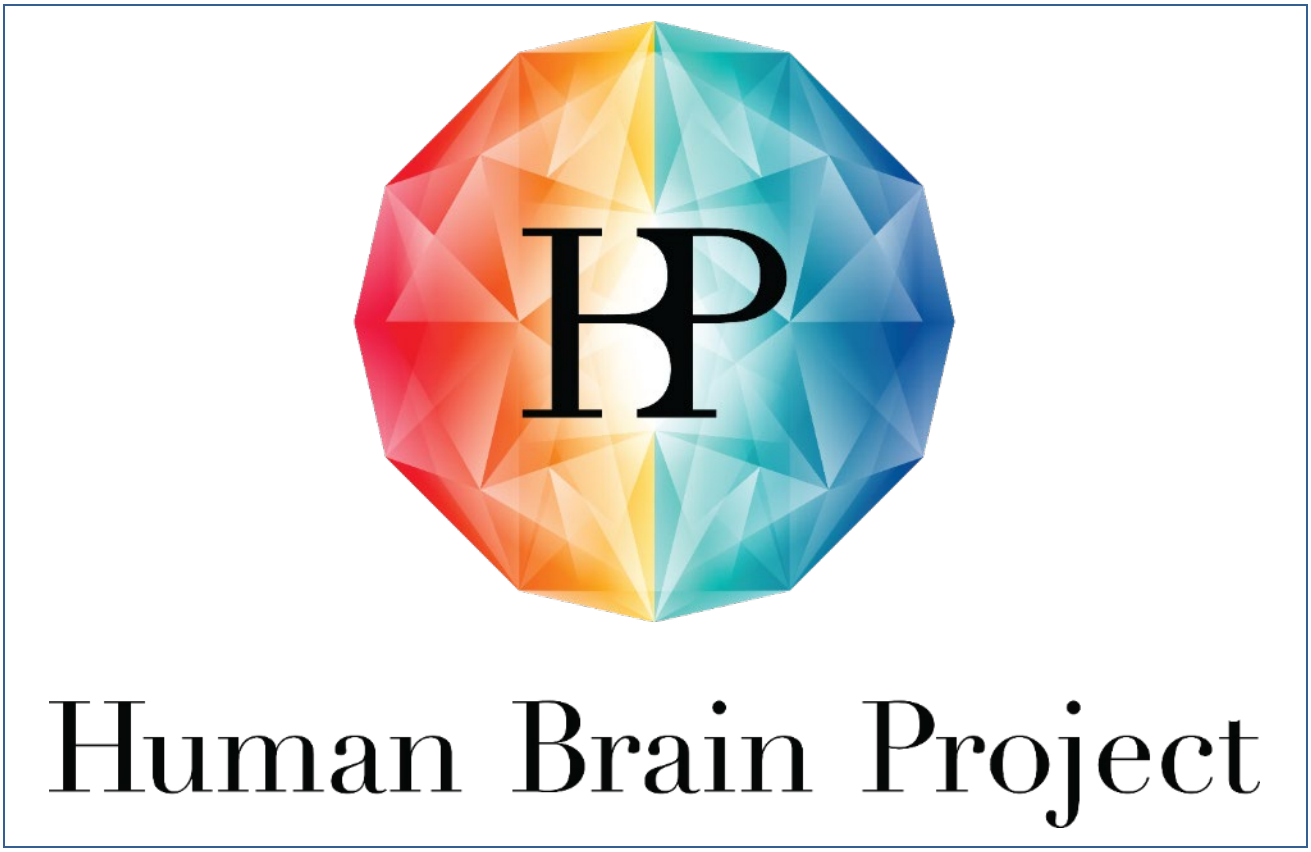
Proposed new Partners for SGA3
(D7.5- SGA3)



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Description in GA:	This Deliverable will provide an overview of the management of the Calls for Expression of Interest (CEoI) for SGA3. It will include the description of the entire process, starting from the preparation of the call documents to the evaluation of the proposals. It will also include the information on the new projects selected for EC funding and on the new partners integrated into the HBP Consortium. This deliverable will have a confidential Annex.
Abstract:	Report on the management of four Calls for Expression of Interest (CEoIs) for WP1, WP3, and WP4 in SGA3, launched between M5 and M7 (in SGA3) for proposing new Partners for becoming a new Task in SGA3. Information on the selected partners is provided.
Keywords:	Call for Expression of Interest, CEoI, SGA3, evaluation, brain atlas, The Virtual Brain, Knowledge Graph, HIP, software adapter functional neural models, modular functional architectures, multimodal perception, vision, scene understanding, decision making, planning, working memory, attention, monitoring, task instructions, learning, distributed symbols, sub-symbolic rules, executive functions, frontal cortex, industry, SME, start-up, digital neuroscience, technology, brain research, medicine, computing
Target Users/Readers:	HBP Governance & Advisory Bodies, HBP Consortium, Public

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1. Introduction

The Human Brain Project (HBP, https://www.humanbrainproject.eu/) is an ambitious 10-year scientific research and infrastructure initiative that is part of the EU Future and Emerging Technology (FET) Flagship programme. The HBP is developing EBRAINS, an innovative ICT infrastructure that will help neuroscientists and clinical researchers integrate data and knowledge about the brain across all levels of its spatial and temporal organisation. Using detailed digital representations, reconstructions, and simulations, it aims to make available ICT tools to thousands of researchers to advance and accelerate our understanding of the functioning of the healthy and diseased human brain. EBRAINS offers a large set of services that is applicable to a broad range of research fields including mental health or molecular medicine. The HBP is not only set to transform neuroscientific research but also the culture of collaboration to bring together resources and interdisciplinary knowledge.

Calls for Expression of Interest (CEoIs) are aimed to strengthen the HBP Flagship by integrating new partners who will provide additional knowledge, ideas and expertise to EBRAINS. CEoIs will target institutions outside of the current Consortium or departments/groups within existing Partners not currently involved in the HBP. The HBP wants to attract increasing numbers of users to EBRAINS by providing compelling offerings for the external science community, by fostering new collaborations across the full range of the Project.

During SGA2, between September (SGA2 M18) and December (SGA2 M21) 2019, nine CEoIs were launched by the HBP, to attract potential new Partners. Details of these CEoIs are given in Annex 1 List of the CEoIs for SGA3 (opened in SGA2). The selected partners have been published on the HBP website.[1]

A short overview of the topic for each of these CEoIs is listed in Table 1.

