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Inserm
La science pour la santé
From science to health

the booster programs

Booster program co-led by
the theme-based institutes of Inserm:

- **Neurosciences, cognitive sciences, neurology, psychiatry (NNP)**
- **Health technologies (ITS)**

Neurotechnologies 2023
booster program

Deadline for electronic submission:

May 9th, 2023

the booster programs

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Cover illustration: Abstract glowing blue brain
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SUMMARY

GENERAL OVERVIEW OF THE NEUROTECHNOLOGIES 2023 BOOSTER PROGRAM

Neurotechnologies are based on a set of approaches that aim to explore the brain to better understand its functioning. It includes measurement of its state, biomarkers detection, and follow-up of pathologies. Technologies are also used for therapeutic strategies based on modulation, compensation, or to repair dysfunctions. Some technological families are the subject of ongoing R&D efforts because they have considerable innovation potential. However, some challenges require the mobilization of a large research collective and Inserm wants to tackle them by mobilizing its forces around this booster program.

Thus, brain imaging is associated with non-invasive technological innovations that allow the unmasking of the structure and functioning of the brain in preclinical and clinical settings. Over the past 30 years, this research field has made significant progress in different imaging modalities. Imaging technologies have led to the research for specific biomarkers for an increasingly early detection of pathologies, whether neurodegenerative, cancerous, or psychiatric.

Neuronavigation, on which brain imaging depends, allows for the guidance of neuromodulation strategies. Such approaches have significant potential in the treatment of neurological or neuropsychiatric disorders (epilepsy, Parkinson's, stroke, depression, schizophrenia, autism, post-traumatic stress disorder, etc.). Depending on the depth of the chosen therapeutic target location, different neuromodulation techniques are possible, based on electrical, magnetic, or ultrasonic stimulations.

All of these innovative techniques will only be able to fully benefit patients if they are easily accessible, with the widest possible national coverage. The concept of the portable and wearable tools, information, and people are thus at the center of the issues of brain imaging and neuromodulation. Portable and wearable neurotechnologies imply not only the miniaturization of imaging and neuromodulation tools, but also the reduction of associated costs, ease to use, and the development of telemedicine tools.

GOALS OF THE NEUROTECHNOLOGIES 2023 BOOSTER PROGRAM

Overall goals

Through complementary approaches, this Neurotechnologies 2023 booster program aims to conduct forward-looking research for the benefit of brain imaging and neuromodulation, with a particular interest in the portable and wearable aspects of these neurotechnologies.

Specific goals

They are as follows:

- Propose technological innovations able to improve the early diagnosis and therapeutic monitoring of neurological diseases. Multimodal and hybrid approaches may be developed. Once identified, a secondary goal will be the ability to detect biomarkers in the same way using both heavy and light medical devices (cf. **work package 1**).
- Develop therapeutic approaches using neuromodulation and propose methods to monitor the effects of neurostimulation. Targeting subcategories of neurons and developing electrodes, brain-machine interfaces, etc. may be targeted (cf. **work package 2**).

› Develop prototypes of new or alternative portable and wearable technologies, devices associated with real-life studies essential in pre- and post-hospitalization, or virtual reality approaches (cf. **work package 3**).

PERSPECTIVES OF THE NEUROTECHNOLOGIES 2023 BOOSTER PROGRAM

The research themes proposed in this 2023 booster program of Inserm, dedicated to neurotechnologies, should have scientific and clinical, societal and economic impacts.

Scientific and clinical impact

The acquired data and their processing will contribute both to the fundamental understanding of human physiology and to the identification of markers of pathologies and their modulations, possibly in natural environments. These imaging and neuromodulation tools should help to better understand the sources of intra/inter-individual variability of markers of (dys)functioning, necessary for the development of personalized medicine.

Societal impact

Portable and wearable systems, at a lower cost of purchase and maintenance than current systems, can be better disseminated throughout France, with their deployment in mobile units, to reach medical deserts. Their acceptability by patients and their families is also an important point to consider.

