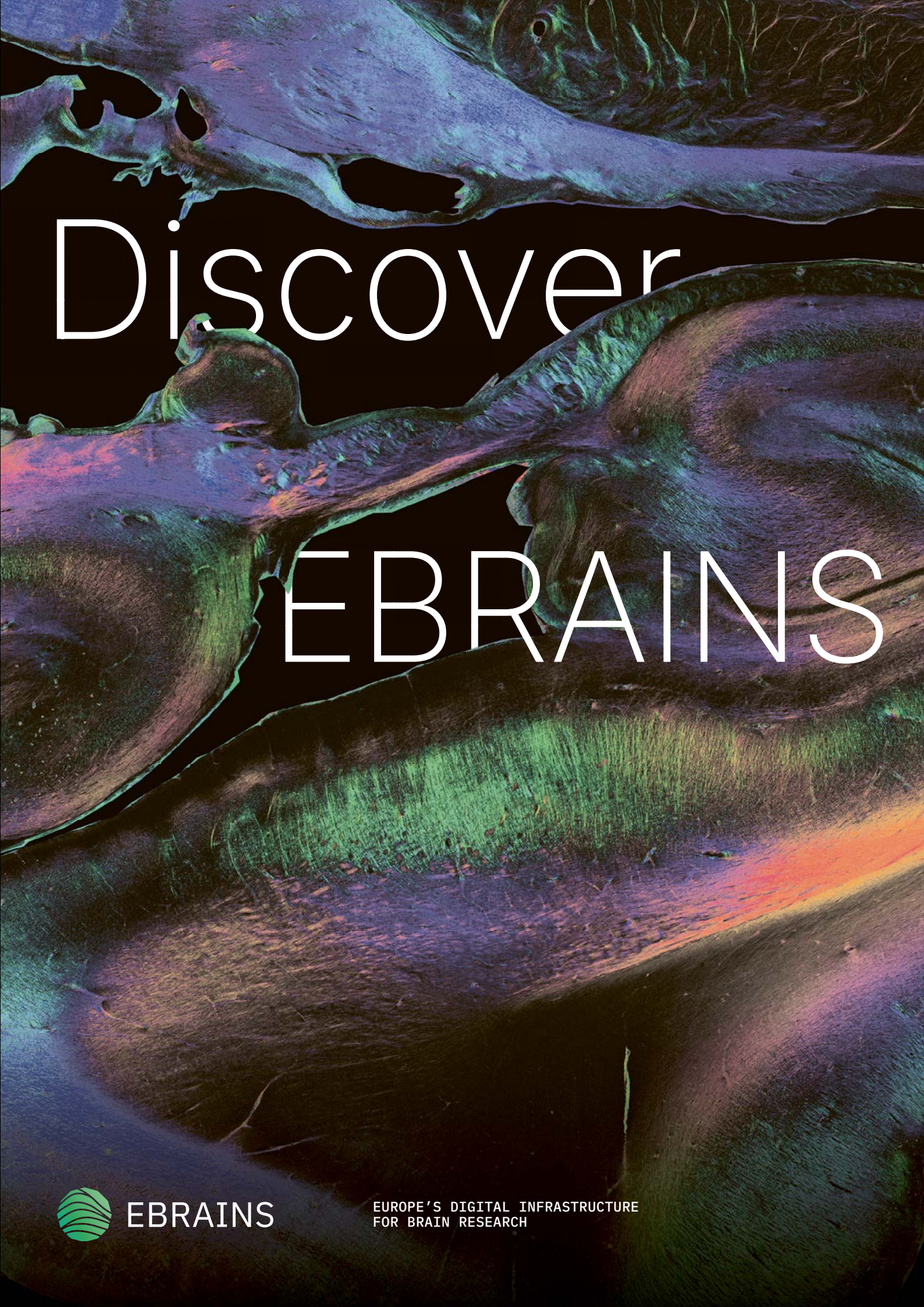

Discover
EBRAINS
EBRAINS
EUROPE'S DIGITAL INFRASTRUCTURE
FOR BRAIN RESEARCH

The complex “wiring” of nerve fibres in the brain's temporal lobe is shown here with 3D Polarized Light Imaging, a method powered by EBRAINS.

INTRODUCTION

What Is EBRAINS?

The EBRAINS tool "The Virtual Brain"

EBRAINS is Europe’s digital research infrastructure for brain science, originally built by the EU-funded Human Brain Project. EBRAINS is now being further developed with the support of the European Commission, a network of National Nodes and institutional partners from across Europe. EBRAINS enables researchers to explore the brain across all levels—from the molecular and cellular levels to the whole organ.

EBRAINS focuses on brain atlases, medical analytics, modelling and simulation, FAIR data services, tools for collaboration and computing infrastructure. In its current phase, EBRAINS is increasing its emphasis on patient data and medical impact.

EBRAINS’ unique tools and data bring together neuroscience, computing and AI to accelerate progress in science and medicine.

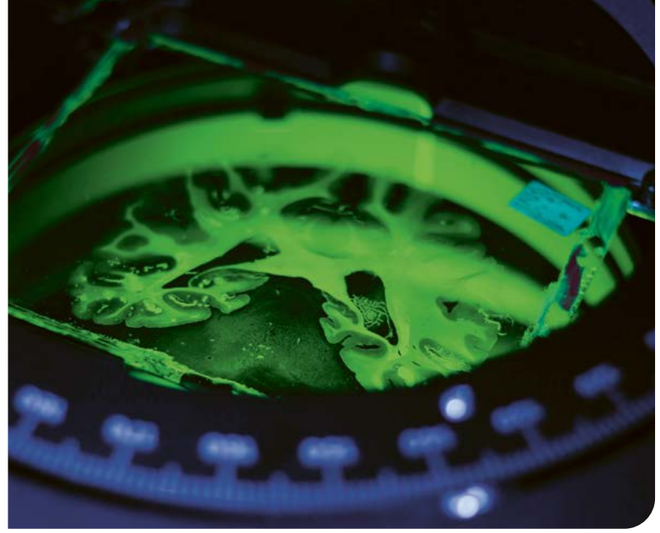
Join EBRAINS to Decode the Complexity of the Brain