Table 1: CEoIs launched during SGA2

CEoI#	Description
1	*Validation and Inference* aimed to attract experts in model validation. The aim was twofold: (i) to validate existing brain models against available experimental evidence; and (ii) to map model parameter variability in light of biological diversity.
2	*Brain atlas and simulation engine adapter construction* aimed to attract experts in computational services related to the informatics integration of Brain Atlas and The Virtual Brain (TVB) simulation engine, with the capacity to perform co-simulations by integrating NEST, and to operate within the context of and with the EBRAINS Platform. Software adaptors should be created for efficient interprocess communication between simulation engines and parallel I/O of heterogeneous neuroscientific datasets on HPC systems.
3	*Whole brain multi-parametric imaging using invasive and non-invasive recordings* aimed to attract leaders in the field of multimodal brain imaging integrating invasive (such as stereotactic EEG) and non-invasive brain imaging techniques (such as MRI or PET).
4	*Rodent microcircuits* aimed to attract leaders in the field of rodent microcircuit modelling to generate a full-brain model of the mouse at the microcircuit and point neuron level. The design of neurons and microcircuits should be multiscale, biologically-realistic (i.e. neurons should be generated through a precise simplification pipeline, maintaining salient biological features), subjected to biological validation, and should address brain architectures involved in motor and cognitive control.
5	*Data and models for studying the neural basis of cognition* aimed to attract leading organisations interested in gathering data, which inform the neural basis of cognition, and in data-driven modelling of cognitive processes.
6	*Data and models for the understanding of consciousness* aimed to attract leading organisations interested in gathering and bringing into the HBP experimental and clinical data, computational

[1] https://www.humanbrainproject.eu/en/follow-hbp/news/the-human-brain-project-hbp-calls-for-expression-of-interest-ceoi-6-projects-selected-for-ec-funding-for-the-third-specific-grant-agreement-sga3/

	models and theoretical work, which inform the neural basis of consciousness as the basis for cognition.
8	*Application of visual scene understanding models to robotics use cases of industrial relevance* was for organisations or groups of organisations interested in applying techniques in visual scene understanding to robotics applications of industrial relevance.
9	*Integration of symbolic processing into the cognitive architectures* aimed to integrate expertise of neural network modelling of high-level symbolic processing for integration in developed biologically inspired cognitive architectures.
10	*Preparing Cellular-Level Models for Portable HPC Simulation using Arbor* was for organisations interested in preparing cellular-level models for portable high-performance computing (HPC) simulation using Arbor.

In addition to these CEoIs, in SGA3, between August (SGA3 M5) and October (SGA3 M7) 2020, four extra CEoIs have been launched (Table 2). Further details of these CEoIs are given in Annex 2 List of the CEoIs for SGA3 (opened in SGA3). The selected proposals and their partners are supposed to become a new Task of the specific WP, as part of the general intended HBP Work Plan for SGA3. The selected partner organisations will be incorporated in the HBP Consortium. The new Partners will have to sign the relevant agreements with the EC, as well as the Consortium Agreement that regulates the relations between the Partners of the Consortium.

Table 2: CEoIs launched during SGA3

CEoI Description
Brain Atlas and simulation engine adapter construction is meant to attract experts in computer engineering and software development interested in contributing to the building of one of the largest computational infrastructures in Europe dedicated to neuroscience.
Application of functional architectures supporting advanced cognitive functions to address AI and automation problems of industrial and commercial relevance is meant to attract organisations interested in the application of functional architectures to address AI and automation problems of industrial and commercial relevance, with special emphasis on vision.
High-level neuro-symbolic processing for guidance of goal-directed behaviour is meant to integrate expertise of neural network modelling of high-level symbolic processing and working memory to support goal-directed behaviour that will be integrated in developed biologically inspired cognitive architectures.
Engagement of Industry, SMEs and start-ups is meant to involve companies in the development of the tools and services for the shared EBRAINS digital brain research infrastructure (RI).

2. Management of the CEoIs

The management of this second series of CEoIs, ranging from the preparation and opening of the CEoIs to the evaluation of the proposals and reporting of the results, started in SGA3 M1 (April 2020) and will end in SGA3 M11 (February 2021) (see Table 3).

Table 3: Timeline of the CEoIs for SGA3

M1-M5	M5-M7	M8-M10	M11
Preparation	Opening	Evaluation	Reporting

The main steps are explained in the following subchapters.

2.1 Preparation of the CEoIs

The topics and the scope of the CEoIs were designed by the relevant HBP members and approved by the EC. Full CEoI details were comprised in the relevant CEoI documents (Call Text, Guide for Applicants, Work Plan and Outcome Overview, Pre-proposal and Proposal Template). These documents were prepared for each CEoI in close cooperation with the scientists involved in the Work Packages for each specific CEoI, and in full agreement with the EC regulations and recommendations.

The Guide for Applicants, one of the documents available to the applicants, provided detailed information on the preparation of the proposal. Specifically, it defined the scope of the Call and the required contributions and impact to be achieved. Furthermore, it mentioned the budget assigned to the specific Call, the number of proposals to be funded and the eligibility rules for the applying institutions. Moreover, the procedure of proposal submission and evaluation and the evaluation criteria were set out in this document. The required format for pre-proposals and proposals was specified in the relevant templates, available to the applicants.

The submission of a pre-proposal was a mandatory step in this round of CEoIs. Scientists who participated in the preparation of the Calls, evaluated the submitted pre-proposals. Their evaluation focused on whether the proposals matched the scope of the Calls and on possible improvements. The feedback was shared on the application platform. Moreover, HBP High Level Support Team (HLST) sent feedback to the applicants of the specific Calls where the total Call budget included a Voucher (10% of the total Call budget) to fund technical support for integration of project results in EBRAINS. The feedback was sent to ensure that the Voucher is correctly allocated to the budget. This step did not have any influence on the evaluation of the following full proposal.

The Call Text summarised the topic and the main objectives of the specific Call. The Call Text for each CEoI is listed below.

2.1.1 Brain atlas and simulation engine adapter construction

This Call aims to attract **experts in computer engineering and software development** with interest to contribute to the building of one of the largest computational infrastructures in Europe dedicated to neuroscience. The new team(s) will be integrated into HBP's efforts of translating state-of-the-art neuroscience into digital approaches and workflows, will benefit from access to informatics and HPC tools and resources in EBRAINS, and will contribute to shaping the next generation of neuroscience research and translation.

The new partners will perform **software development enabling the seamless execution of workflows** in support of the showcases[2] in Work Package 1 (WP1) "*The human multiscale brain connectome and its variability – from synapses to large-scale networks and function*", making use of **FENIX**[3] **tooling** and **EBRAINS services**[4].

