scales. Proposals are expected relating to the production of synthons that, through their self-assembling or self-organization properties, can be used to construct supramolecular organisations,
- the development of polymer-based materials with special properties (thermomechanical, self-healing, etc.) for specific applications (sensors, membranes, smart textiles, etc.) and the processes required for these developments,
- innovative formulation concepts, the study and understanding of structure-property relationships and the multi-scale modelling of soft matter, polymer, composite and nano-composite materials aiming to predict their properties, including in terms of ageing,
- composite materials with an organic matrix relating to various industrial sectors (aeronautics, cars, construction, energies, health, etc.) and works and processes aiming to improve their thermal and mechanical properties, recovery options in view of recycling, or the introduction of functional properties by structuring the surface.

The community involved will include 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 synthesis and transformation technologies.

Projects must consider sustainable development priorities. Projects using or transforming bio-sourced materials must be managed under the "Bioeconomy" theme.

Associated keywords: Design, synthesis and properties of molecular, supramolecular and macromolecular objects, synthetic polymer chemistry, polymerisation processes including additive manufacturing, preparation and properties of functional polymeric materials (composites, hybrids, biomaterials, membranes, etc.), polymer transformation methods, durability and life cycle of supra and macromolecular systems, supramolecular chemistry and physics, containment, encapsulation, self-assembly, molecular and hybrid materials, thin films, bio-inspired systems, impregnation resins, composite materials with an organic matrix, soft matter, complex fluids, structural characterization, functionalisation, oligomers, liquid polymers, surfactants, liquid crystals, micelles, vesicles, colloids, gels and hydrogels, molecular machines, micro- and nano-reactors, responsive systems, molecular recognition, structural and mechanical properties of organic biomaterials, surfaces and interfaces, additive manufacturing, micro-reactors, miniaturisation, reduced waste, photochemistry.

Associated ERC codes: PE03, PE04, PE05, PE08.

Associated SDG: 9 and 12.

2.3. Molecular chemistry

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Molecular chemistry and sustainable chemistry are the essential foundations of the chemical industry, whose products are used by many other sectors. On this basis, any fundamental advance or ground-breaking concept in chemical syntheses, the choice of raw materials used, molecules and compounds, methods, etc., which could lead to subsequent ground-breaking innovations, brings significant potential for applications for many industrial players. Projects must consider sustainable development priorities. Proposals will come under the following three topics:

- The development of new reaction schemes or new molecules (organic synthesis, etc.). Proposals on more environmentally friendly synthesis pathways or processes 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. Combinations with activation processes may also be dealt with,
- methods, eco-efficient processes and new environments for reactions. The development of new technologies and the exploration of new environments are welcomed for this theme. Processes exclusively involving or using supramolecular or macromolecular objects must be managed under the "Polymers, composites, soft matter physics and chemistry" theme. Only processes which are specifically dedicated to molecules are covered under this theme.

The projects submitted under this theme can be of an experimental, theoretical, technological or industrial nature, while favouring a multidisciplinary approach. They may cover all manufacturing stages, from the selection of raw materials to the development of the reaction pathway and associated processes.

Projects addressing bio-sourced chemistry and white biotechnologies must be managed under the "Bioeconomy" theme.

Associated keywords: Chirality and asymmetric synthesis, activation (of bonds) and reaction processes, new molecules, replacement molecules, structure-property relationship, design of new ligands, alternatives to rare and/or toxic metals, catalyst recycling, nanocatalysts supported, electrocatalysts, organocatalysis, multicatalysis: dual, hybrid, tandem, redox, cascade, tandem, domino or multicomponent reactions, one-pot reaction,

enzymatic catalysis, metalloenzymes, artificial enzymes, host-guest, photochemistry, innovative activation (ultrasound, microwave, high pressure), microfluidics, flow chemistry, reduced waste, extraction, detection, identification, emerging reaction environments and eco-compatible environments, solvent-free process, recycling process, process intensification.

Associated ERC codes: PE04, PE05, PE08.

Associated SDG: 9 and 12.

2.4. Metallic and inorganic materials and associated processes

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This research theme will bring together chemists specialised in solids and condensed matter, metallurgists, specialists in solid mechanics and implementation (preparation, assembly, additive manufacturing) or treatment processes to cover the entire field of materials science. Projects must consider sustainable development priorities.

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 the associated surfaces and interfaces as well as the means used to obtain these materials (preparation, transformation, assembly, etc.),
- 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 in relation to their environment,
- recycling, replacement of strategic elements (scarcity, chemical risk, costs, etc.),
- new materials for use under severe energy, mechanical or chemical stresses.

Proposals will therefore come under one of the following five topics:

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

Associated keywords: *Functional properties, multi-scale approaches to characterisation and simulation, multi-physical couplings, metallurgical thermodynamics, preparation and transformation processes, machining and treatment, additive manufacturing, innovative syntheses, microstructures, solid chemistry, tribology, surfaces, interfaces, damage, fatigue, coatings, thin films, process modelling, recycling, structural materials, structural and mechanical properties of inorganic biomaterials.*

Associated ERC codes: PE01, PE02, PE03, PE04, PE05, PE06, PE07, PE08, PE09.

Associated SDG: 9 and 12.

2.5. Chemistry: analysis, theory and modelling

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

- spectroscopy and spectrometric techniques,
- analytical chemistry,

- chemical instrumentation,
- theoretical chemistry/modelling.

This theme also covers methodological and instrumental developments for spectroscopy and theory.

Associated keywords: NMR, EPR, spectroscopy (UV-Vis, IR, Raman, W-ray, etc.), electron spectrometry, mass spectrometry, chromatography, theoretical chemistry, modelling/simulation (molecular dynamics, *ab initio* method, Monte Carlo, etc.), physical chemistry (photochemistry, electrochemistry, thermodynamics, etc.), miniaturisation, imaging, trace detection, structural properties.

Associated ERC code: PE04.

Associated SDG: 9.

Life Sciences

The strategic priorities defined by the French state and the implementation of government plans are mainly enforced via scientific themes as follows:

- *Antibioresistance: themes 3.1, 3.2, 3.3, 3.4, 3.6, 3.7, 3.9 & 3.10, research themes in other fields such as theme 2.3 and cross-disciplinary themes 8.2, 8.3, 8.4, 8.5 & 8.7.*
- *Autism as part of neurodevelopmental disorders: themes 3.3, 3.4, 3.7, 3.8, 3.9, 3.10 & 3.7, re-search themes in other fields such as theme 4.3 and cross-disciplinary theme 8.7.*
- *Translational research on rare diseases, which exclusively covers theme 3.9 “Translational health research”.*

3.1. Biochemistry of living organisms

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This research theme aims to characterise and model the chemical and biochemical transformations undergone by the cell. The scope of this theme, interfaced with biochemistry, covers the following topics:

- enzymology, pharmacology, toxicology,
- studies on the metabolism and bio-energy,
- analytical and “omics” approaches, including quantitative proteomic, lipidomic, glycomic, metabolomic and multi-omic analyses,
- initiatives for acting on living organisms and their application to the detailed analysis of functional biology and human health mechanisms (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 pathways in an attempt to understand the fundamental mechanisms of living organisms or develop biotechnological applications.

Associated keywords: biochemistry, enzymology, pharmacology, toxicology, bio-energetic, proteomics, lipidomics, glycomics, metabolomics, synthetic biology, molecular engineering, screening, biotechnologies.

Associated ERC codes: major LS01, other LS02, LS04, LS07, LS08, LS09.

Associated SDG: 3, 9, 14 and 15.

3.2. Characterisation of structures and structure-function relationships between biological macromolecules

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This research theme, interfaced with physical chemistry and biophysics, covers the following topics:

- prediction and resolution of biological macromolecule structures and their complexes and decryption of their structure-function relationships,
- study of the dynamics of biological macromolecules and their interactions using isolated systems or systems reconstituted *in vitro* or in their cell context,
- technological or methodological developments in structural biology (NMR, crystallography, cryo-electron microscopy, etc.)
- technological or methodological developments in imaging (super-resolution microscopy, correlative microscopy, etc.)
- technological or methodological developments in molecular dynamics,
- structural spectrometry and single-molecule approaches.

Associated keywords: structural biology, structure-function relationships of biological macromolecules and their complexes, structure-function relationships of membranes, biophysics, methodological developments, systems biology, modelling.

Associated ERC codes: major LS01, other LS02, LS09.

Associated SDG: 3, 9, 14 and 15.

3.3. Genetics, genomics and RNA

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This research theme covers the following topics:

- the decryption of general mechanisms and regulations responsible for the 3D structure of genomes, chromatin and related epigenetic changes (the role of gene genetic entities, non-coding DNA, transposable elements, non-coding RNA and RNA-protein interactions, etc.), - including in relation to environmental conditions (exposome),
- the detailed studies of replication processes, repair, recombination, transcription, 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 underlying genome structure, variability and evolution,
- the transgenerational inheritance of epigenetic modifications,
- the characterisation of the genotype-phenotype relationship, including the study of genetic diseases – including complexes - and the role of the exposome in this relationship,

The research will be conducted at the molecular and cellular scale, on animal or plant, multicellular or unicellular, eukaryotic, archaeum or bacterial 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 project must not simply develop one of the last 4 approaches.

