

# Letter of Intent

## 1 Binding letter of intent as advance notification or non-binding letter of intent

<input checked="" type="checkbox"/>	Binding letter of intent (required as advance notification for proposals in 2020)
<input type="checkbox"/>	Non-binding letter of intent (anticipated submission in 2021)

## 2 Formal details

- *Planned name of the consortium*

**NFDI Neuroscience**

- *Acronym of the planned consortium*

**NFDI-Neuro**

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### 3 Objectives, work programme and research environment

- *Research area of the proposed consortium (according to the DFG classification system):*

206 Neurowissenschaften

- *Concise summary of the planned consortium's main objectives and task areas*

Neuroscience comprises highly specialized subdisciplines investigating the nervous system from molecular, cellular, systems, clinical, and computational perspectives. This wide scope results in a multi-faceted landscape of research approaches and a large variety of research data. Yet, the common goal is to develop a unified and systematic understanding of brain function in health and disease, and this requires integration of data and knowledge from the various subdisciplines. But integration and standardized representation of such heterogeneous data and metadata is a conceptual and logistic challenge that is as yet unaccounted for.

Addressing this challenge has broad implications for data acquisition and analysis, as it requires rigorous and comprehensive representation and annotation of research data. In neuroscience, research data is currently shared in a wide variety of formats, using a scattered landscape of services, partly restricted in access due to privacy regulations. This complicates the findability and re-use of valuable data resources for analysis, validation and aggregation of knowledge across studies. Explorative and comparative data analysis is currently hampered by the use of highly customized code that needs to be adapted to each particular use case, employing specific tools that are often not interoperable. Furthermore, computational models are essential for understanding the complex organization of brain function, but the heterogeneity and complexity of model descriptions matches that of experimental data and relating modelling outcomes to experimental findings is difficult to achieve without common representations.

To overcome these obstacles, it will be crucial to consider the entire data life cycle, implementing RDM measures already when data is acquired. NFDI Neuroscience will thus address in particular the situation in the neuroscientific laboratories, where acquisition and primary processing of the data happens and the decisive action for later re-usability of the data must be implemented by adhering to the FAIR principles. For this purpose, NFDI Neuroscience will build on existing solutions to establish a network of interoperable tools and services for efficiently managing the everyday research data workflows. To structure a process supporting community-driven co-design and wide adoption of standards, tools, and services, we propose four specific instruments:

- A **community-based information network** of users and infrastructure providers working together to bring solutions for FAIR and efficient data management to the labs and enable the scientists to utilize infrastructural services for their research and data sharing. This network will provide information, training, and platforms for exchange.
- A **network of experts**, who combine knowledge on methods and data types in neuroscience with knowledge on research data management methods. These *transfer teams* will act as contacts for users as well as for providers through low-barrier communication channels and will establish close connections with researchers and infrastructure institutions. They will proactively seek information, initiate interactions, organize training activities, establish necessary links to other NFDI consortia or inter-/national initiatives for collaboration on common solutions.

- A **network of work groups** where users and providers, community members, transfer teams, and members of other NFDI consortia collaborate to define standards and develop or improve solutions for research data management needs.
- **Dynamic support actions** to efficiently promote adoption and improvement of tools and services. These will enable implementation of community-proposed solutions for specific needs in implementing FAIR research data management.

To implement the proposed instruments in a community-driven process, **scientific task areas** will be focused on the data management needs of neuroscience subdomains. These will be complemented by a task area providing common tools and solutions required across all scientific areas. Task areas are associated with transfer teams that form a tightly interconnected network where developments, information and expertise are exchanged and utilized efficiently. **Common measures** shared by all transfer teams cover the interaction and support of researchers in each subdomain and the networking among transfer teams, with national and international institutions and initiatives, and on specific topics with other NFDI consortia. In addition, each transfer team drives forward **specific measures** identified for its subdomain aimed at NFDI Neuroscience's goal to increase adoption of research data management best practices in the community. Specific measures are developed with community participation and in exchange with other transfer teams, such that solutions emerge that are transferable and coherent across NFDI Neuroscience and in line with international standards. In addition, a **community and coordination task area** coordinates the process of community building, including training and consulting activities, annual meetings, and the communication of offers, services and outcomes of NFDI Neuroscience by implementing a community-spanning information network. It will coordinate the formation of new working groups and implement processes for allocating funds for dynamic support actions.

- *Brief description of the proposed use of existing infrastructures, tools and services that are essential in order to fulfil the planned consortium's objectives*

Emerging from various neuroinformatics initiatives, a number of tools already exist that address research data infrastructure needs such as data logistics (e.g. DataLad), metadata standards (e.g. NIDM, odML), dataformats and structures (e.g. BIDS, NIX, NWB), data representation (Neo), data analysis (e.g. Elephant, FieldTrip, Freesurfer, MNE), or simulation (e.g. NEST, Neuron, TVB). NFDI Neuroscience will be instrumental to improve the interoperability of these tools, and to raise awareness among neuroscientists.

In the context of the Bernstein Network Computational Neuroscience, domain-specific services have been established such as Simlab Neuroscience at the Jülich Supercomputing Center ([http://www.fz-juelich.de/ias/jsc/EN/Expertise/SimLab/slms\\_node.html](http://www.fz-juelich.de/ias/jsc/EN/Expertise/SimLab/slms_node.html)), supporting neuroscientists in using HPC infrastructure; the German Neuroinformatics Node (G-Node <http://www.g-node.org>), providing services and tools for research data management, sharing and publication; the Bernstein Coordination Site (BCOS <https://www.bernstein-network.de/de/das-netzwerk/Netzwerkpartner/BCOS>), providing information about and support for the activities of the computational neuroscience community in Germany.