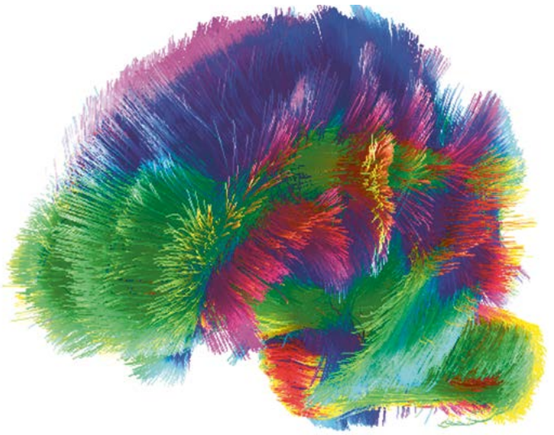
At EBRAINS, we strive to help researchers in the quest of understanding the brain and to make tangible impact in medicine and neurotechnology.

The EBRAINS infrastructure was born from a European spirit of scientific collaboration across countries and disciplines. Now, its powerful technologies are open to all. There are many ways for you to become part of the EBRAINS community. As an individual researcher, you can use our online tools and services, share your own data, collaborate with others, and join our events and workshops.

As an institutional member or EBRAINS National Node, you can facilitate the advancement of your local community and your input can shape digital brain research in Europe. Find out more about all the ways in which EBRAINS can help you reach your neuroscientific goals on the next pages!

Katrin Amunts and Philippe Vernier,
EBRAINS Joint CEOs





TOP: Human brain section in a Polarized Light Microscope
RIGHT: Tractography of a human brain

What We Offer

EBRAINS makes it possible to combine digital research tools into multi-scale research workflows. As these integrated efforts advance, collaboration across deeply ingrained borders of different sub-disciplines and often siloed communities is becoming ever more seamless. This is the unique benefit of an integrated infrastructure—it helps us connect scales, efforts and people.

You can find our open science data, tools and services in six main categories:

Brain Atlases

Navigate 3D maps of the brain and analyse complex neuroscientific data

Medical Analytics

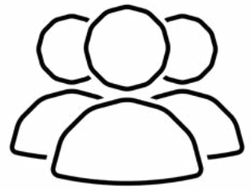
Find, share and analyse unique clinical data in a fully secure and compliant environment

Modelling and Simulation

Model the brain on multiple scales and test your models in computer simulations

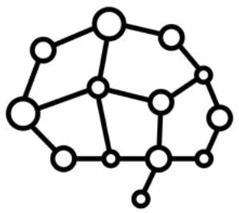
FAIR Data, Models and Software

Explore and share brain data, models and software that are Findable, Accessible, Interoperable and Reusable (FAIR)



Collaborative Platform

Work together in real time using our cloud-based workspace and build tools through co-design

