Status report: ESFRI and Facility Hubs (D6.6 – SGA3)

Figure 1: Map with EBRAINS National Nodes and Facility Hubs

All eleven countries, for which signed Expressions of Interest to create EBRAINS National Nodes are in place as of January 2023, are highlighted in light orange. Established Facility Hubs are indicated by pins: The four Physical Facilities are marked by microscopes, the seven Competence Centres by pins with human faces, and the EITN by a solid green pin. One Competence Centre is a joint offer by institutions in Palermo and Lausanne, which is indicated by dashed pins. (Data source for the map: OpenStreetMap[1])

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[1] https://www.openstreetmap.org/, published under ODbL (https://opendatacommons.org/licenses/odbl/)

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Description in GA:	Report summarising the final status with regards to ESFRI and the Facility Hubs
Abstract:	This report summarises the final status with regards to the application of the EBRAINS Research Infrastructure to become an ESFRI Project and the establishment of Facility Hubs. It describes the process from the submission of the proposal for the inclusion of the EBRAINS Research Infrastructure in the *ESFRI Roadmap 2021* to the announcement in June 2021 that this attempt was successful. The concept of the Facility Hubs and the existing eleven Facility Hubs are briefly introduced, and their uptake by the community and plans for the future are outlined.
Keywords:	ESFRI, ESFRI Project, ESFRI Roadmap, Facility Hub, Physical Facility, Competence Centre, EITN, Research Infrastructure, EBRAINS, EBRAINS National Nodes
Target Users/Readers:	Funders, policymakers, scientific community

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1. Introduction

This report summarises the final status with regards to two important processes during SGA3, namely the successful application of the EBRAINS Research Infrastructure to become a Project on the roadmap of the European Strategy Forum on Research Infrastructures (ESFRI), and the establishment of Facility Hubs.

The [EBRAINS Research Infrastructure](#)[2] (RI) is being developed, deployed and its operation is mainly funded through the [Human Brain Project](#)[3]. The current SGA3 funding phase marks the end of this FET Flagship project, which necessitates the organisation of the future operation of the EBRAINS RI post-HBP. A key step was the application submitted in September 2020 to get the EBRAINS RI listed as ESFRI Project on the ESFRI Roadmap 2021. This report summarises the application process and the planned next steps (see Section 2.1), lists key information of the proposal (Section 2.2), provides a summary of the ESFRI process including the evaluation results of the ESFRI proposal (Section 2.3), and concludes with a list of relevant and related events (Section 2.4).

Facility Hubs complement the offers of the EBRAINS RI by offering access to local neuroscientific facilities or by providing user support and user-specific development of software available on the EBRAINS platform. They are an important component in building a user community around EBRAINS tools and services to establish EBRAINS as the Research Infrastructure for brain science, medicine and brain-inspired technology. This report briefly summarises the Facility Hub concept (Section 3.1), introduces the eleven Facility Hubs established during SGA3 (Section 3.2), and outlines plans for the future (Section 3.3) based on a brief analysis of the uptake by the community.

2. Status with regards to ESFRI

2.1 Summary of the application process

EBRAINS is a distributed Digital Infrastructure at the interface of neuroscience, computing and technology, largely developed by the EC-funded FET Flagship Human Brain Project (HBP). It is a 'one-stop-shop' offering scientists and technology developers the most advanced tools and services for brain research, including FAIR data services, next-generation brain atlasing, simulation platforms and AI-based analysis of big data. EBRAINS catalyses new findings in science, and innovative brain-inspired technologies and computing, to help reach a deeper understanding of the human brain. Beyond neuroscience, it will empower a broad spectrum of biomedicine and other research, including work on COVID-19. It should also enable forward-looking, digital applications for industrial and medical use, for the benefit of patients and society.

The EBRAINS Research Infrastructure (RI) has been formally accepted for the ESFRI roadmap on 30 June 2021 as an ESFRI Project[4]. The evaluation was based on the application submitted in September 2020, the answers provided to the first questions of the expert panels, and on the hearing held in April 2021.

The EBRAINS AISBL is now fully functional and staffed, and EBRAINS is moving forward in the Preparation phase, preparing the Implementation in the course of 2023.

The current status of the EBRAINS RI on the ESFRI roadmap is that it is classified as an ESFRI Project, and in the period of transitioning between the preparation and implementation phases with an overlap, since the RI is already delivering services. The EBRAINS PREP[5] project is in charge of the finalisation of the ESFRI preparation phase. It is envisaged to place the EBRAINS RI on a sustainable footing. Its objective is to put in place the organisational framework that will allow the EBRAINS RI

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[2] https://ebrains.eu/
[3] https://www.humanbrainproject.eu
[4] https://ebrains.eu/news/ebrains-selected-for-esfri-roadmap/
[5] Funded by the European Commission under Grant Agreement no. 101079717

to complete the subsequent Implementation Phase successfully and start its Operation Phase. The new organisational framework will allow EBRAINS to evolve from the largely EC-funded, HBP-developed RI into a sustainable 'Hub-and-Node' RI on the ESFRI Roadmap. By the end of January 2023, EBRAINS AISBL had received Expressions of Interest (EoIs) to create National Nodes in eleven countries: Belgium, Denmark, France, Germany, Greece, Italy, The Netherlands, Norway, Spain, Sweden, and Switzerland. The full geographical footprint of EBRAINS AISBL can also be measured by its current and prospective (official application letter has been received) members, covering 15 countries on the European continent: Austria, Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Lithuania, The Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland.

Currently, the EBRAINS RI has the possibility to be evaluated for the subsequent ESFRI roadmap editions. EBRAINS RI is aiming to comply with all the minimum requirements for the Preparation and Implementation phases and to consolidate the RI at the European Level. This will allow the Research Infrastructure to move from the Project status to the Landmark ESFRI status.

In parallel, the EBRAINS AISBL is exploring the possibility to evolve to a new legal status. One of the options is to become a European Research Infrastructure Consortium (ERIC), in which states directly participate in the funding of certain RI activities. For this, the Management Board of EBRAINS AISBL is preparing a multi-year action plan that will be discussed in the following months with the Board of Directors for its adoption and implementation. The plan covers three levels of activities:

1) Administrative – e.g. write the drafts of statutes and make sure that all required documentation is in place

2) RI evolution – combine the aspirations of the community, the science and technology visions, develop a roadmap for the RI evolution towards an ERIC

3) Political – build political support across Europe and work closely with Node representatives and ESFRI delegates

An example of outreach activities at the political level is the EBRAINS ICRI (International Conference on Research Infrastructures) side event held on Friday 21 October 2021[6].

The HBP Consortium continues to be fully committed to putting the data sets, models, tools, and software of EBRAINS at the disposal of the scientific community to enhance brain research and enable research breakthroughs. The attraction of local and European funds to support and financing are being explored to ensure the provision of EBRAINS core services. Enabling excellent science and technological developments remains a priority along with the excellence in service delivery.

Brain research and brain health are a key priority area for science and for society, and we are convinced that EBRAINS has an important mission to fulfil.

2.2 Details of the proposal

EBRAINS submitted a proposal to become an ESFRI Distributed Research Infrastructure. The EBRAINS proposal consisted of two main parts: the **Scientific Case** and the **Implementation Case**.

These documents were reinforced and substantiated with the proof of political support by the lead Member State and additional Member States, the expression of funding commitment by the Institutions, and the inter-institutional and multi-lateral agreements signed by the core partners formally involved in the consortium.

EBRAINS followed the process and definitions illustrated in the ESFRI Roadmap 2012 Public Guide[7].

