

# National Research Data Infrastructure for Microscopy, Biophotonics and Image Analysis

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# Imaging core facility e.g., CAi @ HHU Düsseldorf

- ...where image data management starts



Microscopy room 1



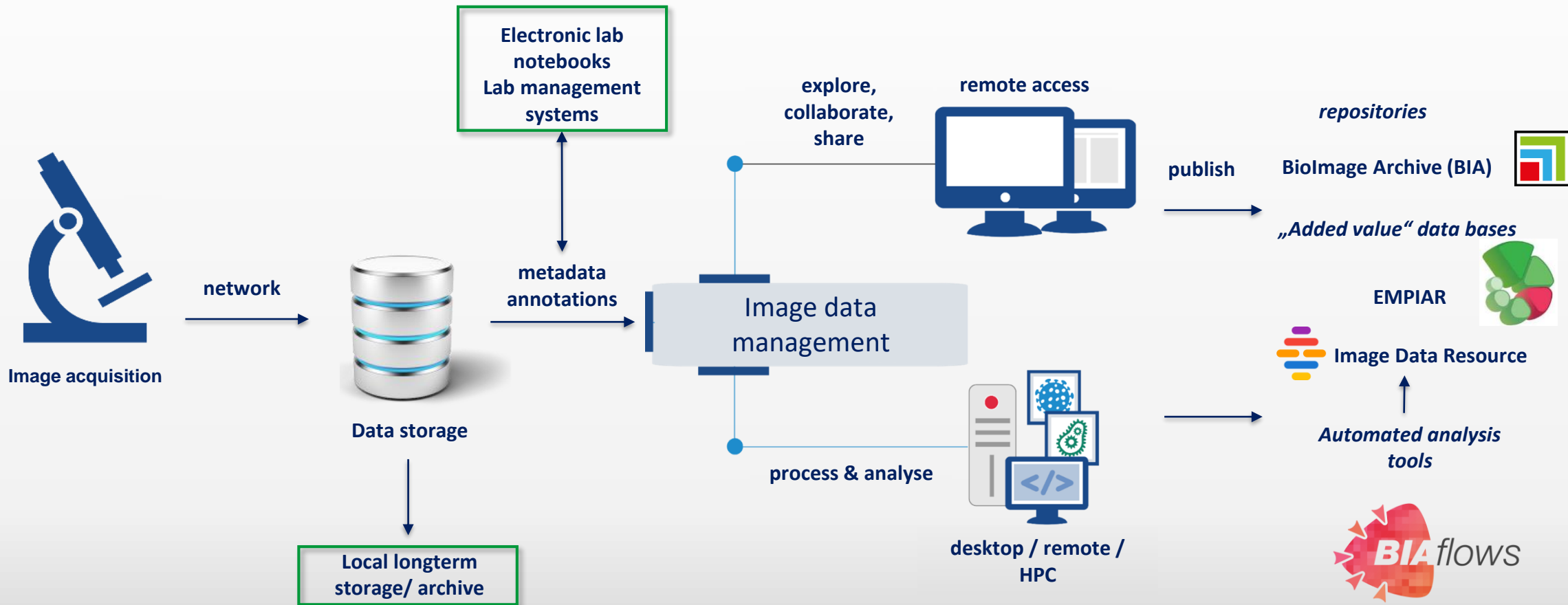
Technical room



Microscopy room 2

# The *typical* Image Data Workflow ?

- Integration in *discipline specific* environments