In particular, they will **contribute to the informatics integration** of

- brain atlases
- The Virtual Brain (TVB) simulation engine
- Knowledge Graph[5]
- Human Intracerebral EEG data Platform (HIP)

and **validation and model inversion processes** in WP1, operating in the EBRAINS IT infrastructure.

The **construction of efficient software adapters** between TVB simulation engine, atlas services and data repositories is of fundamental importance to realise TVB-based simulations making full use of the heterogeneous multiscale data in the brain atlases and intracranial data in HIP in EBRAINS.

Software adaptors shall be created for efficient I/O between TVB simulation engine and storage of heterogeneous neuroscientific datasets on EBRAINS's distributed systems. HBP partners in WP1 are expected to group up with the applicants to ensure a tight coordination and integration with the science and existing engineering efforts.

[2] Showcase 1 - Degeneracy in neuroscience - when is Big Data big enough? Showcase 2 - Improving epilepsy surgery with the Virtual BigBrain
[3] https://fenix-ri.eu/infrastructure/services
[4] https://ebrains.eu/services
[5] https://kg.ebrains.eu/search/?facet_type%5b0%5d=Software

Potential new partners could include **engineers and developers** with a demonstrated capacity to **develop robust and efficient communication layers on distributed computing systems**. 10% of the budget is foreseen for interactions with the HBP High Level Support Team to ensure HBP-wide close integration of the new efforts.

2.1.2 Application of functional architectures supporting advanced cognitive functions to address AI and automation problems of industrial and commercial relevance

This CEoI targets organisations interested in the application of functional cognitive architectures to address AI and automation problems of industrial and commercial relevance, with special emphasis on vision.

The successful applicants will engage in collaboration with HBP Partners who will provide techniques and models supporting a number of cognitive functions including planning, decisions making, scene understanding and contextual awareness. Activities will involve the specialisation of developed functional techniques to allow addressing real-world AI and automation problems of industrial and commercial relevance. Special emphasis is placed on scene understanding, in support of safe man-machine interaction in an industrial robotics setting (cobotics). However, the pursued qualities of robustness and generalisability lend the technology relevance to a wider range of problems, including robust scene understanding in safety-critical applications, planning and decision making for unmanned mobile systems, with applications to monitoring and surveillance. The above (non-exhaustive) list of possible application examples address the sectors of industrial robotics, mobile robotics, automotive, and agri-food. Well-motivated applications to alternate sectors will receive consideration. The choice of specific problems to be addressed should be motivated by explicitly relating one or several of the aforementioned functions to the considered problem(s), articulating the industrial relevance of the problem(s), and providing a detailed discussion relating scope and ambition of the work to be conducted with available resources. The expected objective of the activity involves the development of mature, real-world solutions (no lower than Technology Readiness Level (TRL) 5, ideally up to TRL7), building upon HBP-developed brain-based technology.

It is expected that applying consortia include a partner from industry, who will actively drive problem definition. In addition, consortia should include a designated partner leading the technical work involved in specialising the developed technology to the considered problem, in the perspective of achieving the desired maturity level. Proposals with budgets of up to EUR 500,000 should be able to address the defined scope (two proposals will be selected). As successful consortia are expected to directly include the technical expertise necessary to raise maturity of developed solutions, HLST support is not anticipated.

2.1.3 High-level neuro-symbolic processing for guidance of goal-directed behaviour

A major goal of the HBP is to advance our understanding of how biological learning networks enable human cognitive functions. This perspective is pursued by emulating the architecture and operation of the brain that support these functions and applying them to address cognitive problems. This work is characterised by a close collaboration between cognitive neuroscientists, researchers in learning theory, Artificial Intelligence, and neurorobotics. It heavily relies on services provided by the HBP Research Infrastructure (RI).

The present Call for Expressions of Interest (CEoI) aims to integrate expertise of neural network modelling of high-level symbolic processing and working memory to support goal-directed behaviour that will be integrated in developed biologically inspired cognitive architectures.

This CEoI is linked to the HBP's SGA3 Work Package 3 (WP3): "*Adaptive networks for cognitive architectures: from advanced learning to neurorobotics and neuromorphic applications*"[6].

The CEoI targets researchers actively **developing neural network models of working memory and selective attention for temporary information processing and guidance of goal-directed behaviour**. The **networks should be able to learn to perform symbolic-like computations**. Developed modules will be **integrated with other WP3 work/models** to achieve a large-scale modular cognitive architecture that can **perform higher cognitive tasks** that involve cognitive control, basic reasoning, planning and decision making.

The developed working memory, attention and symbol manipulation capabilities will support the embodied WP3 model to **store and follow task instructions**. The work of this Call will be integrated into existing (and further extended) visuo-motor architectures developed in the HBP. Since WP3 focuses on neuroscience-driven modelling, it is **desirable that the architecture and operation of the developed networks would relate to brain structure and function** where possible.

The applicants will be working in close collaboration with HBP Partners, who will provide expertise and training, as well as support to integrate developed network modules in the **co-developed embodied functional reference cognitive architecture**.

The successful applicant(s) will complement the expertise already present within the Project and will build on the developed visuo-motor and cognitive modular network architectures using tools and services provided by WP3 and the HBP RI in conducting the proposed work.

2.1.4 Engagement of Industry, SMEs and start-ups

This Call for Expression of Interest on **Engagement of Industry, SMEs and start-ups** has been designed by the Human Brain Project to involve companies in the development of tools and services for the shared EBRAINS[7] digital brain Research Infrastructure (RI).

This Call targets **companies, most notably SMEs and technology-based start-ups,** operating in the **field of digital neurosciences.**

We offer participation in the following aspects of EBRAINS RI tools and services, in cooperation with Partners of the HBP Consortium**:**

- scaling-up maturity processes
- acceleration of commercial and non-commercial utilisation by scientific and industrial communities

We welcome proposals for **technology developments that will enhance the offerings of the EBRAINS RI, i.e. integrating new or improved functionalities into its services and facilitating their exploitation in scientific and industrial user markets**.

