National Research Data Infrastructure for Microscopy, Biophotonics and Image Analysis

Stefanie Weidtkamp-Peters (spokesperson)
Heinrich-Heine-Universität Düsseldorf
stefanie.weidtkamp-peters@hhu.de

This presentation will be published under CC-BY 4.0 license https://creativecommons.org/licenses/by/4.0/, author: S. Weidtkamp-Peters, HHU Düsseldorf. Excluded from this license are cited logos and parts explicitly marked otherwise.
Imaging core facility e.g., CAi @ HHU Düsseldorf

• ...where image data management starts

Microscopy room 1  Technical room  Microscopy room 2
The typical Image Data Workflow?

- **Integration** in discipline specific environments

- **Integration** in local IT infrastructure

Electronic lab notebooks
Lab management systems

Data storage

Local long-term storage/archive

Metadata annotations

Image acquisition

Network

Electronic lab notebooks
Lab management systems

Image data management

Remote access

Desktop/remote/HPC

Process & Analyse

Explore, collaborate, share

Publish

Repositories

Biolmage Archive (BIA)

“Added Value” data bases

EMPIAR

Image Data Resource

Automated analysis tools

Electronic lab notebooks
Lab management systems

Galaxy: [https://galaxyproject.eu/](https://galaxyproject.eu/)

EMPIAR: [https://www.ebi.ac.uk/pdbe/emdb/empiar/](https://www.ebi.ac.uk/pdbe/emdb/empiar/)

BIAflows: [https://doi.org/10.1016/j.patter.2020.100040](https://doi.org/10.1016/j.patter.2020.100040)
• Input from the Bioimaging Community: Thank you to all of you!!

• Which platforms for (image-) data management are already in use?

• even OMERO is used only by less than 25% of the researchers
**Bioimaging Data**

**Biological image data / (Light-)microscopy:**
- heterogeneous, proprietary formats (*Bio-Formats* OME-TIFF)
- multi-dimensional (5-D -> N-D), „large & big“ (GB – TB)
- no sufficient cloud compatibility (e.g., object storage)
- no standardized metadata schemes and formats

**Aims - Data & Metadata:**
- open, internationally accepted, industry supported *next-generation file formats* (NGFF)
- quality criteria from image acquisition to analysis and archiving (*reproducibility / re-usability*)
- metadata schemes & –formats and annotation tools (*findability / interoperability*)

→ Need for a dedicated consortium for bioimaging data

**NFDI4BIOIMAGE**
Research Area: Bioimage Informatics

Image analysis is a central part of bioimaging

- very dynamic research area
- heterogeneous behavior of users:
  - from manual analysis to automated high-content AI-analysis
  - always time-consuming
- proprietary and open-source software tools
- no widely accepted RDM standards for image analysis and processing

Aims:

- better access to analysis tools, establish RDM standards
- increase reproducibility & data provenance of analysis workflows

Mark in which steps of using your most important method you are involved:

Which of these steps is the most time consuming for you?

15.07.2021
NFDI4BIOIMAGE Community Meeting
**Roadmap of the BioImaging Community to NFDI**

**Biol imaging Community**

- **2017**
  - RDM4mic
  - OMERO

- **2019**
  - "Research Data Management for Microscopy"
  - [Website](https://german-bioimaging.github.io/RDM4mic.github.io/)

**NFDI round 3**

- **2020**
  - AG "Image Data Analysis and Management"
  - LoI 1. NFDI Conference

**Information Infrastructure for BioImage Data (I3D:bio)**

- Small project (3.5 FTE)
- 4 Co-applicants
- OMERO centric

**Integrative FAIR Image Data Management**

- [Website](https://german-bioimaging.github.io/RDM4mic.github.io/)
The NFDI4BIOIMAGE Team

- Our co-applicants are members of the following institutions:
In 2017 GerBI-GMB e.V. has emerged as the successor of the DFG funded network *German BioImaging*

- Network of *Imaging Core Facilities* and research groups in Germany
  - GerBI represents:
    - > 5000 users of microscope systems *Imaging Core Facilities*
    - researchers from all disciplines in natural sciences: biology, physics, chemistry, medicine etc.