Associated keywords: replication, repair, recombination, structure and dynamics of chromatin and the bacterial nucleoid, epigenetics, gene expression, transcriptomics, non-coding RNA, RNA maturation, ribosomes, genome translation-evolution, genetic diversity, genetic diseases, genotype-phenotype relationships, exposure, genetic tool developments.

Associated ERC codes: major LS02, other LS01, LS08, LS09.

Associated SDG: 3, 9, 14 and 15.

3.4. Cellular biology, developmental biology and evolution

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This research theme covers the following topics:

- understanding elementary biochemical and biophysical mechanisms at the scale of cells found in the living world : cellular cycle, biogenesis and dynamics of intracellular organelle and the plasma membrane, molecular mechanisms of the senescence, ageing and cell death, signalling the reception of the signal at transduction, homeostasis and differentiation of different cell types, maintenance and differentiation of different cell types, maintenance and differentiation of cell strains, cell adhesion, cell movement and migration,
- understanding these mechanisms at the scale of tissues in the organism or in multicellular systems reconstituted *in vitro* (organoids, tissue engineering) to decipher the basic principles of cellular homeostasis, morphogenesis, embryonic and post-embryonic development²⁶ of animal and plant tissues, the ageing of multicellular eukaryotic tissues and organisms, and the structure of prokaryotic cell colonies,
- understanding these mechanisms in the context of the evolution of species and adaptation to environmental conditions.

Associated keywords: 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.

Associated ERC codes: major LS03, other LS08.

Associated SDG: 3, 9, 14 and 15.

3.5. Physiology and physiopathology

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This research theme covers the following topics:

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

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

²⁶ Animal, plant, mushroom, archaeum and bacterial cells.

Associated keywords: *physiology, physiopathology, physiology/systemic and comparative pathology, multi-factor chronic disease, disease and ageing, metabolism and nutrition, the microbiome, reproductive biology.*

Associated ERC codes: *major LS04, other LS07.*

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

3.6. Immunology, infectiology and inflammation

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This theme covers the following topics:

- the characterisation of cellular and molecular mechanisms in organism defence and inflammatory reactions during innate and adaptive immune responses, in order to compile a comprehensive analysis of the immune system in normal and pathological situations, including in case of immunity deficiencies, hypersensitivities, autoimmunity, autoinflammation and transplantations,
- the mechanisms used by pathogens in humans and animals to tap into the host's cellular mechanisms for their own survival, dissemination, and transmission at the scale of the organism,
- the identification of factors restricting infections for humans and animals,
- the development of new mathematical and computing approaches and models aiming to improve our understanding of development and homeostasis for the different components of the immunity system, inflammation, allergies and host-microbes relationships at all scales (cell, organ, organism),
- fundamental biological research on microorganisms which could lead to the development of new anti-infection methods.

Associated keywords: *immunity defences, infectiology, host-pathogen interactions, inflammation, homeostasis and deregulation, microbiology, microbiota, symbiosis/ dysbiosis, immunity deficiencies, allergies, inflammatory process, modelling, responses to grafts.*

Associated ERC code: *LS06.*

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

3.7. Molecular and cellular neuroscience – Developmental neurobiology

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This research theme covers the following topics:

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

This theme includes all invertebrate and vertebrate animal models and experimental and technological approaches and their development (imaging, computation and models, artificial intelligence, behaviour, electrophysiology, pharmacology, optogenetics, etc.) relating to these studies.

Associated keywords: *neurogenetics, cellular neurobiology, biophysics, neuropharmacology and neurophysiology, neuro-development, neurodegenerative diseases, addictions, psychiatry, mental health.*

Associated ERC codes: *major LS05, other LS03, LS07.*

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

3.8. Integrative and cognitive neuroscience

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This research theme covers the following topics:

- all integrative scale studies intended to understand high level brain properties and functions,
- the different hierarchy and structural levels 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 consciousness, aspects specific to the human brain, including the social dimension - e.g. self-awareness, language, relationships with others - and pathologies,
- the biological and social mechanisms and determinants in mental health disorders, neurodevelopment diseases and autism spectrum disorders, neurodegenerative diseases and addictions and rare diseases affecting the nervous system, to prevent and treat them with the aim of encouraging complementary aspects and synergies between fundamental research and preclinical and clinical research in the field of mental health, psychiatry and addictions,
- nervous system pathologies, including cerebrovascular diseases and diseases of the sensory organs, with the exception of non-neural aspects, which are covered under the “*Physiology and Physiopathology*” theme.

Experimental approaches include *in vivo* functional and multi-modal imaging (MRI, MRIf, PET, photonics, ultrasound), photoelectrophysiology, computational analyses, brain-machine interfaces, artificial intelligence, behaviour, optogenetics, psychophysics, etc.).

The epidemiological approach to health inequalities in the field of mental health is evaluated under the “*Public health*” theme, and connected devices under the “*Healthcare technologies*” theme.

Associated keywords: *cognition, behaviour, computational neurosciences, psychiatry, mental health, neurodegenerative diseases, addictions, physiopathology, and clinical approaches, cross-disciplinary studies*

Associated ERC codes: *major LS05, other LS07, SH04.*

Associated SDG: *3 and 9.*

3.9. Translational health research

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This research theme aims to fund studies positioned downstream from frontier research projects carried out in research laboratories and upstream from clinical research projects supported by the Hospital Clinical Research Programme (PHRC) run by the Directorate-General for Healthcare Provision (DGOS).

Proposals that enable new hypotheses to be formulated that can be tested subsequently in a clinical

research framework, and therefore located at the interface between fundamental research and clinical research, will be considered. A DGOS co-funding request may be submitted for projects including a partner health care facility.

Associated keywords: *new therapeutic approaches, new diagnostic approaches, physiology, physiopathology, personalised medicine, pre-clinical proof of concept, bio-markers, epidemiology, cohorts.*

Associated ERC codes: *major LS07, other LS04.*

Associated SDG: 3.

3.10. 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 and biological therapeutical products (including vaccinations, cell therapy and regenerative medicine, gene therapy, nanomedicine).
- new biodrugs formats optimised for production processes,
- pertinent animal models and organoids for the biological and/or pre-clinical evaluation of products with therapeutic benefits,
- vaccination-based prevention procedures,
- prevention and diagnosis tools and products,
- bio-markers.

PRCE projects are well suited for this theme, which takes into account the applications of the proposed research and possible uses.

Proposals on medical devices, imaging and healthcare technologies more generally are managed under the specific "healthcare technologies" theme.

Associated keywords: *cell therapy, new therapeutic targets, drug design, gene therapy, nano-medicine, regenerative medicine, tissue engineering, vaccines, biotechnologies, bio-markers, pharmacology, pharmacology, pharmacology, adjuvants, vectors, antibodies, biodrugs, bioproduction.*

Associated ERC codes: LS07.

Associated SDG: 3 and 9.

Social Sciences and Humanities

The priorities of the French state in the "Social Sciences and Humanities" field are mainly enforced via this scientific field. This heading also covers proposals under interdisciplinary research themes that fall outside this area but involve an SSH component.

4.1. Innovation, work

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This scientific research theme includes the topics of social innovation and changes in labour, employment and social protection. These topics are likely to relate to all social sciences and humanities disciplines. The aim is to encourage the submission of original proposals, based on a wide range of disciplinary, multi-disciplinary and interdisciplinary approaches. Participative and/or experimental research, and research including international comparisons, are welcome. The theme of social innovation must be considered from a very general viewpoint: social, cultural, economic, political and

technological (including digital technologies) innovation, including the social conditions for these innovations and the inherent risks, with no restrictions on topics, terrain, geographic location or historical period. All proposals in relation to changes in labour and employment, hierarchical relations between individuals and related rights, the organisation of collective initiatives and interaction between these factors and their life cycles and living conditions are eligible. Proposals can be submitted on the following topics, whether focused on fundamental research or from a more applied point of view:

- social creativity,
- economic innovation and social innovation, social and economic trials,
- innovation theories,
- conditions and the impacts of innovation, particularly in relation to sustainable development goals,
- legal aspects of new creations and innovation,
- social, cultural, ideological and religious changes,
- labour and employment market, quality, status and transformations, territories and mobility,
- regulations and dynamics of productive organisations,
- changes in labour, employment and social protection,
- changes to hierarchical relations and types of pay (exempt wages, employment bonus, etc.),
- support and integration of those facing difficulty finding employment,
- pathway guarantees, career protection, adaptation of working conditions.

Associated keywords: *innovation, creativity, social transformations, work, atypical employment, extended careers, retirement, fairness, life-long training incentives, social protection, welfare state, social unrest, commercial and non-profit organisations, labour market, economic and social regulations, companies, networks and public-private partnerships, social risks and related rights, prevention.*

Associated ERC codes: SH01, SH02, SH03, SH04, SH06.

Associated SDG: 1,4, 5, 8, 9, 10, 12, 16 and 17.