Priority will be given to proposals centred around themes related to the following existing and upcoming EBRAINS areas:

- **Data and knowledge**: https://ebrains.eu/services/data-knowledge
- **Brain atlases**: https://ebrains.eu/services/atlases
- **Brain modelling and simulation**: https://ebrains.eu/services/simulation
- **Neurorobotics**: https://ebrains.eu/services/ai-and-robotics/neurorobotics
- **Massive computing**: https://www.humanbrainproject.eu/en/massive-computing/
- **Neuromorphic computing**: https://www.humanbrainproject.eu/en/silicon-brains/

[6] WP3 summary can be found in document: "HBP SGA3 CEoI for SGA3 Work Plan Structure and Outcome Overview"
[7] https://ebrains.eu/

- **Medical informatics**: https://mip.ebrains.eu/

Contributing to the HBP legacy through a Research Infrastructure that will accelerate scientific efforts to **"compute the brain"**, will certainly provide applicants with competitive advantages and industrial added value at the intersection of **brain research, medicine, and computing science.**

Four projects will be selected; each will receive funding of maximally EUR 250,000. Implementation of the submitted plans must be possible within a 2-year period (from 1 April 2021 until the end of SGA3, 31 March 2023). Partners in the selected proposals will become full partners of the HBP Consortium. 10% of the budget of each proposal will be dedicated to integration efforts by the High Level Support Team or to a HBP co-developer partner, and thus not be transferred to the applicants.

2.2 Opening of the CEoIs

The CEoIs and all relevant documents were announced on the HBP's website. These documents were also available on the HBP Open Calls Platform, with specific URLs for each Call. The HBP website also had a list of FAQs.

To attract the interest of as many potential applicants as possible, the CEoIs were disseminated through various channels, soon after their opening, e.g. via the HBP website, EC website, HBP and other EU Projects' social media accounts (Twitter, Facebook, LinkedIn), and at the FENS Conference (FENS 2020 Virtual Forum, 13 July 2020). Besides, the announcements on the CEoIs were sent via email (National Contact Points, Digital Innovation Hubs, relevant contacts, associations, companies and mailing lists). Call flyers were distributed to all relevant contacts. Moreover, between 21 September and 23 September 2020, Virtual Info Sessions per CEoI (for potential applicants) were organised to introduce the application procedure and to explain the topic of the Call, to give more details about what is especially relevant for the Call. During these sessions, the relevant HBP scientists, as well as the CEoIs management team responded to potential applicants' questions regarding the application procedure and the scope of the CEoIs. As a result of the comprehensive dissemination period, the CEoIs reached many potential applicants and the Call documents received a high number of downloads until closing (Table 4).

Table 4: Downloads of specific CEoI documents

CEoI	downloads
Brain Atlas and simulation engine adapter construction	344
Application of functional architectures supporting advanced cognitive functions to address AI and automation problems of industrial and commercial relevance	686
High-level neuro-symbolic processing for guidance of goal-directed behaviour	390
Engagement of Industry, SMEs and start-ups	438

Upon opening of the CEoIs, and during the entire period, potential applicants could ask questions, regarding administrative, scientific, technical, as well as general issues, via an email-based ticketing system. Depending on the type of questions, they were forwarded to relevant HBP members to be further handled. The CEoIs were closed upon the Call deadline.

Finally, the submitted proposals were preliminary checked for their admissibility and eligibility in response to the specific Calls and proceeded further to the evaluation process.

2.2.1 Open Calls Platform

To have a centralised database, the Open Calls Platform (OCP) has been created to provide all relevant documents to the applicants and also to allow applicants to register and to submit their proposals and requested budgets. In addition, a section for the remote evaluation was established, allowing individual expert evaluation of proposals, discussions between evaluators, and reaching a consensus via an evaluation consensus blog etc., taking the established evaluation criteria in consideration.

The main reason the Platform has been developed was to make sure that the whole process, from the submission to the evaluation of proposals, is transparent and fair and to ensure the confidentiality of the applicants as well. Moreover, all requirements and recommendations of the European Commission for the Management of Open Calls were fulfilled.

2.2.2 Ticketing system

Prospective applicants received support, regarding different topics related to the CEoI for the HBP, via a ticket platform (in OTRS5[8]). This Platform permitted tracking of all correspondences during the whole Open Call process, which is especially important in case of redresses, keeping all of the inquiries and information centralised. Furthermore, this allowed complete transparency of the process and continuous and simplified internal communication, maintaining the team progress in the same place and enhancing external collaborations.

2.3 Proposal evaluation

Upon submission, proposals were preliminary checked by the Calls Management members according to the admissibility and eligibility criteria (listed below).

A proposal was admissible if it:

1) was submitted via the official online submission system before the Call deadline unless technical problems are encountered
2) was written in English
3) was complete, i.e. all the requested fields within the application have been completed
4) was readable, accessible and printable
5) did not exceed the maximum number of pages indicated in the proposal template
6) all the administrative forms were filled, including the requested budget.

A proposal was eligible if:

1) its contents were in line with the topic of the Call;
2) it was submitted by an eligible proposer (or a small consortium of eligible proposers) and met any other eligibility conditions set out in the Call text or Guide for Applicants;
3) the proposing Partner Organisations were established in EU Member States or Horizon 2020-associated countries;
4) the proposing Partners had the operational capacity to carry out the activities related to the main objectives of the Call - subcontracting is allowed for activities not crucial to the HBP work;
5) its project duration was in line with the timeframe defined in the CEoI, i.e. 1 April 2021 – 31 March 2023.

After the preliminary check, ineligible and inadmissible applicants were informed.

2.3.1 Expert Evaluators

The eligible and admissible proposals were assigned remotely via the HBP Open Calls Platform to evaluators, experts from the relevant research fields and independent of the HBP Consortium and the applicants, the latter to avoid conflicts of interest. The conflict of interest rules for this Call are explained below:

[8] https://otrs.com/

In addition to a high level of competence, the experts must not have any conflicts of interests[9].

A disqualifying conflict of interest exists if an evaluator:

- was involved in the preparation of the proposal
- could stand to benefit, or be disadvantaged, as a direct result of the evaluation carried out
- has a close family relationship with any person representing a participating organisation in the proposal
- is a director, trustee or partner of any beneficiary, participating in the proposal, or is a subcontractor/third party carrying out work for any beneficiary in the proposal
- is employed by one of the beneficiaries, participating in the proposal or by a subcontractor/third party carrying out work for any beneficiary in the proposal
- is in any other situation that comprises his or her ability to review the proposal impartially

Evaluators with disqualifying conflicts of interest cannot take part in the evaluation of proposals. A potential conflict of interest may exist, even in cases not covered by the clear disqualifying conflicts indicated above, if any expert:

- was employed by one of the participating organisations in a proposal in the last three years
- is involved in a contract or research collaboration with a participating organisation, or had been so in the previous three years
- is in any other situation that could cast doubt on his or her ability to review the proposal impartially, or that could reasonably appear to do so in the eyes of an external third party

Evaluators cannot evaluate proposals where they have a potential conflict of interest and they cannot comment on those proposals during the panel meeting.