To understand the important concepts used in the EBRAINS ESFRI Proposal, and to differentiate them from other concepts used under the HBP and EBRAINS AISBL frameworks, some general definitions are given below:

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[6] International Conference on Research Infrastructures; PLUS ID: 5505; https://ebrains.eu/events/ebrains-side-event-at-icri-2022/
[7] https://www.esfri.eu/sites/default/files/ESFRI_Roadmap2021_Public_Guide_Public.pdf

- **Research Infrastructure ('RI')**: 'RI are facilities, resources and services that are used by the research communities to conduct research and foster innovation in their fields. They include major scientific equipment (or sets of instruments), knowledge-based resources such as collections, archives and scientific data, e-Infrastructures, such as data and computing systems and communication networks and any other tools that are essential to achieve excellence in research and innovation'[8]. Accordingly, RIs are implemented along different organisational models, including central sources and laboratories for experiments and measurement sessions, coordination and management of geographically distributed observatories or laboratories, remotely accessible resources for computing, data banks, physical sample repositories, surveys and longitudinal studies. While the above definition captures the common features of RI, there are at least three types of RI.

- **Distributed RI**: 'A distributed RI consists of a Central Hub and interlinked National Nodes. A distributed RI particularly needs to have a unique specific name, legal status and a governance structure with clear responsibilities and reporting lines, including international supervisory and relevant external advisory bodies; have legally binding attributions of coordination competences and resources to the Central Hub; have a unique access policy and provide for a single point of access for all users with a support structure dedicated to optimising the access for the proposed research; have a user program absorbing a relevant fraction of the total capacity of the RI; identify and adopt measurable Key Performance Indicators addressing both excellence of scientific services and sustainability; have a human resources policy adequate to guarantee the effective operation of the Central Hub supporting the research, users program, education and training by equal opportunity hiring and secondments; define a joint investment strategy aimed at strengthening the RI through the Nodes and the common/shared facilities'[9].

- **Lead Country/Entity**: Member State (MS), Associate Country (AC) or EIROforum[10] Member, which leads the preparation of the RI.

- **Prospective Member Country/Entity**: MS, AC and third country, which have submitted Expressions of political Support (EoS) signed by the national ministries responsible for the RI, or another entity – such as EIROforum Member – whose mandated authorities have expressed interest to join the RI through a Council resolution.

- **Participants**: Research institutions and other entities which are partners in the RI Consortium.

Further details of the proposal are outlined below:

Unique specific name
European Brain ReseArch INfrastructureS (EBRAINS)

Legal status
AISBL (association internationale sans but lucratif) International non-profit association, under Belgian Law

Governance structure
Contained in the Statutes and By-Laws of the EBRAINS AISBL

Lead Country/Entity
In the case of the EBRAINS project, accepted in the ESFRI 2021 Roadmap[11], the information is the following:

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[8] See ESFRI Glossary – "Research Infrastructure": https://www.esfri.eu/glossary
[9] See ESFRI Glossary – "Distributed RI": https://www.esfri.eu/glossary
[10] European intergovernmental scientific research organisations forum: https://www.eiroforum.org
[11] https://roadmap2021.esfri.eu/projects-and-landmarks/browse-the-catalogue/ebrains/

Table 1: ESFRI proposal: lead country/entity

Lead Country/Entity	National Ministry responsible for RI / Council of the entity (e.g. EIROforum Member)
France	Ministère de l'enseignement supérieur, de la recherche et de l'innovation

Prospective Member Country/Entity

In the case of the EBRAINS project, accepted in the ESFRI 2021 Roadmap, the prospective Members are:

Table 2: ESFRI proposal: prospective member countries/entities with responsible ministry/council

Prospective Member Country/Entity	National Ministry Responsible for RI / Council Of The Entity (E.G. EIROforum Member)
Member State - Bulgaria	Ministry of Education and Science
Member State - Croatia	Ministry of Science and Education
Member State - Denmark	Ministry of Higher Education and Research
Member State - Greece	General Secretariat for Research and Technology
Member State – Italy	Ministry of Universities and Research
Member State - Netherlands	Ministry of Education, Culture and Science
Associated Country - Norway	Ministry of Education and Research
Member State – Spain	Ministry of Science and Innovation
Member State – Sweden	Swedish Research Council
Associated Country - Switzerland	Federal Department of Economic Affairs, Education and Research EAER

Participants

Research institutions and other entities which are partners in the RI Consortium.

In the case of the EBRAINS project, accepted in the ESFRI 2021 Roadmap, the participants are:

Table 3: ESFRI proposal: participating institutions in the RI consortium

Country/Entity	Institution Name/ EBRAINS AISBL Full member
Germany	Forschungszentrum Jülich GmbH
Italy	Consiglio Nazionale delle Ricerche
Norway	Universitetet i Oslo
Spain	Universidad Politécnica de Madrid
Sweden	Kungliga Tekniska Högskolan
Switzerland	Ecole Polytechnique Fédérale de Lausanne

After the submission of the proposal, EBRAINS has received many applications to become an EBRAINS AISBL member. Therefore, the list will continue to evolve with the integration of new Full and Associate Members to the EBRAINS AISBL[12]. Also, after the submission of the proposal, EBRAINS has received eleven Expressions of Interest to form National Nodes, led by EBRAINS AISBL Full Members. The full list of EBRAINS AISBL members is available here: https://ebrains.eu/about

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[12] https://ebrains.eu/about

Summary of the Science Case

This section is an excerpt of the ESFRI application and might thus partially not represent the current status of research as of March 2023, but from September 2020.

To achieve a comprehensive understanding of the human brain and its connectome means to understand the multi-level organisation of the brain as an embodied network and complex system enabling perception, action, consciousness and cognition. Combining the perspectives of multi-level brain organisation with embodiment is not only relevant to capture the full scope of brain diseases and be able to develop new therapies, but also for the development of neuro-inspired technologies, and in particular neurorobotics. There is an urgent need to accelerate efforts for mental and brain health by making full use of insights from brain research and modern digital tools. Based on use cases from neurology already available in EBRAINS including MIP and HIP, this platform can now be further developed to support research in mental health, psychiatric disorders, neurosurgery, and neuroradiology, but also more broadly in the medical field.

To gain insights into fundamental questions of brain organisation will provide the key to new computing technologies, artificial neuronal networks, cognitive computing and neurorobotics as an integrative overarching technology both for experimentation and for substantially advancing real robotics. Making such technologies more "neuro-inspired" is expected to significantly speed up their development. Neurorobotics and neuromorphic computing will benefit from being increasingly neuro-inspired.

The amount of brain data is increasing rapidly. The effort in terms of time, knowledge and methodology needed to make it findable, accessible, interoperable, and reusable (FAIR) has long been underestimated and resources should be planned, from the very beginning of each research project, to address this. The Human Brain Atlas allows to access multiple brain data according to their spatial organisation through viewers, but also fully programmed software coupling. This might be a game changer for analyses of big and complex data on systems of the highest performance, but also for modelling and simulation, which become biologically more realistic.

Modelling and simulation have started to develop from different angles, and they used different approaches. But now we are in a position where we can link them, which enables bridging the different scales, to better constrain and to verify results of simulation.

Collaboration across boundaries of institutions, sectors, nations, research disciplines and cultures is indispensable for progress in neuroscience. Moreover, insights from brain research will increasingly influence learning and education and have an impact on our society. To stay ahead of emerging ethical, societal, and legal issues, and to strengthen the societal benefit and acceptability of its findings, EBRAINS need structures and strategies for engaging in dialogue with communities on issues of immediate and long-term relevance, including data ethics, neuroethics, animal protection, dual use, gender equality and diversity. The culture of collaboration in the neurosciences is changing. We are convinced that we can contribute to making it more open, cooperative and participatory, for the benefit of neuroscience, medicine and society, which marks the beginning of a new paradigm to understand the brain.