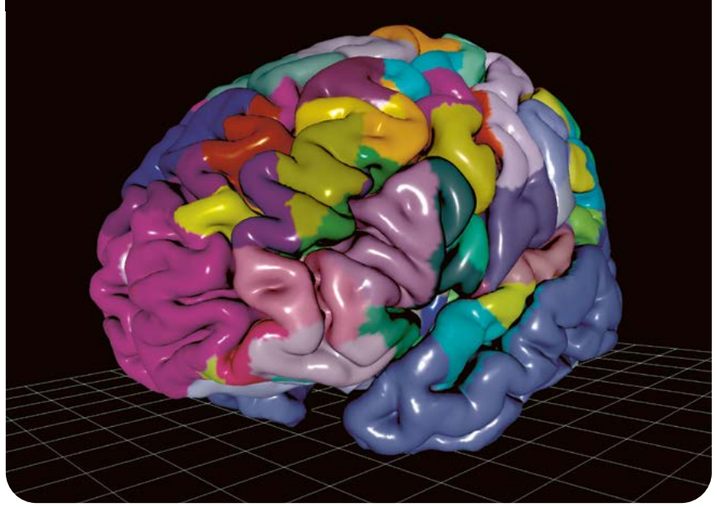


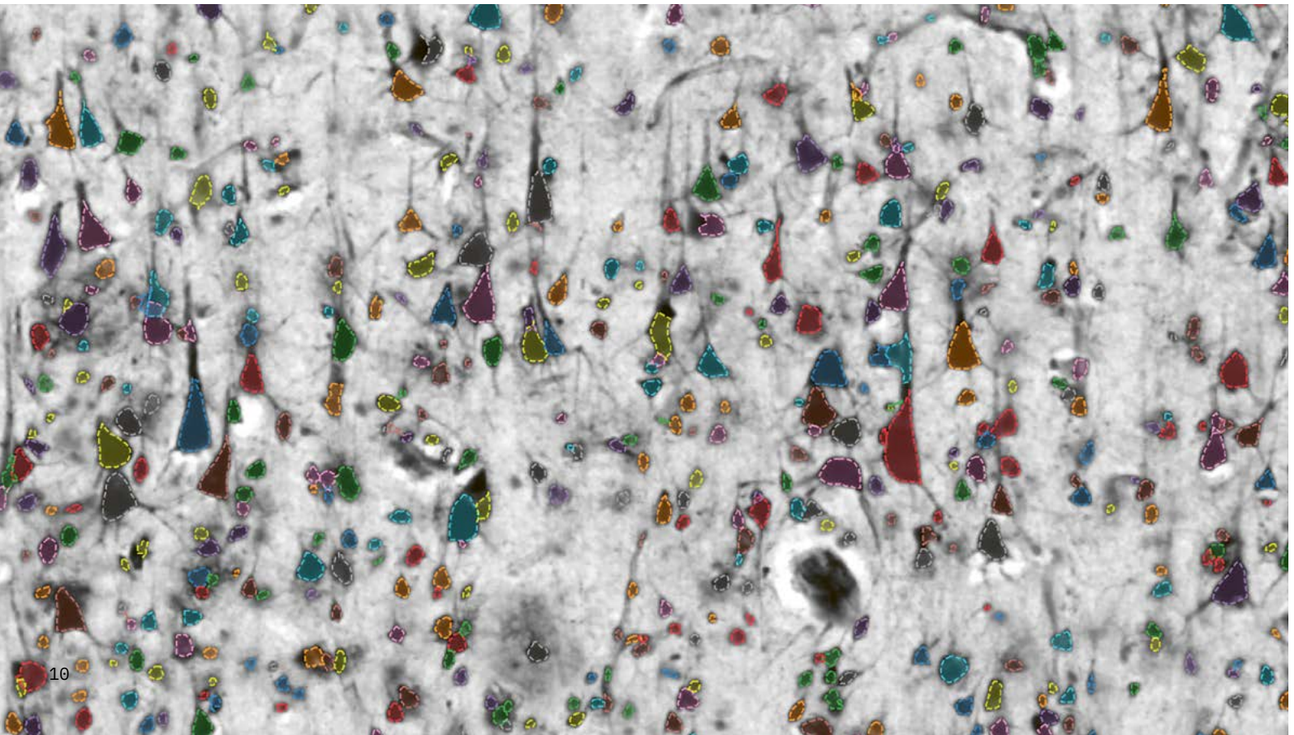
Computing Infrastructure

Access high-performance and neuromorphic computing across Europe for large-scale simulations, AI models and big data

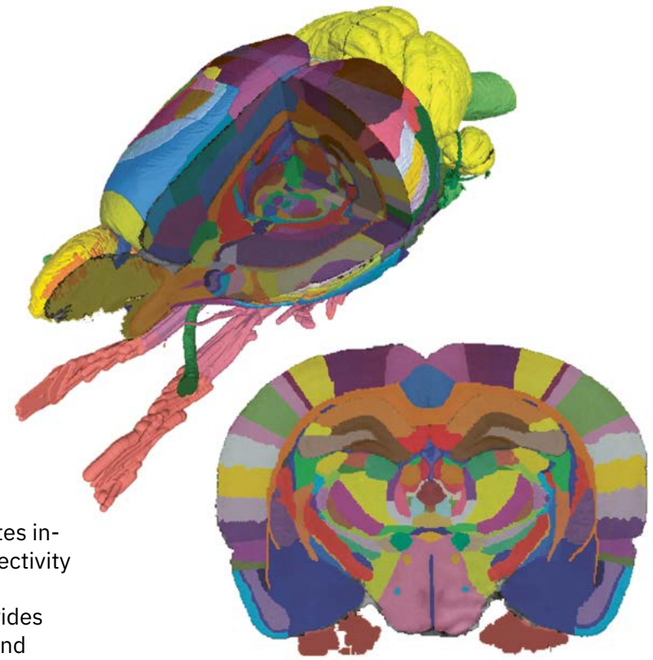
Brain Atlases

EBRAINS offers detailed brain atlases for human, macaque monkey and rodent. These atlases provide comprehensive maps of brain regions defined based on structure, function and neural connections. As spatial reference systems for neuroscience, they are essential for understanding the complexity of the healthy brain, studying brain disorders and developing new treatments. They come together with a set of tools to analyse brain data.





TOP: The Julich Brain Atlas
LEFT: Neurons labelled with the aid of AI
RIGHT: The Waxholm Rat Brain Atlas



Multilevel Human Brain Atlas

A detailed atlas of the human brain that integrates information on brain structure, function and connectivity across multiple modalities and spatial scales.
The EBRAINS multilevel human brain atlas provides detailed information on anatomy, connectivity and function and links it to your own research data. The atlas builds on the cytoarchitectonic maps of the Julich Brain Atlas, which includes the high-resolution Big Brain.

Multilevel Macaque Brain Atlas

This atlas is a new resource that provides in-depth insights into the anatomy, connectivity and functions of the macaque brain. It includes detailed information about brain organisation at multiple levels, ranging from the microscopic to the macroscopic level of the entire brain.

Waxholm Rat Brain Atlas

The Waxholm Space Rat Brain Atlas is a detailed volumetric atlas of the rat brain, to which a wide range of anatomical and functional data have been registered, including detailed data showing cellular distributions, axonal pathways and gene expression patterns. EBRAINS provides a visualisation interface, enabling researchers to explore and compare different aspects of the rat brain in 3D space.

Mouse Brain Atlases

EBRAINS provides developmental atlases for the mouse brain and embeds the Allen Mouse Brain Atlas resources into available tools and workflows.

siibra Software Suite

siibra-explorer is a browser-based 3D viewer for exploring brain atlases that cover different spatial resolutions and modalities.

siibra-python is a Python client to the brain atlas framework that integrates brain parcellations and reference spaces at different spatial scales, and connects them with a broad range of multimodal regional data features. It aims to facilitate programmatic and reproducible incorporation of brain parcellations and brain region features from different sources into neuroscience workflows.

siibra provides structured access to parcellation schemes in different brain reference spaces. It supports both discretely labelled and statistical (probabilistic) parcellation maps, which can be used to assign brain regions to spatial locations and image signals, to retrieve region-specific neuroscience datasets from multiple online repositories and to sample information from high-resolution image data. It is tightly integrated with the EBRAINS Knowledge Graph, allowing the seamless querying of semantically and spatially anchored datasets.

Medical Analytics

TOP: Fibre connections of the corpus callosum
LEFT: Structural MRI image of a human brain
RIGHT: Tractography of a brain with a stroke lesion (red)

Access to medical data is key to helping patients and harnessing the power of AI for clinical progress. At the same time, work with patient data poses special challenges due to the sensitive nature of this data. EBRAINS makes sensitive data discoverable through anonymous metadata in the EBRAINS Knowledge Graph and provides scientists with privacy-compliant tools to access, analyse and share medical brain data securely and ethically. Researchers and clinicians can work with advanced neuroimaging, cognitive and clinical datasets using AI-powered pipelines and modelling tools. Our services support research in early diagnosis, personalised treatment and neurorehabilitation of neurological and psychiatric disorders.

