



Co-funded by  
the European Union



## Human Brain Project

# EBRAINS - A platform for collaboration in digital neuroscience

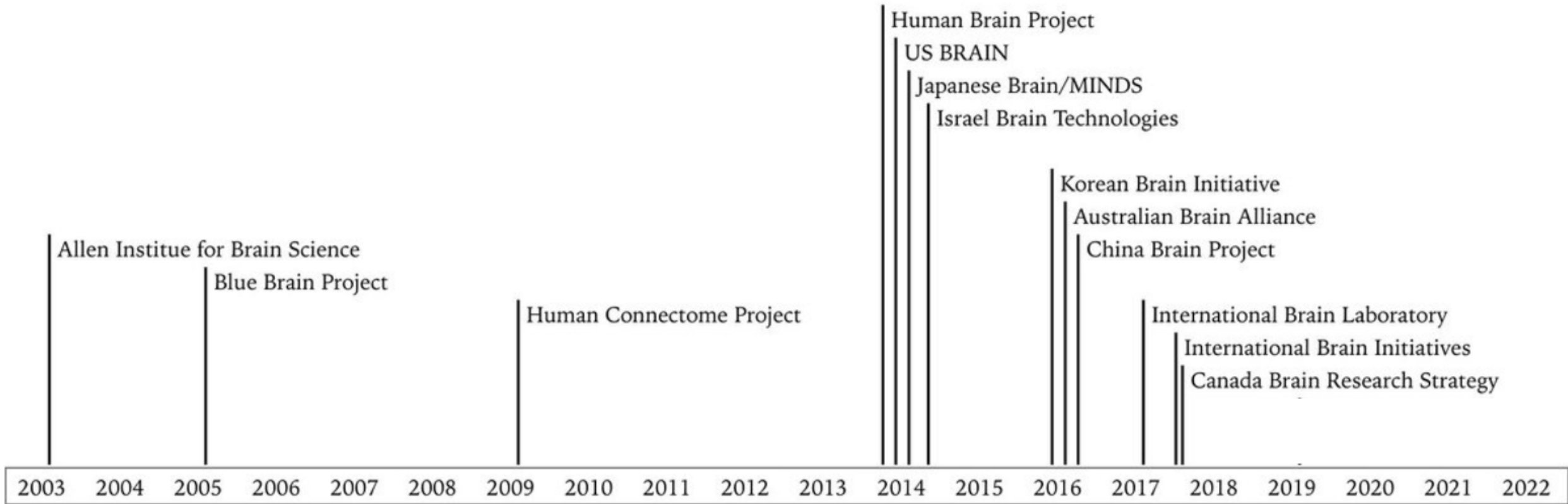
Jan G. Bjaalie

Heidelberg  
Public event: EBRAINS  
November 25, 2019

HBP Infrastructure Operations Director  
HBP Neuroinformatics Platform leader  
International Brain Initiative (IBI) co-chair  
Head of the Norwegian Neuroinformatics Node

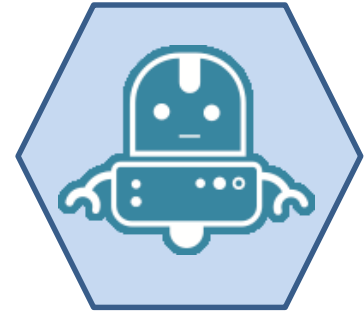
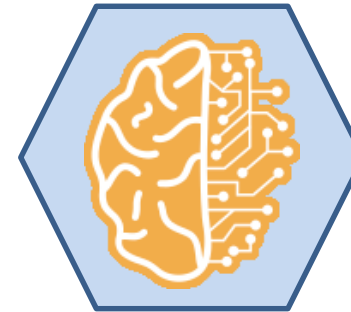
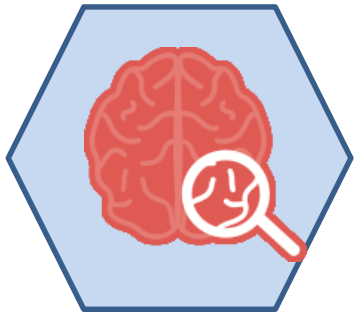
# Human Brain Project (HBP): the first in a wave of large brain projects

## Start of Brain Projects

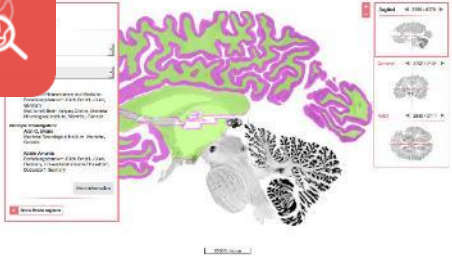



# HBP Platform Release

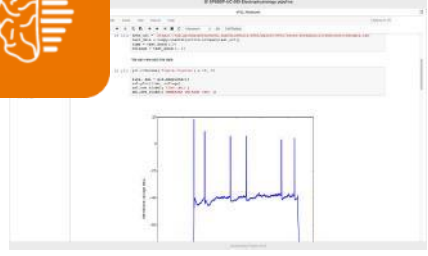

30 March 2016



**Neuroinformatics**




**Brain Simulation**



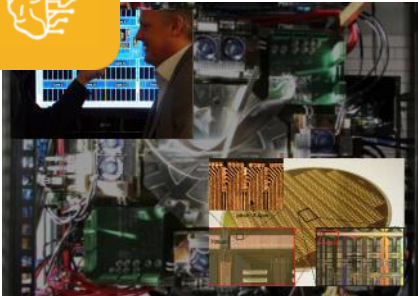

**Medical Informatics**



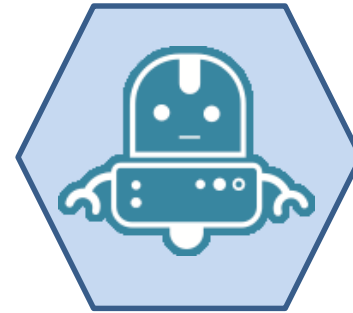
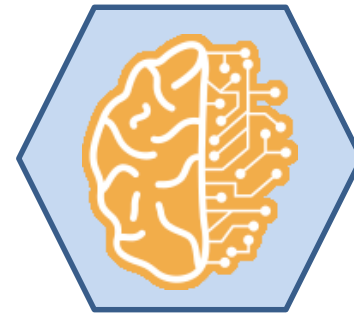
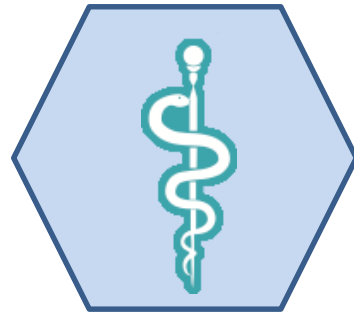
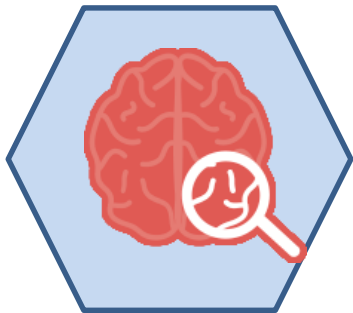
**High Performance Analytics and Computing**

