German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

Overview of GerBI RDM projects: why & how?

Supporting and financing RDM projects within GerBI

Stefanie Weidtkamp-Peters, Josh Moore, Christian Schmidt, Roland Nitschke, Susanne Kunis, Thomas Zobel

04.03.2024

Why?

German Bioimaging
Gesellschaft für Mikroskopie und Bildanalyse

The scientific motivation:

- FAIR data: research data management, especially for image data is challenging due to the complexity of the data type; tools, standards, infrastructure have to be developed
- however, RDM is crucial for the application of AI, for data integration, for economic (re-)use of data, for increasing the releability of data, for sustainability…

The community motivation:

- RDM is requested by imaging core facility users, by research institutions, funders and journals
- German OMERO user group was founded back in 2017, today known as the RDM4mic group, which is open to all
- In 2018, DFG launched the National Research Data Infrastructure (NFDI), **GerBI-GMB was invited (by DFG) to participate**.

Why?

The motivation for GerBI as a scientific society:

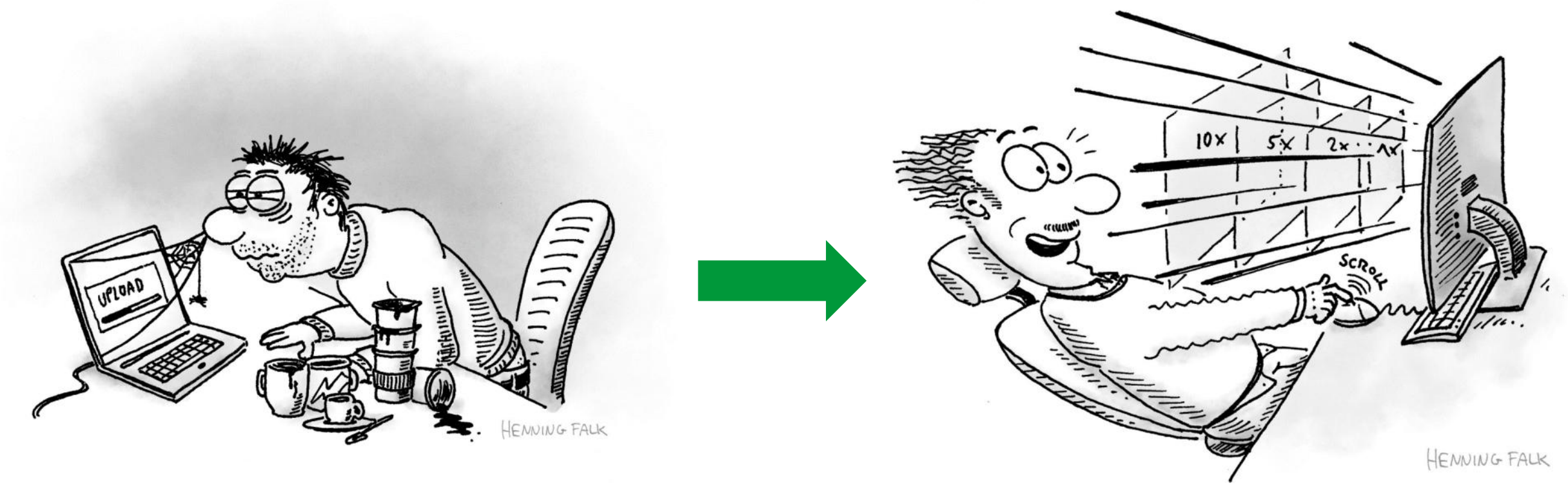
- RDM projects are usually designed beyond the boundaries of a single institute
- they should be aligned with international communities and projects
- RDM projects often require research software development, these positions are outside the public sector pay scale, e.g. subcontracting is a usual mode of operation

➢ GerBI as a scientific society provides well established, but flexible infrastructures, based on a solid community of experts in the field, embedded in the international community

➢ benefits for GerBI are:

- a significant contribution to the sustainability of the society by the third party funding
- active role in shaping the emerging RDM landscape (tools, standards, infrastructure)

Why: Josh and the **N**ext **G**eneration **F**ile **F**ormat



Images: “Adam uploads” & “Navid zooms” by Henning Falk, ©2022 NumFOCUS, is used under a CC BY 4.0 license

GerBI RDM Projects w/ funding – an overview

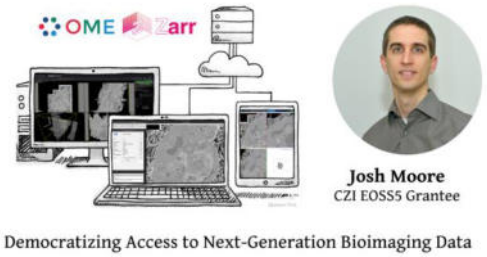
Wellcome Leap
Delta Tissue
2021- Aug. 2024
PI Josh Moore

DFG
NDFI4BIOIMAGE
March 2023 – 2028
PI SWP, Josh Moore

CZI
Single Cell
May 2023- Oct. 2024
PI Josh Moore

EU Horizon foundingGIDE
2024 – 2026
PI Josh Moore

2021 2022 2023 2024



CZI
EOSS5
June 2022- Oct. 2024
PI Josh Moore

Host: CZI Neubias
March 2023 – Feb 2025
PI Robert Haase

$\sum$ > 1 Mio. €

GerBI 3rd party funding infrastructure

German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

- Wellcome Leap DeltaTissue:
  - MARFA - Master Research Funding Agreement - between WL and GerBI, supported by FieldFisher lawyer team
  - Third Party Funding Bank Account at VR Bank Konstanz

- DFG NFDI4BIOIMAGE:
  - GerBI membership of the NFDI society (NFDI Verein)
  - GerBI Guideline for the use of project overheads („Leitlinie zur Verwendung der Programmpauschale“)

- CZI Single Cell:
  - GerBI template for Agreement on the forwarding of a grant („Muster für Mittelweiterleitungsvertrag“), supported by FieldFisher

- EU Horizon FoundingGIDE:
  - GerBI Gender Equality Plan (GEP)

GerBI's road to NFDI

- **May 2018**: DFG launches the National Research Data Infrastructure, **GerBI-GMB is invited (by DFG) to participate**.
- **June 2019**: GerBI-GMB votes for submission of a Letter of Intent for a **consortium for bioimage data management** within the NFDI at the 4th General Assembly in Brno, ELMI meeting
- **August 2019**: internal call for interested partners both for NFDI and for a smaller DFG proposal in the alternative funding line „Information Infrastructures for Research Data"
- **July 2020**: Submission of updated LoI to 2nd NFDI Call in 2020
- **October 2020**: Submission of DFG proposal „I3D:bio. Information Infrastructure for BioImage Data" Applicants: Konstanz, Osnabrück, Düsseldorf, Freiburg. 34 Letters of Support from: RDM4mic and GerBI-GMB members, Leibniz "Health Alliance", NFDI consortia, companies.
- **November 2020**: Uni Konstanz provides a position for an NFDI coordinator (→ Christian Schmidt)