Platform for Human Imaging (PHI)

The PHI includes structural, functional, and diffusion MRI, PET, cognitive assessments and clinical records. It offers secure, standardised tools for collecting and analysing medical brain data across centres. PHI supports large-scale studies and international collaborations, making it easier for scientists to compare results, improve diagnostics and accelerate clinical research. Among the first major unique datasets collected for the PHI will be the 5M Connectome, which combines five advanced brain imaging techniques and data of hundreds of healthy volunteers of different ages. As a detailed, multiscale map of the healthy brain, this data will serve as a powerful baseline for clinical research.

Human Intracerebral EEG Platform (HIP)

Intracerebral EEG (iEEG) data represents a highly detailed and precise window into the electrical activity of the brain. The HIP gives quick and easy access to iEEG state-of-the-art analytical tools on a user-friendly interface. Users can access rich data and integrate their own for iEEG-based research. They can also easily find other iEEG centres to collaborate with.

Medical Informatics Platform

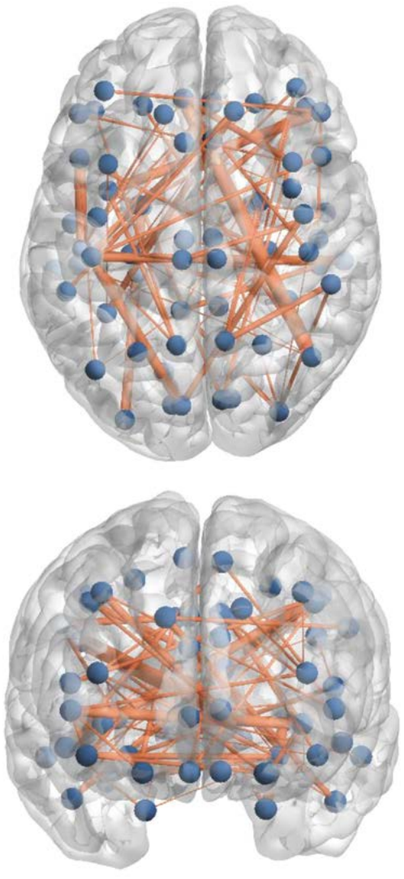
The Medical Informatics Platform (MIP) allows insights from medical data through federated analysis. The platform enables users to explore harmonised medical data extracted from pre-processed neuroimaging, neurophysiological and medical records and research cohort datasets without transferring of the original clinical data. State-of-the-art analytical tools support the work with pooled real-life health data.

HealthDataCloud

The HealthDataCloud provides a secure and scalable data platform enabling multi-institutional research teams to store, share and analyse complex multimodal health datasets. The foundation for the EBRAINS HealthDataCloud is an existing GDPR-compliant and EBRAINS-interoperable Virtual Research Environment (VRE).

Modelling and Simulation

EBRAINS provides interactive tools to create and explore digital models of the brain, from single neurons to the whole-brain level. Researchers can build, simulate and visualise complex models to test hypotheses and better understand brain structure, function and behaviour. The tools support multiscale and multispecies approaches and are integrated with the wider EBRAINS ecosystem. Pre-built model templates and demonstrators lower the threshold for use, making powerful simulation tools more easily accessible to a broad range of scientists. These models are increasingly used to support clinical applications, such as building digital brain twins.



LEFT: Brain network model
RIGHT: Personalised brain models of patients

The Virtual Brain (TVB)

The Virtual Brain is an open-source simulation platform for large-scale brain network models. Researchers can simulate brain dynamics using individual or population-based connectome data, test interventions and explore disease mechanisms. TVB is used for both basic and clinical neuroscience, with modules available for stroke, epilepsy and neurodegeneration.

NEST

NEST is a simulator for spiking neural network models that focuses on the dynamics, size and structure of neural systems, rather than on 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 of balanced random networks) and models of learning and plasticity.