Summary of the Implementation Case

This section is an excerpt of the ESFRI application and might thus partially not represent the current status of the infrastructure as of March 2023, but from September 2020.

EBRAINS is a distributed digital infrastructure at the interface of neuroscience, computing and technology. It is a "one-stop-shop" offering scientists and developers the most advanced tools and services for brain research, including FAIR data services, next-generation brain atlasing, simulation platforms and AI-based analysis of big data. It will catalyse new findings in science, and innovative brain-inspired technologies and computing. Beyond neuroscience, it will empower a broad spectrum of biomedicine and other research, including work on Covid-19. It should also enable forward-looking, digital applications for industrial and medical use.

EBRAINS is a major outcome of the Human Brain Project EU FET Flagship. It promotes open science and aims to encourage a culture of interdisciplinary research collaboration. It is powered by the Fenix Infrastructure as a Service (IaaS), itself a blueprint for other research communities.

EBRAINS will enable scientific community access to state-of-the-art computing and data science, to help reach a deeper understanding of the human brain. It will provide the most comprehensive set of services available anywhere for multiscale brain research. Our aim is to empower the neuroscience community to take advantage of exascale computing. The 22,000 neuroscientists from 33 countries, who are federated in FENS, can be directly involved in co-designing the tools and services as EBRAINS evolves.

The functionalities of EBRAINS will also be open to other communities, going beyond neuroscience. For example: (a) compute-intensive simulation will help to identify new candidate drugs addressing new disease targets, (b) cognitive neuroscience exploration of learning and visuo-motor control is most relevant for AI and neurorobotics, (c) neuroimaging, in combination with the EBRAINS multi-level atlases, is a key support for diagnosis and therapy planning, and linked to progress in neurology, psychiatry, and surgery. In addition, the Fenix high-performance analytics and computing network, created to provide those services to EBRAINS, can be made available to other research fields via PRACE, the Partnership for Advanced Computing in Europe.

EBRAINS has also developed solutions for FAIR data, a prerequisite for making science transparent and reproducible, to create trust, and to ensure responsible research and innovation. Thus, EBRAINS is not only a unique platform for neuroscience but an innovative nucleus attracting users from other research disciplines and industry.

EBRAINS meets the *ex-ante* indicators in the following respects:

Background of new RI: EBRAINS has already gone through its conceptual Design Phase during the past 2 years under the HBP, which has 3 more years left to run (i.e. the duration of the HBP's 3rd Specific Grant Agreement period, SGA3) with assured funding for further development of the EBRAINS RI. The preparation of the new RI is thus well advanced.

Membership Indicator: The legal form chosen for the EBRAINS Central Hub is an AISBL, established in Brussels on 23 Aug 2019, in which Founding and Full Members (seven currently) and Associate Members cooperate to operate EBRAINS (there are many potential Associate Members, including all 131 HBP partners). The current number of partner Facility Hubs (Nodes) - Fenix computing facilities, data service hubs and others[13] - is 22. The EBRAINS AISBL is open to new members, with a clear and transparent procedure for joining.

User Strategy Indicator: The User Fraction per country depends on the kind of service and time since start-up. Instances of user access to EBRAINS services already range from hundreds to thousands per year (depending on the facility), while further growth of EBRAINS use is expected to be particularly strong in data services, HPC and applied technologies. An average European country typically hosts a few thousand neuroscientists, of whom many are expected to use data standards set by EBRAINS.

Networking Indicator: All institutions that will participate in the EBRAINS RI are expected to commit resources to make services or facilities available. Because of its world-wide uniqueness and the ongoing collaboration with IBI[14] and NSF[15] centres, we anticipate a growing proportion of non-European users (rising to about 10-30% of an expanded total user community).

Excellence Indicator: The HBP has attracted top European groups in neuroscience and ICT technologies for brain research, and it maintains the highest standards in publishing, open access to data, software and models, and in its ethical approach to brain research. EBRAINS project management is committed to maintaining world-class research, e.g. through Open Calls, the Lead Scientist Program and Educational Programs. This makes EBRAINS extremely attractive to work with and work for, even at a global level.

Knowledge Transfer Indicator: Because most of the Partners participating in HBP/EBRAINS run their own student programs (Ba/MSc/PhD-level), or are affiliated with them, knowledge transfer to younger generations of researchers is already mature. In addition, the RI runs its own Education Programs, which are more specialized and tailored to the needs of EBRAINS users. Industrial

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[13] The Facility Hubs are introduced in Section 3. In contrast to the description of the Implementation Case, the offers by the Fenix infrastructure are not considered as Facility Hubs, as this is a separate infrastructure.
[14] International Brain Initiative: https://www.internationalbraininitiative.org
[15] (USA) National Foundation centres: https://www.nsf.gov/about/partners/centers.jsp

involvement at various phases of project IPRs and access regulation is mediated by the HBP's office for Innovation and Exploitation[16].

2.3   Relevant steps of the ESFRI process

10/2013   Start of the HBP

03/2016   Public Release of 6 Platforms: Neuroinformatics, Brain Simulation, High Performance Analytics and Computing, Medical Informatics, Neuromorphic Computing and Neurorobotics

04/2016   Implementation start of Co-Design Projects to enable development driven by scientific use cases

04/2018   Start of EBRAINS Design Phase. Platforms joined together to form a single Infrastructure (at that time called 'HBP Joint Platform'). High-Level Support Team (HLST) starts its activities

08/2018   Launch of the Infrastructure Voucher Programme, calls inviting users to access the HBP platform's services and engineering support to advance their research

09/2019   EBRAINS AISBL founded, 6 members

11/2019   EBRAINS portal launched: ebrains.eu

04/2020   Start of EBRAINS, Preparation Phase. Implementation of Service Categories (SC). Focus on bringing EBRAINS to non-HBP users

09/2020   **Proposal for inclusion of EBRAINS RI in ESFRI Roadmap 2021 submitted**

The EBRAINS proposal to be included in the ESFRI Roadmap 2021 was submitted on **8 September 2020**, with France as Lead Country and support of 9 additional countries (BG, EL, IT, NL, NO, ES, SE, CH, DK). We also count 94 letters of support from institutions across Europe.

ESFRI preparation – Overall Action points ahead of the Hearing

The list below presents actions points that were pursued before the Hearing:

- Further political and institutional support building actions
    - HBP ESFRI Task Force engagement: Support was solicited in the HBP ESFRI Task Force meetings of December 2020 and January 2021. EBRAINS encouraged the Task Force members to keep engaging the HBP Partners, ex-HBP Partners and extended network in the next Task Force meetings.
    - EBRAINS reached out to those HBP Partners that had not yet sent letters of support. Approached Potential Prospective Member Countries
        - Bottom-up by contacting the local community in Croatia, Czech Republic, Hungary, Portugal, Ireland and Romania
        - Top-down by contacting ESFRI Delegates (if traction is perceived within the community). In the case of Poland, Portugal, and Hungary, the ESFRI delegates were contacted to request political support. EBRAINS followed the communication up with each partner to try to obtain their support before the hearing.

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[16] During SGA3, exploitation is taken care of by Task T8.5.