GerBI's road to NFDI

German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

- **December 2020:** internal call for interested partners for NFDI
- **July 2021**: DFG approval of „I3D:bio. Information Infrastructure for BioImage Data“ project
- **July 2021**: Binding Letter of Intent for a **consortium for bioimage data management within NFDI**
- **November 2021**: NFDI4BIOIMAGE proposal submission for the 3rd round of NFDI consortia
- **January 2022**: Start of I3D:bio project
- **February 2022**: Online assessment of the 3rd round NFDI consortia
- **June 2022**: Funding recommendation for NFDI4BIOIMAGE (7/16 proposals recommended)
- **November 2022**: Funding approval for NFDI4BIOIMAGE by BMBF
- **March 2023**: Start of NFDI4BIOIMAGE and I3D:bio RDM team at TiM2023

I3D:bio RDM team at TiM 2023

- The I3D:bio project aims to improve FAIR image data management: tools, metadata standards, training….
- The project is focusing on OMERO as a image data base which is widely spread in the community

Let‘s setup a TiM2023-OMERO and make all TiM image data FAIR

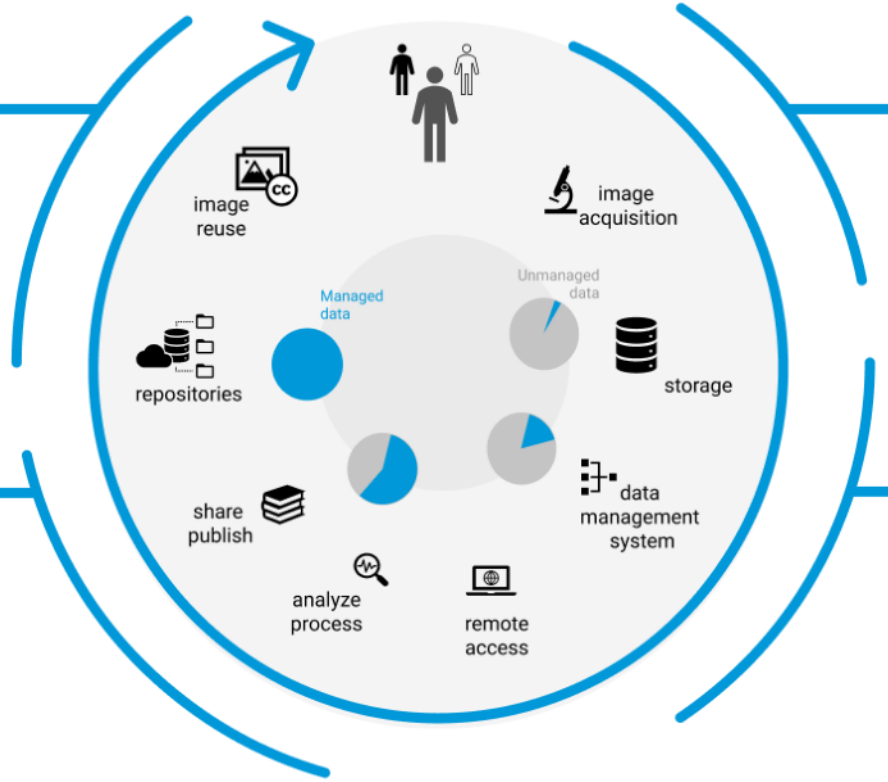
FAIR: **F**indable – **A**ccessible – **I**nteroperable – **R**eusable

NFDI4BIOIMAGE Core mission & objectives

Enable FAIR bioimage data management for German researchers, across disciplines and embedded in the international framework.

Objective 4
Capacitate researchers for FAIR image data management

Objective 3
Maximize the reach of **reproducible** image analysis workflows in the community



Objective 1
Champion the **standardization** of the „bioimage data“ type

Objective 2
Provide scalable **infrastructure** for FAIR image data

https://nfdi4bioimage.de/home/

NFDI4BIOIMAGE – 11 co-applicant institutions

Task Area Team of NFDI4BIOIMAGE

TA 1


Susanne Kunis


Josh Moore

employed by GerBI

Image (meta)data formats and standardization

TA 4


Anna Kreshuk


Thilo Figge


Christian Tischer

Bioimage informatics and analysis

…and data stewards, research software engineers, coordinators…

Technical infrastructure and cloud resources

Training and community integration

TA 3


Phillipp Mallm


Werner Zuschratter


Torsten Stöter

Multimodal data linking and integration

TA 6


Elisa May


Stefanie Weidtkamp-Peters


Christian Schmidt

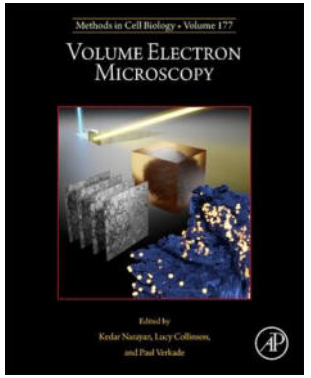

Kathy Schmitz

Coordination, governance and networking & office

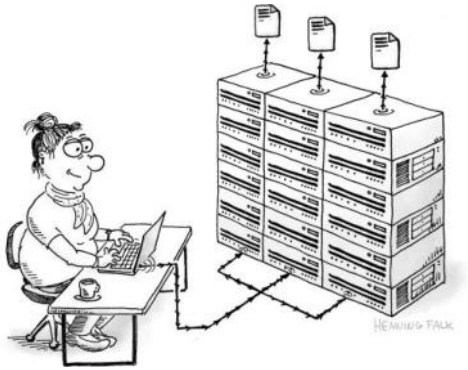
Technology Development

Josh Moore, Senior RDM Officer
German BioImaging, e.V. / Open Microscopy Environment