Arbor

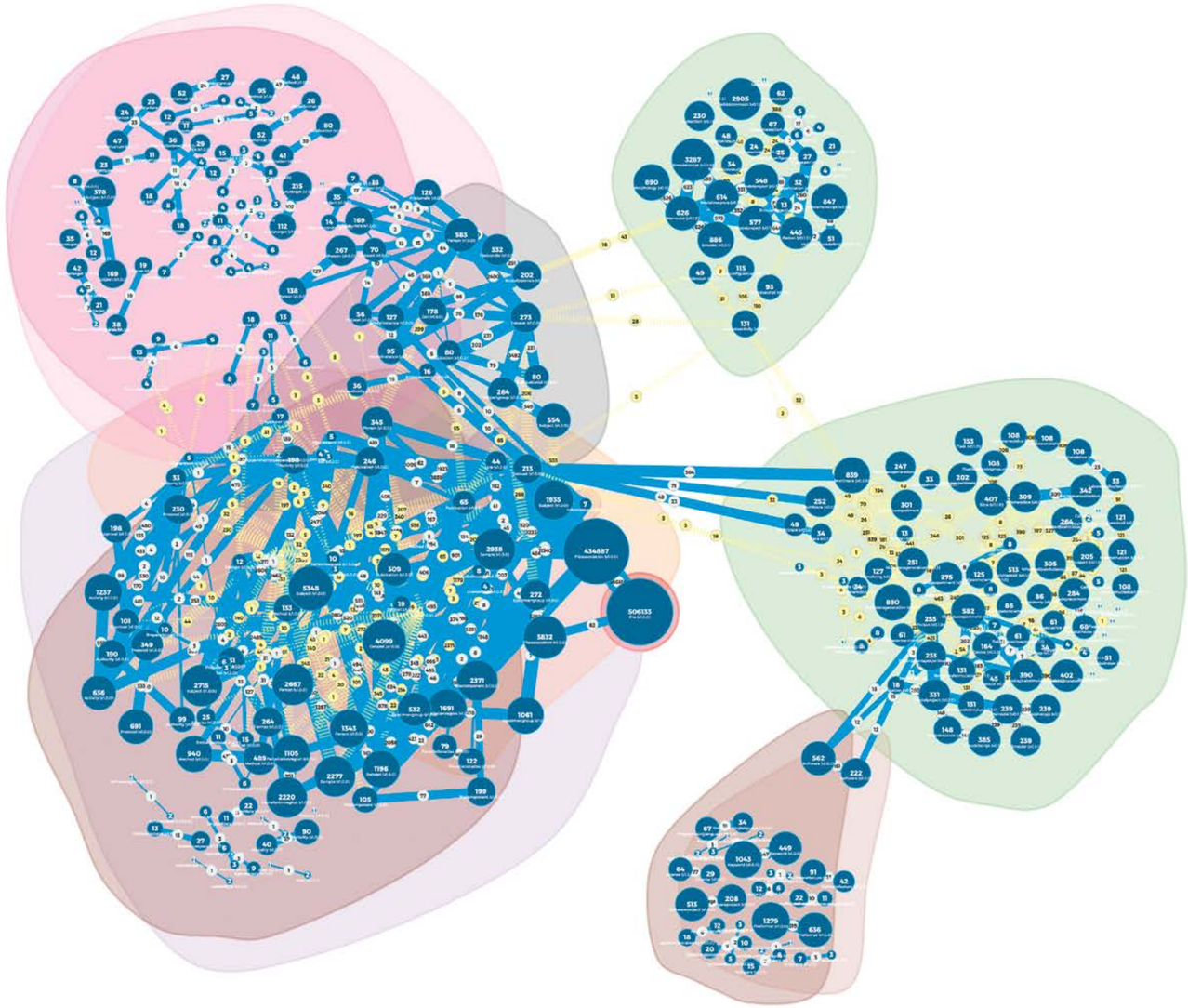
Detailed neuron models can be digitally constructed and tested with Arbor. Arbor offers a high-performance library for computational neuroscience simulations with multi-compartment, morphologically-detailed cells, from single-cell models to very large networks. Arbor is written from the ground up with multi-core CPU and GPU architectures in mind, helping neuroscientists effectively use HPC, including exascale computing, to meet their simulation needs.

Molecular Dynamics Extended Library-CNS

MoDEL-CNS is a database and server platform designed to provide web access to atomistic molecular dynamics trajectories for relevant signal transduction proteins. All data produced are available to download.

FAIR Data, Models and Software

EBRAINS supports open, responsible neuroscience by providing datasets, models and software for sharing and reuse. With the help of the EBRAINS Curation Service, scientists can link their data, models and software to the Knowledge Graph and adapt its description to the internationally recognised and standardised openMINDS metadata schemas. This way, the EBRAINS platform ensures that everything is Findable, Accessible, Interoperable and Reusable (FAIR). A strong framework fosters transparency, compliance and reproducibility, to enable collaboration across labs, countries and disciplines.



Graph structure of contents in the EBRAINS Knowledge Graph

Curation Service

The EBRAINS Curation Service plays a crucial role in maintaining the quality and consistency of the content indexed in the Knowledge Graph. It assists researchers in organising, enriching and ensuring the integrity of their datasets, models and software. By providing expert guidance and automated tools, the Curation Service aids users with reviewing content descriptions and aligning their contributions with the openMINDS metadata schemas, thereby, enhancing interoperability and discoverability. This service also promotes best practices in data management, ultimately fostering a collaborative environment for neuroscience research.

Knowledge Graph

The EBRAINS Knowledge Graph (KG) brings together information from different fields of brain research and connects research data to software for analysis. At the core of the EBRAINS KG lies a graph database linking neuroscientific research across modalities based on the openMINDS metadata schemas. This makes it possible for EBRAINS to support extensive data reuse and complex workflows that encompass everything from data visualisation and analysis to modelling and simulation as well as AI applications. Researchers can find neuroscience data using the effective KG search interface with a variety of filters and keywords. Currently, more than 1100 datasets, many of which are large and complex, are indexed, organised and linked to relevant research. Users can access, run or download open source analysis software. All related metadata can also be accessed programmatically in the EBRAINS KG.

openMINDS

openMINDS comprises a set of metadata schema collections for increasing the findability and interpretability of datasets down to single files that originate from various neuroscience modalities and species. openMINDS metadata schemas are designed to be used as architectural building blocks for graph databases, such as the EBRAINS Knowledge Graph. The modular structure of the schemas allows users to easily establish cross links between registered research products (datasets, models, software). Furthermore, the openMINDS schemas allow users to define relations to ontologies, providing the possibility to connect data beyond the corresponding database to resources hosted elsewhere.

Collaborative Platform

Many of the research tools offered by EBRAINS are interoperable. They can be used not only in isolation but also combined within complex research workflows. For example, the brain atlas data can be entered into simulations, different simulators can be combined into multistep- or co-simulations, and the results can run on various computing technologies from classic to neuromorphic. This is made possible by our Collaborative Platform, which consists of technologies and experts that ensure seamless integration, making data and tools compatible and enabling new interfaces between the services. The Collaborative Platform runs quietly in the background and ensures a smooth user experience.

TOP: Example workflow linking high-resolution data and computational modelling
MIDDLE: EBRAINS promotes collaboration between brain researchers across countries and disciplines

EBRAINS Collaboratory

The EBRAINS Collaboratory is an integrated digital workspace designed to accelerate scientific collaboration. Researchers can collaboratively analyse data, share workflows and produce interactive publications. The Collaboratory unifies essential services for research and development: secure identity and team management, version-controlled file storage, a dedicated JupyterLab environment, collaborative documentation through an intuitive Wiki as well as tools for co-editing and instant communication. It is also a valuable platform for developers to make their tools accessible to the community and for educators to develop courses with shared materials and interactive notebooks.