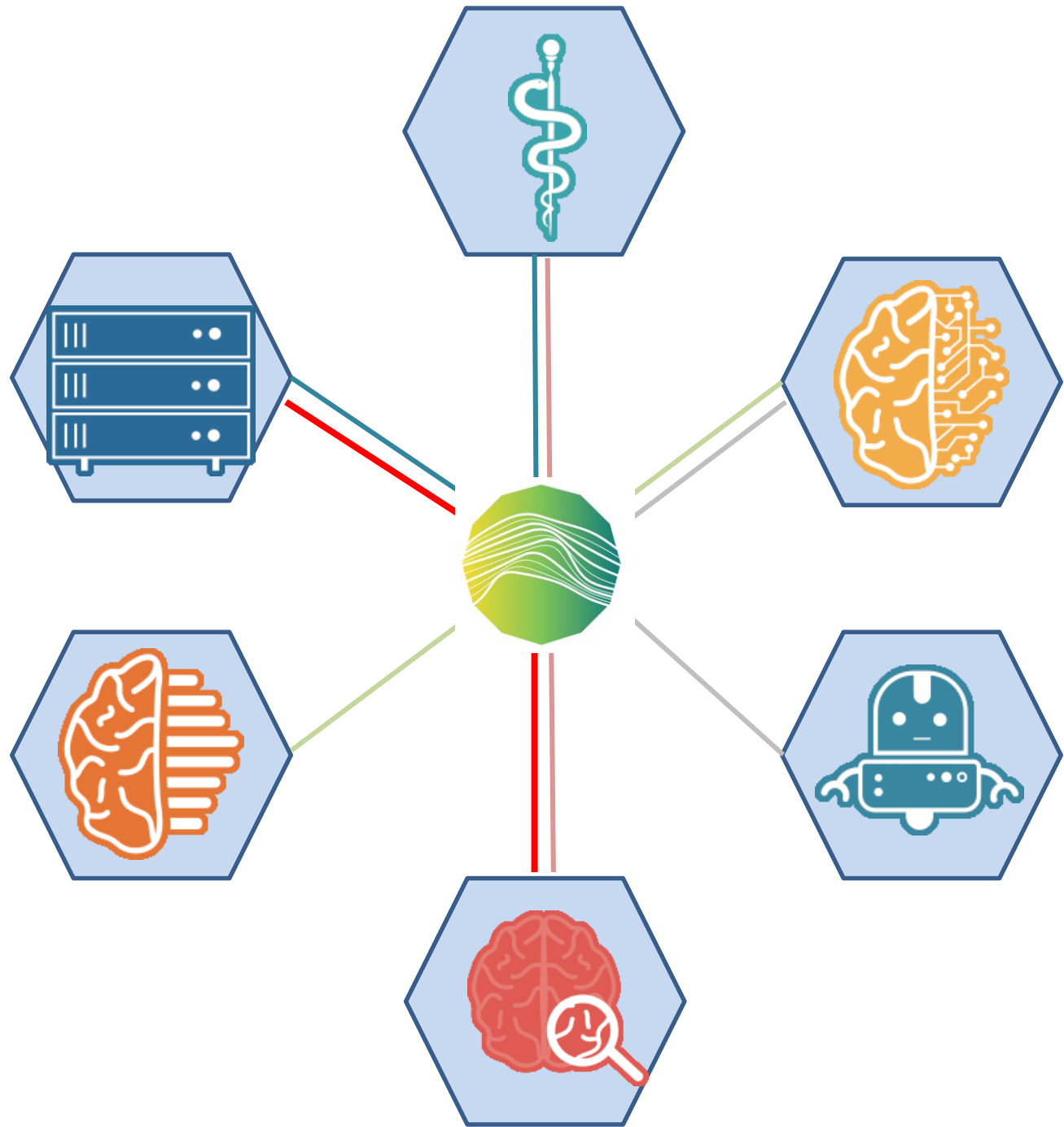


**Neuromorphic Computing**



**Neurorobotics**







**EBRAINS**

**EBRAINS – a research e-infrastructure for brain research – helping the research community collect, analyse, share, integrate and model data about the brain with the aim of better understanding the functioning of the human brain and its diseases**

**Public Event:  
Heidelberg Nov 25 2019**

- **INTRODUCING EBRAINS / PRE-LAUNCH**
- **RELEASE OF A FIRST SET OF SERVICES**
- **RELEASE OF MORE SERVICES AT REGULAR INTERVALS DURING 2020-2023**
- **ALL SERVICES TARGETING EXTERNAL USERS**
- **SERVICES IN PREPARATION CAN BE ACCESSED THROUGH THE HBP WEBSITE**

Data  
metadata

Community

Data assets

Tools & Services

Basic infrastructure

Atlases  
& Data  
curation

Analytical  
workflows

Atlas &  
curation  
tools

Analytical  
tools

Simulation  
engines

Model building  
engines

Simulation

Models

The EBRAINS infrastructure will include

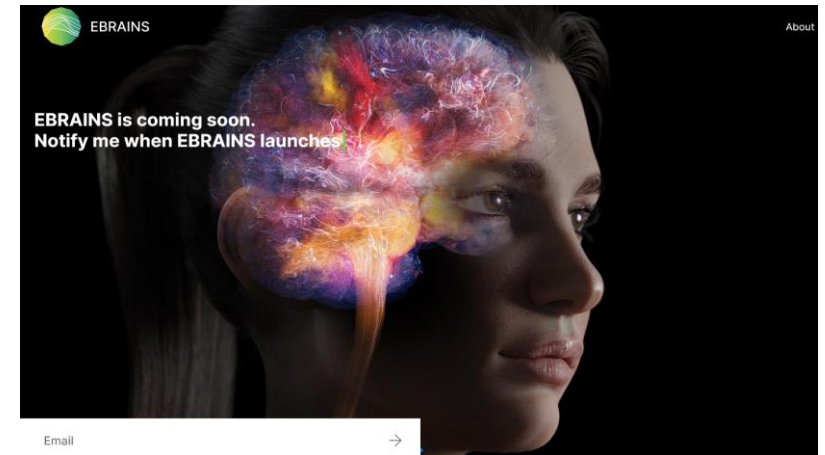
- FAIR data services
- Brain atlases for data integration
- Brain modeling and simulation
- Closed-loop AI and robotics
- Medical brain activity data
- Interactive High-Performance Computing and Neuromorphic Computing



## EBRAINS

- supporting a wide range of research methodologies
- facilitating collaborative research and data sharing
- integrating a large variety of ICT services addressing current and future challenges in the neurosciences
- providing working solutions for experimental, computational, and clinical neuroscientists

<https://ebrains.eu>





# EBRAINS Services

As a taster of what is coming soon you can access three EBRAINS services:

The image displays three vertical service cards with a teal-to-yellow gradient background. Each card has a title, a description, and a call-to-action button at the bottom.

- Find Data:** Under the heading "DATA AND KNOWLEDGE", it invites users to "Browse through multimodal neuroscience data and computational models" and includes a button labeled "FIND DATA & MODELS →".
- Share Data:** Under the heading "DATA AND KNOWLEDGE", it invites users to "Submit your data and receive data management support, long term storage and citable DOIs" and includes a button labeled "SHARE DATA →".
- Brain Atlases:** Under the heading "ATLASES", it invites users to "Access a new generation of multimodal, 3-D reference atlases as tools for exploring the brain, and for analysing and integrating research data." and includes a button labeled "BRAIN ATLASES →".

# EBRAINS Service Categories

## Curated and shared data: *EBRAINS Share Data / Find Data* - neuroscience data publishing

- Comprehensive tools and services for shared data and computational models
- Long term data storage
- Citable DOIs for data
- Defined conditions and licenses for use of data
- Tags to make the data discoverable
- Additional metadata and descriptions making the data interpretable and re-usable

EBRAINS users can share their data through the FAIR data service and thereby obtain greater exposure of their research, or access the shared data assets and boost their productivity.