- Preparation of the ESFRI presentation storyline and the Hearing
- EBRAINS Strategy: launched by the HBP DIR on 12 January 2021, inclusive process planned with the EBRAINS AISBL BoD approval
- EBRAINS Governance: mechanism of implementing the EBRAINS Strategy
- EBRAINS National Nodes: move processes towards their consolidation
- Double-pace EBRAINS efforts to welcome AISBL Members
- Update on the business model
- Update on the innovation plans
- Update on investment plans
- Update on EBRAINS Architecture and the Service definition
- Leverage on the points of sustainability and long-term vision
- Differentiation with other platforms & Added Value
- Analysis of the current status of KPIs
- Methodology of measuring impacts post-2023

04/2021   **EBRAINS RI presents its case at ESFRI Roadmap 2021 Hearing**

The EBRAINS Application to the ESFRI Roadmap 2021 enjoyed a growing political and institutional support. By the time of the hearing, it was endorsed by 12 countries (Bulgaria, Croatia, Denmark, France as Lead country, Greece, Italy, Netherlands, Norway, Portugal, Spain, Sweden and Switzerland) and 128 institutions from 18 countries.

The Hearing took place in an online format on **15 April 2021.**

EBRAINS was represented by Philippe VERNIER (CEA), Katrin AMUNTS (JUELICH) and Steven VERMEULEN (EBRAINS AISBL).

30/06/2021   **ESFRI announces the inclusion of EBRAINS RI in ESFRI Roadmap 2021**

The overall results and conclusions of the evaluation were summarised by the reviewers as indicated in the table and the summary given below.

Table 4: Evaluation results of the ESFRI proposal

Field	Result
Scientific Case	
Scientific Excellence	High
Pan-European Relevance	High
Socio-Economic Impact	Medium
User Strategy and Access Policy	Medium
e-Needs	High
Overall Assessment of Scientific Case	**High**
Implementation	
Stakeholder Commitment	Very-high
Preparatory Work & Planning	High
Governance, Management and Human Resources Policy	High
Finances	High
Risks	High
Overall findings	**High**

'EBRAINS is the outcome of HBP, which has experience and knowledge within its network. It has demonstrated with the generous funding received that it can create impact and scientific knowledge. EBRAINS will deliver a significant boost and support to the neuroscience community. The neurosciences and neuroscientific progress are of very high importance to society and can be considered as a strength of European Research. Not only from a clinical neuroscience viewpoint as to cure brain diseases, injuries, congenital deviations, or ageing effects in a silvering economy, but also due to its possible spin-offs like improved AI algorithms and neuromorphic computers. And, like other giant projects like CERN, unexpected, but quite interesting spin-off innovations are to be expected alongside the roadmap if the different EBRAINS bodies keep an open mind to that.

Nevertheless, EBRAINS needs to emphasize why it aims to become an ERSFRI research infrastructure. The application would have gained from identifying end-users, policy/communication plan and expectations for the RI and other details.

EBRAINS ecosystem/platform is essential to bring together the neuroscience community, no matter how big it is and to flatten the learning curve for (new) generations of neuroscientists by the adopted one stop-counter principle where the community can find/store/share all neuroscience related data, tools, and methods at a European level.

EBRAINS shall actively seek to involve and reach out to those parts of the neuroscience community that had reservations in the past. Only then, EBRAINS can become a well-accepted entity to represent the neurosciences position for example in the EOSC. I think the focus on specific neuroscience needs has to be maintained and bottom-up initiatives are to be decisively supported.

Overall, EBRAINS is in a good shape to be recommended for ESFRI Roadmap inclusion from both the scientific and implementation perspectives. Mainly due to generous funding of HBP project by FET Flagship programme it has established solid infrastructure readiness, though there are recommendations mentioned (scientific and implementation ones) in the report that shall be followed.'

The official announcement of EBRAINS as an ESFRI project in the Roadmap can be found here: https://roadmap2021.esfri.eu/projects-and-landmarks/browse-the-catalogue/ebrains

2.4   Relevant and related events

In the following table, all events relevant or related to the ESFRI application process and follow-up activities are listed.

Table 5: Events relevant for the ESFRI process

Event Name	Name of contribution
FENS 2022 (External Event)	EBRAINS networking event at FENS 2022
MedTech Meetup 2021 (External Event)	Participation to MedTech Meetup
EBRAINS SCIENTIFIC CONFERENCE (External Event)	EBRAINS Services presentation
The ESFRI 20th anniversary conference (External Event)	Attendance of EBRAINS RI Representative
Virtual Meeting: European Biomedical Research Infrastructures' resources for Researchers in Neurosciences (External Event)	Presentation of EBRAINS RI
Joint Commission-ESFRI Workshop: R&I needs of Research Infrastructures (External Event)	Participation to Joint Commission-ESFRI Workshop: R&I needs of Research Infrastructures
Bernstein Conference 2022 (External Event)	EBRAINS booth at Bernstein 2022

TRANSLATIONAL NEUROSCIENCE DAY – NEURATRIS (External Event)	Networking
Open Access Week 2022 (External Event)	EBRAINS introduction
ICRI 2022 - international conference on research infrastructures (External Event)	EBRAINS Side event ICRI 2022
EOSC Symposium (External Event)	EBRAINS Session at EOSC Symposium

3. Status of the Facility Hubs

3.1 The Facility Hub concept

Facility Hubs complement the offers of the EBRAINS Research Infrastructure[17] by offering access to local neuroscientific facilities or by providing user support and user-specific development of software available on the EBRAINS platform beyond what is already offered through the Human Brain Project in the SGA3 phase. Facility Hubs are an important component in building a user community around EBRAINS tools and services to establish EBRAINS as the Research Infrastructure for brain science, medicine and brain-inspired technology.

The HBP offers three types of Facility Hubs:

- Physical facilities (e.g. specialised microscopes)
- Competence centres providing specialised software support beyond the efforts of the High-Level Support-Team (HLST)
- the European Institute for Theoretical Neuroscience (EITN)

The Facility Hubs are aligned with the Fenix infrastructure[18] to provide users with access to computing and storage resources, e.g. for data storage, analysis, modelling and simulation. As necessary, some Facility Hub hosts have integrated their services with Fenix services, e.g., for storing imaging data, for hosting their services or as simulation backends. In addition, they have successfully applied for Fenix allocations, which they are making available to their users. This way the Facility Hub users can directly get started using these allocations, without having to apply for their own Fenix allocations first, if such resources are required to make full use of the respective Hub.

The offers of the Facility Hubs are in-kind contributions from HBP Partners to the EBRAINS Research Infrastructure, complementing the portfolio of EBRAINS services currently on offer and providing academic users access to specialised facilities without charging costs for the usage, whereas the EITN is funded through HBP SGA3 (T4.15).

The Facility Hub concept, access, and terms of use, as well as the first three Facility Hub pilots were already described in Deliverable D6.1[19] 'Online documentation of Facility Hubs concept, offers and access'. Up-to-date information about access and terms of use, and detailed information about the Facility Hubs are available on the dedicated sub-page of the HBP website[20].

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[17] https://ebrains.eu/
[18] https://fenix-ri.eu/
[19] Available here: https://www.humanbrainproject.eu/en/science-development/scientific-achievements/deliverables/third-specific-grant-agreement/
[20] https://www.humanbrainproject.eu/en/collaborate-hbp/facility-hubs/

3.2 Establishment of new Facility Hubs after Deliverable D6.1 (May 2021)

While Deliverable D6.1, submitted in May 2021, only covered the first three Facility Hub pilots, there are now four Physical Facilities and seven Competence Centres available, which have been established during HBP SGA3. For the first Facility Hubs, a Memorandum of Understanding (MoU) between the hosting partner and the HBP Coordinator was signed. Later in the process it was decided to put Collaboration Agreements (CA) in place instead. After all signatures were in place for the MoU/CA of a new Facility Hub, it was added to the Facility Hub website and publicly announced on the HBP website and through the HBP social media accounts.