Economic impact

The envisaged innovations are intended to be valued in French companies. The sensor industry (ultrasound, EEG, NIRS, MEG/OPM) is particularly active in France and could benefit from the envisaged advances and/or the creation of new startups.

These targeted and coordinated actions (multidisciplinary calls for projects, POC studies, support for innovation and public-private partnerships) will need to be based on:

› Work in conjunction with University-Hospital Centers (CHU in French) and in particular Clinical Investigation Centers (CIC in French), including those focused on Technology Innovations (CIC-IT in French), to facilitate the rapid transfer of these advances to healthcare

› Enrichment, coordination and fusion of national cohort and biobank studies

› Reinforcing the attractiveness of research for professionals in the field

› Promoting the development of participatory and inclusive research, including patients and/or their families.

WORK PACKAGE 1: TECHNOLOGICAL INNOVATIONS

This technological innovations work package aims primarily improving the diagnostic tools for neuropathologies in the broad sense, for early detection, better risk assessment and responses to treatment by integrating imaging biomarker strategies.

The currently accessible imaging modalities provide access to a plethora of objective and quantitative measures that can indicate both the presence and progression of diseases. These modalities can also be used for patient recruitment in clinical trials in terms of treatment

efficacy but also for monitoring its safety. However, these modalities are underutilized in their investigation possibilities, still very expensive and bulky. In fact, their uses are limited to large hospitals. In addition, other exploration modalities are slow to enter clinical use. A translational and transdisciplinary research effort is necessary to bring our laboratory advances to the bedsides of patients as soon as possible. The use of the window open on the central nervous system represented by the eye is still underrepresented in diagnostic approaches, although diseases such as Alzheimer's or Parkinson's also affect the retina. Thus, the retina could be used for the early screening of these diseases before the onset of major central deficits such as memory loss, thus paving the way for therapeutic clinical trials.

Therefore, it is necessary to be able to develop and/or validate innovative technologies/tools that allow for the non-invasive (or minimally invasive) visualization of the different mechanisms of neurological diseases. Such tools would have a major impact on the personalized management of these conditions, both for their diagnosis and prognosis and for the monitoring of responses to treatment. In fact, being able to perform a longitudinal follow-up of these pathologies, including at the patients' homes, is a clinical necessity, both for effective medical follow-up and for the psychology of patients.

To do this, we must coordinate to boost neurotechnologies development and their validation in human clinical use. This primarily involves different imaging modalities. Their technological developments, validation, and standardization will obviously be in line with the implementation of corresponding tracers (paramagnetic agents, radiotracers, ultrasound and photoacoustic contrast agents, etc.). Particular effort will be made to deploy miniaturized tools for pre- and post-hospital use, including telemedicine and connected medicine. These tools would also help address one of the challenges of our current healthcare system, medical deserts.

Scientific questions and challenges

Three major scientific challenges have been identified:

A. Preclinical development, optimization, and validation of neurotechnologies necessary for the identification of biomarkers of neurological diseases

B. Validation of neurological disease biomarkers with neuroimaging methods, decoding mechanisms that can be targeted for diagnosis or prognosis, in connection with available and future (including imaging banks) cohorts, registers and biobanks

C. Longitudinal follow-up of diseases (pre-, intra- and post-hospital) with innovative technologies by promoting early diagnosis and the identification of prognostic markers including response markers to treatment.

The expected results include the construction of new diagnostic, prognostic and therapeutic approaches for neuropathologies for better management of these diseases, while reducing the associated costs as much as possible. By encouraging innovation, this program will contribute to wealth creation in areas such as the development of new biomarkers, imaging tools, medical devices and connected tools.