At the international level, several large initiatives and consortia have formed that address infrastructure building and standards development in neuroscience, such as the INCF (<https://www.incf.org>), the Human Brain Project ( <https://www.humanbrainproject.eu>) with EBRAINS (<https://ebrains.eu>), and the Allen Brain Institute (<https://alleninstitute.org>). These initiatives and consortia are linked with emerging brain initiatives in the US

(<https://www.repronim.org>), Canada (<https://conp.ca>), Japan, China, and Australia, which already share basic technical interoperability with NFDI Neuroscience. Multiple platforms provide domain data hosting and sharing ([CRCNS.org](https://CRCNS.org), <https://GIN.g-node.org>, <https://OpenNeuro.org>), data analysis (<https://brainlife.io>, <http://www.cbrain.ca>), simulation (<http://www.OpenSourceBrain.org>, <https://www.nsgportal.org>), software ([Neuralensemble.org](https://Neuralensemble.org)), or training resources (<https://training.incf.org>). Members of the NFDI Neuroscience are already involved in or have well-established collaborations with these initiatives and projects, and are actively integrating and promoting these national and international efforts.

Besides solutions for domain-specific needs, neuroscientists will benefit from generic services, including services offered at the international level within the EOSC (<https://www.eosc-portal.eu>). NFDI Neuroscience will work to establish the necessary interfaces to community tools and the domain-specific services for efficiently utilizing these resources. For these purposes, NFDI Neuroscience will collaborate with other consortia where similarity of data structures suggests the development of common solutions, and with initiatives and consortia dedicated to providing generic services as well as international initiatives devoted to research data management, such as the Research Data Alliance (<https://www.rd-alliance.org/>) and GoFAIR (<https://www.go-fair.org/>).

- *Interfaces to other proposed NFDI consortia: brief description of existing agreements for collaboration and/or plans for future collaboration*

NFDI-Neuro will collaborate with NFDI4Health on sharing standardisation policies and processes including standards to comply with privacy regulations and ethics principles. In the field of neuroscience, both consortia aim to develop common (meta)-data, quality and record linkage standards and interfaces.

NFDI4Bioimage aims to provide generic and domain-spanning services for storage and management of light-based imaging data. NFDI-Neuro will utilize these resources for light microscopy data in neuroscience, and will collaborate with NFDI4Bioimage on developing and harmonizing metadata structures and ontologies.

NFDI-Neuro will coordinate with NFDI4Ing on topics such as common data formats for interfaces (e.g. in brain machine interfaces) and issues related to sensitive data, e.g. recorded sensor data.

DataPLANT and NFDI-Neuro are both highly focused on the needs of the users. We intend to collaborate on developing standards and services for improved data workflow management, and to interact on matters of governance, data publication, and training.

Since image data play an important part in both NFDI4Culture and NFDI-Neuro, we plan to cooperate in the standardization of image metadata and image formats as well as in the joint development of image analysis tools in the field of computer vision.

NFDI-Neuro plans to utilize the infrastructures for molecular data provided by GHGA, DeBioData and NFDI4Microbiota.

NFDI-Neuro plans to exchange with NFDI4Biodiversity and NFDI4Earth experiences and concepts regarding the integration of data from different scales, e.g. genes to ecosystems and cells to brain regions.

## 4 Cross-cutting topics

The majority of topics addressed in the Leipzig-Berlin Declaration on cross-cutting topics (<http://doi.org/10.5281/zenodo.3895208>) are relevant for NFDI Neuroscience. A severe challenge in neuroscience is the high degree of heterogeneity and complexity of datasets in terms of content and metadata. This variety requires detailed descriptions of the data acquisition to be recorded in an understandable and standardized manner to enable re-use of the data. To enhance compliance with such requirements, NFDI Neuroscience will develop and adopt practical methods to assess **data quality**. To achieve interoperability, NFDI Neuroscience will employ a common, version-controlled, domain-agnostic **data structure**, an approach that can also be utilized in other fields beyond neuroscience. The complexity of the data and metadata acquisition process makes extensive planning of the workflow a necessity. Therefore, development of guidelines and tools to provide meaningful **data management plans** that practically assist scientists in setting up these workflows are an important topic for NFDI Neuroscience. In addition to a sufficient level of description, aspects related to **data publication** provide important points of cross-cutting collaboration, like the description of datasets that must include spatial anchoring in coordinate systems (e.g. for brain atlases) such that relationships between datasets can be performed based on brain location, or the establishment of self-describing file and database formats to enable easy browsing of both structural and dynamical data for viewers across disciplines.

Human brain data are personal data and therefore need **data protection** according to the General Data Protection Regulations (GDPR). NFDI Neuroscience will address the need for GDPR conform infrastructures that offer “data protection by design” – yet nevertheless maintain autonomy with respect to how authorized scientists can process their data.

Finally, NFDI Neuroscience shares the need to develop useful **training and support** paradigms to foster the adoption of RDM solutions in the community.

NFDI Neuroscience will contribute to all of these topics with expertise originating from solutions that have been or will be developed in the field. Alignment and collaborations with other NFDI consortia and cross-cutting initiatives will be pursued in developments with cross-discipline relevance, including data protection, generic self-describing file formats, portable versioned data storage solutions, cross-discipline standards for computational model descriptions, and joint definition and coordination of a growing list of metadata schemas and ontologies.