All Facility Hubs, including the first pilots, are briefly introduced in the following sections, while Figure 2 gives an overview of the signature timeline. Similar information is also available on the HBP website.
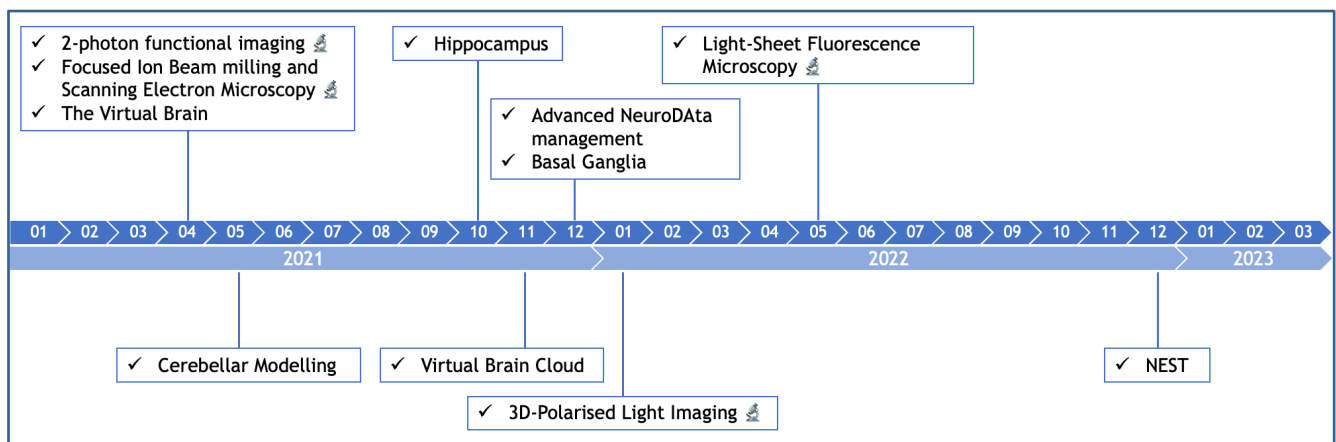

Figure 2: Timeline of the MoU/CA signatures

Physical Facilities are marked with the microscope icon 🔬, all other Facility Hubs are Competence Centres. In cases where the involved parties have signed the document in different months, the latest signature date was used for this figure.

3.2.1 Physical Facilities

3.2.1.1 Two-photon functional imaging

Host: University of Amsterdam (UvA), the Netherlands

Related activities in HBP-SGA3: Two-photon imaging data is used in multiple Tasks, e.g. in T1.3, in combination with 3D-PLI 'to improve the interpretability of complex configurations'.

Description:

Two-photon imaging and ensemble recordings, both conducted in behaving, task-performing animal models, are illuminating our understanding of how cognitive, perceptual and motor functions originate from the behaviour of large, cooperating populations of neurons. The UvA Facility Hub and Competence Centre offers access to a Leica fast resonant two-photon scanner and high-density ensemble recording setups using Neuropixels and other silicon probe configurations. The core expertise in electrophysiological, optical and behavioural recordings is supplemented by opto- and chemogenetics, large-scale data analysis centred on population decoding and computational modelling.

The UvA can host medium (2-6 months) or longer (>6 months) term projects for PhD students, postdocs and research staff who need to acquire multiple technical skills and/or want to acquire data for a project. Shorter or remote visits are possible for researchers wanting to learn individual

skills related to data-analysis. Organising online and on-site courses and webinars for large groups is also possible.

The UvA harbours one of the largest groups for two-photon in vivo neuronal imaging and ensemble recordings in Europe, which is uniquely distinguished by its development of sophisticated behavioural paradigms testing multisensory perception, memory and consciousness, a high level of multidisciplinary integration and technical versatility.

Additional information: [Systems and Neuroscience Group web page](#)[21]

3.2.1.2 3D-Polarised Light Imaging (3D-PLI)

Host: Forschungszentrum Jülich (JUELICH), Germany

Related activities in HBP-SGA3: 3D-PLI is one of the techniques used in T1.3 to build full connectomes of post-mortem human brains at multiple resolutions. Through the HLST (T4.13), a collaboration with Zeiss is funded, which supports new concepts to integrate multiple imaging technologies across scales.

Description:

The Hub '3D-Polarised Light Imaging' at the Institute of Neuroscience and Medicine (INM-1), Forschungszentrum Jülich, Germany, offers hands-on insights into the research of the brain's fibre architecture at microscopic scales, based on unstained histological brain sections.

The imaging technique of choice is referred to as 3D-Polarised Light Imaging (3D-PLI) and has been uniquely developed at the INM-1 over the last ten years. It basically utilises the optical birefringence of nervous tissue, mainly induced by myelinated axons. 3D-PLI makes studies of the fibre architecture (e.g. identification and tracing of fibre pathways and tracts, and quantification of fibre orientations and myelin distributions) in 50μm thick brain sections possible.

An individual project is expected to last no longer than three weeks. The offer is meant to open up a possibility

1) For initial consultation about the topic of fibre-targeted microscopy

2) To carry out a feasibility study

3) To obtain independent cross-validation on a small scale

As for all Facility Hubs, interested groups need to contact the host to apply for a joint project. Once the project has been approved, the collaboration exclusively includes introductory training and guidance in brain cryo-sectioning and tissue mounting specifically required for 3D-PLI applications. Section scanning will be closely supervised by an on-site expert and carried out using one of the available polarising microscopes. Finally, comprehensive image analysis will be performed utilising the Fenix e-infrastructure services, including high-performance computing, data storage and sharing resources at the nearby Jülich Supercomputing Centre.

Additional Information: [Fibre Architecture and Polarised Light Imaging website](#)[22]

3.2.1.3 Focused Ion Beam (FIB) milling and Scanning Electron Microscopy (SEM)

Host: Universidad Politécnica de Madrid (UPM), Spain

Related activities in HBP-SGA3: 3D ultrastructural analysis of synapses from FIB/SEM are provided and used in T1.1.

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[21]   https://sils.uva.nl/content/research-groups/cognitive-and-systems-neuroscience/cognitive-and-systems-neuroscience.html

[22] https://www.fz-juelich.de/en/inm/inm-1/research/fiber-architecture

Description:

The combination of focused ion beam (FIB) milling and scanning electron microscopy (SEM) is a method that permits the rapid and automatic serial reconstruction of large tissue volumes. The FIB/SEM facility — located at the Centro de Tecnología Biomédica (Laboratorio Cajal de Circuitos Corticales, UPM/CSIC, Universidad Politécnica de Madrid) — is intended to be a leading centre for detailed synapse studies using 3D electron microscopy and for the generation of high-resolution images of brain regions in the millimetre to nanometre range.

This FIB/SEM facility is associated with high-level scientific and technical staff who will provide the necessary expertise in electron microscopy to ensure that any scientist can benefit from this facility, regardless of whether or not they have experience in electron microscopy. The projects will be supported by Senior Researchers, High-Level Technicians and Laboratory Technicians. The number of supporting people involved will be based on the project needs, with this experienced staff devoting 20% of their time to supporting the selected projects.

The UPM can host medium (2–6 months) or longer (>6 months) term projects for PhD students, postdocs and research staff who need to acquire multiple technical skills and/or want to generate data for a project.