4.2. Culture, creations, heritage

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This research theme is intended to receive proposals related to culture and cultures, including creative aspects and issues relating to heritage and the cultural and museographic heritage-based approach. All aspects of the genesis, transformation, changes to and dissemination of tangible or intangible cultures, languages, knowledge, ideas and beliefs, arts and human works, as well as the supporting technologies, are dealt with here. These topics are likely to relate to all social sciences and humanities disciplines. The aim is to encourage the submission of original proposals, based on a wide range of disciplinary and interdisciplinary approaches. Participative and/or experimental research, and research including international contributions, are welcome. The following are the main topics dealt with under this theme:

- cultural creations, economics, law and policies on creative output,
- tangible and intangible heritage, heritage sciences (including the analysis of the physical and chemical properties of heritage items, dating and restoration techniques, the digital simulation of heritage monuments and objects, meta-data allocation, the analysis of historical archives),
- birth and evolution of cultural forms, intercultural relationships
- linguistic and environmental variations and diversity,
- religious and secular dynamics,
- the cultural, economic, political and technological contexts of cultural creations.

Associated keywords: tangible and intangible culture, interdisciplinary and historical approaches, comparativism, languages, beliefs and religions, populations, demographic, geographic and linguistic approaches, arts, creations, law and economics for creative output, heritage sciences, cultural protection and preservation, conversation and restoration techniques, museography and heritage development.

Associated ERC codes: SH01, SH02, SH03, SH05, SH06.

Associated SDG: 4, 5, 10, 16 and 17.

4.3. Cognition, education and training

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This theme covers fundamental and applied research in the fields of cognition, learning, normal or pathological sociocognitive development and practices and policies related to lifelong education and training.

Any social sciences and humanities discipline may be involved. A wide range of disciplinary, multidisciplinary and interdisciplinary approaches is expected. Research programs including international contributions (particularly with inter-country comparisons) are welcome.

Projects on the following topics (non-exhaustive list) are therefore expected:

- cognitive abilities, learning and training abilities at various ages of life, the mechanisms linking sensory-motor skills, cognitive, emotional and language development to environmental components (emotional, family, social, school),
- disorders (cognitive, developmental, sensory-motor, etc.) and disabilities, focusing on socio-cognitive origins, their consequences on learning abilities and potential remediation strategies,
- the purpose and role of education in society; the analysis of educational programmes; social aspects of education, the socio-economic analysis of the social, territorial and institutional contexts of education, etc. Comparisons with the situation in other countries would be welcome in this context,
- inequalities and failure at school (including higher education), life-long training and learning (including apprenticeship-type training); individual factors contributing to an unequal likelihood of success (disabilities, sensory, motor or cognitive deficiencies, gifted children, etc.), the drive to learn, the influence of the school itself (classes, subjects, teachers, etc.) and the learning environment (family, area, town versus countryside), the influence of gender and gender representations, the effects of multi-lingualism on learning,
- fun learning techniques, new educational spaces, the creation of education districts, the emergence and development of learning districts
- social support for parents (support with parenting, parent education, parental *coaching*, etc.),
- research focusing on social works, social support as part of education.

Associated keywords: cognition, psychopathology, neuropsychology, sociology in education, teaching innovations and experiments, impact assessments, inequality, school or higher education failure, pathway guidance, training, learning, informal learning, skills, the love of learning, educational performance, educational districts, social initiatives, social support, empowerment, the effects of support on beneficiaries, delaying the loss of independence, support for loss of cognitive abilities, healthcare education, life-long training, educational and training policies, comparative analyses of educational systems, universities and selective schools.

Associated ERC codes: SH01, SH02, SH04.

Associated SDG: 1, 4, 5, 10, 11, 16 and 17.

4.4. Inequalities, discriminations, migrations

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This research theme welcomes proposals which place inequality and discrimination at the heart of their concerns, as well as proposals relating to economic, social, cultural and age-based inequalities and segregation or based on any other factor acting within the framework of social differentiation. These topics are likely to relate to all social sciences and humanities disciplines.

The aim is to encourage the submission of original proposals, based on a wide range of disciplinary, multi-disciplinary and interdisciplinary approaches. Participative and/or experimental research, and research including international contributions, are welcome. This theme will also cover issues relating to governance, democracy (in the general sense), effective redistribution, violence and conflicts, and to forms of violent radicalisation, whether examined from a historical, sociological, anthropological, political, psychological or behavioural perspective. This theme welcomes proposals from a wide range of disciplinary fields addressing the topic of inequality on multiple scales and in different forms:

- social inequality or inequality based on gender, disability or status,
- the dynamics of social inequalities,
- a geographic approach to inequalities,
- funding and the effectiveness of redistribution,
- critical analysis of inequality models and indicators,
- exploring the links between discrimination, social, economic, territorial and cultural diversity,
- models and forms of integration, identities, belonging, multi-culturalism and multi-lingualism,
- quantitative and/or qualitative studies on social and territorial mobility and migrations, on regional or international scales,
- democracy and citizenship, participation and involvement.

Associated keywords: inequality, environmental inequalities, segregation, discrimination, social recognition, migrations, mobilities, identities, integration, violence, radicalisation, rights, democracy, governance, justice; territories and districts, central/suburbs, solidarity, vulnerability, poverty and exclusion, redistribution, social pathways, capabilities, solidarity-based social economics, social participation, social obligations, social justice, social citizenships, social cohesion, gender, age, origin and disabilities.

Associated ERC codes: SH01, SH02, SH03, SH04, SH06.

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

Digital Sciences

5.1. Digital foundations: information technology, automation, signal processing

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This research theme requires upstream research projects striving for fundamental excellence and breakthroughs in the fields of IT, automation and signal processing.

Proposals with a biology or health component must be submitted under the cross-disciplinary "Mathematics and digital sciences to meet the challenges of biology and health" theme.

Associated keywords: logic, computability, decidability, theoretical computer science, combinatorial analysis, graph theory, formal methods, calculations, semantics, cryptography, fundamental, sequential and distributed algorithmics, game theory, optimisation, statistical signal processing, detection-estimation, analysis and representation, information theory, checks and optimisation, control and observation, estimation and identification, dynamic systems, system theory and modelling.

Associated ERC codes: PE01, PE06, PE07.

Associated SDG: 9.

5.2. Artificial intelligence

The priorities of the French state in the "Artificial Intelligence" field are mainly enforced via this research theme. This priority also covers proposals under disciplinary or interdisciplinary research themes that fall outside this area but involve an AI component.

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This research theme requires research into artificial intelligence focusing, in the general sense, on machine learning and the underlying mathematical mechanisms, and on symbolic approaches, big data processing and data science, and knowledge management.

The following topics are listed for information only:

- big data management and processing methods and models, for any type of data (structured data, text, images, audio recordings), data production (observational data, sensor data, calculated data, simulated data) and data quality (imperfect, incomplete, heterogeneous or scarce data),
- knowledge extraction and learning: data mining and text mining, machine learning (supervised, unsupervised, by reinforcement, etc.), creation and annotation of bodies of data, producing complex decision-making rules, modelling decision-making processes and building decision-making help tools,
- knowledge management models and methods, particularly the representation of knowledge and the logic behind this knowledge, ontologies and their use in data enrichment and in finding information, multi-agent systems and the semantic web, etc.
- research projects aiming to improve current technology in order to process complex tasks (computer vision, automatic language and speech processing, automatic translation, etc.), develop standalone decision-making systems or for use in high-level interactions with human users.

Proposals contributing to research in Human-Machine interaction and Robotics must be submitted under the "Interaction, robotics" theme. Proposals in the health, transport and safety fields, or on the interface between AI and SSH, must be submitted under the multi-disciplinary "Mathematics and digital sciences to meet the challenges of biology and health", "Urban societies, territories, constructions and mobility" and "Global security and cybersecurity" or "The Digital Revolution: relationships to knowledge and culture" themes.

Associated keywords: machine learning (supervised, unsupervised, by reinforcement, etc.), domain transfer and representation learning, learning from unstructured data (e.g. text data, tweets, blogs, and other electronic media), statistical models, optimisation, data mining, text and data exploration (TDM), computer vision, scene interpretation and analysis, shape recognition, automated language and speech processing, multimodal data processing, help with decision-making, game theory, computational social decisions, multi-agent systems,

planning, heuristic inquiry, satisfying constraints, SAT solver, knowledge extraction, knowledge representation, logic, ontologies, semantic web, data mergers, uncertainty management, big data, new large-scale distributed computing modules for data, distributed artificial intelligence, content indexing, information searches, data displays, data quality, trusted systems, privacy protection, ethics, validation, certification, robustness, explainability, causality, reproducibility.

Associated ERC codes: PE01, PE06, PE07.

Associated SDG: 9 and 14.

5.3. Micro- and nanotechnologies for information and communication processing

This research theme is intended to support research in the field of "Digital Sciences" and covers "Micro- and nanotechnologies for information and communication processing" excluding quantic technologies, which are dealt with under the "Quantum Technologies" theme.

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This theme covers the key generic technologies of electronics and photonics for information and communication, the integration of devices into systems or the exploration of new paradigms for future generations of components (neuromorphics, bio-inspired, etc.). All projects should address well-identified scientific and technological obstacles to information and communication technologies and sciences. Proposals must attempt to demonstrate quantifiable improvements to performances, or new ground-breaking knowledge.