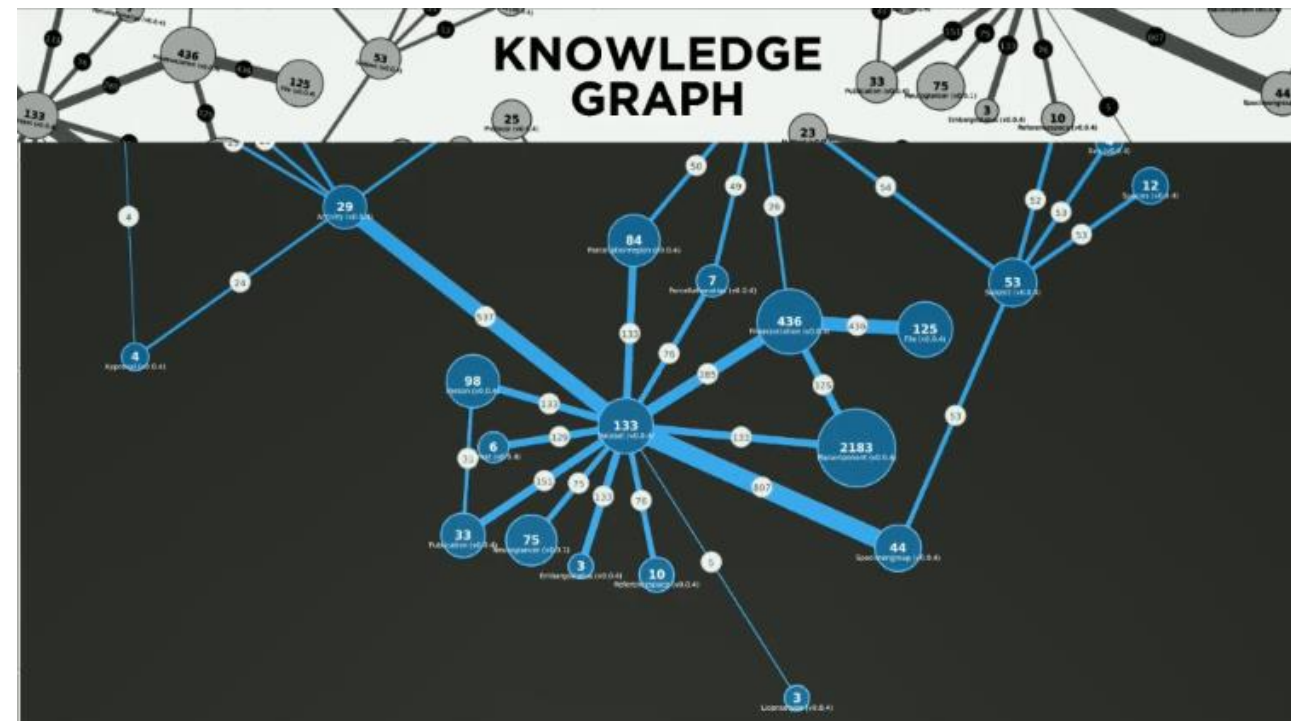


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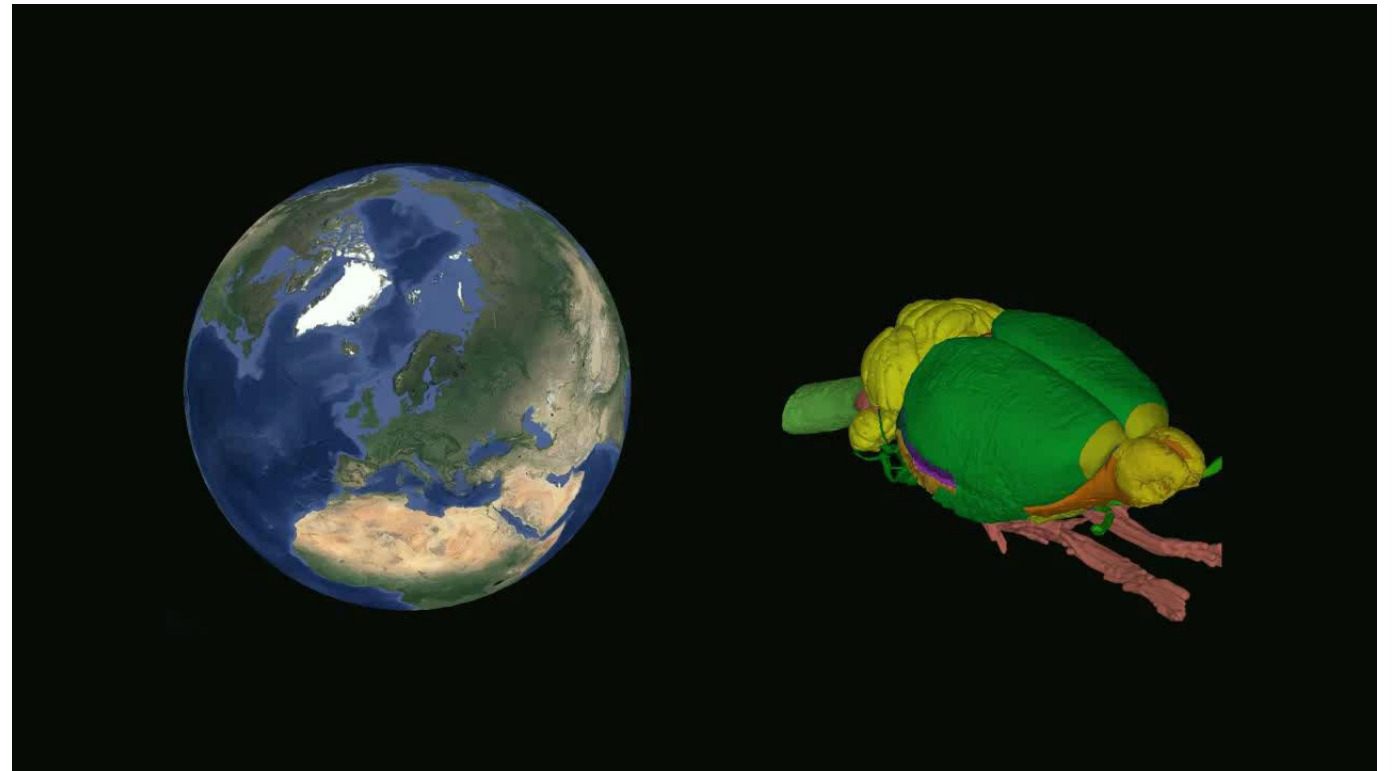
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# EBRAINS Service Categories