For detailed information see '*FIB/SEM: Description and applications to study the brain*' at http://cajalbbp.es/CBB

3.2.1.4 Light-Sheet Fluorescence Microscopy (LSFM)

Host: European Laboratory for Non-Linear Spectroscopy (LENS), Italy

Related activities in HBP-SGA3: LSFM is not an explicit part of the SGA3 Work Plan.

Description:

Light-Sheet Fluorescence Microscopy (LSFM) of cleared brain samples offers the unique opportunity of exploring brain complexity on large scales yet at cellular resolution. The European Laboratory for Non-Linear Spectroscopy (LENS) has gathered long-standing experience in the whole LSFM pipeline, comprising sample preparation (clearing and staining), the actual imaging using custom-designed optical setups, and image post-processing (volumetric stitching, compression, feature segmentation). The LSFM Facility Hub offers access to two microscopy setups capable of high-speed and high-resolution imaging with simultaneous two-colour acquisition. One system can accommodate large bulky samples such as a whole mouse brain, while the other microscope is designed for thin but large tissue slices (several cm in lateral size, 0.5mm to 1mm in thickness).

Within the Facility Hub, LENS can provide the full service (clearing, imaging and processing) or can host external scientists that wish to use the microscopes or acquire technical skills in light-sheet microscopy. Specific projects need to be discussed beforehand to ensure optimal planning of resource usage and the organisation of specific training if needed.

LENS is an interdisciplinary international laboratory performing research in the field of biophotonics, photonic materials, and quantum technologies. It is home to a PhD school and offers the International Doctorate in Atomic and Molecular Photonics through the University of Florence.

Additional information: http://bio.lens.unifi.it/

3.2.2 Competence Centres

3.2.2.1 Cerebellar Modelling

Host: University of Pavia (UNIPV), Italy

Related activities in HBP-SGA3: Modelling and simulation of the cerebellum is part of the SGA3 Work Plan, e.g. in T1.5, which defines multiscale regional models of different brain regions, and in

T1.6, which simulates whole-brain network dynamics of interconnected areas including the cerebellum. Support for the required tools is also available through the HLST (T4.13).

Description:

The Facility Hub is based at UNIPV and performs multiscale modelling, spanning from neurons and microcircuits to large-scale networks and the whole brain. The Hub leverages on the unique concept of the Brain Scaffold Builder (BSB), a modelling workflow that allows multiscale modelling of neurons, microcircuits, large-scale networks and whole brains.

Although initially designed for the cerebellum, BSB can be easily applied to any brain networks through customised developments on demand. The BSB supports different modelling platforms and formats and can be applied to neuromorphic hardware, robotic control systems and virtual brain simulators. A special aspect of this Hub is to provide the infrastructure and expertise for multiscale experimental validation of the models in rodents. It relies on EBRAINS and shares with it a set of highly integrated APIs and several sophisticated model building tools.

Dedicated community managers will help users through any issue they may have in exploiting the Facility Hub, in arranging the specific development workflows and simulation of interest, or to help in getting the appropriate High-Performance Computing allocation for the project. In summary, the Hub will allow researchers and customers with different interests, background, and expertise to develop their own computational models and transform them into different kinds of applications. Dedicated tutorials and community managers will guide users through all the steps needed to reach their specific goals.

The highest impact of this unique installation is expected on engineering and medicine, especially concerning brain-inspired technologies and the investigation and cure of brain diseases.

Additional information: https://dangelo.unipv.it/

3.2.2.2 The Virtual Brain (TVB)

Host: University of Aix-Marseille (AMU), France

Related activities in HBP-SGA3: TVB is integrated with other simulators and analysis tools in T5.4. It is used for multiple projects inside the HBP, e.g. for the integration of mean-field models to simulate entire brain regions (T1.5). Support is provided through the HLST (T4.13).

Description:

The Virtual Brain (TVB) is a full-brain network-simulation engine, which significantly reduces the gap between computational models and human brain imaging data. The TVB Facility Hub [23] and Competence Centre at Aix-Marseille University provide field-specific expert support for activities linked to the use of TVB (model building, simulation, analysis, validation and model inversion). Training is provided in TVB workshops and through internships. The TVB Facility Hub serves as the first point of contact for domain-specific questions and refers users to other HBP/EBRAINS groups for further assistance as appropriate.

Potential users: Students, postdocs and researchers in neuroscience, as well as engineers in neurotechnology and clinicians.

Uniqueness: Field-specific expert performance in various domains (high-performance computing, simulation science, brain imaging, neuroscience) is integrated into complex workflows, enabling interoperability of tools within TVB and EBRAINS eco-system. TVB Facility Hub and Competence Centre provides the user with support in building up an integrated understanding of TVB and adapting the workflows to the user's own needs.

Impact: To increase the capacity of neuroscientists to use ICT tools such as TVB and EBRAINS to advance science and enable more efficient translation into clinical applications.

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[23] https://hub.thevirtualbrain.org/

Additional information:

- https://hub.thevirtualbrain.org/

- https://ins-amu.fr

- https://www.thevirtualbrain.org

3.2.2.3   Advanced NeuroDAta management (ANDA)

Host: University of Oslo (UiO), Norway

Related activities in HBP-SGA3: ANDA supports users with the EBRAINS Data and Knowledge Services (WP4), complementing the activities in the HLST (T4.13).

Description:

ANDA is a research data management service targeting neuroscience researchers who are planning to share and publish their research data on the EBRAINS platform, adhering to the FAIR principles of open science. EBRAINS is a research infrastructure providing services for brain and brain-inspired research, including Data and Knowledge services for sharing, finding, and using research data.

Many national and international funders, agencies, and stakeholders have instituted requirements for sharing of research data. An increasing number of researchers are also seeing the need for data sharing using new technologies that will make their research more productive and competitive. The EBRAINS Research Infrastructure offers solutions to meet these expectations while serving the needs of both the data providers and data users. Data sharing requires planning. ANDA assists at an early stage in the planning towards data sharing.

The EBRAINS Data and Knowledge services consist of an integrated suite of services, policies, and practices for Findable, Accessible, Interoperable, and Re-usable (FAIR) data, making it easy for the broader neuroscience community to share and publish data and models, and to find and use heterogeneous data, models, and related software relevant for a broad range of research fields in basic and clinical neuroscience. The services also meet the needs of researchers who are aiming to publish data accompanying peer-reviewed journal articles.

A key instrument for the planning of data sharing is the formalised Data Management Plan. ANDA provides advice on how to develop a Data Management Plan tailored for sharing through EBRAINS. Using ANDA ensures that the management and sharing of your research data comply with the FAIR principles, making data Findable, Accessible, Interoperable and Reusable.

Key aspects

- How to prepare for data sharing: organising data and capturing metadata

- How to sort concepts and define roles and responsibilities of research staff

- How to use by EBRAINS recommended metadata standards

- How to use EBRAINS curation services

- How to publish data and create data collections on EBRAINS

- How to prepare for use of EBRAINS services for data analysis

Who can use our service?

Neuroscientists from around the world and from all fields of neuroscience, ranging from in vitro studies to human brain research, who are aiming to share their data through the EBRAINS Data and Knowledge services.

Contact/ booking information:

You can request ANDA support by filling in this request form[24].

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[24] https://nettskjema.no/a/207496#/page/1

For general questions about the EBRAINS Data and Knowledge services, please contact support@ebrains.eu

For more information about EBRAINS Data and Knowledge Services, visit https://ebrains.eu/services/data-and-knowledge/

3.2.2.4 Virtual Brain Cloud (VBC)

Host: Charité Berlin (CHARITE), Germany

Related activities in HBP-SGA3:

The Integrated TVB-EBRAINS Services are an outcome of the SGA2 Co-Design Project The Virtual Brain[25] and a collaboration with the European Open Science Cloud (EOSC) and HBP Partnering Project Virtual Brain Cloud[26], both under the lead of Petra RITTER (Charité). Services are being further developed and extended during SGA3 as part of Tasks in HBP WP1, WP4, WP5, WP6 and HBP Service for Sensitive Data – EBRAINS Health Data Cloud[27].

