

## Outline of the consortium

Biological imaging and photonics are key enabling technologies for the life and biomedical sciences as they are uniquely capable of capturing the spatiotemporal complexity of the living matter. Thanks to technological innovations driven by fundamental discoveries in physics and chemistry, bioimaging today is a big-data, quantitative discipline delivering insights into biological systems from the organismal to the molecular level. NFDI4BIOIMAGE will address the data management aspects of bioimaging, biophotonics. The initiative has a multidisciplinary scientific scope and will engage with many different research areas, including biology (cellular, molecular, developmental, environmental, neuro-, etc.), physics (applied optics and photonics), chemistry (spectroscopy, biomaterial science) and computer science (bioimage informatics).

The vision that drives this initiative is a culture of sharing and re-using bioimage data as common practice in any research project, similarly to how scientists nowadays readily exchange experimental protocols and materials. To this end, NFDI4BIOIMAGE will strive to provide scientists from all natural science and biomedical research fields with workable and trusted solutions to handle the ever-increasing amount of bioimage data according to the FAIR principles. These require data to be Findable, Accessible, Interoperable, and Re-Usable. We will support this aim by developing standards and tools for bioimage data management. Increasing data accessibility and re-usability will advance bioimage informatics, the scientific discipline devoted to quantitative analysis and software-aided knowledge extraction from bioimage data. It will also promote the productive integration of bioimaging data with other -omics datasets from the life and biomedical sciences. Finally, NFDI4BIOIMAGE understands itself as part of a broader international effort to make bioimage data openly available to and explorable by the whole scientific community, independently of the specific discipline. The field of genomics has showcased the impact of this type of effort on scientific and societal progress. Unfolding the full potential of bioimaging and biophotonics by establishing a state-of-the-art, high-quality bioimage data management ecosystem holds similar if not higher promises and is the central mission of NFDI4BIOIMAGE.

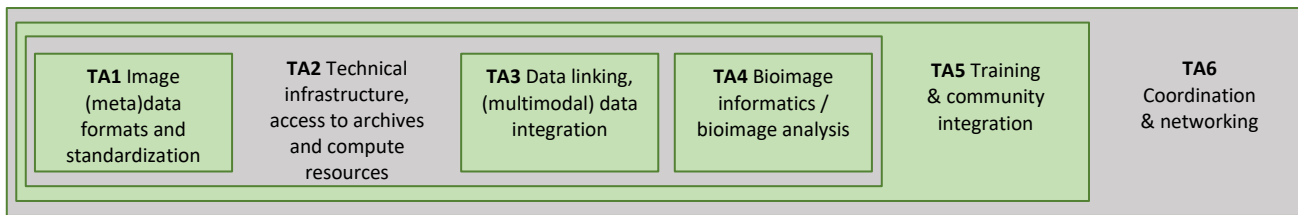
### Objectives and Task Areas (in progress)

To achieve the aims mentioned above, NFDI4BIOIMAGE will realize the following objectives:

- **Standardization:** data acquisition, metadata, file formats, (meta)data models, ontologies, annotation tools, data provenance (TA1)
- **Storage concepts and cloud environments:** access and submission requirements, capacity, long-term vs. short-term, distributed vs. centralized, data flows in the cloud (TA2)
- **Data integration:** combination with -omics data and other discipline-specific data types, integrative dataset queries, interoperability, interfaces (TA3)
- **Bioimage informatics tool development:** bioimage analysis, automated AI-based bioimage analysis pipelines, workflow management and reproducibility, interoperability of analysis tools, statistics, and modeling (TA4)
- **Education:** training, workshops, online tools, open educational formats (TA5)
- **Networking:** international harmonization, knowledge exchange, connection to other NFDI consortia and non-NFDI RDM-initiatives (TA5/6)

The objectives are allocated to task groups that will focus on the respective task areas while also working together on overarching topics. NFDI4BIOIMAGE will also contribute to more generic, cross-cutting issues relevant for all NFDI consortia.

## Consortium composition



### Task Area Structure of the NFDI4BIOIMAGE initiative – 6 Task Areas (TA)

The NFDI4BIOIMAGE consortium is composed of scientists who are leading experts in the relevant topics, i.e., file formats and standards for bioimage data and metadata; machine learning-based tools for bioimage analysis; construction and provision of infrastructure for archiving bioimage data; linking bioimage data and other -omics data types; imaging technology development, and more. Importantly, NFDI4BIOIMAGE is grounded in a well-organized network of >70 imaging core facilities spread at research institutions across Germany. These local infrastructures, represented by German Biolmaging e.V., anchor NFDI4BIOIMAGE to the community of users and represent a powerful distribution grid for the services of the larger data infrastructure.