Considered approaches

- The expected technological innovations include MRI, in vivo MRS, PET, MPI (Magnetic Particle Imaging), ultrasound imaging, photoacoustic imaging, and neurophysiology approaches including EEG, MEG, eye tracking, etc. (and not forgetting multimodalities such as PET/MRS, PET/ultrasound, EEG/ultrasound, etc.)
- Technologies developed to contribute to the analysis of biological systems (rodents, non-human primates and humans), the development of innovative neonatal screening methods, the development of biomarkers for mental illnesses, or vision pathologies.

WORK PACKAGE 2: NEUROMODULATION

Non-invasive and non-convulsive neuromodulation techniques are increasingly being studied for their potential in the treatment of neurological or neuropsychiatric disorders (epilepsy, Parkinson's, stroke, depression, schizophrenia, autism, post-traumatic stress disorder, etc.). They are referred to as non-invasive brain stimulation (NIBS) methods and include neuromodulation (subthreshold) and neurostimulation (suprathreshold) methods. These techniques include transcranial magnetic stimulation (TMS) or repetitive (rTMS), transcranial electric stimulation with continuous (tDCS) or alternating current (tACS), and transcranial ultrasound stimulation (TUS). More invasive neuromodulation techniques have also demonstrated their effectiveness, such as deep brain stimulation (DBS) (Parkinson's disease, resistant obsessive-compulsive disorders, resistant anorexia nervosa) or for auditory rehabilitation (cochlear implants). These brain-machine interfaces are diversifying with the recent validation of optogenetics for visual restoration and the recent developments in sonogenetics, two approaches based on gene expression to sensitize neurons to light or ultrasound.

In the last ten years, due to the advent of non-invasive brain-machine interfaces, research has also developed around self-neuromodulation, through neurofeedback. EEG, but also fMRI, MEG or fNIRS, are used to monitor in real time a component of brain activity and provide this quantitative information to the subject/patient so that they learn to regulate it. A science of neurofeedback, guided by the principle of evidence-based medicine, has developed and today raises issues that are at the heart of those posed by neurotechnologies as a whole.

Despite the increasingly widespread use of these techniques, the underlying biophysical and neurophysiological mechanisms, in the short and long term, are poorly understood. Thus, studies must be conducted to overcome several challenges in order to: i) demonstrate their effectiveness and safety, ii) increase and rationalize their use.

Scientific questions and challenges

Six scientific challenges have been identified:

A. Neuroplasticity. The mechanisms of interaction between low-magnitude electrical/magnetic/ultrasound fields and neuronal circuits at different scales are complex. They involve variations in membrane potentials in different neuronal populations, modifications in neurotransmitter release, effects on the discharge timing of neurons that modify neuroplasticity in targeted or distant regions. In fact, non-invasive transcranial brain stimulation modulates cortical excitability beyond the stimulation period for several minutes to several hours or days. Many evidences, including pharmacological, physiological, and behavioral studies in humans and animals, suggest that the effects of non-invasive transcranial brain stimulation are produced by effects on synaptoplasticity. A first challenge is to understand these neuroplastic effects, both immediate and lasting.

B. Neuronal training. Neuromodulation techniques use continuous or alternating stimulation protocols. Applied rhythmically, they induce specific neuronal oscillations in frequency and phase, offering a causal perspective on the underlying neuronal mechanisms. A second challenge is to optimize dynamic stimulation protocols and selectively train certain subpopulations of neurons (glutamatergic or GABAergic).

C. Large-scale networks. The optimal stimulation sites for a given pathology and patient-specific may be focal or, on the contrary, form networks consisting of interconnected brain regions. The third challenge is to therapeutically optimize multi-site stimulation devices that allow the neuromodulation of "large-scale" brain networks with low-magnitude electromagnetic/ultrasound fields that also minimize transcutaneous effects.

The question of the impact of stimulation on areas distant from the targeted area remains open.