Technology Development



Technology Development / **History**



2000 → 2005 → 2016 → 2018 → 2024

OME · University of Dundee · IDR · Zarr · German BioImaging

OMEFILES · BIO-FORMATS · OMERO

Technology Development / **Goal**

Center of Excellence

Package your data for sharing
(with permission)
★

including descriptive labels

★★

that are machine readable

★★★

in consistent containers

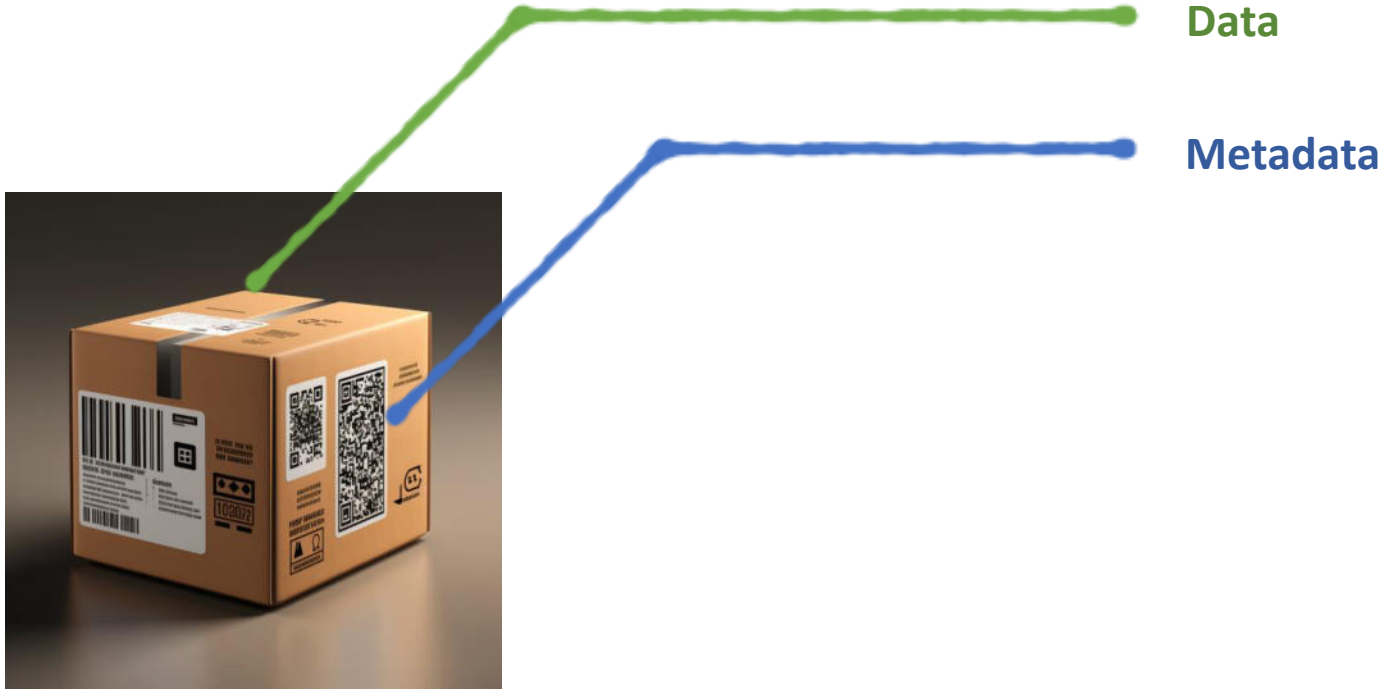
★★★★

to enable science.

★★★★★

Images generated by Andra Waagmeester & Josh Moore through AI generation using Midjourney (Sep. 2023)

Technology Development / **Goal**



Technology Development / **NGFF**

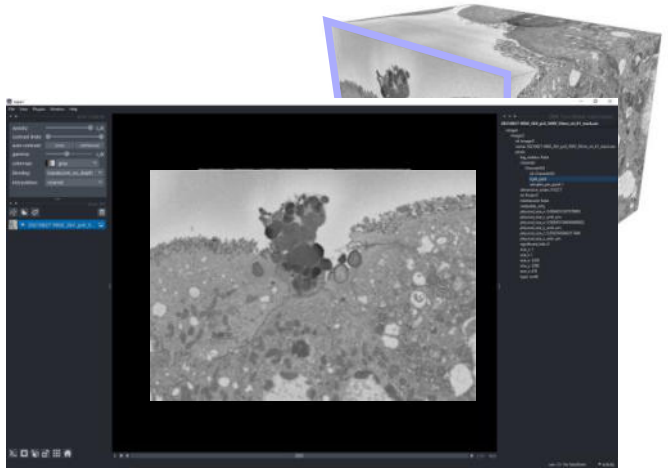
German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

that are machine readable

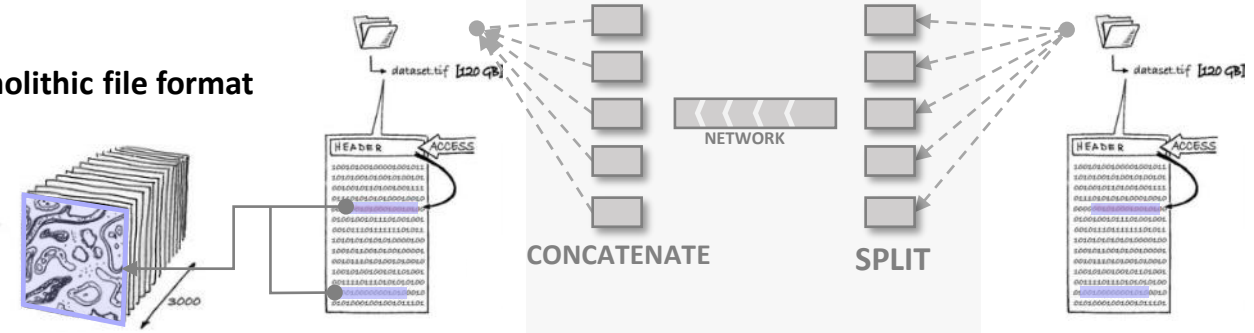
★★★

CHAN ZUCKERBERG INITIATIVE

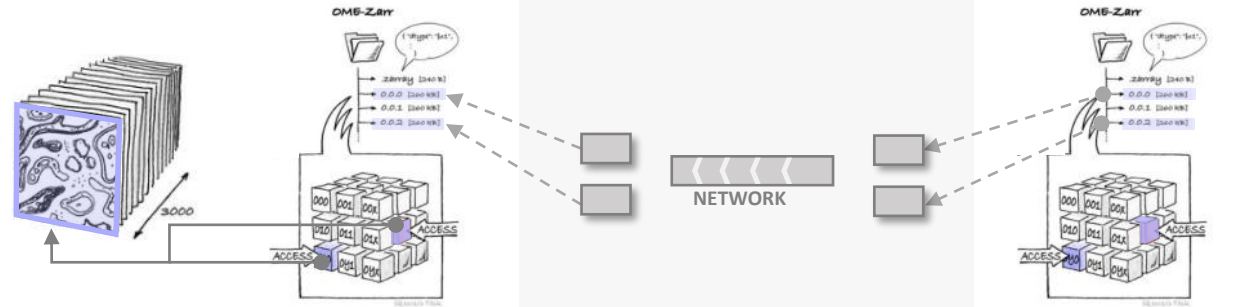
2022-2024 Open Science



Monolithic file format



Local computer | Access via network | External data storage



Chunkable file format

Susanne Kunis

Technology Development / **SpatialData**

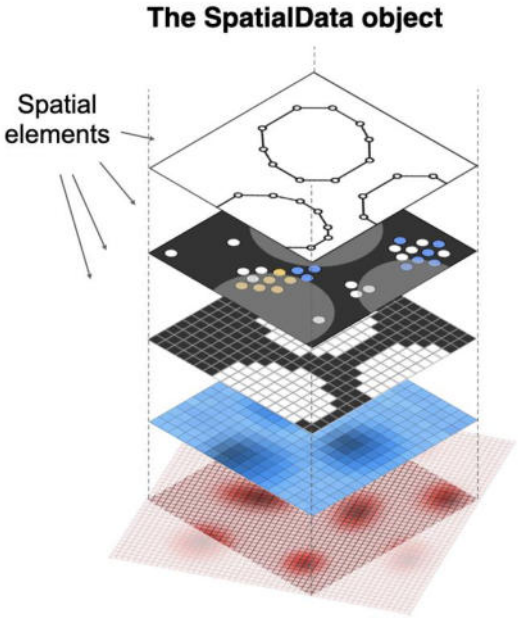
German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