***EBRAINS Brain atlases:* navigate the brain in 3D - find, contribute and analyse brain data, based on location**

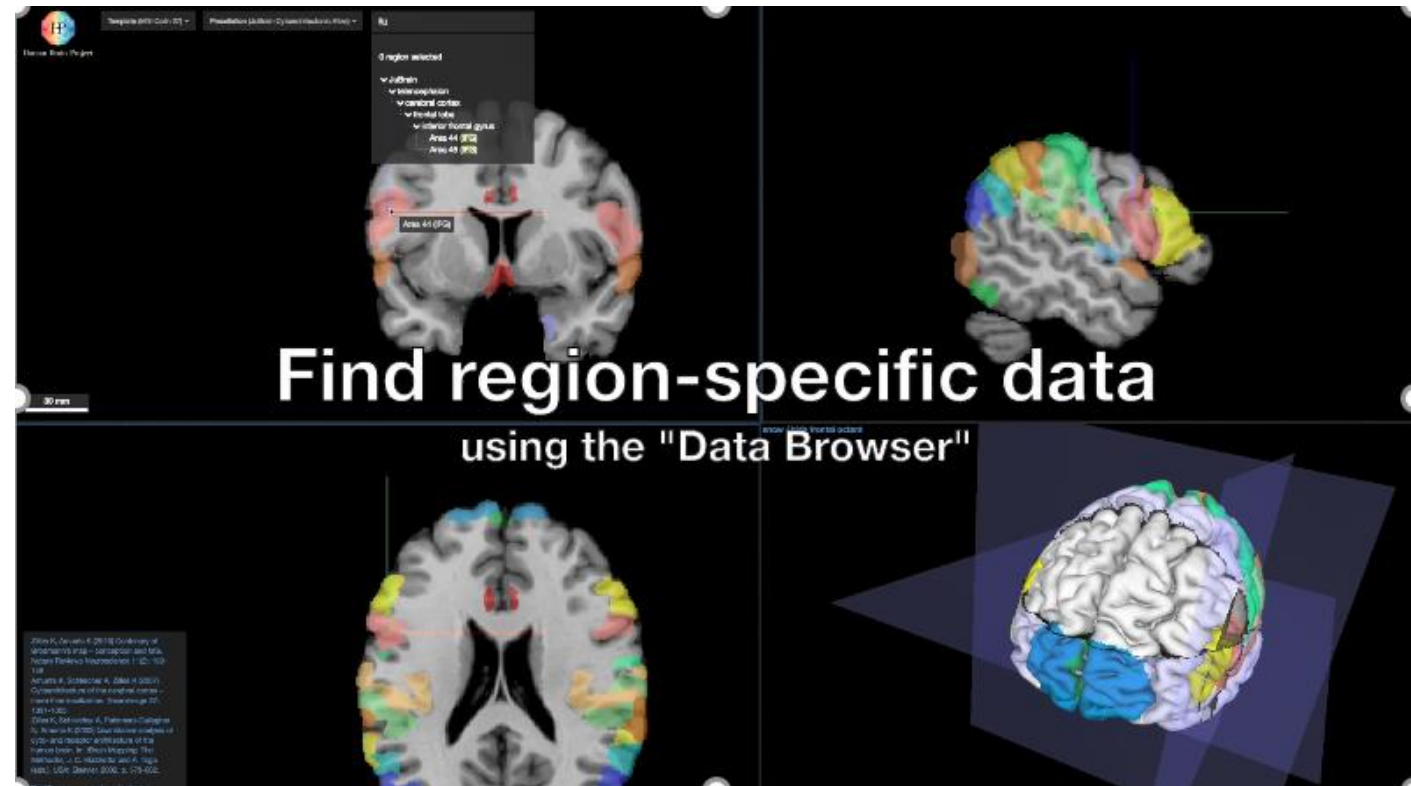
- Comparable to the way Geographical Information Systems (GIS) organize data in 2D maps of the Earth's surface
- Enabling users to work with neuroscientific data according to well-defined 3D locations and regions of the brain
- Detailed 3D reference atlases of the human, non-human primate, and rodent brains
- Continuously enriched by a growing collection of multi-modal and multi-scale experimental data that are spatially linked



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## Space

Centimeters  
( $10^{-2}$ )

Millimeters  
( $10^{-3}$ )

Micrometers  
( $10^{-6}$ )

Nanometers  
( $10^{-9}$ )

Picometers  
( $10^{-12}$ )



## Time

Years  
( $10^0$ )

Days  
( $10^0$ )

Hours  
( $10^0$ )

Minutes  
( $10^2$ )

Seconds  
( $10^0$ )

Milliseconds  
( $10^{-3}$ )

Microseconds  
( $10^{-6}$ )

Nanoseconds  
( $10^{-9}$ )

Picoseconds  
( $10^{-12}$ )

S  
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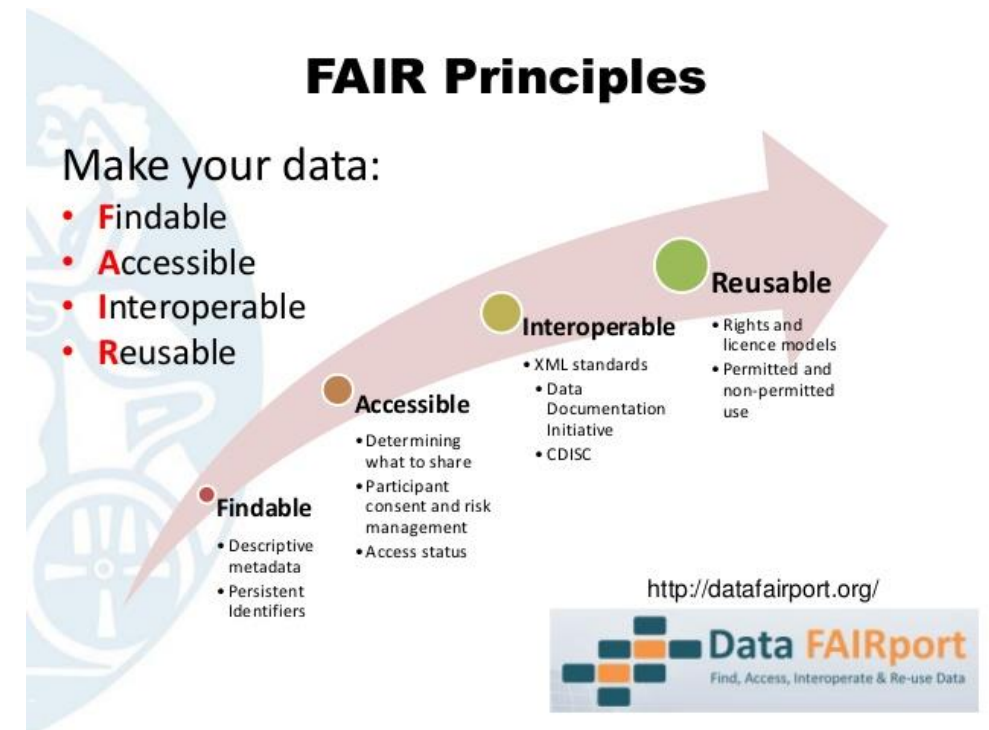
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## Neuroscience data

- Multiple modalities
- Multiple spatial scales
- Multiple temporal scales

# Data integration challenge

- Combining data residing in different sources and providing users with a unified view of them
- Increasingly important as the volume of data explodes
- Focus in many scientific disciplines and in other sectors of society
- Numerous challenges



# Data integration requires data sharing

- Culture of Knowledge sharing is well developed
- Knowledge builds on data: Culture of Data sharing is lagging behind
- Transformative HBP Neurodata management:
  - Creating a large repository of organized and curated data, unique at the level of containing heterogenous multi-level and multi-modality data
  - Data from HBP and other sources of shared data
  - Accompanied by efficient workflows for organizing, curating, and analysing neuroscience data in the context of brain atlases
- Key aspect: HBP 3-tier curation process for data and models
  1. Basic metadata
  2. Location metadata - registration to reference atlas
  3. Deep integration