D. Subcortical networks. For some neurological and neuropsychiatric disorders, deeper regions may be involved. These regions are not always accessible by classical methods. This constitutes a fourth challenge: how to non-invasively neuromodulate the activity of subcortical regions with good spatial precision? Can sonogenetic approaches answer this problem?

E. Cellular selectivity. Neuromodulation techniques often lack cellular selectivity in comparison to approaches that are coupled with genetic therapy through the use of promoters (optogenetics or sonogenetics). In this case, the challenge will be to select promoters specific to neuronal types in order to define the best cellular targets according to the pathology and the stimulation site.

F. Neurofeedback. In order to consolidate the proper use of non-invasive neuromodulation techniques, it is necessary to develop the following points:

a) Experimental validation of the effect of neurofeedback (target biomarker + device + mode of interaction + administration protocol) using clinical studies.

b) Optimization of measurement (sensors), portable and wearable devices, ergonomics and acceptability, robustness, integration into a product that can be deployed on a large scale and at a lower cost.

c) Development of dedicated models and algorithms to analyze and interpret brain activity in real-time and in a closed loop, as well as optimizing the learning curve of the subject/patient.

Finally, the concept of neurofeedback can be extended to any learning associated with the use of a brain-machine interface over time in order to control it (whether it is an invasive or non-invasive BCI).

Considered approaches

› For these challenges, neuro-inspired computational models (physiological and biophysical) coupled with the analysis of preclinical and clinical data (especially electrophysiological) can provide insights. For challenge **D,** emerging ultrasonic or time interference-based methods could provide solutions. For challenge **E,** the need is to do single cell transcriptomics to define specific cellular promoters. For challenges **A, C, D and F,** the use of neuroimaging methods (structural MRI, functional MRI, diffusion MRI, NIRS, PET, multi-scale electrophysiology) is necessary.

WORK PACKAGE 3: PORTABLE AND WEARABLE TOOLS

Portable and wearable tools, in a broad sense, are expected to play a major role in public health. They allow the clinicians to use portable medical devices in the operating room, in an examination room, or even in the patient's bed. Portable and wearable tools also cover the possibility for the expert clinician to provide remote assistance to a peer. It also extends to all means developed to facilitate the use and improve the reproducibility of acts, and therefore a wider use of medical devices, for example by paramedical nursing staff. Finally, at the ultimate stage, it should allow for home use through autonomous or remotely operable devices. Portable and wearable tools therefore aim to play a leading role in medical deserts and healthcare centers far from university hospitals.

This is a strong work package, completely transversal, which covers both the detection and measurement of biomarkers and neuromodulation. Therefore, there is a real need for portable neuroimaging technologies, without compromising on spatial or temporal resolution.

Electroencephalography (EEG), near-infrared spectroscopy (NIRS) or ultrasound (fUS) have a strong potential but (i) it remains to improve their spatial resolution (for EEG, or NIRS), (ii) to allow for deep exploration (for EEG, or NIRS), or (iii) to develop usable prototypes for transcranial ultrasonography in adults. It is also important to improve the portable and wearable aspects of electrophysiological devices for use in complex natural situations (EEG, or development of a portable version of the magnetoencephalography - MEG/OPM).

In the field of neuromodulation, improving portable and wearable tools (in the broad sense) would allow for widespread use and could envisage home therapies, for example in the field of motor, sensory or cognitive rehabilitation.

Scientific questions and challenges

Five scientific questions and technological challenges have been identified:

A. Clinically available portable neuroimaging techniques suffer from limited resolution and/or penetrability. How can we improve the resolution of images and deep imaging capabilities in the brain of portable systems?

B. Currently, biomarker detection is carried out in controlled and constrained environments (generally hospitals and neuroimaging centers in particular). How can we explore the possibilities of using portable and onboard measures in natural or naturalistic situations?

C. Portable neurostimulation techniques (TMS, tDCS, tACS) currently have limited resolutions and/or do not allow for modulation of activity in deep brain areas. How can these limitations be overcome?