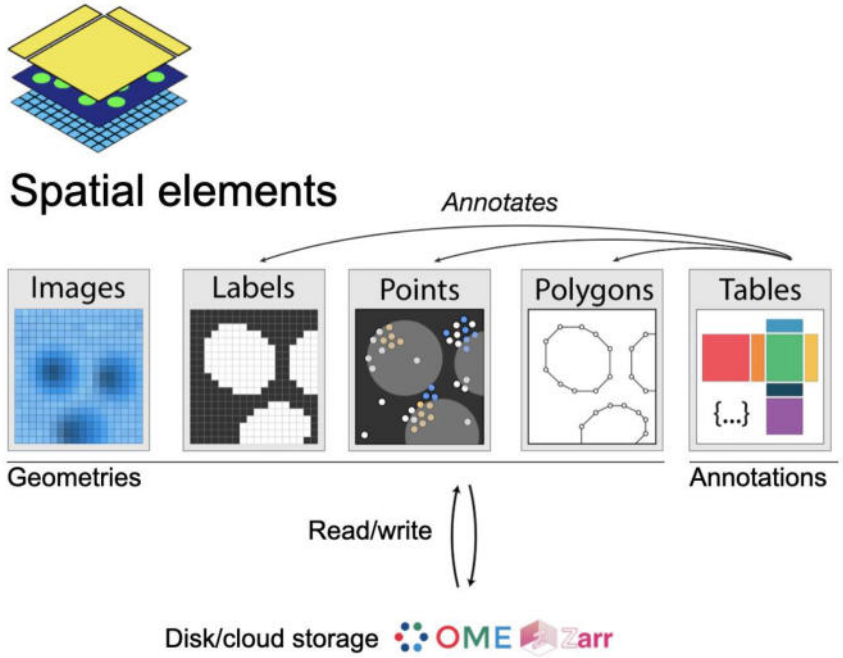
that are machine readable

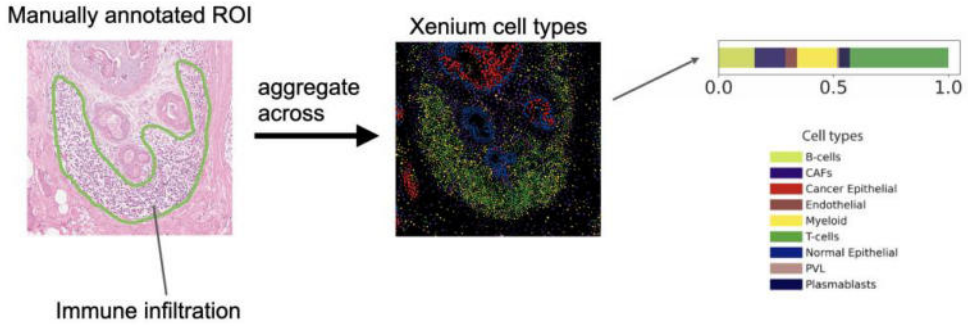
★★★

CHAN ZUCKERBERG INITIATIVE

2023-2025 Single Cell








Luca Marconato


Giovanni Palla


Isaac Virshup


Kevin A. Yamauchi

Technology Development / **Linked Data**

German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

leap
2021-2024

that are machine readable

★★★

Andra Waagmeester

Technology Development / **Linked Data**

German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

leap[W]
2021-2024

that are machine readable

★★★

> “A new platform – a ‘tissue time machine’ – that can profile tissue states and predict transitions between states (‘Delta Tissue’ or ‘ΔT’). The platform would provide quantitative, multi-scale, multi-modal information sufficient to build integrated prediction models of key cell and tissue states and transitions.

Adrie JC Steyn, Africa Health Research Institute
Assaf Zaritsky, Ben-Gurion University of the Negev
Gunnar Carlsson, BlueLightAI, Inc.
Michael Roukes, California Institute of Technology
Chris Sander, Harvard Medical School
Fabian Theis, Helmholtz Zentrum München
Maddy Parsons, King’s College London
Simon Fredriksson, Pixelgen Technologies
Shankar Subramaniam, University of California San Diego
Greg Hannon, University of Cambridge
Virginie Rozot, University of Cape Town
Denise Kirschner, University of Michigan Medical School
Hagan Bayley, University of Oxford
Omer Bayraktar, Wellcome Sanger Institute
Stéphane Pagès, Wyss Center for Bio and Neuroengineering
Joerg Bewersdorf, Yale University