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

On the dimensional scales concerned (micro and nano), the proposals will fall into the following 3 fields:

- materials for components and devices: preparation, manufacturing, processes, etc.
- elementary components and systems: characterisation, integration, application, etc.
- circuits, architectures and systems: design, simulation, testing, etc.

Associated keywords: *semiconductors, materials, electronics (micro and nano), photonics (micro and nano), spintronics, metamaterials, artificial materials, technological processes, design, simulation, manufacturing, characterisation, instrumentation, devices for optics, non-linear optics, near field optics, optic sources, fibre optics, millimetric components, THz, nanophotonics, plasmonics, electronics (organic, flexible), components (alternative, neuromorphics), AI components, integrated circuits and systems, 3D integration, heterogeneous integration, photodetection, imagers, new architectural paradigms, RF, micro-nanosystems, sensors for ICT.*

Associated ERC codes: PE02, PE03, PE05, PE07.

Associated SDG: 9.

5.4. Multi-purpose communication networks, high-performance infrastructures, software sciences and technologies

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This research theme deals with proposals aiming to remove fundamental or applied research obstacles in three main fields, sometimes combined:

- Communication networks, as the focus of a study covering all parts of the network, considering their many topologies (ad hoc, peer to peer, mesh networks, etc.), speeds (high-speed communications versus object networks) and usages. This research theme deals with the physical layer, including network antennas and interactions, up to the exploration of different user conditions and the configuration when on the move, used as proof for availability and reliability analyses, and allowing for context-sensitive services, and is also supported by progress in terms of standardisation (5G, 5G+) and the networks of the future (air-ground, satellite, etc.)
- Communications and computing infrastructures used to develop computing models, algorithms and massively parallel processing techniques, the optimisation and dynamic management of resources based on quantitative measurements and properties (performance, robustness, memory, energy), exascale algorithmic and programming environments. Following on from the previous sub-theme and when considering high-performance computing, the study of the distribution of computing resources over various network topologies and architectures ("edge cloud", fog, cloud, cache, etc.) and various virtualisation aspects for applications, servers, and networks (SDN), etc.
- Software technology and science developments. This theme covers both new programming languages, including Domain-Specific Languages (DSL), and software engineering with a similar design base (e.g. model-directed engineering), the exploration of advanced multi-modelling, variability and adaptability management techniques for the design of product lines, while simplifying programme analysis, and software verifications and certification. This sub-theme also deals with the construction of software technologies for embedded systems integrating various related aspects and constraints (real-time or mixed operations, mixed criticalities, software-intensive system, cyber-physics, etc.)

Associated keywords: operating systems, real-time OS, middleware, virtualisation, self-adaptive systems, embedded systems, connected objects, mixed hardware architectures, virtual prototyping, service composition, web programming, service platforms, optimised compilation to centralised or parallel architectures (Multi-core), computation models for parallelism, distributed algorithms and systems, blockchain technology, software architectures, program analysis, verification and proof of safety and security properties, testing and debugging methods, optical communications, radio communications, architecture and programmability of communication systems, reliability and availability, mobility, scaling, elasticity, energy efficiency, inspection, management and information plans, hardware accelerators, massive parallelism, the cloud, orchestration and optimisation of communications/execution/storage resources, guaranteed QoS and SLA, data analytics to optimise networks, end-to-end security, management of shared infrastructures, context-sensitive services, service-infrastructure interface.

Associated ERC codes: PE06, PE07.

Associated SDG: 8 and 9.

5.5. Interaction, robotics

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The projects expected under this research theme relate to all scales and aspects of Human-Machine interaction, including natural dialogue and the creation of multimedia content, and to all components of interactive and autonomous robotics (service robotics, medical robotics, industrial robotics, multi-robot cooperative systems). Proposals including ethical considerations are encouraged.

Manufacturing robotics proposals targeting industrial performance rather than the development of robotics in itself, must be submitted under the "Factory of the future: People, organisations, technologies" theme.

Associated keywords: *multi-sensory interfaces (gesture, movement, sound, speech, etc.), learning, wearable computing, augmented reality, virtual reality, immersive environments, user centric design, conversational agents, adaptable interfaces, collaborative interactions, creation of multimedia content, multi-source data, interface ergonomics, augmented human, visualisation, vision, dialogue, human/data interaction, humanoids, aerial robots, land robots, autonomous vehicles, underwater robots, adaptable systems, exoskeletons, planning, cognitive architectures, decision-making autonomy, human-robot collaboration, mobility, sensors, field robotics, multi-robots systems, cognitive psychology, social robotics, affective robotics, affective computing, surgical robots, instrument/organ interactions, soft robotics, computer-assisted medical-surgical actions, manufacturing robotics, cobots.*

Associated ERC codes: PE06, PE07, LS09, LS05, SH04.

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

5.6. Digital models, simulations, applications

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Multi-disciplinary proposals bringing together probabilistic experts, analysts, statistics, data scientists and computer scientists are encouraged in order to promote breakthroughs in each discipline, which will significantly improve performance, costs, lead times, quality, volumes, etc.

Obstacles include:

- in the programming paradigms relating to future architectures, the introduction of runtimes, in situ visualisation, fault tolerance, etc. "Post Moore era" framework),
- digital methods and algorithms: construction and use of surrogate models, time/space parallelism, data transfers, etc. for both software and hardware, energy consumption, use of non-volatile memories (NVM), etc.,
- when modelling complex problems: assimilation problems – potentially mixed with "data models" –, probabilistic, multi-scale and multi-disciplinary analyses, optimisation methods (robust, stochastic, etc.),
- development of models and optimisation in view of coupling and interaction between hardware and computing systems, virtual representations, simulations and the physical world: real-time simulations and interactivity, quantification of uncertainties, combination of a range of computational architectures, design of models which can be scaled based on data use, etc.

Proposals addressing digital modelling and simulation issues in a more application-oriented framework such as energy, climate, the environment, cosmology, smart cities, etc. are also expected under this theme.

Associated keywords: *supercomputing, HPC, exascale, scaling, scalability, performance, fault resilience/tolerance; massive, heterogeneous and hierarchical parallelism, heterogeneous, hybrid architecture; CPU, GPU, FPGA, multicore, machine cluster; energy efficiency, optimisation; (quantification) uncertainties, multiscale, multi-physical, domain decomposition, assimilation and inversion of data, modelling and simulation; digital twins, combined hardware and software systems, co-design (software, hardware, application), validation and verification, scientific computing library, linear algebra, modelling languages, workflows, pre and post-processing (mesh, visualisation, etc.), data lifecycle. Associated ERC codes:* PE01, PE06, PE07, PE08.

Associated SDG: 9.

5.7. Quantum technologies

The priorities of the French state in the "Quantum Technologies" field are enforced via this research theme.

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This research theme aims to support research initiatives relating to the fields of "Energy and Materials Sciences" and "Digital Sciences".

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

- quantum communications aiming for maximum security,
- quantum computing: quantum processors and architectures based on "qubits" and quantum algorithms, models and the programming environment for quantum computing, quantum computing applications, etc.
- quantum simulation, implementation methods and systems,
- quantum sensors and metrology (imagery, in particular medical imagery, atomic clocks, accelerometers and gyrometers),
- fundamental research and development of new concepts to implement these technologies.

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

Associated ERC codes: PE02, PE03, PE06.

Associated SDG: 9 and 16.

Mathematics and its Interactions

6.1. Mathematics

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This research theme deals with proposals ranging from purely fundamental to more applied aspects, and targets excellence and breakthroughs in mathematical research.

The cross-disciplinary theme "Mathematics and digital sciences to meet the challenges of biology and health" is more suitable for interdisciplinary proposals submitted by a consortium including

researchers in the field of biology or health.²⁷

More generally, mathematical projects with effective interaction with other disciplines can be submitted under other scientific themes.

Associated keywords: algebraic, arithmetic and differential geometry, topology, algebra, number theory, dynamic systems, ordinary differential equations, analysis, functional analysis, partial differential equations, mathematical physics, probability, statistics, number analysis, scientific computing, data processing, logic, discrete and combinatorial mathematics, cryptography, modelling, simulation, optimisation, checks, game theory, mathematics in relation to signals and images, history of mathematics.

Associated ERC codes: PE01, PE06.

Associated SDG: 9.

Physics of Matter, High Energy, Planetary and Universe Sciences

7.1. Physics of condensed matter and diluted matter

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The scope of this research theme covers a broad field of physics, mainly fundamental and essentially through such sectors as ERC PE02 (with the exception of the sub-disciplines PE02_01 to 04) “Basic components of matter: 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”.

Proposals concerned with the physics of soft matter, traditionally part of the physics of condensed matter, are covered under this theme. On the other hand, proposals concerned with the physical chemistry of soft matter must be submitted under the “Polymers, composites, physics and chemistry of soft matter” theme.

Furthermore, proposals that come under the generic topic of quantum technologies are to be submitted under the “Quantum Technologies” theme.