- Active in image analysis and management since 2013 (working group “*Image Data Analysis and Management*”)

- 2019 of the **OMERO**-user group *RDM4mic*
• **TA1:** Susanne Kunis, University of Osnabrück & Josh Moore, OME Team, GerBI

• **TA2:** Markus Blank-Burian, University of Münster & Björn Grüning, University of Freiburg

• **TA3:** Pavol Bauer, LIN Magdeburg & Philipp Mallm, DKFZ Heidelberg

• **TA4:** Marc Thilo Figge, HKI Jena & Anna Kreshuk, EMBL Heidelberg

• **TA5:** Robert Haase, TU Dresden & Thomas Zobel, University of Münster

• **TA6:** Elisa May, Uni Konstanz/ DKFZ Heidelberg & Stefanie Weidtkamp-Peters, University of Düsseldorf
NFDI4BIOIMAGE – Task Areas to do

- **TA1, TA3, TA4:** the (bioimage) data and metadata workpackages
- **TA2:** technical challenges
- **TA5:** focussing on
  - networking with the scientific community: new integrative structures
  - training, education & workshops
- **TA6:** coordination, governance, national & international networks

15.07.2021
Integration into the NFDI initiative (TA 6)

- Exchange with discipline-specific consortia
- Identify synergies, avoid redundancies
- Overarching topics
  - access management
  - metadata formats / Linked Open Data
  - FAIR Digital Objects
  - legal aspects of data use, licensing, GDPR, etc.
  - perspective for sustainable structures (sustainable funding models)
  - development of new job profiles
  - etc.
Collaboration with other consortia

- GHGA
- DataPLANT
- NFDI4Biodiversity
- NFDI4Microbiota
- NFDI4Health

- NFDI-Neuro
- NFDI4Immuno
- NFDI4Phys
- NFDI4Patho
- NFDI4Chem
- DeBioData

Further possible collaborators:
- NFDI4Earth
- NFDI4DataScience
- NDFIxCS
- InnoMatSafety
- NFDI-MatWerk
- METHODS
- 2linkNFDI
- Metadata-Tools4NFDI

Connectivity, collaboration, interfaces to related data types from medical imaging (DICOM, XNAT-platform etc.)

Spatial transcriptomics

Interoperability ARC – OMERO – MDE

Quality criteria physical image generation

Integration of plasma technology data and spectroscopy data

eetc..
National & International Partners (TA 6)

- RDM4Mic Gruppe
- QUAREP-LiMi
- OME-Team
- EMBL-EBI
- Global BioImaging
- Euro-BioImaging
- BioImaging North America
- 4D Nucleome Project
- Flamingo Project
- NEUBIAS
- Australian Characterisation Commons at Scale
Establishment of a bioimaging research data infrastructure

• for all users of Imaging Core Facilities and CF staff scientists
• for researchers using home-built equipment or mobile (partly remote-controlled) microscopy systems
• for infrastructure providers - image data specific requirements in the area of IT
• for RDM staff in Germany and beyond
• as "IT-Labspace/ sandbox" for the establishment of new RDM concepts for biological image data

Collaborations within the NFDI

• Development and provision of image data management for consortia (especially in natural sciences and medicine)
• Next-generation file formats as overarching topic
• Connection to other databases / multimodal linking of data types (TA3)
• Strategic integration of Core Facilities into the NFDI
Thank you for your attention

Co-applicants
Elisa May (DKFZ, Heidelberg / Uni KN)
Anna Kreshuk (EMBL, Heidelberg)
Marc Thilo Figge (Leibniz HKI, Jena)
Robert Haase (TU Dresden)
Thomas Zobel (WWU Münster)
Björn Grüning (Uni Freiburg)
Pavol Bauer (LIN Magdeburg)
Susanne Kunis (Uni Osnabrück)
Josh Moore (German BioImaging)
Markus Blank-Burian (WWU Münster)
Jan-Philipp Mallm (DKFZ Heidelberg)

Contributions to the NFDI4BIOIMAGE initiative
Antje Keppler, Aastha Mathur (EMBL, Euro-BioImaging, Global BioImaging)
Christian Tischer (EMBL Heidelberg)
Dirk v. Suchodoletz (Uni Freiburg, DataPLANT)
Thomas Bocklitz (Leibniz IPHT, Jena)
Carl-Magnus Svensson, Ruman Gerst (HKI, Jena)
Jan Bumberger (UFZ Leipzig)
Matthias Landwehr (Uni Konstanz)
Janina Hanne (GerBI-GMB)
Markus Becker (INP Greifswald)

Collaborators
RDM4Mic-Gruppe, QUAREP-LiMi (dezentral)
Jan Ellenberg (EMBL Heidelberg)
Oliver Stegle (DKFZ, GHGA)
C. Martins-Rodriguez, B. Usadel, T. Mühlhaus (DataPLANT)
Philip Gribbon (Fraunhofer IME)
Peter Boor & Rainer Röhrig (UK Aachen)
Hans Günther Döbereiner et al. (NFDI4Phys)
C. Pfander, F. Leitner, J. Bischof (Eu-BI)
Stephanie Rehwald (Uni Duisburg-Essen, fdm.nrw)
Magdalene Cyra & Matthias Fingerhuth (fdm.nrw)
Universität Konstanz (Projektunterstützung)

https://nfdi4bioimage.de/en/survey/
deadline 21. July 2021

NFDI4BIOIMAGE Community Meeting
15.07.2021