Description:

The Virtual Brain Cloud Facility Hub at Charité Berlin offers Brain Simulation as a Service: The Virtual Brain on EBRAINS[28]. Services are being made available as open-source cloud ecosystem on EBRAINS[29].

Services comprise software for constructing, simulating and analysing brain network models on EBRAINS cloud and Fenix-ICEI infrastructure in compliance with data protection law. The service includes the following components:

- TVB network simulator
- Magnetic resonance imaging processing pipelines to extract structural and functional connectomes
- Multiscale co-simulation of spiking and large-scale networks
- Simulation-ready brain network models of patients and healthy volunteers
- Interfaces to knowledge bases (ScaiView literature mining, pathway inventory NeuroMMSig, EBRAINS atlases) for the integration of biological knowledge in 3D-brain models
- Extensive educational material
- Data protection concept & data protection impact assessment

TVB cloud services facilitate reproducible online collaboration and discovery of data assets, models, and software embedded in scalable and secure workflows, a precondition for research on large cohort data sets, better generalisability and clinical translation.

Additional information:

- https://www.brainsimulation.org/
- https://ebrains.eu/service/the-virtual-brain

3.2.2.5 Hippocampus

Hosts: Institute of Biophysics (Consiglio Nazionale delle Ricerche, Palermo, CNR, Italy) and Blue Brain Project (École Polytechnique Fédérale de Lausanne, EPFL, Switzerland)

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[25] Co-Design Projects were a formal, cross-cutting structure in earlier HBP phases, see https://www.humanbrainproject.eu/en/about-hbp/project-structure/work-packages/
[26] https://virtualbraincloud-2020.eu/
[27] https://www.healthdatacloud.eu/
[28] https://arxiv.org/abs/2102.05888
[29] https://ebrains.eu/service/the-virtual-brain

Related activities in HBP-SGA3: Modelling and simulation of the hippocampus is part of the SGA3 Work Plan, e.g. in T1.5, which defines multiscale regional models of different brain regions, and in T1.6, which simulates whole-brain network dynamics of interconnected areas including the cerebellum. Support for the required tools is also available through the HLST (T4.13).

Description:

The Hippocampus Hub is a Reference Model and Community Web Portal for scientists, students, and interested users to explore data and use, or implement, models related to the hippocampus.

In the Reference Model section, biophysically detailed models of neurons, synapses and a hippocampal microcircuit are featured. The hippocampus CA1 followed in 2022. This section allows the user to review the models in detail, explore the underlying data and execute models in in-silico experiments, using high-performance computing infrastructure provided by the HBP EBRAINS infrastructure and Fenix.

In the Community Model section, an interoperable database of hippocampal related data, such as morphologies or electrophysiological traces are fetched from public resources and a modelling portal for single cell and circuit in-silico experiments is provided.

The Hippocampus Hub is a unique facility, and we expect to have a big impact on the consolidation and reach of dissemination for hippocampus research, helping to increase the community uptake.

Additional information: https://www.hippocampushub.eu/

3.2.2.6 Basal Ganglia Center

Hosts: Royal Institute of Technology (KTH) and Karolinska Institute (KI), Sweden

Related activities in HBP-SGA3: Modelling and simulation of the basal ganglia is part of the SGA3 work plan, e.g. in T1.5, which defines multiscale regional models of different brain regions, and in T1.6, which simulates whole-brain network dynamics of interconnected areas including the cerebellum. Support for the required tools is also available through the HLST (T4.13).

Description:

The Basal Ganglia Modeling Center in Stockholm is co-hosted at the Royal Institute of Technology (KTH) and Karolinska Institute (KI). This modelling Hub facilitates modelling and simulations of the basal ganglia, using a data-driven approach. Modelling is performed at multiple scales, from the molecular, detailed neuron and microcircuit-level, to large scale brain networks and behaviour, where both function and dynamics can be linked between these scales and investigated.

Emphasis is on allowing the user to set up new or use pre-defined virtual experiments to investigate the basal ganglia and related structures. These virtual experiments can then be directly compared to, or verified by, animal experiments. As the models are refined and allow a test of putative mechanisms for learning and selection of behaviour, this will lead to new insights and reduce the number of animals needed for experiments.

The Hub is relying on EBRAINS tools and workflows. For example, a software framework, Snudda, can be used to automatically set up a microcircuit model using detailed morphologically reconstructed neuron models, which is then currently simulated using NEURON on either local machines or on supercomputers for the large networks. Also, a toolset for the simulations of subcellular signalling processes, involved for instance in learning is provided.

Community managers will help users to use and collaborate using the EBRAINS tools and workflows useful for understanding the basal ganglia in health and disease. In addition, some guidance in getting the appropriate HPC allocation for the project will be provided. In summary, the Hub aims at facilitating, for researchers with computational, biological or medical backgrounds and areas of expertise, collaborations around questions regarding basal ganglia function. Tutorials will be provided when needed. Our aim is to create a multidisciplinary community, where scientists help each other, and share their new findings and ideas, forming new collaborations. We will also actively develop open-source tools and improve our modelling pipeline.

The highest impact of the Basal Ganglia Modeling Center will likely be on basic science, engineering and medicine, the latter with regards to the many neurological and psychiatric diseases that affect the basal ganglia such as Parkinson's disease.

Additional info on Basal Ganglia research in Sweden, see SWEBAGS (https://swebags.ebrains.se/) and the International Neuroinformatics Coordinating Facility (https://www.incf.org/)

3.2.2.7 NEST

Host: Forschungszentrum Jülich (JUELICH), Germany

Related activities in HBP-SGA3: NEST is one of the simulators used for multiple research projects in the HBP. The development is part of T5.3. It is integrated with other simulators in T5.4 for whole-brain simulations and in T5.5 for multi-simulator interactions. Support is provided also through the HLST (T4.13).

Description:

NEST is a simulator for spiking neural network models based on over 25 years of development that focuses on the dynamics and structure of neural systems, rather than the exact morphology of individual neurons. It is ideal for networks of any size including models of information processing (e.g. in the visual or auditory cortex of mammals), models of network activity dynamics (e.g. laminar cortical networks or balanced random networks) and models of learning and plasticity.

In addition to advanced neuroscientific research, NEST can also be used in education and teaching (NEST Desktop) and as a reference implementation to validate neuromorphic systems.

The NEST Facility Hub, operated by Forschungszentrum Jülich, Germany, represents an organisational point of contact that can be approached both from the NEST user and developer side, as well as from the infrastructure side. The Hub offers an up-to-date simulation engine on the level of neurons and synapses provided via Jupyter notebooks on EBRAINS with connection to High Performance Computing (HPC). Additionally, it supports users, developers and infrastructure operators in making workflows possible, sustainable and maintainable, acting as a central point bridging between these different views. Users and developers additionally will be provided with software packages for common distributions, as well as containerised solutions such as Docker containers and VM images.

The NEST support helps users of the simulation engine with the installation and handling of the tool and developers in enhancing the openly available community code. For this purpose, a mailing list, an EBRAINS ticketing system, a fortnightly open NEST developers video conference, a Github issue tracker for the coordination of activities, and code reviews have been set up (see https://www.nest-simulator.org/community/). User and developer engagement are supported by user-level documentation, developer documentation and maintenance, and operations documentation (see https://nest-simulator.readthedocs.io/en/v3.3/).