Associated keywords: acoustics, aggregates, ultra-cold atoms and molecules, self-organisation, atomic and molecular collisions, growth, instrument developments, fluid dynamics, electromagnetism, molecular electronics, strongly related fermions, quantum fluids and gases, heterostructures and nano-objects, hydrodynamics, instabilities, radiation-matter interaction, photonic and electronic interactions, magnetism and spin electronics (projects dealing with spintronic systems must be submitted under the “Micro- and nano-technologies for information and communication processing” theme, part of the “Digital Sciences (SDNum)” field), morphogenesis, nano-optics, optics, non-linear optics; quantum optics, ultra-fast optics, off balance phenomena, macroscopic quantum phenomena, atomic and molecular physics, physics of irregular systems, physics of mechanical behaviour, physics of gases and plasmas, laser physics, mesoscopic physics, non-linear physics, statistical physics, propagation of waves in complex environments, atomic and molecular spectrometry, structures of solids and liquids, structure and dynamics of disordered systems, superfluidity, supraconductivity, surfaces, biological and biophysical systems, complex systems, turbulence.

Associated ERC codes: PE02, PE03.

Associated SDG: 9.

7.2. Subatomic physics and astrophysics

²⁷Proposals applied to biology and health applications and focusing on mainly mathematical issues are expected under this “Mathematics” theme.

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This theme deals with research aiming to improve fundamental knowledge and achieve highly-innovative developments in instrumentation, networking, data processing and exploitation in the field of subatomic and theoretical physics, astrophysics and cosmology.

Associated keywords: *algorithms and complexity, mathematical aspects of string theories, astrochemistry, astronomy, high-energy astronomy and particles, astroparticles, astrophysics, multi-messenger astrophysics, cold atoms, cosmology, instrument developments, formation of stars and planetary systems, galaxy formation and evolution, conventional and quantum gravity, quantum data, black matter and black energy, rigorous statistical mechanics and applications, interstellar medium, gravitational waves, off balance phenomena, accelerator physics, physics of fundamental interactions, mathematical physics, non-linear physics, nuclear physics, particle physics, solar physics, stellar physics, subatomic physics, theoretical physics, time-space reference systems, disordered systems, conventional and quantum dynamic systems, integrable systems, low dimensional quantum systems, wave theory.*

Associated ERC codes: PE02_01 - PE02_04, PE09_03 - PE09_17.

Associated SDG: 9.

7.3. Planetary science & structure and history of the Earth.

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This theme deals with research aiming to improve fundamental knowledge and achieve highly-innovative developments in instrumentation, networking, data processing and exploitation in the field of planetary science, exobiology, the structure, history and dynamics of the Earth (including paleoenvironments far earlier than the anthropocene).

Associated keyword: *risks (telluric hazards, space weather and near-Earth objects), chemistry and physics of planetary atmospheres, cosmochemistry, instrument developments, planetary science, exoplanets, planet formation, geochemistry, geochronology, geodynamics, geomagnetism, geophysics, gravimetry, mineralogy, pre-anthropocent paleo-environments, paleontology; paleomagnetism, planetary science, petrology, sun-Earth relations, sedimentology, seismology, structure of the globe, tectonics, primitive Earth, deep Earth, volcanology.*

Associated ERC codes: PE09_01, PE09_02, PE09_04, PE09_05, PE09_16, PE09_17, PE10.

Associated SDG: 9, 13, 14 and 15.

Multi-disciplinary fields

8.1. Human-environment interactions

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This theme aims to support research initiatives primarily relating to integrated and multi-disciplinary approaches focusing on relations between anthropic activities and the environment. Its scientific scope covers three aspects:

- societies facing environmental changes (accidental and deliberate)
- integrated approaches to sustainable development at territorial level and for the sustainable management of shared environmental assets (*global commons*)
- interactions between ecosystem sustainability, food security and nutrition.

This theme covers proposals that help analyse development and governance modes aiming to adapt to global environmental changes, as well as to natural and technological risks or the depletion of

resources, while considering environmental, social, cultural, economic and political changes and vulnerabilities.

Research may address different temporal and spatial scales, and sectoral or multi-sectoral, comparative, retrospective or prospective, qualitative and quantitative approaches.

The proposals submitted mainly involve integrated and multi-disciplinary approaches combining different disciplines in humanities and social sciences, environmental and living sciences.

This theme excludes projects addressing the sustainable management of exploited ecosystems (see "Developing socio-ecosystems and their components to ensure sustainable management" theme)

Associated keywords: *stakeholders, participative action, adaptation, anthroposphere, multi-stakeholder approaches, catastrophes and impacts, behaviours, conflicts, cooperation, rights, cooperation, territorial dynamics, sustainability, diachronic studies, environmental justice and intergenerational fairness, sustainable management, integrated management, political institutions, ecosystems/socio-economic systems interactions, environmental mediation, standards, economic organisations, perceptions, public policies, prevention, representations, resilience, resources, risks, ecosystemic services, political systems, territories, transitions, vulnerability.*

Associated ERC codes: LS08, PE10, SH01, SH02, SH03, SH06.

Associated SDG: 2, 6, 11, 12, 13, 14, 15, 16 and 17.

8.2. Contaminants, ecosystems and health

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The scientific scope of this research theme covers research projects, and particularly multi-disciplinary approaches, which contribute to expanding our knowledge of the characterisation and fate of physical, chemical or biological contaminants as well as their effects on human, animal and plant health and on ecosystems in line with the "Eco Health" concept, in particular projects on:

- the characterisation of the exposome (incl. contaminant cocktail, individual and collective behaviours and interactions between different types of stress),
- contaminants, environmental and human metrology, including bio-indicators and bio-markers,
- the effects and underlying mechanisms of contaminants on living organisms, human health and ecosystems,
- the eco-dynamics, interactions and multi-generational impacts of contaminants,
- mechanisms of evolution and adaptation in exposed organisms,
- the evaluation of new governance tools for the risks associated with contamination, considering the reactions of local populations.

Associated keywords: *adaptability, biocides, biodiversity, biocides, bio-indicators, bio-markers, legal and regulatory frameworks, cocktail of contaminants, physical contaminants, controversies, eco-dynamics, health ecology, ecosystems, ecotoxicology, environment, epidemiology, exposome, epigenetics, exposome, metals, metrology, microbiome, micro- and nano-plastics, modelling, nanomaterials, organometallics, perception by society, endocrine disruptors, pesticides, mineral pollutants, persistent organic pollutants, animal health, human health, plant health, strategies of economic players, rare earth elements, environmental toxicology, toxins.*

Associated ERC codes: LS02, LS04, LS07, LS08, LS09, PE01, PE02, PE03, PE04, PE05, PE07, PE06, PE08, SH01, SH02, SH03.

Associated SDG: 2, 3, 6, 9, 11, 14 and 15.

8.3. Infectious diseases and the environment

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This theme relates to environment-based pathogens, emerging or re-emerging infectious diseases and/or adaptations and antimicrobial resistance. The proposals submitted will involve integrated and multi-disciplinary approaches combining disciplines in environmental science, biology-health, humanities and social sciences.

More precisely, this research theme covers the following topics:

- all pathogens affecting humans, animals and plants, regardless of their origin (bacteria, viruses, parasites, fungi, algae and non-conventional pathogens) and their products,
- the dissemination and adaptation of pathogens and their hosts, generic and non-genetic determinants for transmission, infectious diseases emergence mechanisms (human, plant or animal, including zoonoses) in connection with environmental and anthropogenic factors,
- methods to fight, monitor and prevent, to identify populations and areas at risk, prepare for epidemic or pandemic risks, the social conditions for epidemic treatment systems, (health ecology),
- modelling emergence, dissemination, exposure, transmission or elimination parameters, retrospective analyses and the creation of databases to help in defining indicators for a predictive approach to evolving epidemics in the framework of health monitoring,
- resistance to antimicrobial, antiparasitic, antifungal, insecticide and biocide treatments,
- processes used by pathogens and their hosts to adapt to environmental changes,
- the organisation and resilience of human and animal healthcare systems in view of the risks inherent to emerging and re-emerging infectious diseases,
- the impact of individual and collective practices and behaviours on transmission.

Associated keywords: *anthropy, "One Health" and "Eco-Health", database, prevention and management conditions for emerging diseases, different determinants in infectious diseases (biological, medical, environmental, social, etc.), epidemics, exposome/infections, wild fauna, modelling, niches, pandemics, emerging and re-emerging pathogens, persistence, prediction, treatment, reservoirs, antimicrobial resistance, risks, mental health, space-time, species transfer, vectors, virulence, zoonoses.*

Associated ERC codes: LS01, LS02, LS06, LS07, LS08, PE06, PE10, SH02, SH03.

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

8.4. Public health, health and societies

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This research theme relates to integrated and multidisciplinary research (epidemiology, bio-statistics, management, economics, sociology, law, history, philosophy, ethics etc.) in the field of public health whose goal is to:

- analyse and understand the role of different determinants (social, economic, behavioural, environmental, health systems, etc.) and their interactions, in well-being, vulnerability, health, the genesis and mitigation of inequalities throughout life.
- propose frameworks for analysing the impact of multiple determinants on health and individual and collective health-dependent activities, our relationship to our health and that of others, health as the subject of public policies, treatment and healthcare conditions, at the different ages of life and in various conditions (chronicity, disability, vulnerability, ageing, etc.),
- assess risks at individual, family, collective and global level, and propose methods for the surveillance, planning, prevention, evaluation and adaptation of health policies, systems and

services (including for primary care) in routine or crisis (epidemic, conflict, etc.) circumstances.