EBRAINS Lab

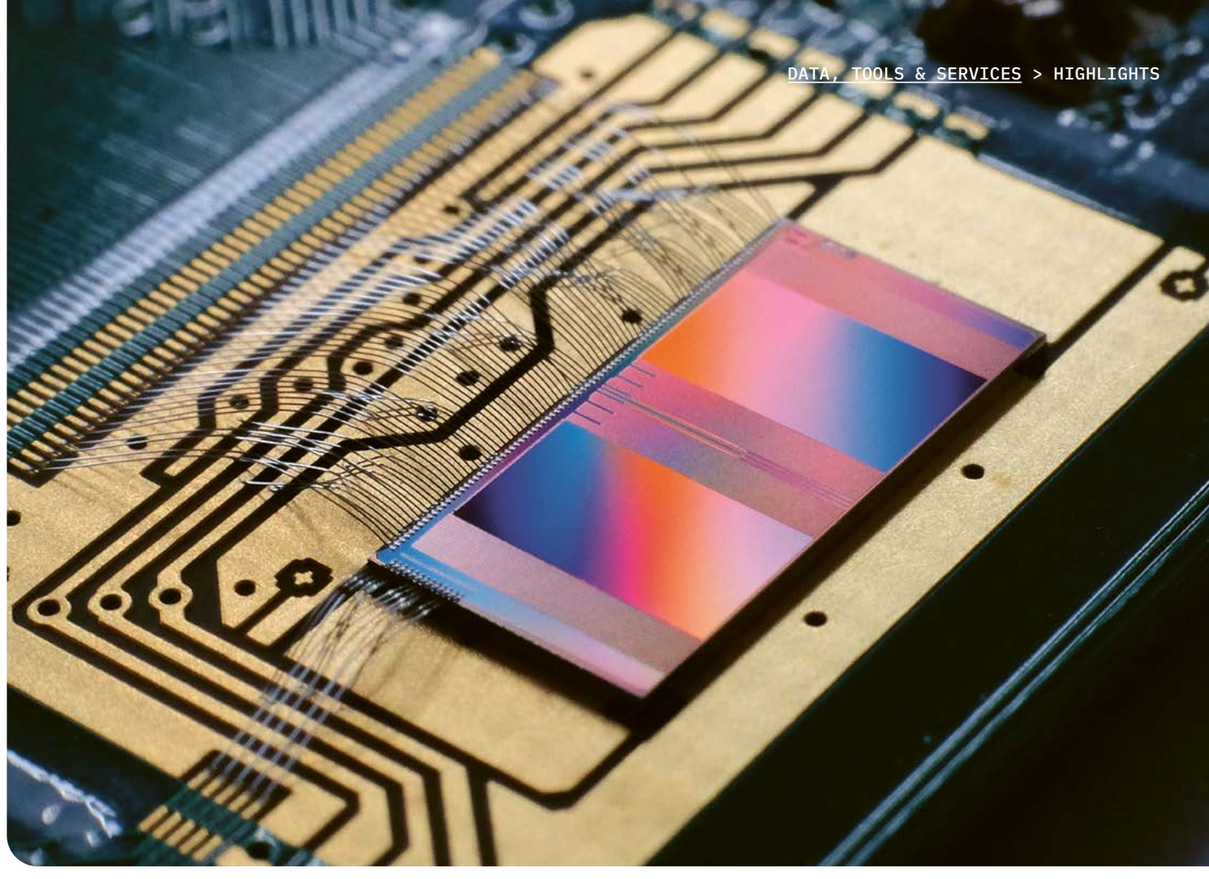
The EBRAINS Lab offers a modern, cloud-based JupyterLab environment designed for interactive programming, data analysis and collaboration. With official EBRAINS tools pre-installed and tightly integrated with the Collaboratory's storage and data services, the Lab provides a workspace for developing, testing and sharing scientific workflows. Its integration with cloud resources and high-performance computing ensures that projects can move effortlessly from initial exploration to large-scale analysis.

EBRAINS Software Distribution (ESD)

The EBRAINS Software Distribution offers a unified software ecosystem designed to simplify development of scientific workflows and ensure reproducibility.
It includes over 70 EBRAINS tools and hundreds of dependencies, from simulators, analysis frameworks and visualisation tools to EBRAINS-specific interfaces to the Knowledge Graph and neuromorphic systems, all tested for interoperability and optimised for both interactive use and high-performance computing. By providing a curated set of tools in consistent versions across laptops, cloud environments and supercomputers, the ESD reduces technical overhead and time spent on software management.

Computing Infrastructure

EBRAINS computing services empower users to scale their science on Europe's most powerful computers. EBRAINS gives researchers access to high-performance computing, large-scale data storage and neuromorphic systems, all tailored to support neuroscience.



LEFT: The JUPITER Exascale Development Instrument JEDI
TOP: Close-up view of a BrainScaleS-2 chip

Supercomputing for Neuroscience

EBRAINS connects you to Europe's leading supercomputing centres, including TGCC-CEA (France), CINECA (Italy), CSCS (Switzerland) and the Jülich Supercomputing Centre (Germany). Their powerful systems support everything from multimodal data analysis to whole-brain simulations, enabling research that would be impossible on standard machines. Crucially, the supercomputing sites in Germany and France will provide access to the first European Exascale supercomputers, "JUPITER" and the upcoming "Alice Recoque".

Neuromorphic Computing

EBRAINS also offers access to neuromorphic systems—hardware inspired by the brain itself. These platforms open the door to innovative brain-inspired algorithms and energy-efficient AI for neuroscience. EBRAINS hosts Europe's most powerful large-scale neuromorphic computing systems, BrainScaleS and SpiNNaker, which scientists can access remotely. BrainScaleS emulates the behaviour of neurons using analogue electrical circuits and relies on spikes, instead of a stream of continuous values used in most computer simulations. SpiNNaker is a massively parallel digital computer running spiking neural network algorithms through its 1,000,000 processing cores. It mimics the way the brain encodes information and can be accessed as a testing station for new brain-derived AI algorithms.