# Questions

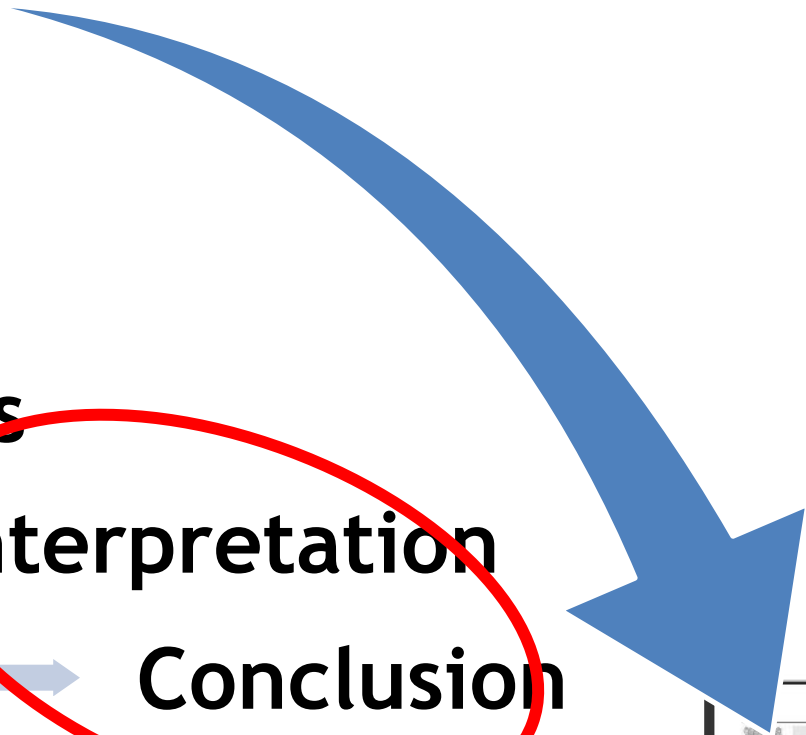
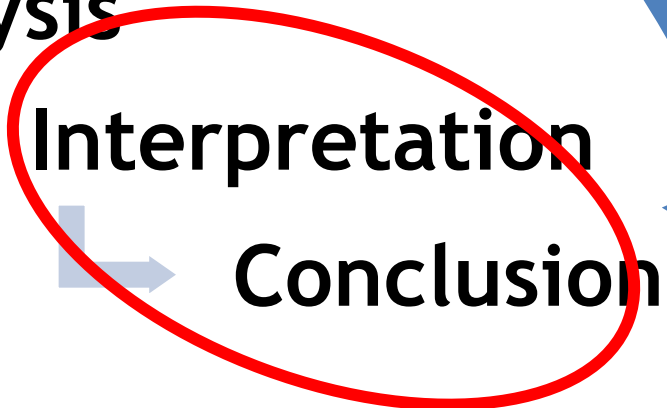
↳ Experiments

↳ Data

↳ Analysis

↳ Interpretation

↳ Conclusion



# Questions



## Experiments



## Data



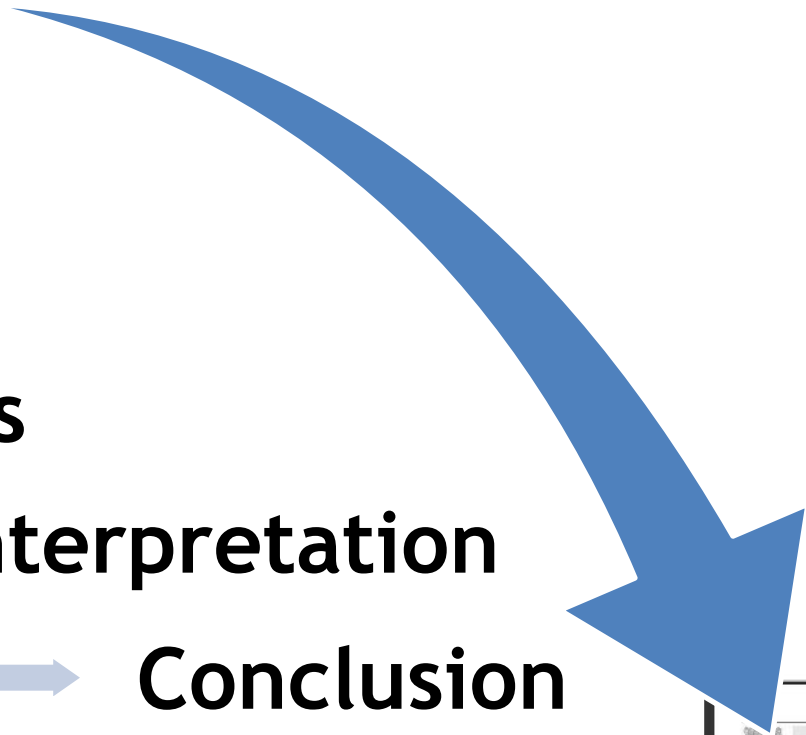
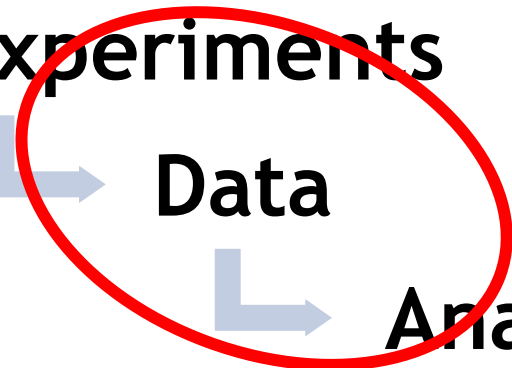
## Analysis



## Interpretation



## Conclusion





EUROPEAN  
COMMISSION

Brussels, 14.3.2018  
SWD(2018) 83 final

## COMMISSION STAFF WORKING DOCUMENT

### Implementation Roadmap for the European Open Science Cloud

... to create a fit for purpose pan-European federation of research data infrastructures, with a view to moving from the current fragmentation to a situation where data is easy to store, find, share and re-use.