- propose works on the organisation of health and medico-social services in terms of access, efficiency, fairness and stakeholder satisfaction, as well as the territorial organisation of healthcare and use of health technologies,
- analyse the role played by public or private stakeholders and the viewpoint of the population in preparation and implementation or delays with local and global public health strategies, particularly if controversies or disputes arise.

Special attention will be paid to conceptual research and the methodologies to be used to analyse the effects of the social, behavioural and environmental healthcare determinants and their interactions, and the effects of public health and health system operations throughout life and in the various activity spaces (homes, school, at work, etc.). A DGOS co-funding request may be submitted for projects including a partner health care facility.

Associated keywords: health practices, individual and collective behaviours, health standards, health promotion, health services and system, organisation, players, healthcare access, determinants in social inequalities effecting health and vulnerability, knowledge of at-risk groups, relationships to risks and risk perception, risk management, surveillance, prevention, protection, regulations, evaluations, policies, screening, early diagnosis, chronic diseases, use of existing health data

Associated ERC codes: LS02, LS07, SH01, SH02, SH03, SH04, SH06.

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

8.5. Mathematics and digital sciences for biology and health

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This theme helps to support interdisciplinary research projects combining innovative developments and research in the fields of biology and health, the establishment of concepts and the development of new mathematical, computing, automated, physical or signal processing methods. Proposals submitted may relate to:

- the development of heterogeneous or big data pairing, security, management, exports and collection, for data from various sources ranging from omics biology, to medical/administrative databases containing health data (National Health Data System) or from any other source of personal health data for the purposes of preclinical, clinical, populational or epidemiological research or to assist with decision-making,
- the analysis and modelling of data from omic approaches (transcriptomic, proteomic, etc.), structural biology, cellular and tissue microscopy, imaging and e-health, and virtual and augmented visualisation of these complex multimodal, multi-scale and strong content data.
- processing signals and medical images in order to segment, extract and characterize the data, as well as to merge multimodal, multiscale, morpho-functional data with a view to improving biological knowledge and/or developing new approaches with medical benefits,
- the quantitative analysis and modelling of biological and physiological processes used to develop predictive approaches in biology and healthcare, and methods used to compare the results of these approaches with experimental data, particularly data assimilation and machine learning mechanisms,
- the simulation of complex biological systems using high performance and scientific computing and associated optimisation, immersive simulation (virtual and augmented).

Associated keywords: big data in biology, large-scale machine learning and artificial intelligence for life

sciences, assistance with decision-making, predictive analysis, analysis and processing of signals and images, modelling of biological processes, biological simulation, emerging properties of biological systems, computational biology, bioinformatics, biomathematics, e-health, medical information technology.

Associated ERC codes: LS01, LS02, LS03, LS05, LS07, PE01, PE06, PE07.

Associated SDG: 3 and 9.

8.6. The Digital Revolution: relationship to knowledge and culture

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This theme aims to support interdisciplinary research initiatives relating to two main fields - "Digital Sciences" and "Social Sciences and Humanities".

The proposals expected will come under one of the two main fields:

- Digital humanities:
 - education and training,
 - creation and sharing knowledge,
 - arts, culture and heritage.
- Computational social sciences

The projects will be supported by a team or an interdisciplinary partnership, bringing together researchers in digital science and technology and in human and social sciences. The progress aimed for can concern a single disciplinary field (SSH or ICST) if it mobilises concepts or tools from recent advances in the other field. These conditions explicitly encourage the submission of interdisciplinary projects, indicating in what way and how the co-construction of common research objects, at the interface of disciplines, enables scientific questions to be better conceived and/or contributes to the renewal of methodologies. This theme will not therefore cover proposals leading to both types of research (SSH and ICST) in two separate series of tasks.

Associated keywords: Educational staging, serious games and gamification, customisation and adaptation to the learner, training in digital technologies, digital literacy, remote learning, co-learning, co-teaching, digital school and connected territory, immersive environment (school, class, tool), cognitive, sociological and anthropological approaches to learning through/by digital, educational innovation, digital and transformation of research and knowledge practices, access to research publications and data, credibility and verification of information on-line, media education, analysis of speeches and controversy, use of big data and new analytical capabilities, quantification of self, behavioural sciences, digital humanities, open data and linked data, digital approaches to heritage, native digital heritage, knowledge modelling, access to information, cultural and digital mediations, virtual collections, immersive and mobile devices, music, digital approaches to artistic creations, digital/algorithmic governmentality, democracy and citizen debates in the digital context, analysis of public policies via open data, computational social sciences.

Associated ERC codes: PE06, SH03, SH04, SH05, SH06.

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

8.7. Healthcare technologies

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This research theme is intended to support interdisciplinary research initiatives in the fields of engineering and systems applied to new concepts, tools and methods in relation to healthcare technologies in the following fields:

- instrumentation, detection systems and agents for anatomic, functional, cellular and molecular imaging with medical benefits and integration in multimodal approaches,
- the technologies used for these elements can improve the efficiency of screening, the provision of vectorised drugs, or bioproduction processes,
- implantation in (or on) the living system, diagnosis and analysis (embedded sensors) and therapy,
- biomaterials relating or independently to regenerative medicine,
- organoid-related manufacturing processes and systems,
- in vitro analysis and diagnosis technologies, implantation in a living organisms, biomaterial aspects relating to regenerative medicine,
- surgical technologies including remote operation, associated materials and devices, implantable devices, life-support devices and prostheses: progress may be used to improve reliability, biocompatibility and the performance of these technologies, miniaturisation, remote-operability and increased energy autonomy. Any development of these technologies which could potentially integrate modelling, simulation or execution,
- e-health technologies,
- disability compensation and autonomy.

PRCE proposals considering applications of the proposed research topics and potential uses are suitable for this theme.

Associated keywords: medical devices, biosensors and monitoring instruments, medical imagery, stimulation tools, signal and image processing, biomaterials/biomechanics, home automation, home equipment, disability, e-health, medical IT, bio-printing, regenerative medicine.

Associated ERC code: LS07.

Associated SDG: 3, 9, 10 and 12.

8.8. Global security, Cybersecurity

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Dominant trends are emerging in an unstable geopolitical environment and the understanding of new tools and human behaviours appears as a priority, a means of arbitration and a source of disturbance for strategic equilibria. Research was requested and significantly contributes to proposing new, appropriate and competitive solutions to help implement ground-breaking and innovative technologies.

Consider "Global Security" implying shared brainstorming, responsibilities and actions while defining new legal and ethical rules. Any and all combinations would be preferable, aiming to federate and create new synergies meeting the expectations of the Horizon Europe programme in particular.

Based on this approach, this theme relates to research proposals aimed at characterising the risks and vulnerabilities inherent to European societies (resilience, logistics, handling consequences), improving the prevention and protection of property and people, developing the protection of infrastructures and networks and the protection of objects, data, content and software, managing crises and contributing to resilience, analysing instruments, including legal and economic ones.

The panel is open to any fundamental or finalised, single-disciplinary multi-disciplinary or interdisciplinary research, working towards social, scientific and technological changes in terms of safety and security. Participative research involving users (main/end, corporate and NGO users, regional authorities, operators providing vital services, etc.) is encouraged.

Proposals must be positioned with respect to four topics:

- risks, crisis and post-crisis management regardless of origin, system resilience, trusted territories and an educational approach,
- organised crime, terrorism and violent radicalisation pathways (operational aspects, data management, etc.),
- cybersecurity: freedom and security in cyberspace, securing information systems and fighting cybercrime,
- protecting critical infrastructures (CI) against physical and virtual threats, and protecting vital networks, sensitive sites, protection and urban security – of so-called "soft" targets, monitoring of sovereign areas.

Sectoral keywords associated with the panel: *Cybersecurity for networks, information systems, data, software and embedded systems, Intrusion detection, protection against attacks, Communications security, personal data protection, hybrid threats, ethical and legal security by design, system engineering targeting physical and virtual protection, security team equipment, evidence management, assisting individuals, security of sites and premises open to the public, transport, digital and biometric authentication processes, surveillance of maritime, terrestrial and air spaces, detection of misinformation, system resilience, collaborating work tools, public and international policies, organisational sociology, social and cultural modelling, national security, global security, secure/non-secure societal transitions, combating Radiological-Biological-Chemical-Explosive (RBCE) type threats.*

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

Associated SDG: 9, 16 and 17.

8.9. Bioeconomy: chemistry, biotechnology, system processes and approaches, from biomass to uses

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This research theme covers fundamental and applied research projects on "bioeconomics", particularly biomass cascade usages, cycle loops and related 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 biomass transformation methods and technologies for various usages, including biotechnologies and chemical and/or physical transformation processes. All bioresources (exploited, harvested, livestock, forestry, waste) in continental and marine systems are covered.

This theme contributes to the implementation of the national bio-economics strategy validated in 2017 and the sustainable development goals of the United Nations.

The theme covers disciplines and topics related to:

- the production, use and sustainable management of bioresources, regardless of source,
- the pre-processing and transformation of bioresources: biotechnology, chemistry, associated processes and combinations,
- the formulation, preparation and transformation of biosourced materials,
- the modelling and staging of flows (materials, energy, capital), at various - mainly territorial - scales,
- the analysis of value chains based on environmental, economic and social criteria.