D. How can we develop home-based therapies, particularly in the field of motor, sensory, or cognitive rehabilitation?

E. The development of portable systems and new sensors, particularly for the measurement of biomarkers, will generate a considerable amount of data. How can we best manage the amount of data to limit it to the most relevant?

Considered approaches

› **A.**

a) Ways to improve existing portable techniques can be considered (EEG, sEEG, NIRS), especially in the development of sensors (active dry sensors, wireless systems, design of new electrode helmets, etc.), as well as the integration and synchronization of these approaches with other embedded devices (virtual reality, eye-tracking, other physiological signals).

b) Another possibility is the development of new imaging systems capable of acquiring dynamic data from the brain (anatomical, functional, vascular, even microvascular), such as the most recent multi-channel ultrasound systems. The scope of investigation does not only involve image formation, but also the collection of clinical data for continuous measurement of physiological scores (tissue or vascular properties) for the prevention and detection of diseases. In this respect, compact portable ultrasound scanners, which are becoming increasingly common, are for example the beginning of ultrasonic sensors adapted to continuous monitoring of advanced physiological parameters.

c) Finally, from currently heavy techniques such as MEG, we can consider developing more portable versions (OPM) with comparable resolutions, comparable performance, validate clinical and research uses.

› **B.**

We can identify complementary measures to be taken with onboard systems (sound, video, eye-tracking, event marking, etc.) and develop protocols and analyses taking into account the lack of repeatability of the situations explored in natural situations. Comparison of

these measures to laboratory measures, and exploration of the understanding of intra-individual sources of variability, can be pursued.

› **C.**

We can seek to improve the capabilities of current systems (TMS, tDCS, tACS). Breakthrough approaches (such as the development of new generation electromagnet coils that truly concentrate magnetic fields in depth) should be prioritized over incremental improvements. New approaches may also be considered (such as focused ultrasound) provided that devices can be developed that can be used in clinics in the short term.

› **D.**

The development of portable and telemonitoring systems is encouraged and will require not only embedded technological developments but also telemonitoring/telerehabilitation platforms (possibly accessible on smartphones) and comparison of their effectiveness to traditional hospital rehabilitation.

› **E.**

The processing of the large amount of data collected by existing sensors (connected systems) or under development (new ultrasonic, NIRS, EEG or SEEG sensors) will be attached to the Priority Research Program & Equipment dedicated to Digital Health (*PEPR Santé numérique* in French). However, developing real-time signal analysis algorithms is often necessary to filter data upstream and provide immediate feedback to the user (patient) and caregivers. These algorithms may involve artificial intelligence. They are an integral part of the planned devices.

PROGRAM OPERATION

Governance and organization

Booster program. Inserm, by supporting collaborative projects that will profit on validated proofs of concept, funds the research booster programs to accelerate the acquisition of knowledge, its transfer and value-creation.

The booster programs of Inserm promote research of excellence and breakthroughs on priority areas, in European positioning, and in obtaining additional funding. These programs are established by a consortium involving participants and are organized around work packages.

A scientific coordinator selected by Inserm (coordinating institution of the program) and the directors of the Neurosciences, cognitive sciences, neurology, and psychiatry (NNP) and the Health technologies (ITS) theme based institutes of Inserm will lead the program. It will be guided by the heads of each work package (the head of the said work package is designated by and amongst the participants in each work package), and handled by a program manager. Each work package will involve a number of participants that may vary depending on the booster program.

The scientific advisory board (SAB). Is an international scientific expert committee responsible of: (a) selecting potential participants based on the letters of intent, (b) producing recommendations for the direction of the booster program, (c) advising on the arrangement across the participants and work packages, (d) reviewing the final scientific program that will be submitted for approval to Inserm, (e) and evaluating the finalized booster program. It is composed of the directors of the Neurosciences, cognitive sciences, neurology, and psychiatry (NNP) and the Health technologies (ITS) theme-based institutes of Inserm and four to six (4-6) international experts designated by the directors of the said relevant Inserm theme-based institutes.

