

Letter of Intent for the NFDI

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

[Please indicate clearly whether your document is a binding letter of intent as advance notification or a non-binding letter of intent.]

<input type="checkbox"/>	Binding letter of intent (required as advance notification for proposals in 2019)
<input type="checkbox"/>	Non-binding letter of intent (anticipated submission in 2020)
<input checked="" type="checkbox"/>	Non-binding letter of intent (anticipated submission in 2021)

2 Formal details

- Planned name of the consortium:
NFDI4 Biological Imaging and Medical Photonics
- Acronym of the planned consortium:
NFDI4BIMP
- Applicant institution
Universität Konstanz, Universitätstrasse 10, 78464 Konstanz
Head: Prof. Dr. Kerstin Kriegelstein
- Spokesperson
Prof. Dr. Elisa May, Universität Konstanz, elisa.may@uni-konstanz.de

3 Objectives, work programme and research environment

- Research area of the proposed consortium (according to the DFG classification system)
Biology: 201, 202, 203, 204, 206; Medicine: 204, 206; Chemistry: 304; Physics: 308

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

The main objective of NFDI4 Biological Imaging and Medical Photonics (NFDI4BIMP) is to become the national reference entity for FAIR management of image data across research disciplines within the NFDI. NFDI4BIMP is a joint initiative of German BioImaging Gesellschaft für Mikroskopie und Bildanalyse e.V. (GerBI-GMB) and the NFDI4Medical Photonics consortium of the Leibniz Research Alliance "Health Technologies". GerBI-GMB unites the majority of biological and biomedical imaging core facilities at German research institutions in a well-organised and very active network. GerBI-GMB core facilities have very close interactions with a large number of microscopy research groups and provide access to and expertise in imaging technologies to several thousands of life science researchers every day. The NFDI4Medical Photonics consortium of the Leibniz Research Alliance "Health technologies" represents photonic research groups, photonic data science groups, and research groups which apply photonic methods in combination with data science to biomedical research questions. Thus, the NFDI4BIMP has a comprehensive overview of the data management scenarios and requirements of the bioimaging and photonics communities. It is in an excellent position to develop strategies and workflows, as well as implement, test and provide tools and processes for the proper management of research image data according to the FAIR principles to a large community of researchers. It will cover, in the first instance, data from biology, the life sciences and photonics-based medical diagnostics, but will also strive to create image-data related resources and services that are valuable for the whole NFDI. Building upon already existing close links to international activities in this area, NFDI4BIMP aims also at becoming a gateway for German researchers to access and use open repositories for image data which are being created at the European level, in the first place the BioImage Archive hosted

at EMBL-EBI and launched on July, 2nd¹, as well as further pertinent international repositories. NFDI4BIMP will also ensure interoperability of these archives with eventual national or local solutions for long-term image data storage.

To achieve these objectives, the consortium will address the following main task areas:

- Define, implement and distribute standards and calibration tools for image data acquisition for improved data quality, comparability and reproducibility in different scientific areas.
- Identify suitable schemes for the accurate and exhaustive description of image data and the respective metadata, and promote their usage by the scientific community.
- Extend and promote the usage of database systems based on image data models in combination with data structuring ontologies.
- Identify and address the need for interfaces between different image data management systems, between different data models and file formats used in the imaging community to enable interoperability and collaboration.
- Support the development of linkages between open source software for image data analysis and image data management platforms. Promote the proper documentation and publication of data analysis workflows.
- Uphold openness for other (non-image) data types by developing e.g., interfaces to data bases for other data types, in order to foster the combination and integration of knowledge from different disciplines and methodological approaches.
- Consolidate and expand the links to international and in particular European endeavours aimed at the FAIR management of image data to foster synergies and avoid the duplication of efforts. Ensure communication and compatibility between national and international image data management solutions.
- Promote awareness for the necessity of FAIR data management plans and of resources for image data in the scientific community and create extensive education and training opportunities.
- Promote the inclusion of commercial providers of microscopy and photonics equipment in the processes for the development of FAIR image data management.

¹ <https://www.ebi.ac.uk/about/news/press-releases/bioimage-archive-launch>

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

The NFDI4BIMP consortium builds upon GerBI-GMB, a network of 45 imaging core facilities across Germany which, over the last 10 years, have practiced an intense and lively exchange of knowledge and expertise on all topics of biological imaging. The network has conceived and realized novel training formats for imaging scientists such as Job Shadowing and Facility Management Courses and has substantial experience in the organisation of scientific events. NFDI4BIMP will furthermore capitalize on the links and interactions developed during the preparation of two concepts for the German Roadmap for Research Infrastructures 2015 for which a decision by German Ministry for Research and Education is still pending: the German BioImaging Research Infrastructure (GerBI-RI) and the Leibniz Center for Photonics in Infections Research (LPI). The GerBI-RI proposal, in particular, envisioned the creation of a “virtual” node for the coordinated development and distribution of algorithms and tools for the processing and evaluation of large image data. This concept goes hand in hand with the aims of NFDI4BIMP.