Andra Waagmeester

Technology Development / **GIDE**

German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

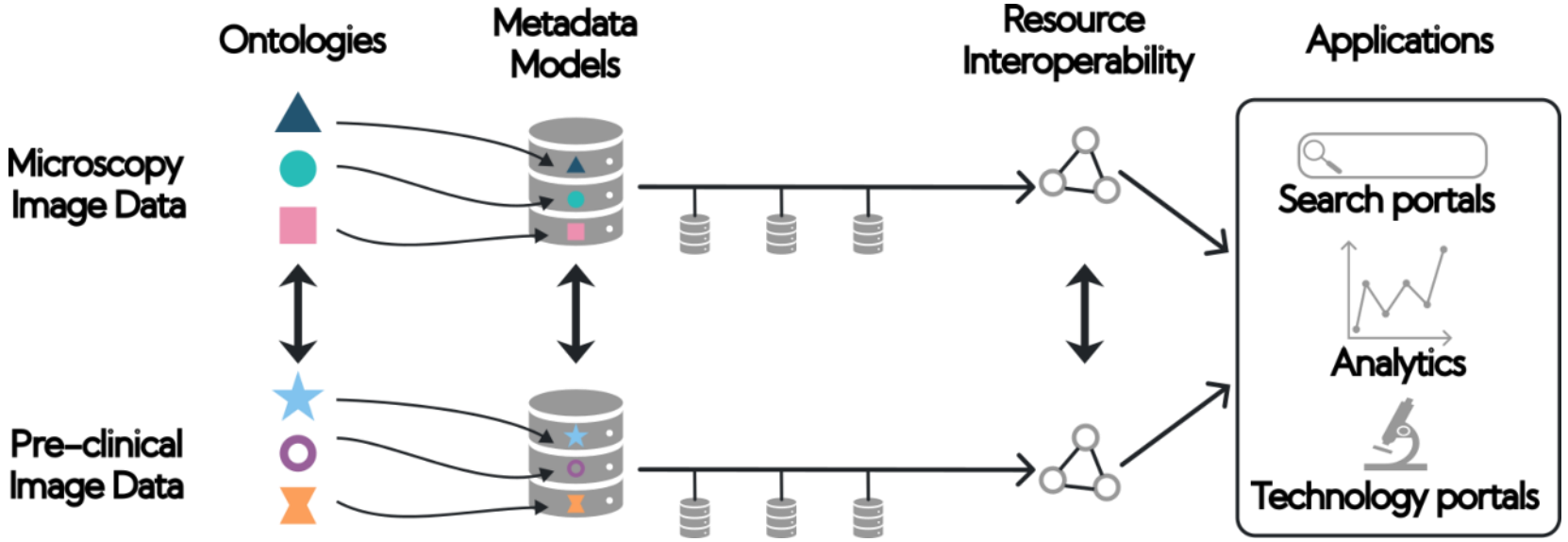
Funded by the European Union

in consistent containers

★★★★

foundingGIDE (**G**lobal **I**mage **D**ata **E**cosystem)

2024-2026



Matthew Hartley

Shuichi Onami

Technology Development / **FAIR-IO**

German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

Funded by
DFG Deutsche Forschungsgemeinschaft
German Research Foundation

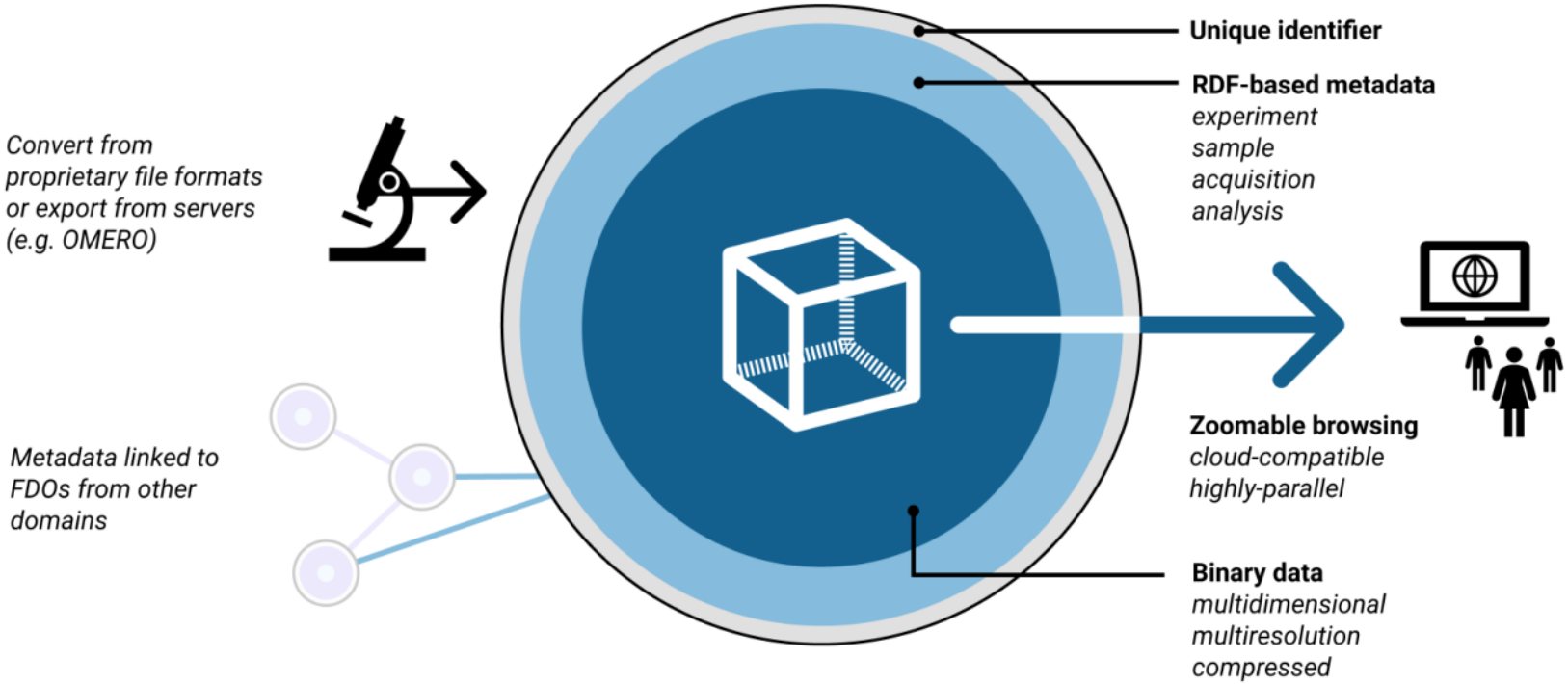
in consistent containers

★★★★

NFDI 4 BIOIMAGE

2023-2028

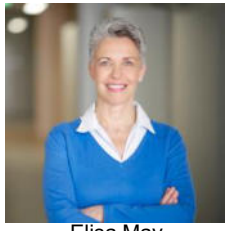
FAIR Image Objects (*FAIR-IO*), *an FDO-subtype for bioimaging*