The program scientific committee. Responsible for monitoring the progress of the scientific component of the program. It is composed of the scientific coordinator and the heads from each work package.

The program steering committee. Responsible for managing the running of the program, including the budget, and approving proposals from the program scientific committee for activities relating to the implementation of the overall program strategy. It is composed of the scientific coordinator, the directors of the Neurosciences, cognitive sciences, neurology, and psychiatry (NNP) and the Health technologies (ITS) theme-based institutes of Inserm, and the director Strategic program department of Inserm.

Program implementation

Preparation of the program. A prospective meeting of the theme-based Inserm institutes and the executive management of Inserm leads to the identification of a specific scientific need or opportunity.
Following this meeting, a scientific working group composed of national field experts[1] compiled a list of the relevant scientific issues to address, and to bring together complementary scientific and technical skills. Their discussions have culminated in the proposed booster program and work packages.
It is important to note that since the letters of intent to participate in the program will be evaluated by an international SAB, there will not be a conflict of interest if any of the national field experts apply to be part of the program.

Set-up of the consortium. The program is established by a scientific consortium involving the participants and is organized around work packages. The set-up of the consortium will occur in two stages: an initial selection of potential participants based on letters of intent by the international SAB, followed by the generation of the preliminary scientific program thanks to a phase of co-construction of the scientific component of the program and working work packages.

Electronic submission of the letter of intent. The letter of intent will specify the program's work area in which the proposal fits and will describe how the participant's skills and know-how can be used to overcome one or more of the conceptual and/or technological obstacles identified as high-priority scientific components of the booster program.
The proposals can originate from the following participants:

- A single researcher
- A research team.

Co-construction of the work packages. The international SAB will select the participants based on the evaluation criteria described below. Following the selection of the participants based on letters of intent, and based on the proposals and recommendations of the SAB, the directors of the Neurosciences, cognitive sciences, neurology, and psychiatry (NNP) and the Health technologies (ITS) theme-based institutes of Inserm and the director of the Strategic program department of Inserm will invite the selected participants in drafting the preliminary scientific program. This program will be presented to the directors of the Inserm theme-based institutes, the Strategic program department of Inserm and the SAB in the form of a collaborative symposium.

[1] Composition of the working group: Jean-François Aubry (Paris), Emmanuel Barbier (Grenoble), Pascal Benquet (Rennes), François Berger (Grenoble), Olivier Bertrand (Lyon), Jean-Michel Escoffre (Tours), Bruno Jardri (Lille), Cyril Lafon (Lyon), Vincent Lebon (Orsay), Stéphane Lehéricy (Paris), Véronique Marchand-Pauvert (Paris), Pierre Maurel (Rennes), Catherine Oppenheim (Paris), Serge Picaud (Paris), Mickael Tanter (Paris), Denis Vivien (Caen), Fabrice Wendling (Rennes), Luc Zimmer (Lyon)

After the symposium, and following the recommendations that came from it, the scientific coordinator will submit a final scientific program to the program steering committee and to the executive management of Inserm. It will detail the contribution of each participant, the objectives and expected outcomes, as well as a detailed 3-year funding plan and identified external funding sources. Shortly after, the kick-off meeting of the program will take place.

Follow-up of the program. The program steering committee will organize an annual scientific meeting that will bring together the international SAB, the participants involved in the consortium, and the program steering committee. During this meeting, the participants will present and discuss the progress of the booster program, the next stages to tackle, and, if necessary, propose new directions for research.