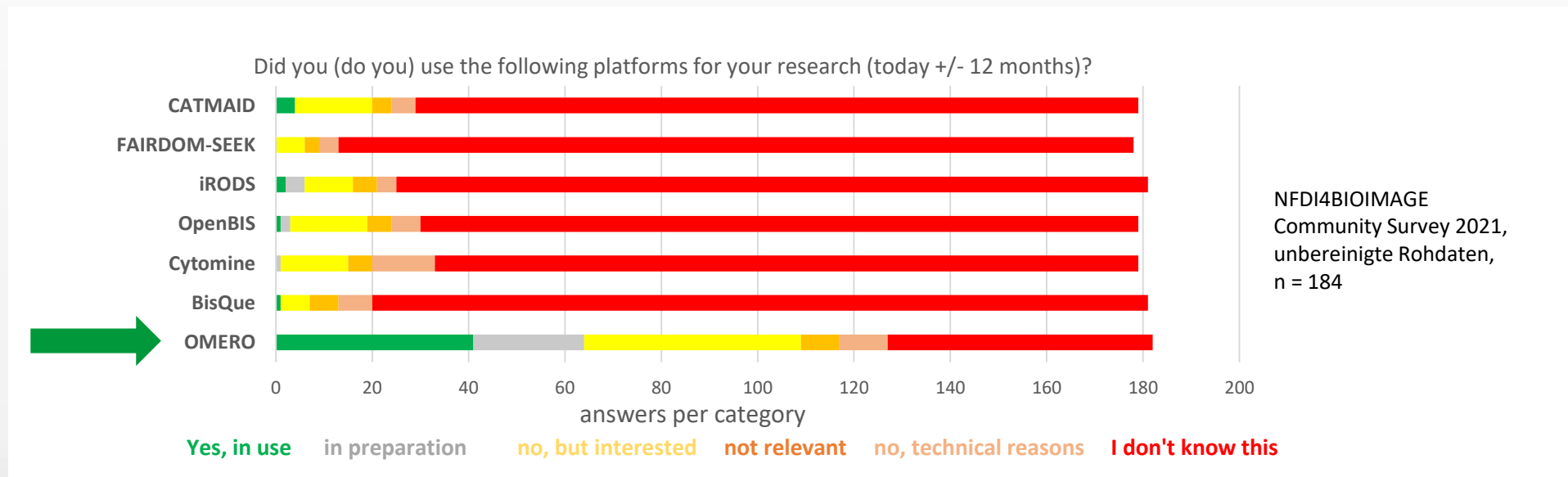
Adapted from <http://openmicroscopy.org>

- Integration in *local* IT infrastructure

# Image Data Management – *Survey 2021*

- Input from the *Bioimaging Community*: **Thank you to all of you!!**

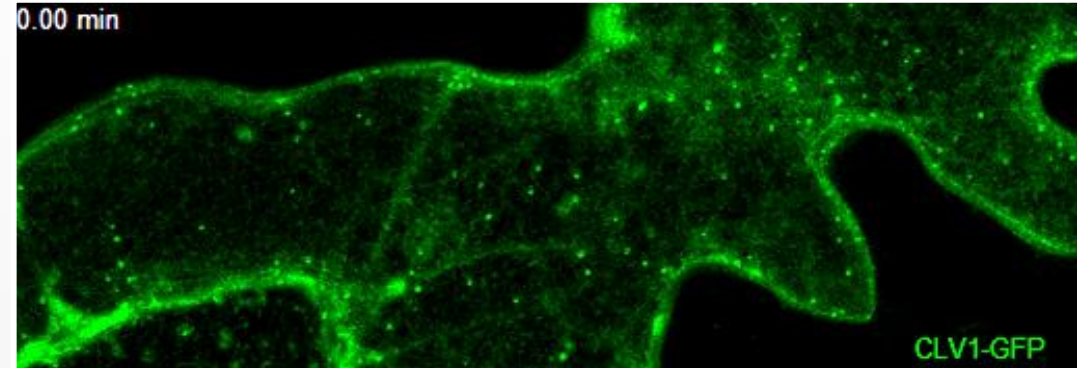
- *Which platforms for (image-) data management are already in use?*