https://doi.org/10.5281/zenodo.7394675


Susanne Kunis

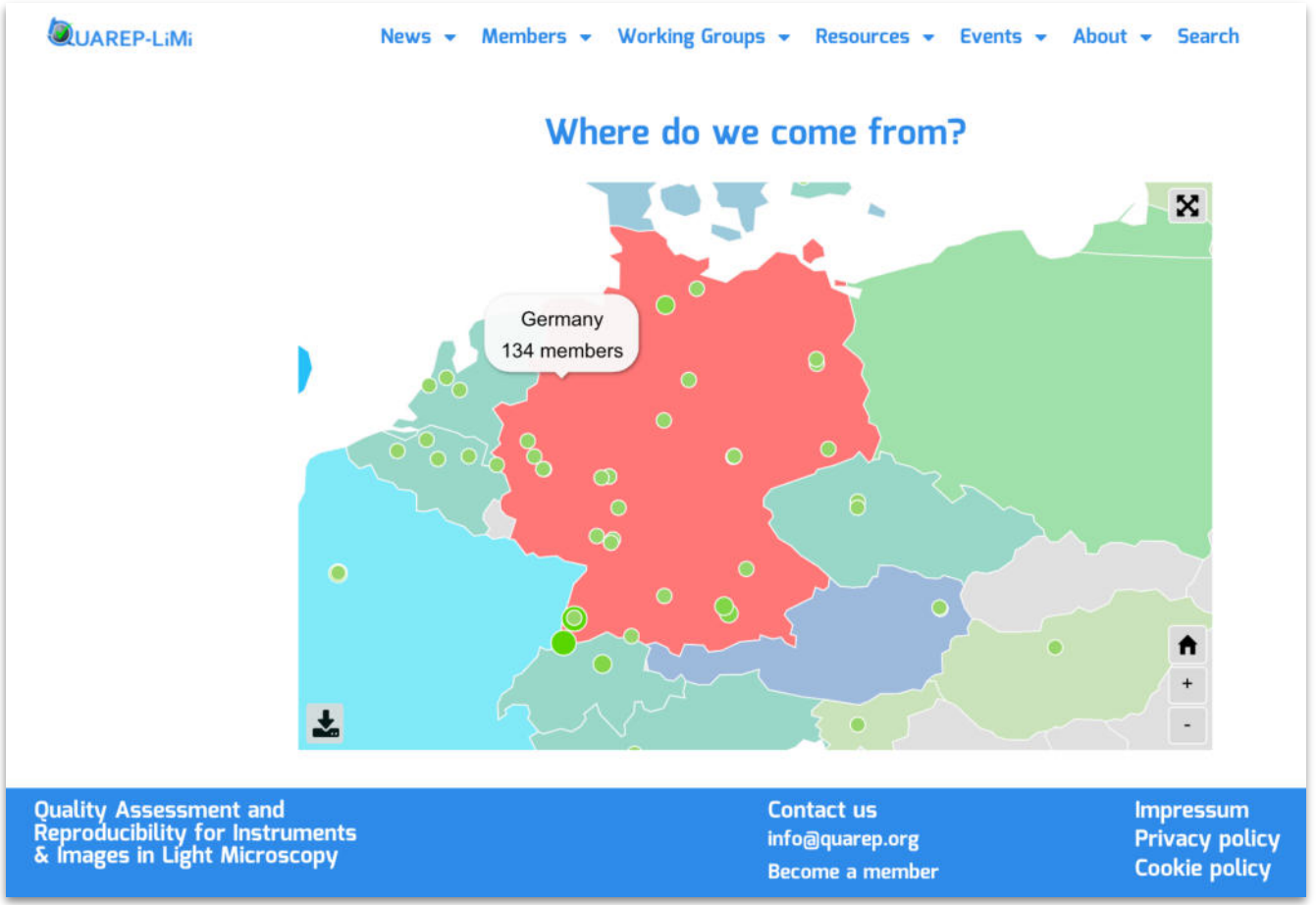

Stefanie Weidtkamp-Peters


Elisa May

Technology Development / **Beyond**

to enable science.