ELIGIBILITY AND EVALUATION CRITERIA FOR THE LETTERS OF INTENT

Eligibility criteria

To be considered eligible to participate in the consortium, the electronic letter of intent must meet the following conditions:

- Respond to the objectives of this call for proposals and address at least one of the scientific questions and challenges of the work packages previously described
- The participant must be or must involve a researcher or tenured teacher-researcher working within a scientific team labelled by Inserm[2]. They may, for the needs of the program, propose the association of participants from other institutions, with the agreement of these institutions
- Each participant must specify:
  - Their time commitment to the program
  - The resources, particularly in terms of staff or equipment that they intend to use as part of the program
- Participants that have already initiated a joint reflection before submitting the letter of intent will be favored. In this case, individual applications are still necessary, specifying any pre-established collaborations.

Evaluation criteria

After checking the eligibility criteria, the letters of intent are subject to evaluation by the scientific expert committee. Letters of intent that do not meet the eligibility criteria are not evaluated.

The evaluation criteria are as follows:

- **Quality and originality of the proposed research**
  - Clarity of research objectives and hypotheses
  - Innovative and progress compared to the state of the art
- **Know-how/skills**
  - Relevance of skills in relation to the objectives of the program
  - Ability to associate skills in a wide network

[2] A labelled team is a team approved by Inserm in accordance with its own process of evalution.

› **Excellence of one or more teams**

- International recognition
- Competencies of team leaders in their discipline

› **Quality of the research environment**

- Human resources mobilized in the program
- Infrastructure available to carry out the program

› **Innovation/competition**

- Innovative nature of the project in relation to international scientific challenges or in relation to international competition

› **Expected outcomes**

- Impact of the outcomes in terms of knowledge and solving technological challenges
- Articulation of the project in the construction of a consortium in response to international calls.

ELIGIBILITY CRITERIA FOR THE FINALIZED PROJECT

To be considered eligible, the final scientific program must meet the following conditions:

› The project must respond to the objectives of the booster program

› Each work package must include at least two participants with complementary skills, at least one of the participants involved in the work package must be a team labelled by Inserm or be employed by Inserm

› The scientific coordinator of the consortium must be significantly involved in the program.

NEUROTECHNOLOGIES 2023 BOOSTER PROGRAM CALENDAR

Publication of the call for projects	**April 3rd, 2023**
Opening of the project submission website	**April 3rd, 2023**
Deadline for electronic submission of the letter of intent	**May 9th, 2023**
Meeting of the scientific expert committee for the selection of letters of intent	**June 9th, 2023**
Seminar and presentation of the work packages	**June 15th, 2023**
Co-construction of work packages	**June 15th to September 15th, 2023**
Deadline for submission of the finalized project to the coordinating establishment	**October 16th, 2023**
Discussions with partners	**October 20th to November 20th, 2023**
Kick-off meeting	**November 2023**

OPERATING CONDITIONS OF THE CONSORTIUM

Coordination of the consortium

The coordinating institution of the consortium is Inserm.

Duration of the project

Three (3) years.

Scientific reports

The scientific coordinator of the consortium will provide scientific reports to the coordinating institution according to the charter of good practices of Inserm (inserm.fr/en/our-research/good-practices-at-inserm) in the following schedule:

A brief progress report 6 months after the program has started
A halfway through the booster program
A final report no later than 2 months after the end of the program

The reports may lead Inserm to request additional information, suspend the program, or end financial support or request reimbursements notably if the program is not being run properly or funding is not being used properly.
The final program report could lead to a potential extension of 2 more years following the SAB's evaluation.

Responsibility of the scientific coordinator

The scientific coordinator must inform Inserm and its partners, if necessary via the program steering committee, of any substantial modification of the research program or any difficulties hindering the program completion.
The scientific coordinator must also participate actively in the program monitoring procedures organized by Inserm (presentation seminars, colloquia, etc.).

Publications and communication

It is requested that for all communications and publications, including presentations at conferences, interviews or other events, proper acknowledgment is given to the booster program. Without prejudice of any other statement, the publication or communication must include the following funding statement:

"**Financial support from Inserm to the booster program Neurotechnologies 2023**"
or "**Avec le soutien financier de l'Inserm dans le cadre du programme d'impulsion Neurotechnologies 2023**"

These publications will be sent to Inserm for reference as soon as possible and at the latest five (5) days following publication, which enables the preparation of a possible institutional communication.