In addition, a number of imaging facilities within GerBI-GMB has started the implementation of image data management plans mainly based on the open source image database tool OMERO, which is provided and supported by the Open Microscopy Environment (OME) community.

GerBI-GMB is also in contact with Euro-BioImaging, the European Research Infrastructure for imaging technologies in the biological and biomedical sciences. Euro-BioImaging will provide access to image data repositories and analysis tools in collaboration with EMBL-EBI, which will also be the hosting institution of the planned Bioimage Archive, an integrated public repository for bioimage data. EMBL-EBI also hosts the Image Data Resource (IDR), an added-value image database which links data from several imaging modalities with public genetic or chemical databases and cell and tissue phenotypes expressed using controlled ontologies. These data infrastructures will greatly enhance data sharing and reanalysis by the scientific community.

Ahead of the NFDI4BIMP proposal for the NFDI, we intend to submit shortly a proposal for the DFG funding program “Information Infrastructures for Research Data”. Main task for this project will be to consolidate developments and initiatives for image data management that have recently started at individual research groups, institutes and core facilities but are not yet well coordinated and visible. We will

begin working towards the goals of the NFDI4BIMP on a smaller scale engaging a subgroup of imaging core facilities and research groups who are farther in the implementation of data management processes and thus provide proof-of-principles for a larger consortium. By these means, we will create a structure which can act as a seed for the future NFDI4BIMP and will grow by including new members as they proceed with their FAIR data management plans.

Importantly, we see ourselves as a methodological and thus “transversal” consortium within the NFDI spanning across a wide range of disciplines. At this time point, we do not see any obvious avenue for integration or fusion of such a methodological consortium for image data with one or a few disciplinary consortia that would result in a larger “vertical” consortium with a coherent scope. By setting up an infrastructure for image data management while the first disciplinary NFDI consortia are launched, we hope to trigger connections between them and the future NFDI4BIMP from day one of the NFDI, with the long-term goal to become integrated in all consortia dealing with image or image-related data.

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

The envisaged NFDI4BIMP is a merger of the initially proposed German-BioImaging Microscopy Data Consortium and the NFDI4Medical Photonics consortium (see corresponding extended abstracts submitted to the 1st NFDI Conference) making the expertise of imaging core facilities in data management utilizable for imaging research groups and providing a larger user community.

Other proposed NFDI consortia with synergetic possibilities are the following:

DataPlant aims to provide the research data management practices, tools, and infrastructure to enable collaborative research in fundamental plant research. In collaboration with this consortium we plan to develop protocols to ensure integration of imaging data into data-centric workflows, which will be provided by the DataPLANT consortium.

DeBioData is a consortium for pre-clinical research data with a focus on drug discovery. The aim is a resource for the integrated access to pre-clinical data generated through a wide spectrum of methodologies, including imaging at the cellular, tissue and small animal level. For imaging data, we will collaborate on interfaces enabling data exchange and data integration in the domain-specific databases.

NFDI4AIRR: A consortium for data describing the Adaptive Immune Receptor Repertoire will rely among others also on imaging data, for which NFDI4BIMP can provide resources and tools.

NFDI-Neuro: Image data are one of the pillars of modern neuroscience. This discipline has been driving the development of optical imaging technologies via its very demanding applications in terms of temporal resolution and spatial scalability. NFDI4BIMP and NFDI-Neuro will collaborate for developing image data management solutions, including harmonized metadata structures and ontologies that foster comparability and provide a robust data basis for neuroinformatic approaches.

NFDI4Biobanks: Interaction with this consortium will aim at developing a shared framework for biomaterials-related image data enabling sharing of data among members of the biobank consortium and beyond, and contributing to increase the quality of the services offered.

NFDI4Biodiversity gathers very heterogenous types of data, including image data, aimed at the covering the whole diversity of the ecosystem. NFDI4BIMP may provide tools and services for the management of biodiversity-related image data favouring the processes of data integration and improving data quality in this particular domain.

NFDI4Chem is a consortium for all chemistry data including spectral data, like spectroscopic and spectrometric data. Synergies between the NFDI4Chem and the NFDI4BIMP might exist for spectral and spectrometric imaging data along with 'pure' image data like atomic force microscopic (AFM) imaging data.