Additional information:

- Homepage: https://www.nest-simulator.org
- Community: https://nest-simulator.org/community/
- EBRAINS: https://ebrains.eu/service/nest-simulator/
- EBRAINS ticketing system: https://ebrains.eu/support/

3.2.3 European Institute for Theoretical Neuroscience (EITN)

Host: operated by Centre National de la Recherche Scientifique (CNRS)

Related activities in HBP-SGA3: The EITN is coordinated in SGA3 Task T4.15.

Description:

The EITN is a structure created at the beginning of the HBP in order to promote interactions between its members, as well as towards the rest of the scientific community. It co-organises international workshops and other teaching and training events. Since the activities of the EITN are or will be described in the corresponding documents of its dedicated outputs and Deliverable D4.14, they are not repeated in this Deliverable.

More information about the EITN can also be found on the EBRAINS[30] and EITN[31] websites.

3.3   Plans until the end of SGA3 and beyond

The Memorandums of Understanding (MoU) and Collaboration Agreements (CA) of the Facility Hubs with the HBP Coordinator have the end of March 2023 as end date, as this was the original end date of HBP SGA3. Therefore, the decision needs to be made how to proceed until the end of SGA3 (September 2023) and beyond. The uptake of the Facility Hubs by the community was therefore monitored, to allow for a well-informed decision about the future of this concept.

To monitor the uptake of the Facility Hubs by the community, all Facility Hub hosts were asked to fill in a short usage tracking spreadsheet every six months. This form has two sections, one related to contacts with *interested* users, and one related to actually *supported* users.

Since most Facility Hubs were established during 2021, the first monitoring period was January-June 2022. The Facility Hubs 3D-PLI and LSFM were only established during that period and thus only reported for the second period, i.e., July-December 2022. The NEST Facility Hub was only established at the end of 2022 and thus has not reported any usage data yet.
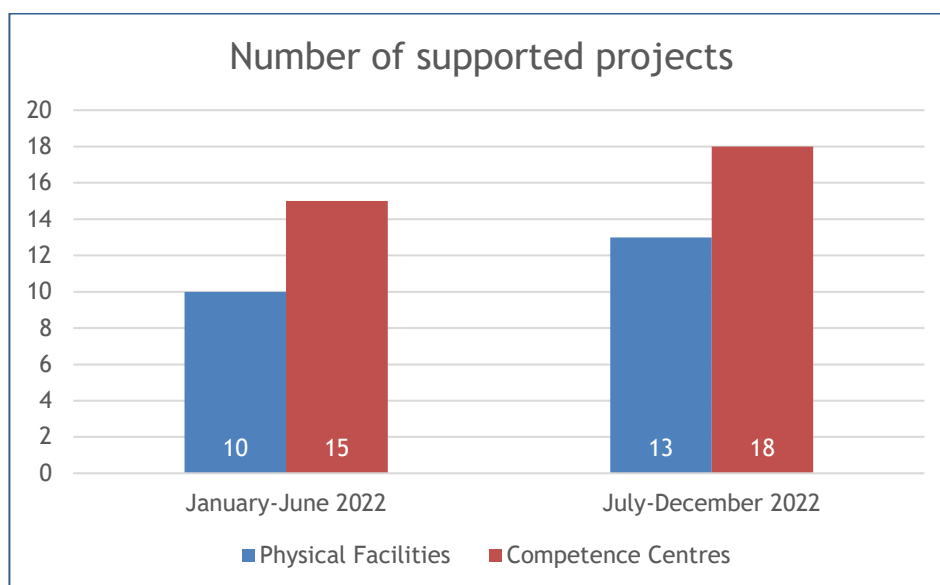

Figure 3: Number of projects supported by the Facility Hubs

The total number of projects supported by the Physical Facilities has increased from 10 to 13 from the first to the second reporting period (see Figure 3). Also, the number of projects officially supported by the Competence Centres has slightly increased from 15 to 18 in the course of 2022.

It turned out that the numbers reported by the Facility Hubs are only comparable to a certain extent, which is also the reason why no details about the uptake of all individual Facility Hubs are presented in this document. For the Physical Facilities it is relatively clear if a collaboration was the result of their offering. For the Competence Centres it is often more difficult to distinguish if a request was sent to them as a reaction to the Facility Hub offering, or if they were contacted independently as a lab or individual offering a certain model, simulator or expertise. This concerns in particular those Facility Hubs, which did not setup a dedicated email address for this purpose, but which instead

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[30] https://ebrains.eu/news/eitn/
[31] https://www.eitn.org/

provided the institutional email addresses of the involved experts for being contacted. Therefore, for some Facility Hubs it is not possible provide concrete data with regards to the number of interested and supported projects.

In both reporting periods of 2022, the number of supported projects ranges between zero and nine per Facility Hub. Some Hubs have additionally established many contacts to potential users through workshops and trainings, which were offered by the teams in the context of SGA3. In some cases, the Facility Hubs could not formally report any supported projects, as all their contacts were established through other channels. For instance, in the case of the ANDA Facility Hub the team dealt with many curation requests, but none of these contacts was established through their Facility Hub email address setup for the Facility Hub. Also, the Physical Facility 3D-PLI has not received any requests from labs that would like to bring their tissue to the facility for imaging but establishing such collaborations (involving complex imaging and analysis workflows) would likely also take some time for the users to plan and execute. Such offers of Physical Facilities thus need to be offered longer-term to be taken up, so that other labs have the chance to plan with data that could be acquired through such offers in the mid-term when applying for grants.

Overall, the Facility Hub concept has worked out well, as many contacts could be established. To increase the uptake of the Facility Hubs in the future, more promotional activities would be beneficial, assuming that the offer will be extended beyond March 2023.

The Facility Hub hosts were asked in December 2022 about their plans until the end of SGA3 and beyond. All Facility Hub hosts replied that they were interested in continuing their offers until the end of SGA3, whereupon the Facility Hub Coordination in T6.12 (JUELICH) contacted EBRAINS AISBL to initiate the necessary steps. In February 2023, the EBRAINS Management Board approved the extension of the MoUs/CAs until September 2023, which will be implemented soon.

Being asked about their plans for the period after SGA3, most Hub hosts indicated an interest to continue offering their facilities or services as part of the EBRAINS National Nodes. In some cases, these plans are already more concrete and mature than others, as the National Nodes are in different stages of being established. It remains to be seen if the term 'Facility Hub' will continue to be used post-SGA3. The EBRAINS Management Board invites the Facility Hubs to use the existing EBRAINS Service Selection Procedure to formally get their services integrated into EBRAINS for the time after SGA3. In this way the Facility Hubs would follow the same procedure as any other service developed in and funded through the HBP.

A few Hubs indicated that they were not sure about their plans post-SGA3 yet, or that they might consider restarting the offering at a later point in time, but not immediately after the end of SGA3. Reasons for this are the low uptake by the user community and/or the current planning status of the respective National Node, and thus some uncertainty with regards to future contributions to EBRAINS in general. For some Hubs it would also be important to have their Facility Hubs listed on the EBRAINS website, as this is an important prerequisite for them to acquire national funding for the future. To date, the EBRAINS website only lists services which are formally integrated in the EBRAINS RI.

As already stated above, if the Facility Hubs (using this term or as 'normal' EBRAINS services) continue to be offered in the future, it will be important to increase promotional activities to ensure that the relevant communities are aware of what is available to them. In particular for Physical Facilities, it is important to make a longer-term offer, so that other labs have a chance to, e.g. consider generating data using the offered facilities for their future research projects.