Before receiving full access to the proposals, the evaluators received a questionnaire to be signed and sent back, this served to ensure that the expert would be acting as an independent/self-contracted person. Once this questionnaire had been validated by the legal office, they received the list of the proposals (they just saw the list of applicants, not yet the content of the proposal) to which they were assigned as evaluator and/or rapporteur and a declaration of confidentiality and non-existence of conflict of interest (if any conflict arises in the course of duties, the experts must inform the Open Call Management team). Once this had been sent back, the evaluators received their contract to be signed. After signing the contracts, experts received the credentials for the Open Call Platform where the relevant proposals were assigned for evaluation. Moreover, evaluators received the Guide for Independent Experts, containing explanations of their role and evaluation principles. Furthermore, this guide comprised a detailed description of the evaluation process and directions for the evaluation regarding admissibility and eligibility criteria and rules for conflict of interest. In addition, the Guide for Applicants was provided.

2.3.2 Kick-off Meetings

Before the remote evaluation process started, the evaluators were invited to attend kick-off meetings. One kick-off meeting for each CEoI took place between 30 November and 2 December 2020. Beside evaluators, observers and principal investigators involved in the specific Calls and the Work Package attended the meetings, explaining the topic of the Call, giving more details on what is especially relevant for the Call and providing additional insights about the match of the proposals to the aims of the HBP. Moreover, the members of the Open Call Management introduced the evaluation procedure and the evaluation timeline. During these meetings, evaluators had the opportunity to ask questions on the process and the Call topic. For further questions after the

[9] https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/pse/h2020-guide-pse_en.pdf#page=12

meetings, the evaluators could contact the HBP members via the ticketing system (see section 2.2.2).

The proposals were evaluated in two steps, remote evaluation and a panel meeting.

2.3.3 Remote Evaluation

Each proposal was reviewed individually by three assigned evaluators, via the Open Call Platform, between 30 November and 15 December 2020. The evaluators evaluated each proposal considering the evaluation criteria (see Annex 3 Proposal evaluation criteria for the CEoI Industry, SMEs and start-ups and Annex 4 Proposal evaluation criteria for other CEoIs). For each criterion, the experts gave a score from 0 to 10 (see Annex 5 Proposal evaluation scores) and formulated a set of positive or negative arguments. Each argument was described with a minimum of two or three lines of text. Once the evaluation was completed, the expert acting as Rapporteur initialised the Consensus Blog on the HBP Open Calls Platform. This took place in the period between 15 December 2020 and 22 December 2020. In the consensus blog, the experts discussed their individual evaluations and explicitly agreed on the text and the final mark for each criterion. Each expert posted on the consensus blog and reacted to the posts by other evaluators. The provisional marks were turned into a consensus score that was based on the comments of the evaluators made on the consensus blog or on the arithmetical mean of the individual scores of the individual reports, these consensus scores were included in the Consensus Reports per proposal. The Rapporteur drafted the Consensus Report including justifications of consensus scores and dissenting views, if any. This report was the base document for the decisions made in the panel meeting.

Scores were weighted. The standard threshold for individual criteria was 6; no threshold was foreseen for the Equal Opportunities score. The standard overall threshold (including the Equal Opportunities score), was 6. Only proposals, reaching or exceeding the thresholds of each criterion, were eligible for funding.

2.3.4 Panel Meetings

In the second step, all the experts who acted as evaluators were invited to participate in the panel meeting. The panel meetings took place on the following dates:

- CEoI Brain Atlas: 18 January 2021, at 13:00 CET
- CEoI Industry, SMEs and start-ups: 20 January 2021, at 14:00 CET
- CEoI Functional Architectures: 21 January 2021, at 10:00 CET
- CEoI Neuro-symbolic processing: 19 January 2021 at 13:00 CET

During these meetings, each proposal was individually discussed. The agenda (varying slightly among the meetings due to the different number of proposals to be discussed) was as follows:

1) Welcome and explanation of the procedure
2) Discussion and scoring of the proposals
3) Agreement on the decision and final ranking
4) Conclusion

This meeting was chaired by an HBP Calls Management member. After presenting the participants and explaining their roles, the objectives of the meeting and the procedure were described. The main purpose of the meeting was to discuss and endorse the final scores and comments for each proposal. Furthermore, the evaluation criteria and the scores were listed and the panellists were once more reminded on the conflict of interest and confidentiality rules. Before the meeting, one of the evaluators was assigned as the scientific panel chair to take minutes on the scientific discussions regarding the proposals and the justifications of the decisions made during the Panel Meeting.

The evaluation summary sheet including the preliminary ranked list of proposals was shared with the panellists via the video conference system. In addition, the sheet presented the consensus score (reached after consensus blog discussions) for each criterion, individual scores of each evaluator per criterion and the average of the individual evaluation scores per project. For each proposal, the assigned rapporteur was asked to present a summary of the proposal and the consensus reached after the remote evaluations. Later, the three relevant evaluators were asked to comment on each criterion and the score given for the proposal. The panellists were informed that the changes in the consensus scores per criterion, if any, would be made simultaneously on the scoring table for the final scores according to the decisions made during the meeting, which could be followed on the screen.

The outcome of the meeting was a ranked list of proposals for funding, Panel Meeting Minutes and the Panel Meeting Report and Evaluation Summary Reports (ESR) for each proposal which was drafted by the rapporteur(s) considering the panel discussions and final decisions. The Panel Meeting Minutes covered the details of the panel discussions per proposal as well as the Consensus Reports. The Panel Meeting Reports summarised the Panel and the final decisions made, including the ESRs. The final drafts of the ESRs, that were drafted after the panel meeting by the rapporteurs were sent to the relevant evaluators and their final comments on the reports were requested.

2.4 Reporting and feedback

The final ranking was presented to the HBP Science and Infrastructure Board (SIB) and the Directorate (DIR) for endorsement of the selected proposals to be funded and integrated into the envisaged HBP SGA3 Work Plan. To ensure transparency, the results of the evaluations have been made available to the European Commission. When the Calls were finalised, applicants received letters with feedback on their proposal. Depending on the final scores proposals:

1) did not pass the evaluation thresholds
2) did pass the evaluation thresholds but were not selected for funding due to better-scored proposals
3) passed the evaluation thresholds and have been selected for funding

The evaluation summary report (ESR) for each proposal, with the overall scores and comments, was added to the letter. Any request for redress could only be based on procedural grounds and had to be submitted by the proposal coordinator within 30 days from the receipt of the official letter.