Intellectual property

Subject to prior agreement regulating this topic, the rules of ownership, use and exploitation of the results of the program will be defined in an agreement concluded by and between the legal body involved in the consortium.

Consortium agreement

The drafting of a consortium agreement is strongly recommended, in particular to manage the aspects of governance of the program, sharing data, the production of the program deliverables

including the production of scientific reports, the organiwation of progress meetings, intellectual property, use and exploitation of results from the program. It becomes mandatory as soon as a legal body regulated by the French private law (or equivalent for a foreign legal body) is involved in the program.

RULES FOR SUBMISSION

Submission of the letter of intent

The submission of a proposal through the Eva3 Inserm website involves:

- Registration on the Eva3 Inserm website providing the candidate's information (surname, first name and email); enabling the reception of a user code and passwordgiving access to a secure Eva3 personal space
- Online submission of the letter of intent on the Eva3 website.

Electronic submission deadline

Deadline	May 9th, 2023
It is strongly recommended not to wait until the closing deadline of the call to submit the letter of intent.	

PUBLICATION OF RESULTS

The list of participants selected from the letters of intent will be published on the Eva3 Inserm website. In addition, all the candidates will receive a notification of the result of their application.

COMMITMENTS OF THE PARTICIPANTS

Each participant shall provide evidence or shall warrant that:

- Its commitment within the programm shall be consistent and compatible with its others commitments outside of the program prior and after the beginning of the program
- Nothing prevents its involvement in the program (therefore, prior to the beginning of the program, each participant shall notably obtain the prior approval, when requested, of its employer and during the program each participant shall inform Inserm without delay of any situation that could prevent the participant from participating in the program).

When a participant shall not meet anymore one of the critera described in this document, Inserm shall be entitled to exclude the said participant (excluding participant) of the program and, as the case may be, claim reimbursement of all or part of the fund provided by Inserm.

A participant may withdraw from the consortium for legitimate reasons, subject to giving three (3) months notice to Inserm by a registered letter with acknowledgment of receipt.

The excluding or departing participant undertakes to communicate to the other participants, at no charge and without delay, all the records and information needed to enable them to continue the Program.

Similarly, the excluding or departing party undertakes not to impose its intellectual property rights to prevent or preclude the continuation of the program and, subject to third-party rights, undertakes to grant a license to use its background knowledge and possibly its proprietary results.

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Inserm is the only public research organization in France entirely dedicated to health. Our objective: to promote the health of all by advancing knowledge on living organisms and their diseases, and by developing innovation.

Inserm's booster programs

The challenges in biology and health are constantly evolving and offer numerous opportunities for innovation. In this context, and in line with its mission to accelerate the advancement of knowledge, support interdisciplinary and integrated research, and ensure continuity between basic and clinical research, Inserm is establishing scientific booster programs whose goals are to:

- Structure scientific communities in specific and priority areas by creating national interdisciplinary consortia that will rely on the expertise and skills of Inserm teams
- Make French biomedical research a leading player in these fields by accelerating the acquisition, transfer, and valorization of knowledge, potentially involving industry partners at the conception of the programs.

These federative programs aim to create a new dynamic in innovative fields by developing complementary expertise to explore research areas that are poorly studied.

Only collaborative projects will be funded, which consist of a unique set of actions: several work packages whose implementation will rely on a consortium of teams.

These programs are open to academic and industrial partnerships of variable geometry: either a partnership on the entire program or a partnership on one or more work packages of the program.

Scientific questioning at the border of biological knowledge, new technological opportunities, the pooling of the strengths of Inserm teams in the field of the booster program, and potential societal valorization are determining elements for the establishment of these programs.