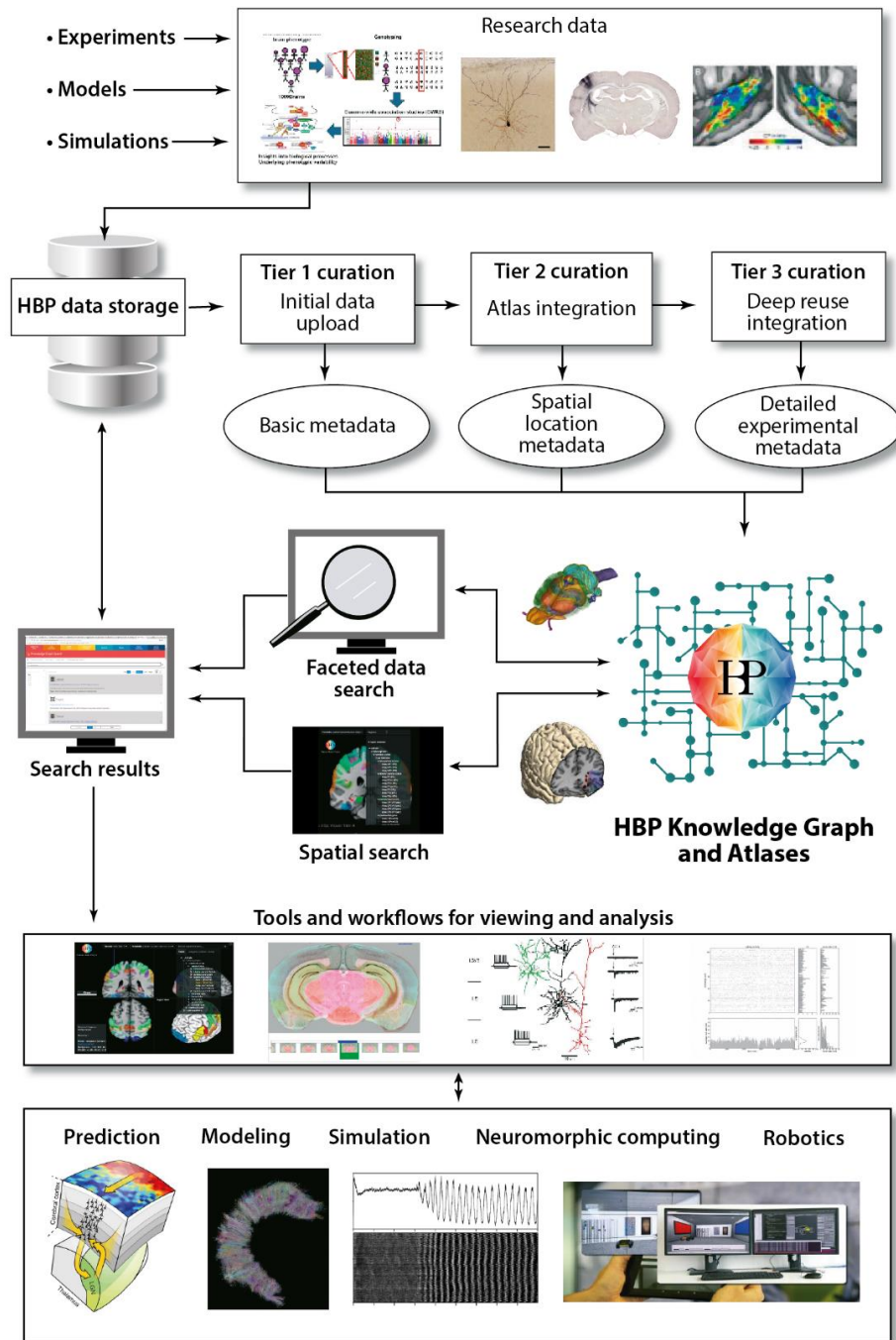


**EUROPEAN OPEN  
SCIENCE CLOUD**

Launched November 2018

# HBP Neurodata management: enabling data sharing

- Computational neuroscientists will benefit from having access to «primary data» or more data from experiments: **extract key features relevant for modeling and simulation**
- Experimental and clinical neuroscientists will benefit from having access to data from other laboratories: **improved analysis, new combinations of data, adding data**
- Groups producing and sharing data will benefit from **future data sharing impact factors**
- By providing well organized and interpretable data, accompanied by well defined conditions for access and use, **HBP Neurodata management will build trust and professionalize the sharing of data**



## Data to knowledge

Research data are uploaded to data storage at the HBP High Performance Computing centers

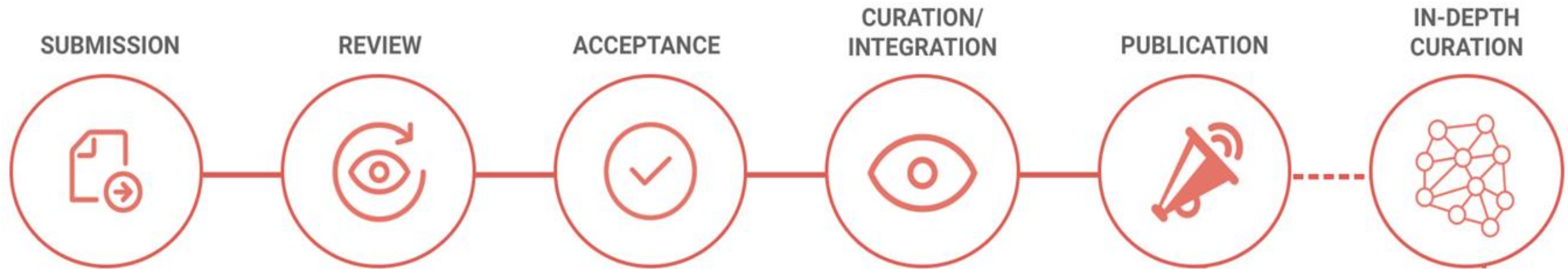
The data are tagged with metadata through a 3-tier curation process, **INCLUDING ETHICS CURATION**

The data are made accessible through searches for metadata in the online HBP Knowledge Graph and HBP Atlases

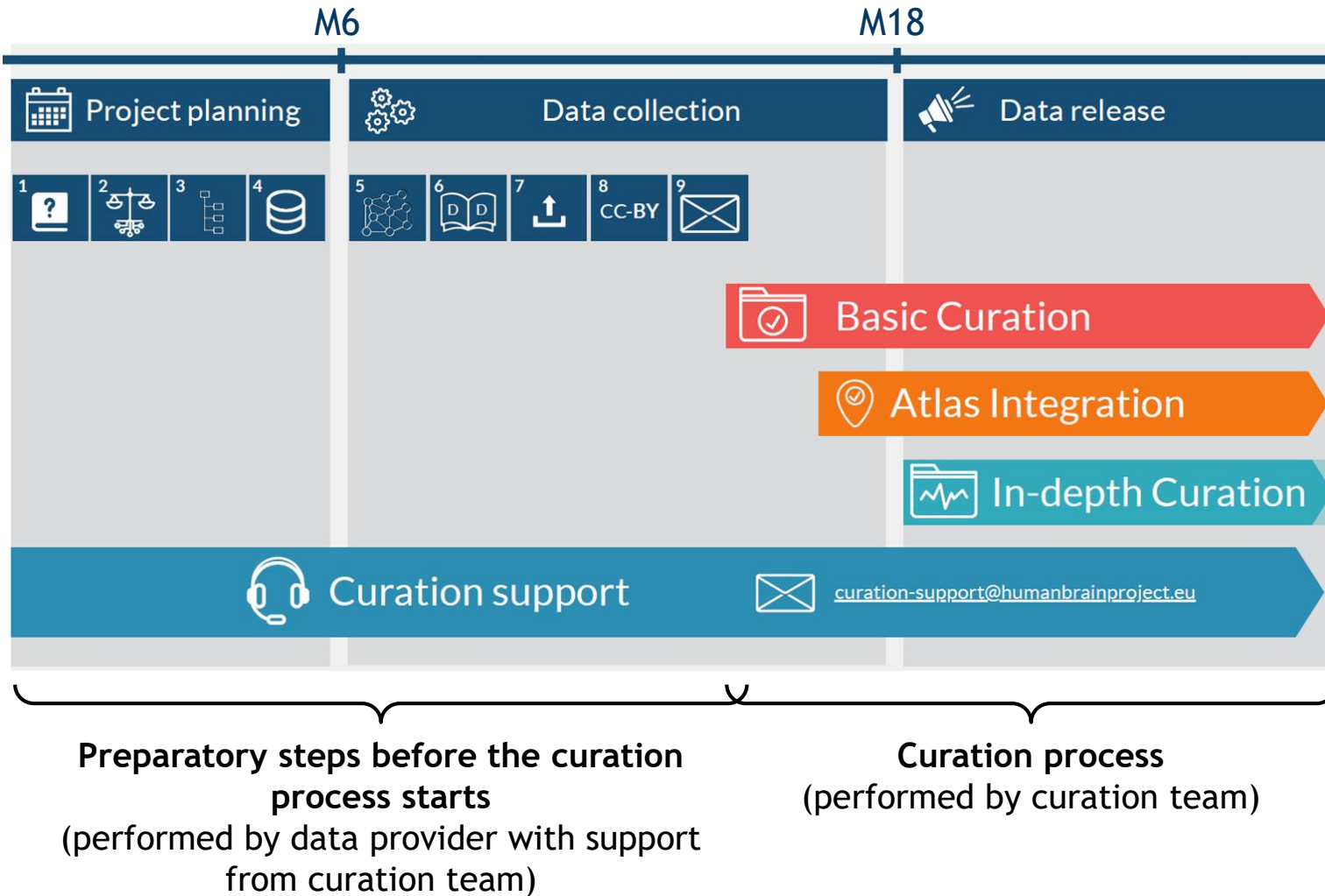
Users can analyze data using tools and workflows for visualization and analysis available through the HBP infrastructure