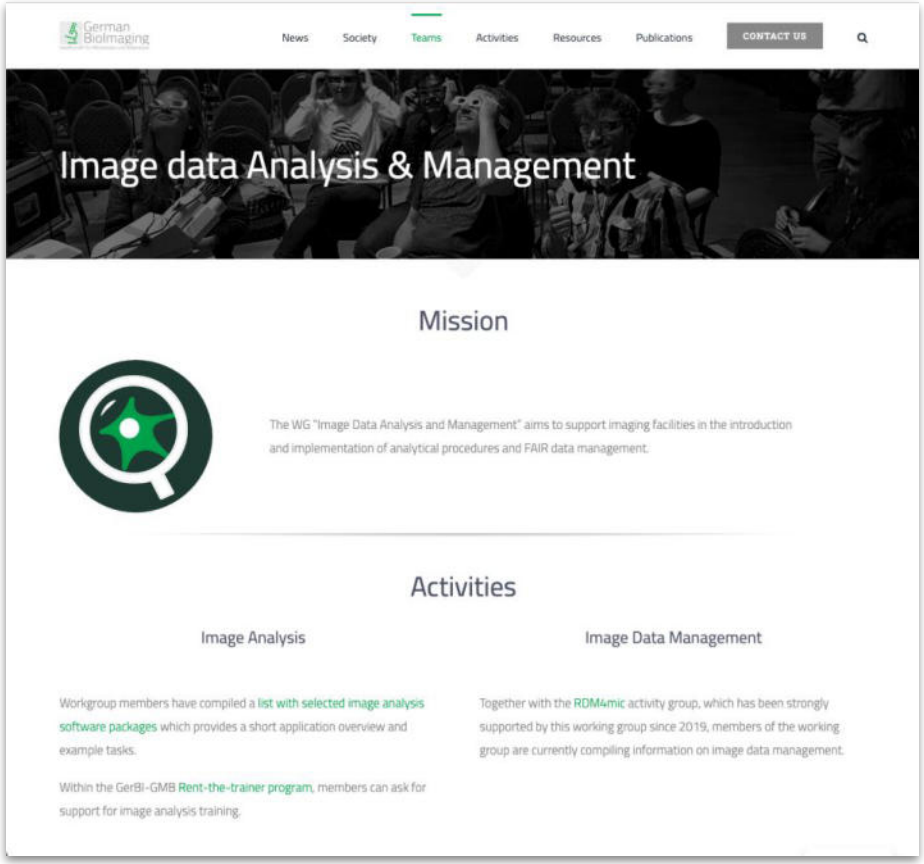
★★★★★

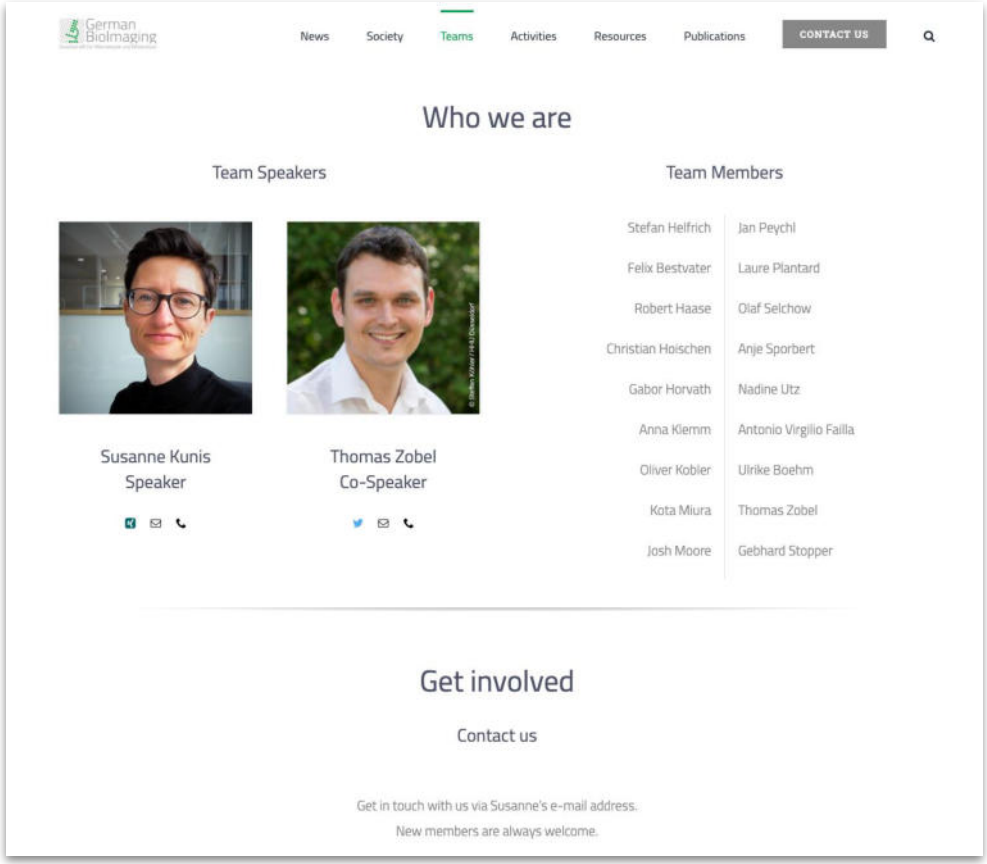


Roland Nitschke

Caterina
Strambio De Castillia

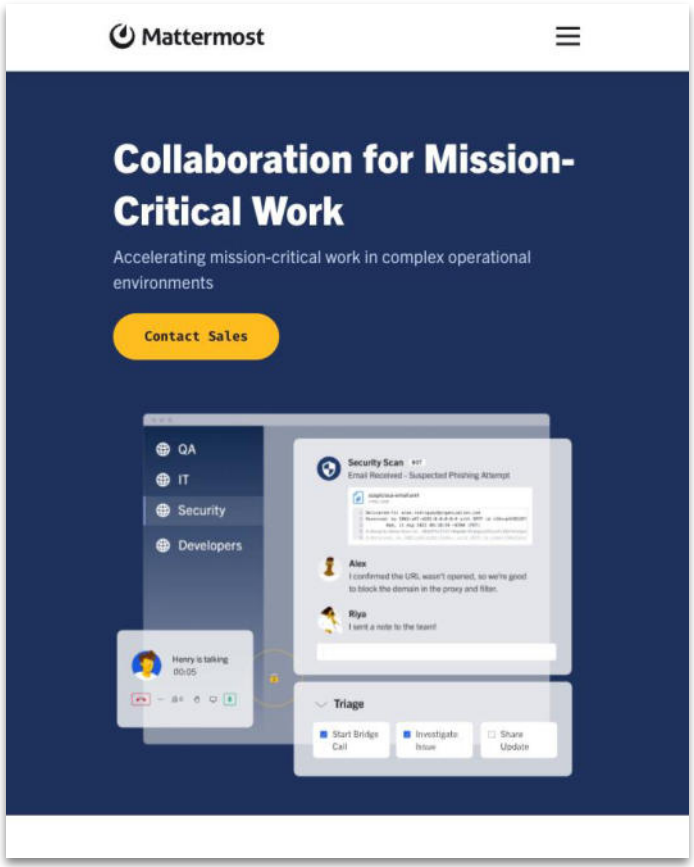
Tech Development / **Getting involved**

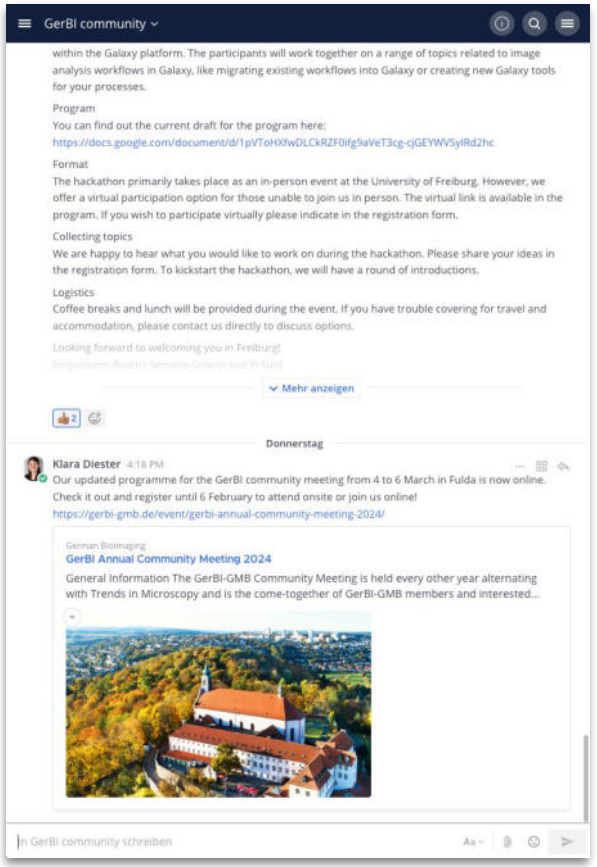




https://gerbi-gmb.de/teams/image-data-analysis-management/

Tech Development / **Getting involved**





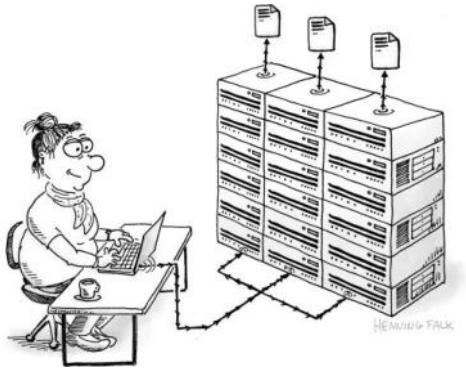
https://mattermost.gerbi-gmb.de/gerbi/channels/gerbi-community

Tech Development / **Getting involved**

German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

Your

input, data, etc.!



https://github.com/zarr-developers/zarr-illustrations-falk-2022#bea-computes

German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

Christian Schmidt
Scientific Project Manager
Project Coordinator of I3D:bio
Networking and Outreach Coordinator of NFDI4BIOIMAGE
GerBI member since 2022

From RDM4mic to I3D:bio

Center for Advanced imaging (CAi) at the HHU
CECAD Cologne
iBiOs at CellNanOs Uni Osnabrück