How to Participate

As a Researcher

TOP AND LEFT:
Young researchers during a poster session at one of our brain research events

EBRAINS provides data, tools and services openly to researchers worldwide. You can sign up for an account for free to explore the many resources and find out how EBRAINS can accelerate your research. In addition, there are many ways to get involved with EBRAINS. You can build your skills through training and events, connect with peers in the EBRAINS Community space and apply for funding through Open Calls. Multiple opportunities are waiting!

PARTICIPATE

Get an EBRAINS Account

With an EBRAINS account, you have open access to data, tools and services. Sign up for free on ebrains.eu to explore the many resources and find out how EBRAINS can accelerate your research!

Education

EBRAINS offers a variety of educational and training opportunities designed to support researchers, particularly early-career researchers, in exploring our tools and services and becoming active contributors. Users can benefit from a diverse range of hands-on workshops, online tutorials, an extensive e-library of recorded lectures and a directory for lab visits. Our Student Ambassadors Programme and Education Task Force foster connections across the neuroscience community. Building on this, Student Ambassadors further engage our vibrant Student Community by organising targeted events, such as the annual EBRAINS Student Conference.

EBRAINS Community

Join the EBRAINS Community space online to connect with others working in neuroscience, brain medicine and brain tech. Set up your profile, subscribe to sub-communities that match your interests and explore relevant discussions. It’s a place to collaborate, share knowledge and grow with an inclusive, user-driven community.

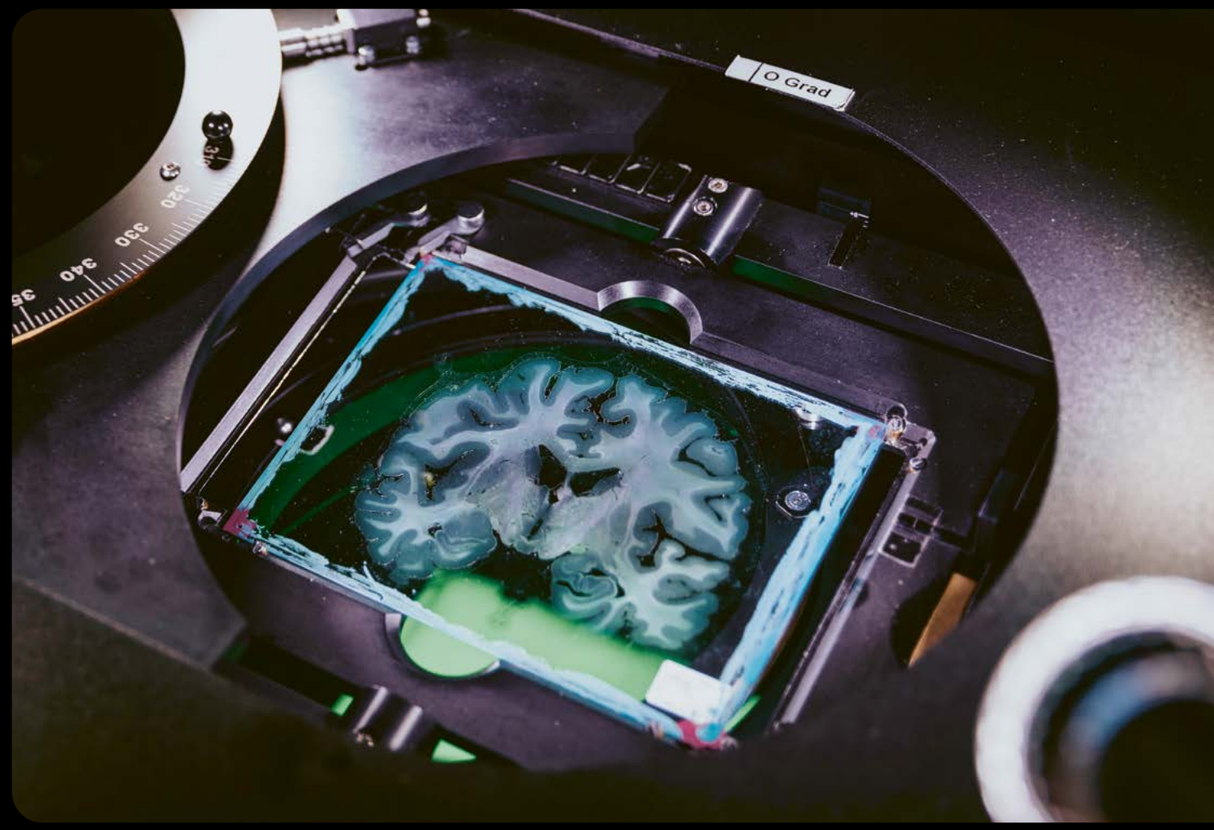
Open Calls

As part of the EBRAINS 2.0 project (2024–26), five Open Calls have been launched to integrate data and workflows into the infrastructure. The selected proposals received funding to develop new brain atlases, support Alzheimer’s disease research, advance early diagnosis of dementia, and more. These teams also had the opportunity to collaborate closely with the EBRAINS consortium, contributing to the testing and validation of workflows, models and simulations. Stay tuned for future EBRAINS Open Calls!

How to Participate

As an Institution

EBRAINS is a distributed infrastructure, built by and for the brain research community—and your institution can become part of it! EBRAINS works as a European-level undertaking, combining scientific contributions and national perspectives. Digital technology allows us to connect the greatest European strengths in research and make them accessible to everyone. In this way, EBRAINS enables overcoming the fragmentation of research efforts and fosters coordination and cooperation between different stakeholders. EBRAINS aims to build on the best of national efforts through the establishment of National Nodes run by EBRAINS member institutions.