The multiple-scale data are used for informing modeling and simulation, and for extracting principles of relevance for development of brain-inspired technologies

# EBRAINS Share Data



# EBRAINS Share Data



- 1 Download and read the **data integration guide**
- 2 Complete the **ethics survey**
- 3 Organise your data **consistently**
- 4 Create an account for the **HBP storage**
- 5 Download and fill in the **metadata template MINDS**
- 6 Download and fill in the **DataDescriptor**
- 7 **Upload** your data to the HBP storage
- 8 Choose a **licence** for your dataset(s)
- 9 Contact the curation support to inform us about your **submission**

# EBRAINS Find data



Search (e.g. brain or neuroscience)

**SEARCH**



**Project**  
75 Results

**Dataset**  
571 Results

**Subject**  
861 Results

**Sample**  
1129 Results

**Model**  
34 Results

**Contributor**  
479 Results

FILTERS

[Reset](#)

Viewing 1-20 of 571 results

View as

**Grid**

List

Sort by

Relevance ▾

SPECIES

- Homo sapiens 448
- Mus musculus 65
- Rattus norvegicus 57
- Macaca mulatta 4

EMBARGO

- Free 484
- Embargoed 84
- Restricted access 1

**Results for complexity measures and a read-out of the state of cortical circuits after injury**

The combination of transcranial magnetic stimulation (TMS) and electroencephalography (EEG) allows to measure non invasively with high temporal resolution the brain response to direct perturbation of different cort...

Methods

transcranial magnetic stimulation (TMS)

**Human Intracranial EEG Database (HID)**

From the Human Intracranial Database project

The Human Intracranial Database (HID) is a collection of stereotactic electroencephalography (sEEG) data in epileptic patients, performing eight behavioral tasks. The behavioral tasks were used as functional localizer...

Methods

stereotactic electroencephalography (sEEG)

Keywords

analysis method behaviour assay

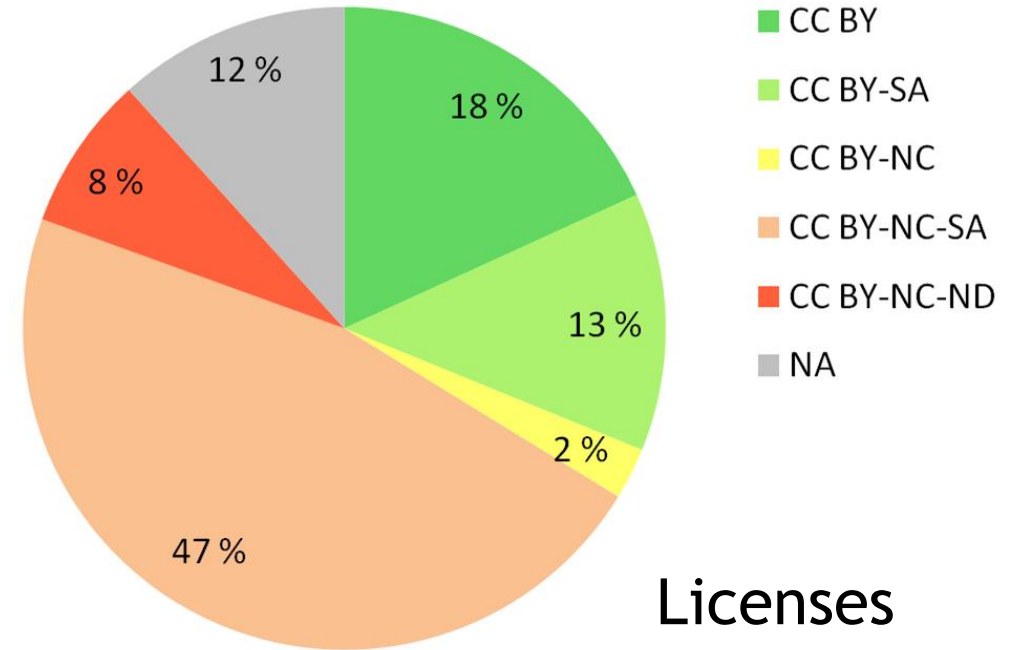


# EBRAINS Find data

HBP Knowledge Graph  
Highest FAIRness score



HBP Knowledge Graph  
Lowest FAIRness score



Licenses used in the HBP

License	CITATION REQUIRED	COMMERCIAL USE	MODIFY & ADAPT	CHANGE LICENSE
CC BY (default)	✓	✓	✓	✓
CC BY-SA	✓	✓	✓	✗
CC BY-ND	✓	✓	✗	✗
CC BY-NC	✓	✗	✓	✓
CC BY-NC-SA	✓	✗	✓	✗
CC BY-NC-ND	✓	✗	✗	✗

- ✓ You have to cite the original work.
- ✓ You can use the work commercially.
- ✓ You can modify and adapt the original work.
- ✓ You can choose a new license type for your adaptation of the work.