Proposals in relation to food must be submitted under the "Food and food systems" theme.

The requested disciplines fall within life, engineering and chemical sciences, and humanities and

social sciences. Integrative interdisciplinary approaches are welcome.

Associated keywords (in alphabetical order): soil use, life cycle analysis, territorial planning, multi-criteria analysis, biomass supply, GHG footprint, biocatalysts, bioenergy, biofuel, biowaste, circular bioeconomics, biogas, biomasses (quality, availability, management), biorefinery, synthetic biology, industrial biotechnology, environmental biotechnology, firewood, recovery chain, hybrid catalysis, biosourced chemistry, wood chemistry, green chemistry, usage competition, coproducts, energy crops, anaerobic digestion, environmental economics, sector sustainability, preparation and properties of biosourced materials (packaging, plastic, composite), fermentation, identification of new bioresources, metabolic engineering, insects, lignocellulose, macro et micro-algae, anaerobic digestion, micro-organisms, photosynthetic micro-organisms, bioeconomy impact modelling, modelling of logistics optimisation, platform molecule, public policies, biosourced polymers, biomass thermochemical conversion process, biomass biological conversion process, integrated energy-matter coproduction processes, biosourced industrial products (lubricants, solvents, detergents, inks, adhesive, pigments, paints), biosourced cosmetics, wood products, social realities and representations, staging, environmental services, natural substances, biosourced synthons, treatment and recovery of biomass waste and by-products.

Associated ERC codes: LS02, LS08, LS09, PE04, PE05, PE08, SH02, SH03.

Associated SDG: 1, 7, 9, 12, 14 and 15.

8.10. Urban societies, territories, constructions and mobility

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Research proposals submitted under this theme should explore ways in which **territories**, at any scale - from districts to urban systems - **transport, housing, and users**, can manage environmental requirements via sustainable development.

Without losing sight of vulnerabilities and social-spatial inequalities, research should assess and improve the performance of buildings, transportation and territories, and lead to alternatives. Research projects must aim to reduce environmental pressure and adapt to future changes, be they breakthroughs or incremental, including climate and demographic changes (ageing, etc.). Close attention is paid to progress in digital sciences and technologies aiming to support and promote this transition, using modelling and data and by preparing solutions integrating digital technology. Governance, citizen participation in public debates and societal transformation, changing public policies, laws, and the emergence of new business models that play a role in the management and transformation of urban systems must all be analysed in view of these priorities.

The aim is to contribute to developing a range of methodological and technological approaches, mainly via **integrated inter- or cross-disciplinary approaches**, specifically by providing the necessary knowledge and understanding to analyse, assess, diagnose, help to design, construct, renovate and renew urban systems, intra and extra urban transport systems²⁸ and buildings. Close attention may be paid to **systemic approaches**, which can be used to analyse societal, environmental and technical processes in terms of their interactions, complexity and dynamics. Participation in the projects of stakeholders such as regional authorities, as well as companies, is also encouraged.

The scope of this theme is defined by the following three themes:

²⁸ Research projects focusing on energy efficiency for transportation (combustion, hybridisation, general energy optimisation on board vehicles, etc.) are excluded from this theme and come under the "Sustainable energy: clean, safe and efficient" theme.

- **territories and cities**, on all scales – including suburbs - and all aspects (social, environmental, physics), both in OECD members and in emerging or southern countries:
 - urban growth, urban sprawl, planning, urban forms, public spaces, usages, changing practices, standard of living, territorial inequalities (the environment, health, etc.), diversity, universal designs and accessibility, access to urban facilities, mobility, urban tourism, appeal, urban economics, access to employment, urban and territorial policies, planning decisions and policies, governance, citizen participation,
 - quality of the urban environment (air, water, soil, sub-surface, landscaping, etc.), hydrology, managed and integrated usage of urban soil and sub-surface resources, an integrated approach to energy in urban areas, urban micro-climatology (heat islands, etc.), nature in cities, urban agriculture, ecosystemic services, circular economy and urban metabolism and flows, industrial ecology and synergies with urban and industrial territories, access to resources (water, energy, food), shared energy and material flows, waste recovery, reconversion of brownfields and the combat against manmade degradation,
 - risks, vulnerabilities, resilience, changes and adaptations facing territories and urban systems / urban societies,
- sustainable **construction**: buildings (new and old), low-carbon islands and districts with a reduced environmental impact (particularly the use of easily-recyclable materials with little impact on natural resources), sustainable management and construction of heritage buildings and infrastructures,
- **transport system**: transportation safety and security, assistance with mobility and driving, autonomous vehicles, inter-connected and smart transport systems, multi-modal approaches,
- and cross-disciplinary subjects in relation to **networks and services**: transport networks and services for people and goods, digital networks and services, urban (e)services, urban engineering (water, sewage, waste, energy, etc.).

Associated keywords: City, urban transitions, urban planning, urban territories, suburbs, mobility, housing, urban development, urban morphologies, architecture, universal designs and accessibility, access to urban facilities, public spaces, economics, public policies, governance of cities, citizen involvement, social inequalities, lifestyles, practices, quality of the environment, (air, water, urban imaging, pollutions, quality of the urban environment (air, water, soil, sub-surface, landscaping, etc.)), hydrology, managed and integrated use of urban soils and sub-surface resources, an integrated approach to energy in cities, the combat against manmade degradation, ecosystemic services in cities, urban metabolism, urban climate, vulnerabilities and resilience of urban systems, low carbon buildings, complexes and districts with a low environmental impact, energetic and environmental renovation, civil engineering, construction, management and rehabilitation of existing heritage, infrastructures, transport safety and security, driving aids, autonomous vehicles, connected vehicles, vehicle reliability, urban engineering, passenger transport services and networks, logistics, IoT (Internet of Things), inter and multi-modal approaches, green transport options, urban services, e-services, urban data, smart cities, smart transport systems.

Associated ERC codes: LS08, LS09, PE01, PE02, PE03, PE06, PE07, PE08, PE10, SH01, SH02, SH03, SH04, SH06.

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

8.11. Nanomaterials and nanotechnologies for the products of the future

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This research theme covers proposals addressing the contributions of the nanometric dimension to the design, production and study of the properties of materials. The proposal should mainly be submitted based on the presence of specific nanometric scale objects or phenomena in the final outcome of the project. Proposals may come under the following 4 topics:

- production of complex functional nano-objects,
- management of interfaces at the nano scale, functionalisation and interactions between interfaces,
- nano-object assemblies and 2D and 3D nanostructuring of the material,
- synthesis of innovative nano-objects and nanomaterials for health. This topic is open to all proposals primarily aiming to overcome the challenge of preparing and studying physical and chemical aspects of new families, preferably from a multi-functional viewpoint. Projects focusing on the study of therapeutic, pharmacological and/or biological properties must be submitted under the appropriate theme allocated to the "Life sciences" field.

It is also important to note that proposals concerning the study of the contribution of the nanoscale dimension to the field of sensors (to improve performance, for example) as well as the instrumentation dedicated to nanomaterials must be submitted under the "Sensors, instrumentation" theme in this field.

Projects proposing ICST systems must be submitted under the "Micro- and nano-technologies for information and communication processing" theme, Digital Sciences (SDNum) field.

Associated keywords: *nanomaterials, nanoparticles, nanowires, nanotubes, core-shells, forming and stability mechanism, thin and/or nanostructured films, eco-design, sustainability, life cycle, recycling potential of nanomaterials, nano-safer by design, control of physical properties (optical, thermal, magnetic, etc.) composite interfaces in composite materials, surface and/or nano-object functionalisation, control of chemical or biological reactivity, interaction between surfaces and interfaces, simulation, modelling, assembly, self-assembly, electrospinning, nanofluidics, nanoscale aspects of the adhesion, bonding or management of fluid interfaces, nanopowder rheology, imaging agents, encapsulation, release mechanisms, biocompatibility, biophysical properties of nanoparticles and nano-structured materials.*

Associated ERC codes: LS07, PE03, PE04, PE05.

Associated SDG: 3 and 9.

8.12. Sensors, instrumentation

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This research theme welcomes proposals whose main purpose is an experimental approach aiming to develop new sensors and innovative instrumentation on several spatial scales. Proposals must optimise their focus on the "instrumentation – measurement – data processing" analysis chain, while specifying instrumental, experimental, digital, algorithmic or theoretical aspects. The theme covers three main topics relating to *in situ* and *in operando* approaches or the line monitoring of (nano-)objects or processes:

- dynamic measuring methods and instrumentation: development of *in situ* characterisation and *operando* line monitoring of the characteristics of materials, devices and systems,
- characterisation at the nanoscale and characterisation of nanomaterials: development of instrumentation and protocols dedicated to characterisation at the nanometric scale, meeting

observational and detection metrology needs, including in complex, fluid or solid environments, whether diluted or not. Any type of physical property can provide the basis for these instruments,

- digital conversion of characterisation methods: advanced data acquisition and analysis techniques,
- innovative sensors on the nanometric scale: project on the breakthrough provided by the nanoscale in terms of sensor/actuator performance. Proposals should extend beyond the simple manufacture of materials and the characterisation of their sensitivity to a parameter (physical, chemical or biological) and envisage integration for instrumentation purposes.