3. Results of the CEOIs

33 admissible and eligible proposals were submitted to the four CEOIs. These were successfully finalised and evaluated and seven proposals were selected for funding.

12 new Partner Units will be integrated to run projects from June 2021 to March 2023. Details of these proposals are given in Table 5.

Table 5: Details of proposals selected for funding

Proposal acronym and name	Principle Investigators	Beneficiary short name	Country
CEOI Brain Atlas and simulation engine adapter construction			
No proposal selected*			
CEOI Application of functional architectures supporting advanced cognitive functions to address AI and automation problems of industrial and commercial relevance			
GROW - General-purpose Robot for Object retrieval in Warehouses	**Lead: Gianluca BALDASSARE**	CNR	Italy
	Graziano TERENZI	Inglobe Technologies	Italy
	Adriano CAPIRCHIO	AI2Life	Italy
	Lead: Francesco REA	IIT RBCS	Italy

PROMEN-AID - Proactive Memory iN AI for Development	Rafael LOPEZ	ROBOTNIK	Spain
	Maria Teresa ARREDONDO WALDMEYER	UPM	Spain
CEoI Engagement of Industry, SMEs and start-ups			
NEURO-CONNECT - Knowledge management solution for multimodal brain atlas and connectome integration	**Lead: Josine VERHAAL**	Biomax Informatics AG	Germany
CESPAR - Closed-loop exoskeleton simulation for personalized assistive rehabilitation within HBP NRP	**Lead: Berat DENIZDURDURAN**	Alpine Intuition	Switzerland
	Amarlic ORTLIEB	Autonomyo	Switzerland
Neuro-robin - Closed loop upper limb neurorobot simulator	**Lead: Maria LOPEZ-VALDES**	Bit&Brain Technologies SL	Spain
LB2020 - LIVING BRAIN	**Lead: Maria Teresa MONTEMAYOR**	GEM Imaging SA - ONCOVISION	Spain
High-level neuro-symbolic processing for guidance of goal-directed behaviour			
SPIKEFERENCE - Spike-driven deep active inference for sequential goal behaviours	Pablo LANILLOS	SKU	Netherlands

*One proposal has been suggested for funding, later it has been identified to be ineligible for funding due to being a subcontractor of the HBP. No additional proposals over the threshold have been submitted to this Call. Therefore, this Call has no winner project.

3.1 Information on selected projects

After the official announcement of the CEoIs results, an overview of the proposed work has been requested from the winner applicants to be shared publicly. Information on selected proposals are presented below.

3.1.1 GROW - General-purpose Robot for Object retrieval in Warehouses

The overall goal of GROW is to develop the scene understanding technology of the HBP to achieve a Technology Readiness Level 5 (TRL5) by integrating it into a system developed by CNR for autonomous 'open-ended learning' (OEL) robot technology. This system will be used to address the market need for a robot-based autonomous retrieval of sets of small objects from shelves in weakly-engineered warehouses. Scene understanding is critical in the addressed scenarios as these present highly cluttered conditions that require disentangling the identity and features of a large number of objects that are highly variable in terms of visibility, shape, position, and orientation. The project will deliver: (a) the industrialisation of the HBP scene-understanding technology, (b) the assessment and dissemination of the technology, and (c) pre-market analyses.

3.1.2 PROMEN-AID - Proactive Memory iN AI for Development

The overall goal of PROMEN-AID project is dual. At one end, we intend to model and implement cognitive processes of short-term and long-term bi-directional memory capabilities. On the other hand, we intend to improve the human robot interactions based on shared memory. The project solves AI and automation problems of industrial relevance, and interacting computational processes as building blocks of a cognitive architecture for robot-human interaction. Specifically, the project will aim at addressing the overall goal by enabling memory-based awareness, by improving action planning by long-term memory of artificial agents. Further, the project will improve the interaction

between human workers and artificial agents with specific analysis of shared memory-based task accomplishment.

3.1.3 NEURO-CONNECT - Knowledge management solution for multimodal brain atlas and connectome integration

Biomax will develop NeuroCONNECT, a novel knowledge management and database solution for the semantic integration and management of multimodal brain connectivity information and brain atlases in HBP/EBRAINS. NeuroCONNECT will be configured in NeuroXM™ Brain Science Suite, a cutting-edge knowledge management solution specifically designed for the semantic integration of connectome data from different structural and functional imaging modalities. The novelty of the NeuroXM Suite is in its unique functionality to represent multimodal connectome information in a unifying feature space that creates a flexibility and interoperability never seen before in connectomics. Connectome data will be enriched with metadata from anatomical ontologies, brain atlases and demographic information and therefore will become a knowledge hub for all connectome data in HBP/EBRAINS infrastructure.

3.1.4 CESPAR - Closed-loop exoskeleton simulation for personalized assistive rehabilitation within HBP NRP

One of the goals of the HBP-NRP is to provide connections between physical sensors, actuators, devices and simulated brains. The idea is to allow researchers to have a platform to study realistic closed-loop experiments, such that a perception - cognition - action loop can be created. In our proposal, we would like to apply this goal to clinical neurorehabilitation. The major caveat of existing neurorehabilitation schema is the requirement of personalization. Such as, fine-tuning exoskeleton controllers for each patient is an important step. Testing devices on human subjects with physiotherapists is not only very time consuming and expensive but also very unpleasant for both patient and physiotherapist. The main goal of our proposal is to automatize the personalization of the exoskeleton controller and rehabilitation schema while using the closed-loop simulation architecture of the HBP-NRP and biologically plausible spinal cord and brain models.

3.1.5 Neuro-robin - Closed loop upper limb neurorobot simulator

This proposal frames in the context of motor neurorehabilitation devices with application to stroke patients, a neurological disorder flagged as a public health priority by the WHO. Brain-machine interface (BMI) closed-loop interventions have been demonstrated as effective motor rehabilitation tools for these patients. Despite clinical validations in stroke patients and other conditions, progress to develop R&D or industrial products is very slow because: 1) although each stroke is different and requires a personalized BMI therapeutic process, we have no analytic tools to adapt it to each individual; and 2) the transition from theoretical BMI models to the real world is difficult and expensive. This proposal leverages on the HBP simulation tools to: 1) easily simulate EEG with lesions and validate new models; 2) personalize and optimize existing BMI therapies; and 3) transfer the simulated models to real world existing hardware, accelerating the transfer from scientific developments to real applications for academic, clinical or industrial deployment. We want to combine more than a decade of research and development of BMI and neuro-rehabilitation of Bitbrain and collaborators with key results of the HBP project and EBRAINS, to develop a new transversal use case in the EBRAINS Neurorobotics Platform: “Closed-loop upper limb neurorobot simulator for stroke neuro-rehabilitation”.