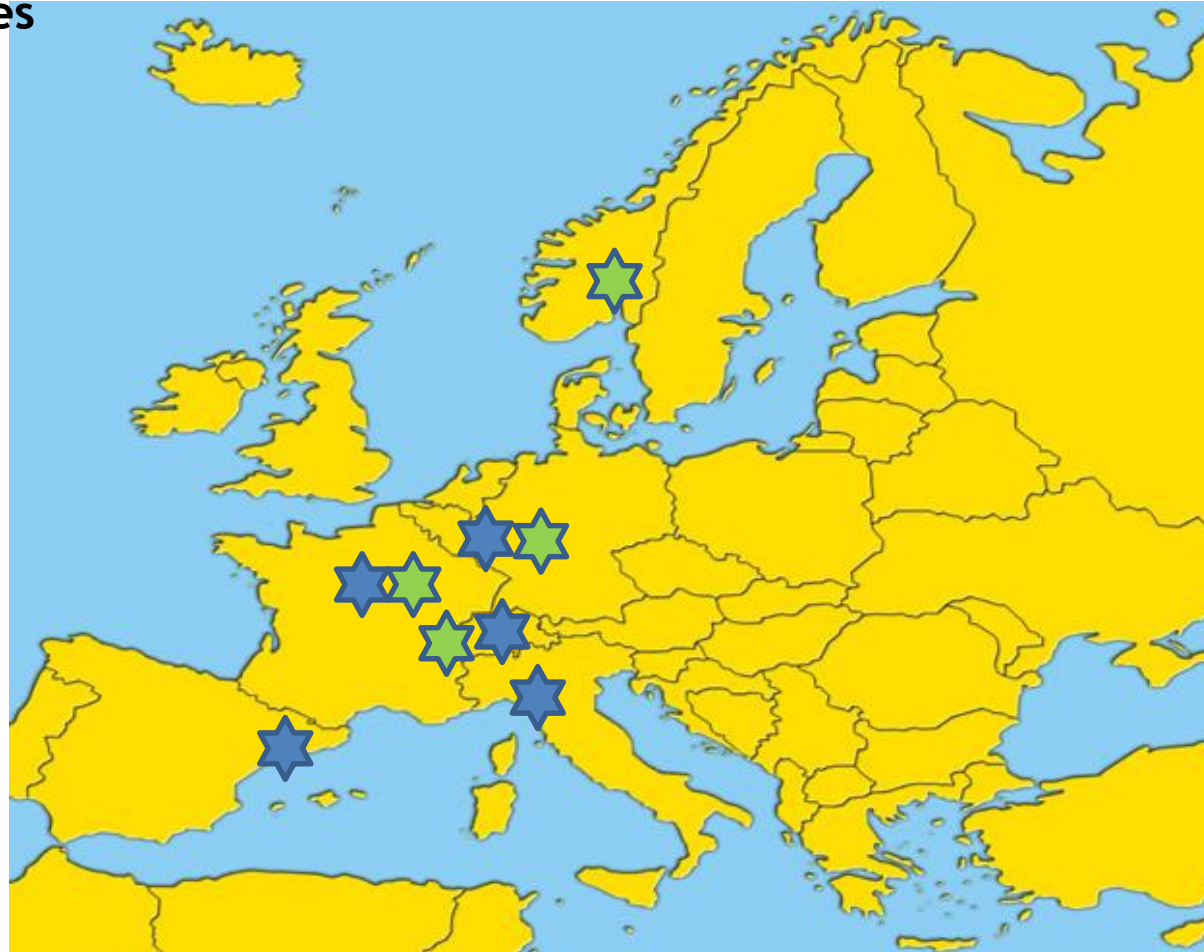
# HBP neurodata infrastructure

## ★ Curation and ontologies

UiO :

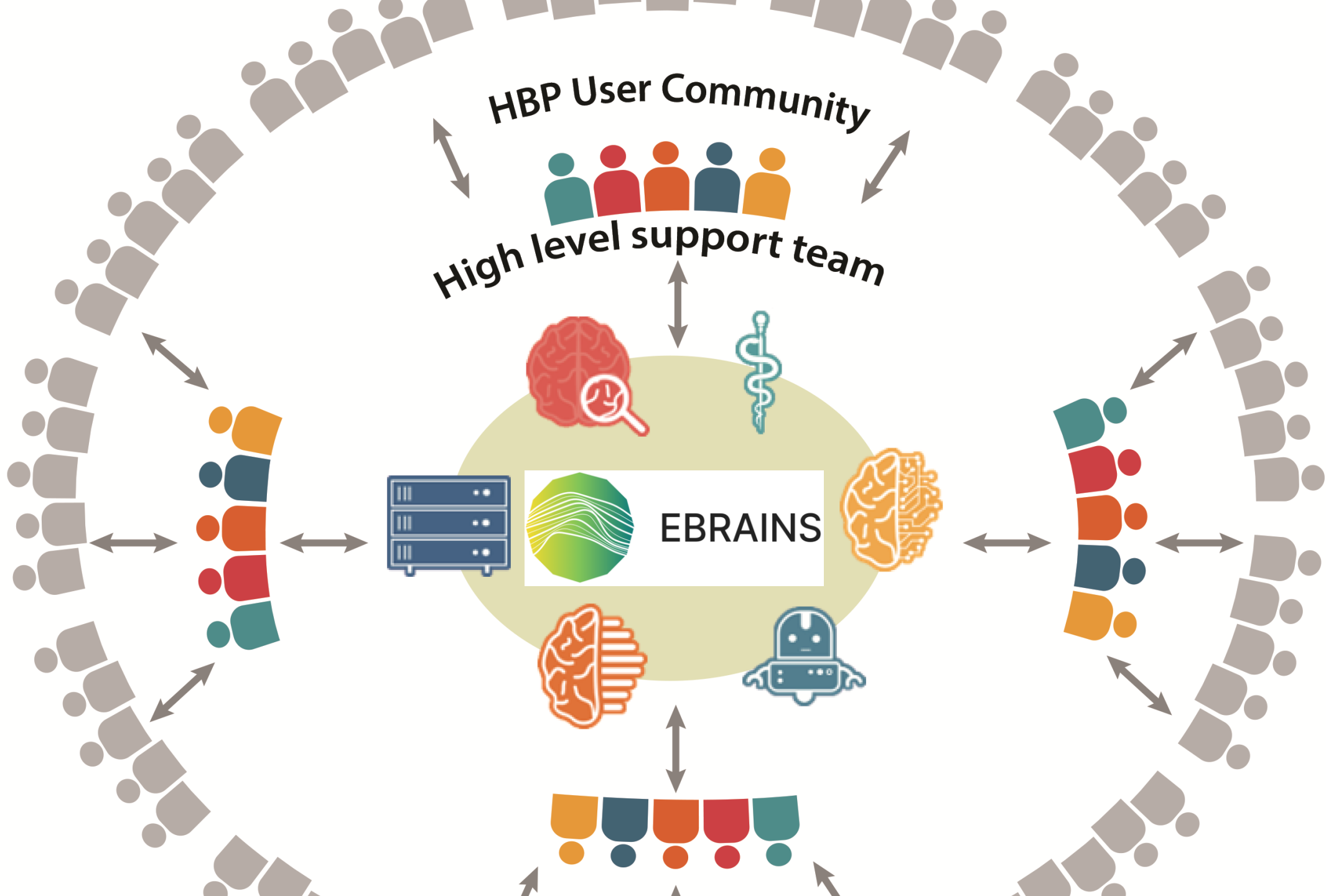


University of Oslo



## Storage and computing ★





# HBP Infrastructure Voucher Program

- **Openness measure** to attract new groups/projects to the HBP IT infrastructure
- **Calls** to invite external researcher to submit ideas and request HBP engineering solutions
- **Target groups:** academic & clinical research, pharma and industry

February 2019: 15 Voucher Projects funded

September 2019 (to be announced in February 2020)

.... more coming

# The Human Brain Project calls for projects to contribute to its research infrastructure - new calls updated

Currently 9 Open Calls  
Deadline December 2 - 11, 2019  
Funding available in each call: 450 - 1300 kEURO

# HBP Partnering Projects

- Currently 23 Partnering Projects contributing to the implementation of the HBP roadmap
- Primarily recruited through FLAG-ERA, a new funding mechanism gathering most regional and national funding organisations (NRFOs) in Europe with the goal of supporting the Future and Emerging Technologies (FET) Flagship concept and more specifically, the FET Flagship initiatives Graphene and Human Brain Project (HBP)



The screenshot displays the FLAG-ERA website interface. At the top right is the FLAG-ERA logo, which features a stylized sun and stars. Below the logo is a navigation menu with the following items: ABOUT, NEWS (highlighted in a yellow box), FLAG-ERA CALLS, FUNDED PROJECTS, HUMAN BRAIN PROJECT, and GRAPHENE FLAGSHIP. Below the navigation menu is a section titled "Highlights" with a sub-section "News". The "Highlights" section contains a news item titled "FLAG-ERA JTC 2019 evaluation first step: 65 pre-proposals selected" dated May 15, 2019. The "News" section contains two news items: "The HBP Research Infrastructure Voucher Programme Call 2019" dated 30 JUL and "Graphene Flagship Seeking Partners for Core 3 Project" dated 7 MAY. At the bottom of the page, there are logos for FLAGSHIP and the European Union.



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# Human Brain Project

# Thank You

[www.humanbrainproject.eu](http://www.humanbrainproject.eu)

 @HumanBrainProj

 Human Brain Project