- even *OMERO* is used only by less than 25% of the researchers

## 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



Y. Stahl, S. Weidtkamp-Peters, HHU Düsseldorf

## 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**

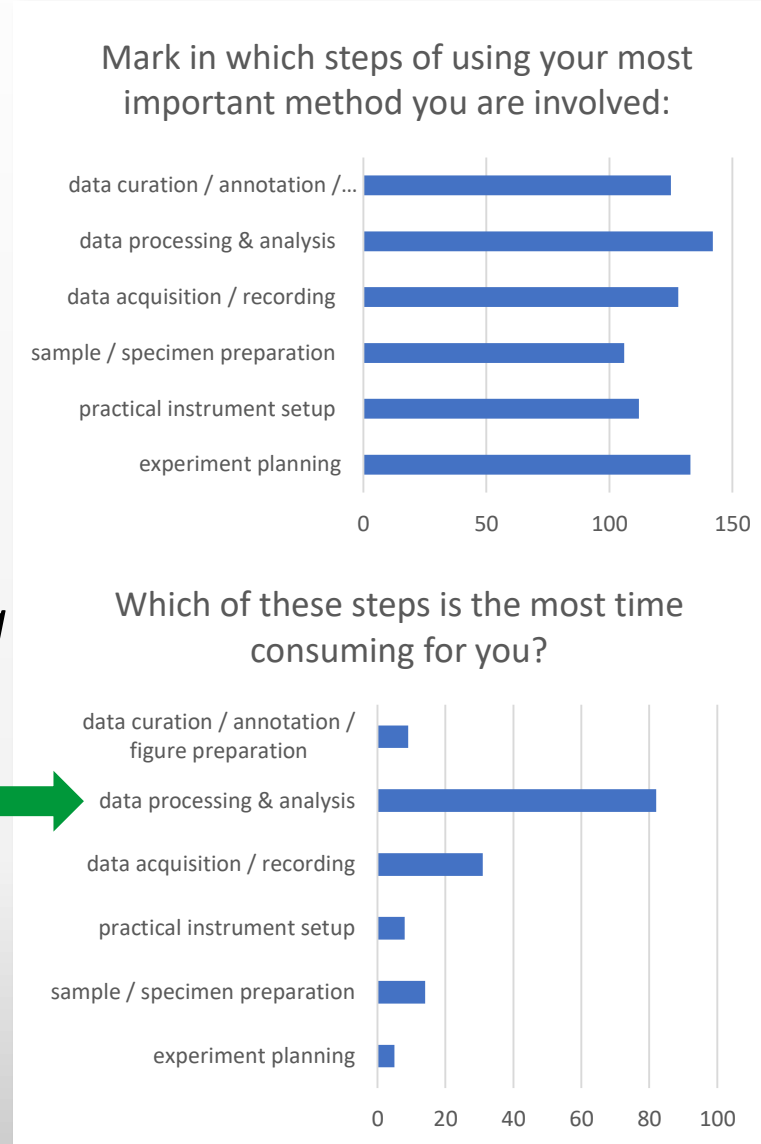
**NFDI4BIOIMAGE**

## Image analysis is a *central* part of bioimaging

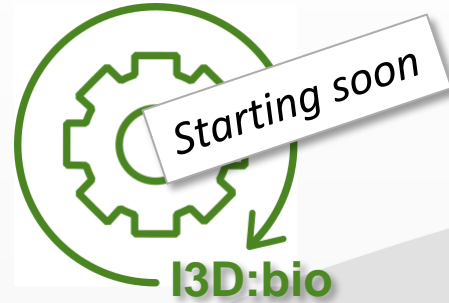
- very dynamic research area
- heterogeneous behavior of users:
  - from manual analysis to automated high-content AI-analysis
  - always time-consuming
- proprietary and open-source software tools
- *no widely accepted RDM standards for image analysis and processing*

## Aims:

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



# Roadmap of the BioImaging Community to NFDI



NFDI round 3

2021

2020

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

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

2019

**AG „Image Data Analysis  
and Management“  
LoI 1. NFDI Conference**

2017

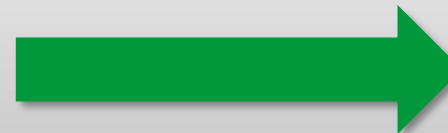
**„Research Data Management  
for Microscopy“**