### *Applicant and Co-Applicant institutions*

Universities: University of Düsseldorf, University of Freiburg, University of Konstanz, TU Dresden, University of Osnabrück, University of Münster  
Leibniz: Institute for Natural Product Research and Infection Biology Jena, Institute for Neurobiology Magdeburg  
Helmholtz: German Cancer Research Center  
European Molecular Biology Laboratory Heidelberg, German Biolmaging

### *Participating institutions and partners*

Universities: University of Freiburg, Leipzig University - ICCAS Leipzig, University of Duisburg-Essen, University of Mainz, University of Cologne, Heidelberg University, TU Dortmund University, University of Göttingen  
Leibniz: Institute for Photonic Technologies Jena, Institute for Plasma Science and Technology Greifswald, Institut für Analytische Wissenschaften ISAS Dortmund  
Helmholtz: Center for Environmental Research Leipzig, Forschungszentrum Jülich  
Others: Global Biolmaging, Euro-Biolmaging

## Services planned

The service portfolio will be defined to match the users' needs as assessed via surveys and open communication. It will be continuously adapted to evolving community demands. The services of NFDI4BIOIMAGE are the main output of the work performed in the task areas. NFDI4BIOIMAGE will set up a web portal to aggregate and distribute information, knowledge, and tools for bioimage data management. Items include (not exhaustive):

- Easy to navigate overview about bioimage data management, and related links and tools
- Collaborative work-space for the participants
- State-of-the-art guidelines and tools for image data annotation
- Guidelines and templates for data management plans and electronic lab notebook use
- Guidelines for submitting datasets to trusted repositories/archives, including a collection thereof
- Downloadable & cloud-based software tools, instructions for performing data management tasks

Where necessary, a team of trained Data Stewards will support deployment of the developed tools. These are bioimaging-specialists, hired and commissioned by the consortium to deliver project-based support or train local data stewards and scientists involved in bioimage data management.

## Implementation of the FAIR principles and data quality assurance (in keywords)

**Findable:** TA1 Metadata standards and (meta)data quality; TA3 data linking  
**Accessible:** TA2 Open repositories; TA1/TA4 cloud-ready file formats and analysis tools  
**Interoperable:** TA3 Data integration and TA4 Bioimage Informatics  
**Re-usable:** TA1 Standardization of data and file formats; TA2 Accessibility; TA4 Interoperability of analysis tools; TA5 Education and training; Cross-Cutting topic: Licensing and persistent identification

### National Research Data Infrastructure (NFDI)

<https://www.nfdi.de/>

- **Network of discipline-specific and/or method-centric consortia** facilitating research data management standards according to the FAIR principles
- **Up to 30 consortia** in the expansion stage (from 2022), established in three rounds of applications (2019-2021) → last call in 2021!
- Joint Federal Government-Länder funding program: **70 Mio € / year** (+ overheads) overall, two funding periods of 5 years each
- Roles of institutions (and persons) within a consortium:
  - one **applicant institution** (Speaker, budget administration, reporting, own *in-kind* contrib.)
  - flexible number of **co-applicant institutions** (Co-speakers, significant responsibility for a work program part, own *in-kind* contribution, eligible for funding received from applicant)
  - flexible number of **participating Institutions** or persons (involved on a sustained basis in discrete project parts, e.g., as use cases, no direct funding eligibility)
- Strong cross-disciplinary collaboration with other consortia, strong international networking

### NFDI4BIOIMAGE initiative

<https://nfdi4bioimage.de>

- *Method-centric* for **biological/biomedical imaging (microscopy)**, and *discipline-specific* for **bioimage informatics (bioimage analysis)**
- Multidisciplinary scope, engaging with many different research areas: mainly **biology & biomedicine** (cellular-, molecular-, developmental-, environmental-, neuro-, immunobiology, etc.) with a strong connection to physics (applied optics/photonics), chemistry (spectroscopy, staining methods, etc.) and biomaterial science
- Involved institutions (as of July 2021):

#### Applicant & Co-Applicants:

- Heinrich Heine University Düsseldorf (spokesperson: Stefanie Weidtkamp-Peters), German Cancer Research Center Heidelberg (Jan-Philipp Malm), University of Konstanz (Elisa May), University of Osnabrück (Susanne Kunis), German BioImaging (S. Weidtkamp-Peters), Technical University Dresden (Robert Haase), Leibniz Institute for Natural Product Research and Infection Biology Jena (Marc Thilo Figge), Leibniz Institute for Neurobiology Magdeburg (Werner Zuschratter), EMBL Heidelberg (Anna Kreshuk), University of Münster (Thomas Zobel, Markus Blank-Burian), University of Freiburg (Björn Grüning)

#### Participants/Partners:

- Forschungszentrum Jülich, Helmholtz-Center for Environmental Research Leipzig, Leibniz Institute for Plasma Science and Technology Greifswald, University of Mainz, University of Cologne, Heidelberg University, TU Dortmund University, University of Duisburg-Essen, University of Göttingen, Leipzig University Medical Faculty, Leibniz Institute for Photonic Technologies Jena, Leibniz ISAS Dortmund, Open Microscopy Environment Consortium at University of Dundee, Global BioImaging, Euro-BioImaging
- Intended funding requests: about **2.3 Mio € / year** (plus overheads)

#### Time Schedule

- Winter-term: Peer-review with oral presentation and feedback, funding decision: Nov 2022

### Why participate and how?

- Gain visibility within the large national and international community of bioimaging users, leveraging the networks of German BioImaging, Euro-BioImaging and Global BioImaging.
- Shape the research data management landscape in Germany.
- Informal participation as “community use case” is highly welcome!