3.1.6 LB2020 - LIVING BRAIN

Oncovision (GEM Imaging SA, OCV) is a multi-award winning, innovative Spanish SME creating molecular/functional vision equipment revolutionizing personalized patient care at every stage, from screening to diagnosis, therapy planning and biopsy/surgery/interventional guidance and assessment of therapy results. More than 150.000 patients in 40+ countries have been successfully diagnosed and treated with the support of OCV's technologies.

OCV developed, as H2020 project, CAREMIBRAIN dedicated brain PET, generating detailed functional images of the brain with at least double sensitivity and three+ times better (1,5 mm) resolution vs best in class whole body PET, and also quantifies changes vs "normal" segmented by age, sex and other conditions. From measuring metabolism to neurotransmitter dynamics, drugs and their effects, synaptic density or even monoclonal antibodies, dedicated brain PET is providing a new window to understand and better care for our brain, combining unprecedented clinical value with minimal radiotracer dose, patient ergonomics, ease of use, new point of care options and cost effectiveness.

The clinical contribution of dedicated brain PET is revolutionary in neurodegenerative diseases (dementias, including Alzheimer's, Parkinson's disease, aphasias, multiple sclerosis MS, amyotrophic lateral sclerosis ALS, Huntington's, ...), functional conditions (epilepsy, learning disabilities, autism, ...), stroke and other vascular brain diseases, CNS inflammations and infections -including neurological impact of COVID19, psychiatric conditions and, of course, brain cancer.

LIVING BRAIN is the development of a prototype next-generation brain-dedicated PET, multiplying sensitivity, resolution and quantification performance, as well as other exclusive, clinically relevant advantages and Time of Flight. These innovations have been identified as decisive by expert Neurologists and Nuclear Medicine experts, and will be opening unprecedented opportunities for patients affected by multiple neurological diseases or conditions, as well as in Neurological research.

3.1.7 SPIKEFERENCE - Spike-driven deep active inference for sequential goal behaviours

The SPIKEFERENCE project aims to control industrial robots with spiking neural networks using neuroscience-inspired algorithms (deep active inference), providing adaptation and conditional hierarchical problem-solving. The outcome of the project will be a step forward in brain-inspired computational models, both theoretically and experimentally, bridging the gap between low-level control and neurosymbolic approaches, contributing to major challenges within the Human-Brain Project, such as the development of neuroscientific-driven adaptive cognitive architectures, and providing novel spike-driven closed-loop controllers that can be deployed in real robots.

4. Equal opportunities

Gender equality concerns all parts of Horizon 2020 (see the Guidance on Gender Equality in H2020 and the Gender Equality Strategy "A Union of Equality: Gender Equality Strategy 2020-2025"[10]). The HBP has committed itself to offer equal opportunities[11], especially to balance the proportion of male and female scientists in leadership positions, as well as among PhD students and post docs, but also to overcoming artificial barriers, prejudices or preferences.

The HBP has been funded as FET Flagship under Horizon2020 and is as such responsible for considering gender and diversity as research content and in research teams. To raise awareness amongst potential new collaborators and partners it was decided to emphasise the importance of gender, diversity and equal opportunities via Open Call evaluation criteria. 10% of the overall proposal weighting has been explicitly attributed to equal opportunities. This required that more

[10] https://ec.europa.eu/info/sites/info/files/aid_development_cooperation_fundamental_rights/gender-equality-strategy-2020-2025_en.pdf
[11] https://www.humanbrainproject.eu/en/about/gender-equality/

information had to be provided by the applicants. This criterion was explicitly and in detail discussed during all panel meetings among the evaluators.

Accordingly, the gender balance results of the selected projects were satisfactory. 50% of the Lead Principle Investigators are female in these seven projects.

5. CONCLUSION

Overall, in SGA2, nine Calls for Expression of Interest (CEoIs) have been launched by the HBP for the third Specific Grant Agreement SGA3 between September (SGA2 M18) and December (SGA2 M21) 2019. As a result of these CEoIs, seven proposals have been selected for funding and 10 new academic Partner Units have been integrated to run projects from October 2020 to March 2023.

In addition to these CEoIs, in SGA3, between August (SGA3 M5) and October (SGA3 M7) 2020, four extra Calls for Expression of Interest (CEoIs) have been launched. As a result of these CEoIs, seven proposals have been selected for funding and 8 new industrial partners and 4 new academic Partner Units will be integrated to run projects from June 2021 to March 2023 pending an SGA3 Amendment to be approved by the EC.

A third wave of two CEoIs is in progress and the related results will be described in a new version of this report by end of 2021.

Annex 1 List of CEoIs for SGA3 (opened in SGA2)

CEoI	Opened on	Closed on	Work Package (WP)	Total Call Budget (EUR)	Organizations eligible
CEoI1: Validation and Inference	19.09.2019	02.12.2019	WP1	700,000 for one proposal	External and internal (60%/40% of the allocation)
CEoI2: Brain atlas and simulation engine adapter construction	19.09.2019	02.12.2019	WP1	450,000 for one proposal	External and internal (60%/40% of the allocation)
CEoI3: Whole brain multi-parametric imaging using invasive and non-invasive recordings	19.09.2019	02.12.2019	WP1	450,000 for one proposal	External and internal (60%/40% of the allocation)
CEoI4: Rodent microcircuits	19.09.2019	02.12.2019	WP1	900,000 for one proposal	External and internal (60%/40% of the allocation)
CEoI5: Data and models for studying the neural basis of cognition	24.10.2019	12.12.2019	WP2	1,300,000 for one proposal	External and internal (60%/40% of the allocation)
CEoI6: Data and models for the understanding of consciousness	24.10.2019	12.12.2019	WP2	800,000 for one proposal	External and internal (60%/40% of the allocation)
CEoI8: Application of visual scene understanding models to robotics use-cases of industrial relevance	11.10.2019	05.12.2019	WP3	800,000 for one proposal	External and internal (60%/40% of the allocation)
CEoI9: Integration of symbolic processing into the cognitive architectures	11.10.2019	05.12.2019	WP3	800,000 for one proposal	External and internal (60%/40% of the allocation)
CEoI10: Preparing Cellular-Level Models for Portable HPC Simulation using Arbor	04.10.2019	21.12.2019	WP5	900,000 for two proposals	External and internal (60%/40% of the allocation)