<https://german-bioimaging.github.io/RDM4mic.github.io/>



Adaptiert nach  
<http://openmicroscopy.org>

BioImaging Community



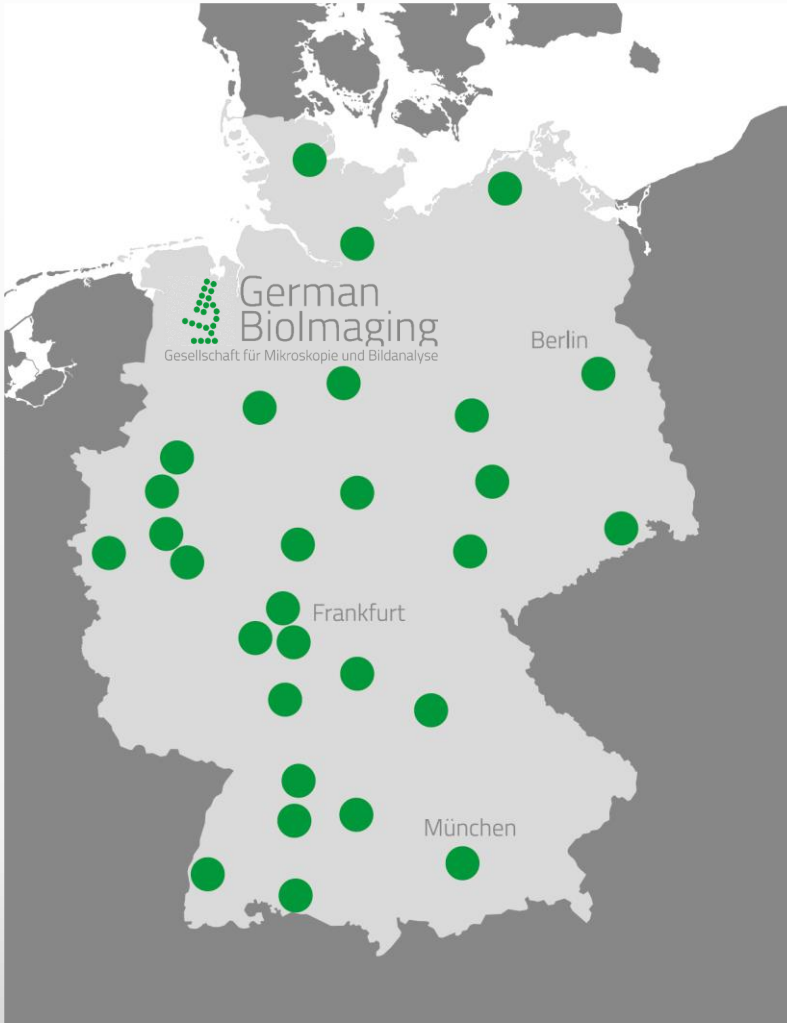
Integrative **FAIR** Image  
Data Management

# The NFDI4BIOIMAGE Team

- Our co-applicants are members of the following institutions:

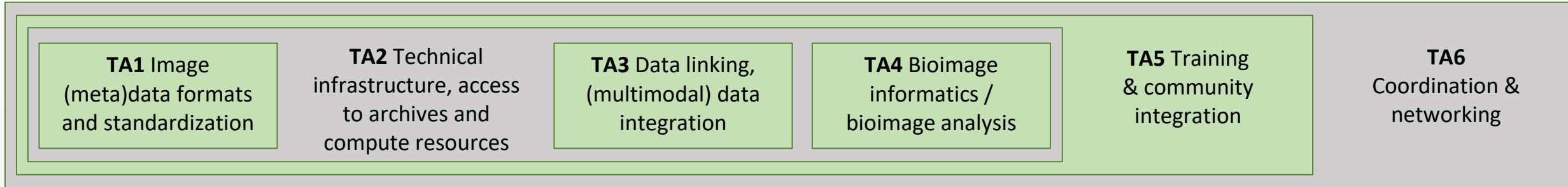




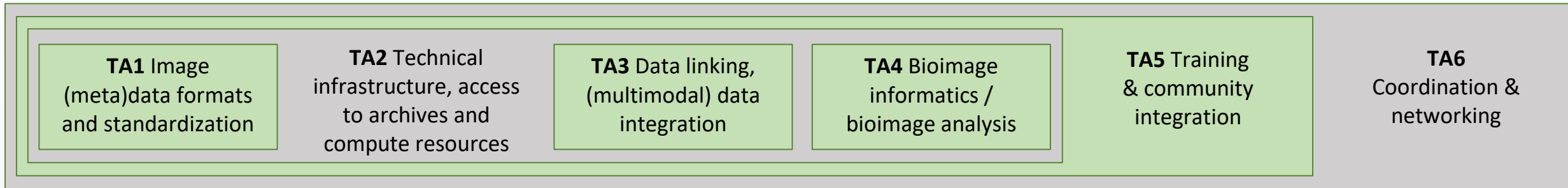


- In 2017 GerBI-GMB e.V. has emerged as the successor of the DFG funded network *German BioImaging*
- Network of *Imaging Core Facilities* and research groups in Germany
  - GerBI represents:
    - > 5000 users of microscope systems *Imaging Core Facilities*
    - researchers from all disciplines in 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*

# NFDI4BIOIMAGE – Task Areas & TA leads



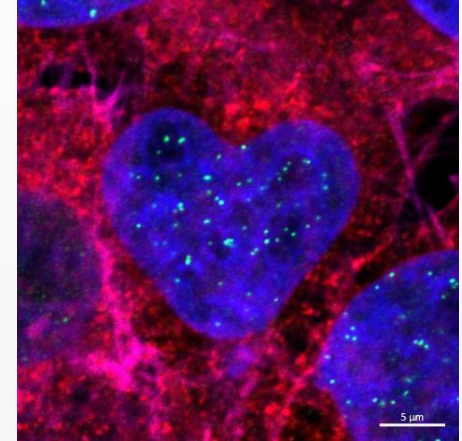
- **TA1:** **Susanne Kunis**, University of Osnabrück & **Josh Moore**, OME Team, GerBI
- **TA2:** **Markus Blank-Burian**, University of Münster & **Björn Grüning**, University of Freiburg
- **TA3:** **Pavol Bauer**, LIN Magdeburg & **Philipp Malm**, DKFZ Heidelberg
- **TA4:** **Marc Thilo Figge**, 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



- **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

# 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.



S. Weidtkamp-Peters, HHU Düsseldorf

# 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

*spatial  
transcriptomics*

interoperability ARC –  
OMERO – MDE

quality criteria physical image  
generation

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

Integration of plasma technology data and  
spectroscopy data

etc.....

# 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)

## Collaborators

RDM4Mic-Gruppe, QUAREP-  
Jan Ellenberg (EMBL Heidelberg)  
Oliver Stegle (DKFZ, GHGA)  
C. Martins-Rodriguez, B. Usadel, T. Mülhhaus (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)

## 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-GMP)  
Markus P.

**NFDI4BIOIMAGE Community Survey:**  
<https://nfdi4bioimage.de/en/survey/>  
**deadline 21.July 21**

... (Mörgridge Institute & Uni Göttingen)  
... (Allen Institute for Cell Science & ISAS Dortmund)  
Matthew Hartley (EMBL-EBI, Hinxton)  
OME-Team (University of Dundee)  
Astrid Schauss, Monica Valencia-Schneider, Peter Zentis (Uni Köln)  
Dominik Brilhaus, Hajira Jabeen (CEPLAS)  
Wiebke Möbius (MPI Göttingen)  
Paul Czodrowki (TU Dortmund)  
Kyle Harrington (HIP, MDC Berlin)  
Raimund Vogl, Jürgen Hölter (WWU Münster, IT)