Projects that primarily fall under the generic topic “Quantum Technologies” are to be submitted under the corresponding theme (SDNum field). In the same way, proposals which relate more specifically to the material or the application, rather than to the measuring instrument itself, must be submitted under the corresponding topics.

Associated keywords (in alphabetical order): sensors (thermal, mechanical, magnetic, chemical, electro-chemical, biochemical, optical, piezo-electrical, inertial, etc.), in situ characterisation, controlling chemical reactivity and biological responses, line control, imagers, wave-matter interactions (nanophotonics, photodetection), acoustic instrumentation (resonators, non-destructive testing, detection), optical instrumentation (microscopy, spectroscopy, optical systems, integrated optics, non-linear optics, near field, sources, optical fibres, super-resolution and derived techniques, etc.), measurements of physical properties (mechanical, optical, thermal, electrical, magnetic, etc.), metrology, micro and nano-fluids, near field and electronic microscopy (atomic force, ionic microscopy, atomic probe), acoustic microscopy, acoustic emissions) and thermal, correlative microscopy, superficial nanostructuring, operando, advanced data processing techniques, optimised acquisition techniques, x-ray techniques (2D/3D imaging), multi-modal techniques, tomography.

Associated ERC codes: PE02, PE03, PE04, PE05, PE07, PE08.

Associated SDG: 9.

8.13. Industry and the factory of the future: People, organisations, technologies

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This research theme is open to fundamental research projects and projects with an industrial purpose aiming to design and construct the factory of the future. The expected projects must help remove scientific and/or organisational obstacles under one of the following three ground-breaking themes:

- supporting, understanding and enhancing the development of new digital, manufacturing or production technologies to meet the demand for innovative, personalised and optimised products,
- promoting a systemic vision and organisation of the factory for a development process that considers the product life cycle and value chain.
- focus the factory on people who remain 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 ground-breaking themes are divided into seven topics:

- people in new productive organisations,
- smart, connected, controlled factory,
- virtual factory,

- flexible and agile factory,
- green and citizen-oriented factory,
- robotics for industrial performance, human-robot collaboration as part of production systems (technological, organisational and legal aspects)
- new production and control technologies

The expected projects must come under these topics. They can be from different communities including engineering sciences, information and communication sciences and technologies, system sciences, humanities and social sciences, including the epistemology of sciences and techniques, 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, frontier research proposals for the factory of the future projects are especially welcome under this theme.

Associated keywords (in alphabetical order): *adaptation-resistance and support for change, decision-making help tools, operator driving assistance, logistics networks and chain, cobots, quick configuration, diagnosis, eco-design, eco-efficiency, industrial ecology, circular economy, functionality economics, local eco-system, cognitive ergonomics, fab-lab, cognitive engineering, product-service system life cycle assessment and management, system engineering, frugal innovation, industrial innovations, innovative measuring and testing instrumentation, integration of additive manufacturing, Human-Machine interaction, Internet of Things, maintenance - mainly predictive and preventive, operational research and optimisation, work organisation, customisation of products and services, sustainable processes and services, lean production in terms of energy and resources, products, augmented reality, virtual reality, recycling, individual or collective activity control, manufacturing robotics, cyber-physics systems, command-control learning techniques, innovative manufacturing technologies, industrial innovation theories, manual labour.*

Associated ERC codes: LS05, LS06, LS07, PE01, PE02, PE06, PE07, PE08, SH01, SH02, SH03, SH04.

Associated SDG: 8, 9, 10 and 12.

F. Provisions on the GDPR and Disclosing results

➤ *Personal data*

ANR uses computer processes²⁹ while selecting and monitoring projects and carrying out impact studies as part of its remit³⁰. On this basis, personal data³¹ is collected and processed in accordance with article 6.1 (e) and (c) of the GDPR³². Such data undergoes the processing necessary for the performance of a task carried out in the public interest and/or for compliance with a legal obligation.

ANR retains personal data concerning non-selected projects for the duration necessary to assess the projects followed by the period allotted for appeal procedures. The retention period for data pertaining to selected and funded projects runs for the duration necessary for the project to be monitored and verifications to be carried out by authorised bodies³³.

The data collected for this purpose can only be disclosed to the relevant departments of ANR, experts, and evaluation committee members for projects they are involved in; and, where applicable, to regulatory bodies, the ANR's subcontractors, partners and other funding agencies working with the ANR³⁴, competitiveness clusters, departments within the ANR and administrations. Some of these recipients are located outside the European Union. Transfers of personal data to such recipients are made on the basis that they are necessary to carry out one of the aforementioned tasks and for reasons of public interest. Contracts concluded between ANR and its potential subcontractors shall contain a data protection clause in accordance with Article 28 of the GDPR.

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

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

Details regarding the safeguards taken by 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.

➤ *Document disclosure*

ANR may be required to communicate certain data and documents to constituents, other French or foreign funding agencies, other administrations (including its supervisory bodies), regulatory bodies, within the framework of collaboration agreements, open public data, access to administrative

²⁹ Specialist information system (IS), submission and project evaluation sites, Processing to monitor projects, project portfolios and analyses

³⁰ Defined in Decree No. 2006-963 of 1 August 2006 on the organisation and operation of ANR

³¹ Last name, first name of the researchers, date of birth, professional contact information, degree(s), position (current and previous), fields of activity, place of work, organisation, address(es), curriculum vitae, ORCID number, name and reference of projects, pre-proposals, project proposals (scientific document, administrative and financial appendix).

³² General Data Protection Regulation (EU) 2016/679

³³ 10 years from the date on which the grant is awarded for audits by the European Commission

³⁴ Case of co-funding and collaborations with other French or foreign research projects funding agencies.

documents³⁵, interchange between administrations and the reuse of public sector information³⁶. Such disclosure can include, for example, project characterisation data, expertise, the evaluation committee's summary report, project proposals, contract documents, scientific documents, administrative and financial appendices.

The dissemination and communication of such administrative data and documents are carried out in compliance with applicable regulations and are subject to the protection of personal data, intellectual property and trade secrets. Indeed, certain documents or data collected must not be disclosed or may only be done so in a restricted manner.

In the case of collaboration with other funding agencies, or co-funding in particular, document disclosure and confidentiality are regulated by contracts. Document disclosure will be limited to the area of collaboration between the ANR's partner funding agency and itself.

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

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

*Annex: Evaluation panels working with bilateral collaboration projects **confirmed** as part of the Generic Call for Proposals 2020: International Collaborative Research Projects (PRCI)*

Country (agency)	Collaboration themes	Lead Agency	Evaluation panels involved*
Brazil (FACEPE)	<ul style="list-style-type: none"> • Information and communication technologies • Social sciences and humanities • Materials • Engineering, chemistry, physics • The environment and biological resources 	-	01, 02, 03, 04, 06, 07, 10, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 36, 38, 40, 41, 42, 43, 45, 46, 47, 48, 49
Brazil (FAPESP)	<ul style="list-style-type: none"> • Information and communication technologies • Social sciences and humanities • Materials • Engineering, chemistry, physics • The environment and biological resources 	ANR	01, 02, 03, 04, 06, 07, 10, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 36, 38, 40, 41, 42, 43, 45, 46, 47, 48, 49
Canada – Quebec (FRQSC)	Social innovations in view of demographic changes and the future of working in the digital era	ANR	26
Hong Kong (RGC)	All disciplinary fields funded by ANR and RGC	-	All except 39
Russia (RSF)	<ul style="list-style-type: none"> • Mathematics • Earth sciences • Oceanography 		01, 40, 49
Singapore (NRF)	<ul style="list-style-type: none"> • Materials, nanotechnologies, nanosystems • Information and communications sciences including quantum technologies and artificial intelligence • Applications of digital technologies in the fields of health, sustainable mobility and sustainable cities. 	-	08, 09, 10, 18, 22, 23, 24, 25, 33, 38, 42, 45, 46, 47, 48
Taiwan (MOST)	All disciplinary fields funded by ANR and MOST	-	All except 39
Germany (DFG)	All disciplinary fields funded by ANR and DFG, except social sciences and humanities**	DFG ⁽¹⁾	All except 26, 27, 28, 36 & 41
Austria (FWF)	All disciplinary fields funded by ANR and FWF	FWF ⁽¹⁾	All
Luxembourg (FNR)	All disciplinary fields funded by ANR and FNR	ANR	All
Switzerland (FNS)	All disciplinary fields funded by ANR and FNS	FNS ⁽¹⁾	All

* Evaluation panels: cf. § E Scientific fields covered by the Generic Call for Proposals 2020, page 13 of the AAPG text
Each scientific theme corresponds to a Scientific Evaluation Committee (CES), se §B.3. The AAPG 2020 Scientific Evaluation Panels (CES) taken from pages 19-20 of the AAPG Guide 2020

** Social sciences and humanities are subject to a specific ANR-DFG call for proposals ("FRAL")

⁽¹⁾ In 2020, submissions are reviewed by the partner agency (DFG, FWF or FNS)