These are the consortia with whom NFDI4BIMP has exchanged information during the NFDI conference and the preparation of this Lol. As mentioned above, aiming at a transversal consortium, we envisage the possibility of collaboration with any consortium in the NFDI wishing to develop and implement management of image data according to FAIR principles.

Please identify cross-cutting topics that are relevant for your consortium and that need to be designed and developed by several or all NFDI consortia. Cross-cutting topics of relevance for NFDI4BIMP will be: Standardization; Data quality and metadata; Interoperability and Transfer; Software and Interfaces; Education and Training; Governance; Careers.

- *Please indicate which of these cross-cutting topics your consortium could contribute to and how.*

NFDI4BIMP may contribute to all abovementioned cross-cutting topics by capitalizing on previous and current work by the network GerBI-GMB² and work of the members of the Leibniz Research Alliance “Health Technologies”.

Standardization: A large part of the researchers of the Leibniz Research Alliance “Health Technologies” was engaged in ring trials and workshops at the EU scale aiming at the standardization of bio-photonic imaging data. Therefore we can contribute our related expertise on standardization, data quality and metadata to the NFDI as a whole.

Data quality and metadata: A comparison of data sources is important to generate standardized data bases and repositories. This can only be achieved if an open data format like the OME (open microscopy environment) data model for imaging data exists and is well accepted within the community, and standard operation procedures (SOP) are developed ensuring the comparability of experimental results and its digital representation. To allow for more flexibility to represent all required metadata an extended version of the OME data model is under discussion in the international OME community. GerBI-GMB is already taking part in this process.

Interoperability and Transfer: By ensuring the comparability of image data acquired between different laboratories and by introducing and further developing an open data format, the interoperability and transfer of the images are ensured. In a next step, this also allows for data mining and the use of data intensive machine learning methods as the overall size of a dataset would increase due to merging possibilities. Therefore, NFDI4BIMP aims to develop standard operation workflows for the exchange and transfer of imaging data in information infrastructures.

Software and Interfaces: Some GerBI-GMB core facilities are already starting to utilize electronic lab-notebooks (ELN) together with image databases on an open source basis. Building on these preliminary tests software and interfaces between ELN and the image data bases will be generated, taking the requirements of a variety of researchers within GerBI-GMB and Leibniz Research Alliance “Leibniz Health Technologies” into account. The open source image database tool OMERO, representing at the moment the most frequently used tool in imaging core facilities and also research groups, is now being evaluated for its potential to integrate other

²Ferrando-May et al. Advanced light microscopy core facilities: Balancing service, science and career. *Microsc Res Tech.* 2016 79:463-79

data types or, alternatively provide interfaces or adaptors for linking different data types for interoperability.

Education and Training: Within the workgroup “Training” of GerBI-GMB we are continuously developing novel educational and training formats for imaging scientists in particular in the context of infrastructures like core facilities (Job Shadowing, Core Facility Management Course, GerBI-GMB Microscopy Spring School). For establishing training opportunities we will also exploit our connections to NEUBIAS, the very successful Network of European Bioimage Analysts, a COST action in Horizon 2020, in which members of the GerBI-GMB Workgroup Training are actively participating and which has a focus on the development and dissemination of bioimage analysis tools and on training of life scientists in image informatics. Beside these training efforts Raman4Clinics and its planned successor Raman4Pathology are further educational active COST actions in the field of medical photonics.

Governance: On the one hand, we can build upon the governance structure that was conceived for the German Biolmaging Research Infrastructure which accounted for the participation of about 20 different German partner institutions and included also the biological imaging user community at large as represented by GerBI-GMB. Furthermore, with the foundation of GerBI-GMB e.V. we have established and gained experience with a governance structure that values strong participation and representation of all members and also includes representatives from commercial enterprises in the decision making process.

Careers: GerBI-GMB has been very active in the past years in the area of career paths for infrastructure providers, in particular core facility leaders. In 2013/2014, we engaged in a dialogue with the German Council for the Science and Humanities concerning the formulation of the “Recommendation for Career Goals and Paths at Universities”. GerBI-GMB has been involved in discussions with DFG about the critical importance of providing sustainable funding for personnel at University core facilities. There are also ongoing discussions on this topic with international infrastructure associations (Core Technologies in Life Sciences CTLS, Bioimage North America, BINA). NFDI4BIMP will also take advantage of the high awareness for the career prospects and the professional education of researcher in the Leibniz Association, which has published the “Career Guidelines for the Leibniz Association” and has implemented a strong career development program for young researchers.