Annex 2 List of CEoIs for SGA3 (opened in SGA3)

CEoI	Opened on	Closed on	Work Package (WP)	Total Call Budget (EUR)	Organisations eligible
CEoI Brain Atlas and simulation engine adapter construction	05.08.2020	26.10.2020	WP1	450,000 for one proposal	External and internal (60%/40% of the allocation)
CEoI for Application of functional architectures supporting advanced cognitive functions to address AI and automation problems of industrial and commercial relevance	05.08.2020	26.10.2020	WP3	1,000,000 for two proposals	External and internal (60%/40% of the allocation)
CEoI for High-level neuro-symbolic processing for guidance of goal-directed behaviour	05.08.2020	26.10.2020	WP3	450,000 for one proposal	External and internal (60%/40% of the allocation)
CEoI for Engagement of Industry, SMEs and start-ups	05.08.2020	26.10.2020	WP4	1,000,000 for four proposals	External

Annex 3 Proposal evaluation criteria for the CEoI Industry, SMEs and start-ups

1. Excellence	**Weight: 30%**
• Quality of the proposed actions: research and technology development processes, methodologies, definition of protection and exploitation plans	*Score 1: ../10 (Threshold: 6/10)*
2. Impact - adequacy	**Weight: 10%**
• Adequacy and relation of the solution to the EBRAINS objectives	*Score 2: ../10 (Threshold: 6/10)*
3. Impact - relevance	**Weight: 20%**
• Relevance of the solution in relation to neuroscientific and industrial needs	*Score 3: ../10 (Threshold: 6/10)*
4. Impact- innovation	**Weight: 10%**
• Innovation potential of the solution: maturity, novelty, attractiveness for targeted users	*Score 4: ../10 (Threshold: 6/10)*
5. Implementation - adequacy	**Weight: 10%**
• Adequacy of the company (and potential subcontractors) in relation to its experience, size (SMEs are prioritised), knowledge base, innovation management abilities, networking potential, exploitation capacities, resources committed, and co-funding	*Score 5: ../10 (Threshold: 6/10)*
6. Implementation - feasibility	**Weight: 10%**
• Feasibility of the proposal from technical, financial, and market perspectives	*Score 6: ../10 (Threshold: 6/10)*
7. Equal Opportunities	**Weight: 10%**
• Equal Opportunities for the company teams, diversity aspects (gender, age, career stage, other factors) must be considered: Are there measures in place and described in detail to enhance fair work distribution and equal opportunities for career development? Is the proportion of women leaders and contributors justified in detail? In case of an imbalance compared to the proportion of women in similar scientific or industrial disciplines, are measures planned to improve gender equality?	*Score 7: ../10 (NO Threshold)*
8. Ethical implications and compliance	**Mandatory**
• Ethical implications and compliance with applicable international, EU and national law • Ensure that the study proposed will not promote indications that raise ethical issues	*No Score*
OVERALL SCORE	*Overall score: ../10 (Threshold: 6/10)*

Annex 4 Proposal evaluation criteria for other CEoIs

1. Excellence	Weight: 30%
• Clarity and pertinence of the objectives • Credibility and soundness of the proposed concept, credibility of the proposed methodology and degree of conformity to provided specifications • Extent that the proposed work is beyond the state of the art, and demonstrates innovation potential (e.g. ground-breaking objectives, novel concepts and approaches, new products, services or business and organisational models) • Quality and effectiveness of the detailed research plan (including appropriateness of tasks and experiments, milestones, and indicators to monitor progress) • Appropriate consideration of interdisciplinary approaches and, where relevant, use of stakeholder knowledge and gender dimension in research and innovation content. Regarding the gender dimension: in research activities where tissues, living materials and human beings are involved as subjects or end-users, differences based on sex, gender, age, health conditions etc. may exist. If applicable to the present research: are diversity factors like sex, gender, age etc. addressed as an integral part of the proposal?	*Score 1:* *../10* *(Threshold: 6/10)*
2. Impact	**Weight: 40%**
• Contribution to the design and development of EBRAINS, the HBP research infrastructure • Contribution to scientific activities pursued within the HBP (e.g. human neurosciences and to theory development) • Any substantial impacts not mentioned, that would enhance innovation capacity, ability to create new market opportunities, to strengthen competitiveness and growth of companies, address issues related to climate change or the environment, or bring other important benefits for society • Quality of the proposed measures to exploit and disseminate the project results (including management of IPR) and to manage research data where relevant	*Score 2:* *../10* *(Threshold: 6/10)*
3. Implementation	**Weight: 20%**
• Quality and effectiveness of the work plan, including extent to which the resources assigned to the tasks are in line with their objectives and deliverables • Co-funding provided by the Partners (institutional staff, access to facilities, etc.) • Quality of the Organisations and of the group of applicants as a whole (including complementarity, gender balance, involvement of key actors, prior history, relevant experience of the individual partners) and extent to which the consortium as whole brings together the necessary expertise • Appropriateness of the management structures and procedures, including risk and innovation management	*Score 3:* *../10* *(Threshold: 6/10)*
4. Equal Opportunities	**Weight: 10%**
• Equal Opportunities for teams, diversity aspects (gender, age, career stage, other factors) must be considered: Are there measures in place and described in detail to enhance fair work distribution and equal opportunities for career development? Is the proportion of women scientists and contributors justified in detail? In case of an imbalance compared to the proportion of women in similar scientific disciplines, are measures planned to improve gender equality?	*Score 4:* *../10* *(NO Threshold)*
5. Ethical implications and compliance	**Mandatory**
• Ethical implications and compliance with applicable international, EU and national law	*No Score*

• Ensure that the study proposed will not promote indications that raise ethical issues	
OVERALL SCORE:	*Overall score: ../10* *(Threshold: 6/10)*

Annex 5 Proposal evaluation scores

0	The proposal fails to address the criterion	The proposal fails to address the criterion under examination or cannot be judged due to missing or incomplete information.
1-2	Poor	The criterion is inadequately addressed, or there are serious inherent weaknesses.
3-4	Fair	While the proposal broadly addresses the criterion, there are significant weaknesses.
5-6	Good	The proposal addresses the criterion well, but a number of shortcomings are present. Improvements will be necessary.
7-8	Very good	The proposal addresses the criterion very well, although a small number of shortcomings are present. Some improvements are still possible.
9-10	Excellent	The proposal successfully addresses all relevant aspects of the criterion in question. Any shortcomings are minor.