LEFT: Lithuanian University of Health Sciences coordinates the first EBRAINS National Node in the Baltics
RIGHT: Human brain section in a Polarized Light Microscope

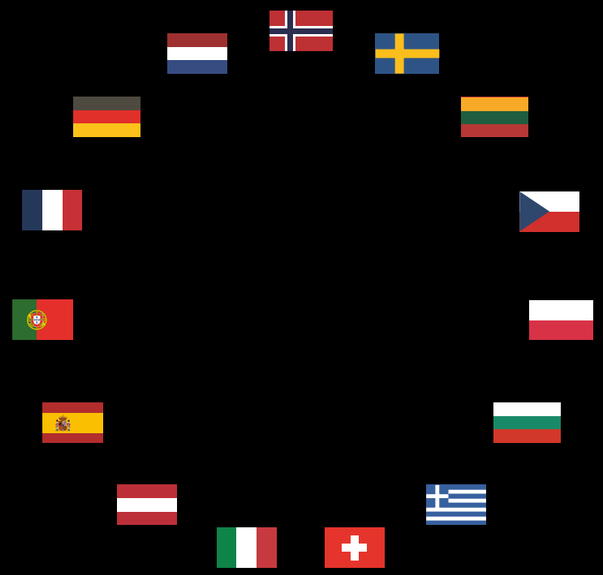
Become an EBRAINS Member

We invite you to become a member of the EBRAINS AISBL; to co-design future iterations of EBRAINS' cutting-edge tools, develop new project consortia built around the use of the research infrastructure, and ultimately, play a role in shaping digital brain research in Europe. The EBRAINS AISBL is a non-profit organisation under Belgian law based in Brussels. Universities, research institutes and organisations committed to advancing neuroscience, technology and clinical translation can become members. Full members directly influence the infrastructure's development by participating in decision-making processes, may offer services on the platform and help define EBRAINS' funding strategy. Associate members propose services, engage with the community and join project consortia. All EBRAINS members strengthen the ecosystem through collaboration and benefit from the increased visibility and exposure.

Become a National Node

National Nodes are made up of EBRAINS members who provide their scientific expertise, software, services and support to the neuroscience community through the EBRAINS infrastructure. National Nodes also help grow the EBRAINS user base in their country to increase scientific exchange and advancement and interface with national ministries and funding bodies. Each National Node is led by one institution with the status of a full member. The other National Node partners (e.g., legal entities such as universities, research institutes or private organisations) are strongly encouraged to become associate members of the AISBL.

A European Infrastructure



45 institutional members
from 15 countries

14,700 users from 95 countries

MAP & NUMBERS

11 National Nodes

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Europe’s Digital
Infrastructure
for Brain Research

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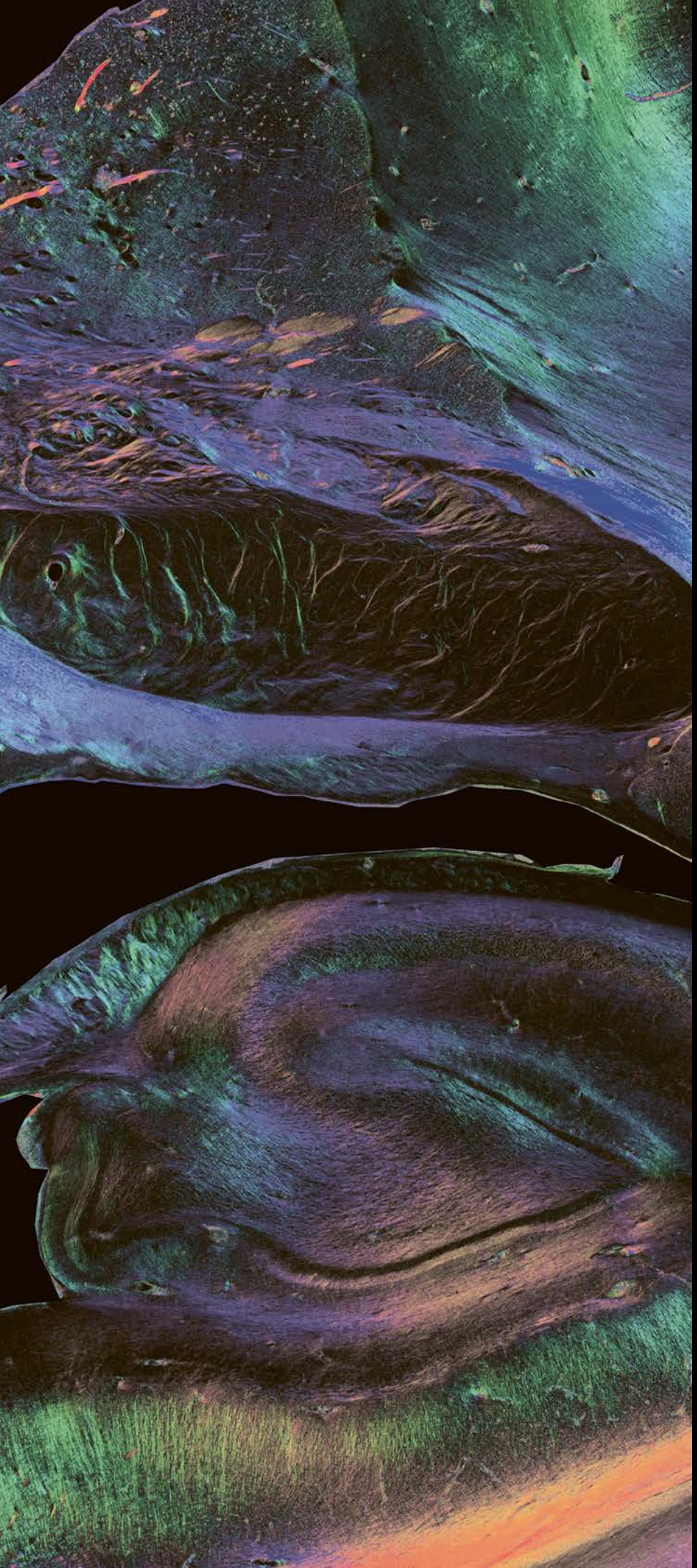

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