→ Exchange about the experience with OMERO

initiated the **RDM4mic** group → „powerful subunit“…

…integrated into **GerBI-GMB** work group 6 „Image analysis and management“

→ Identification of common issues and challenges,

but: *No dedicated resources* to overcome these challenges

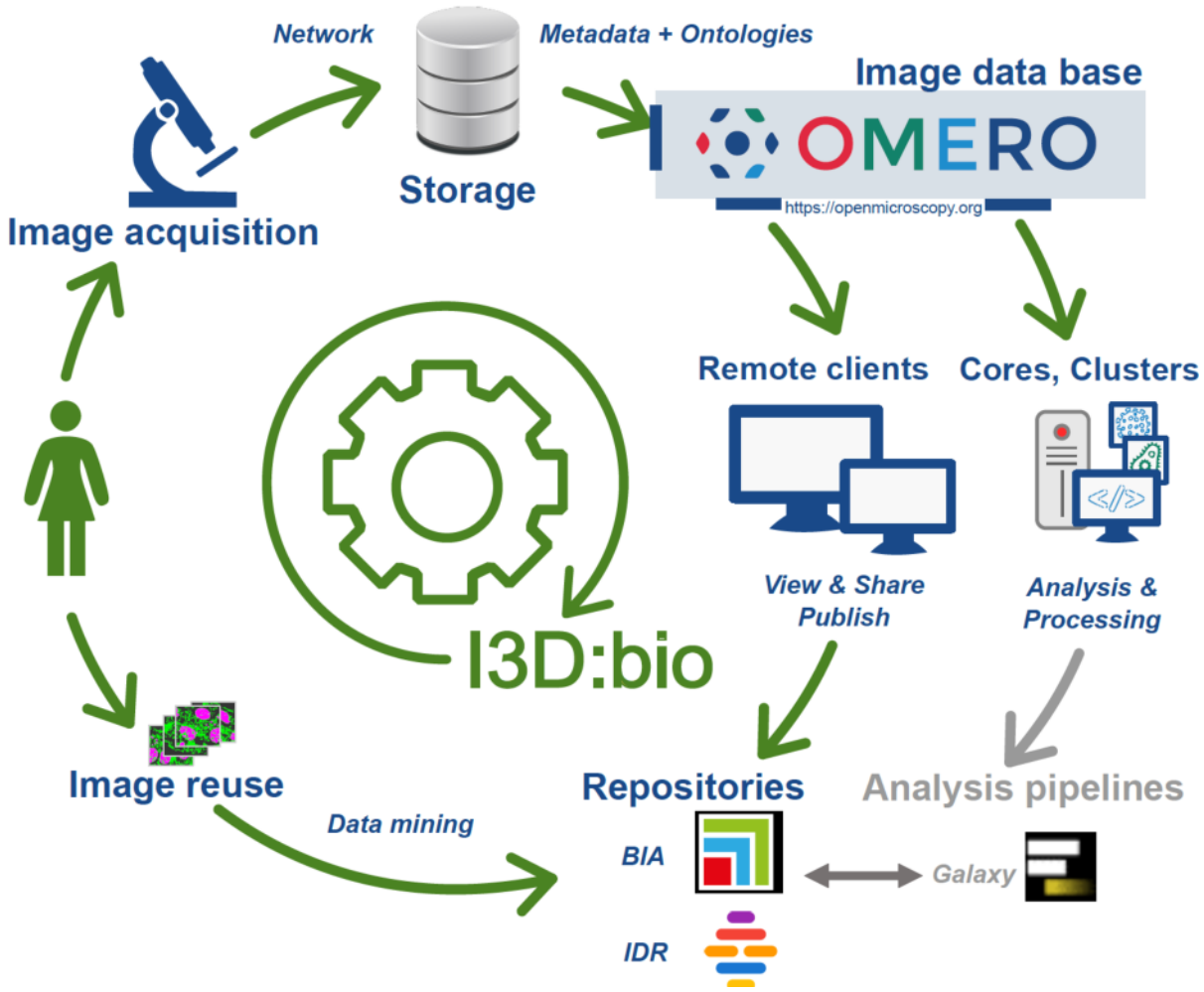
2019: First NFDI conference → Decision: Apply as a consortium in Call #3, 2021

2020: Write a small-scale grant → **I3D:bio** (approved in 2021, started in 2022)

I3D:bio
Information Infrastructure for BioImage Data

www.i3dbio.de

I3D:bio's focus on OMERO



Why OMERO?

OMERO is the most widely used & best known RDM system

→ *Explore capabilities & limitations*

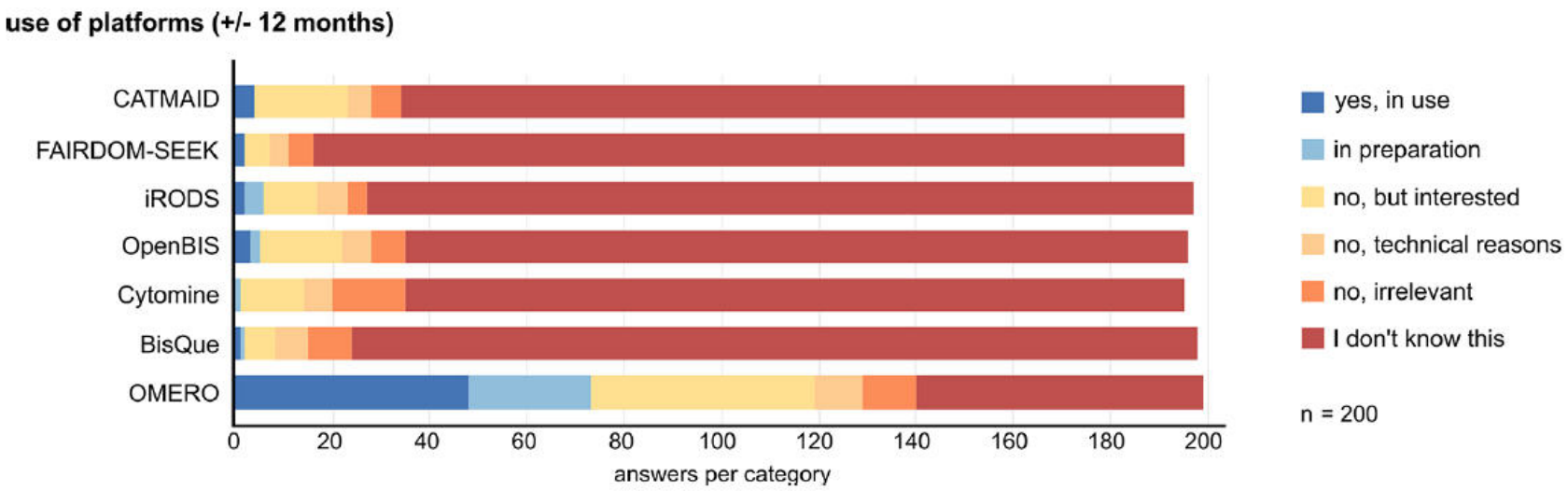


Figure 4. Data management platform knowledge and use by participants.

Schmidt C, Hanne J, Moore J et al. Research data management for bioimaging: the 2021 NFDI4BIOIMAGE community survey [version 2; peer review: 2 approved]. F1000Research 2022, 11:638 (https://doi.org/10.12688/f1000research.121714.2)
PMID: 36405555, CC-BY 4.0 (http://creativecommons.org/licenses/by/4.0)

- Open-source
- Long history of experience
- Global community of supporters & developers
- The original developer works for GerBI (Josh)

Why metadata?

German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

Metadata guidelines and tools are requested

→ *Explore user tools, how to change habits, and the needs to make metadata FAIR*

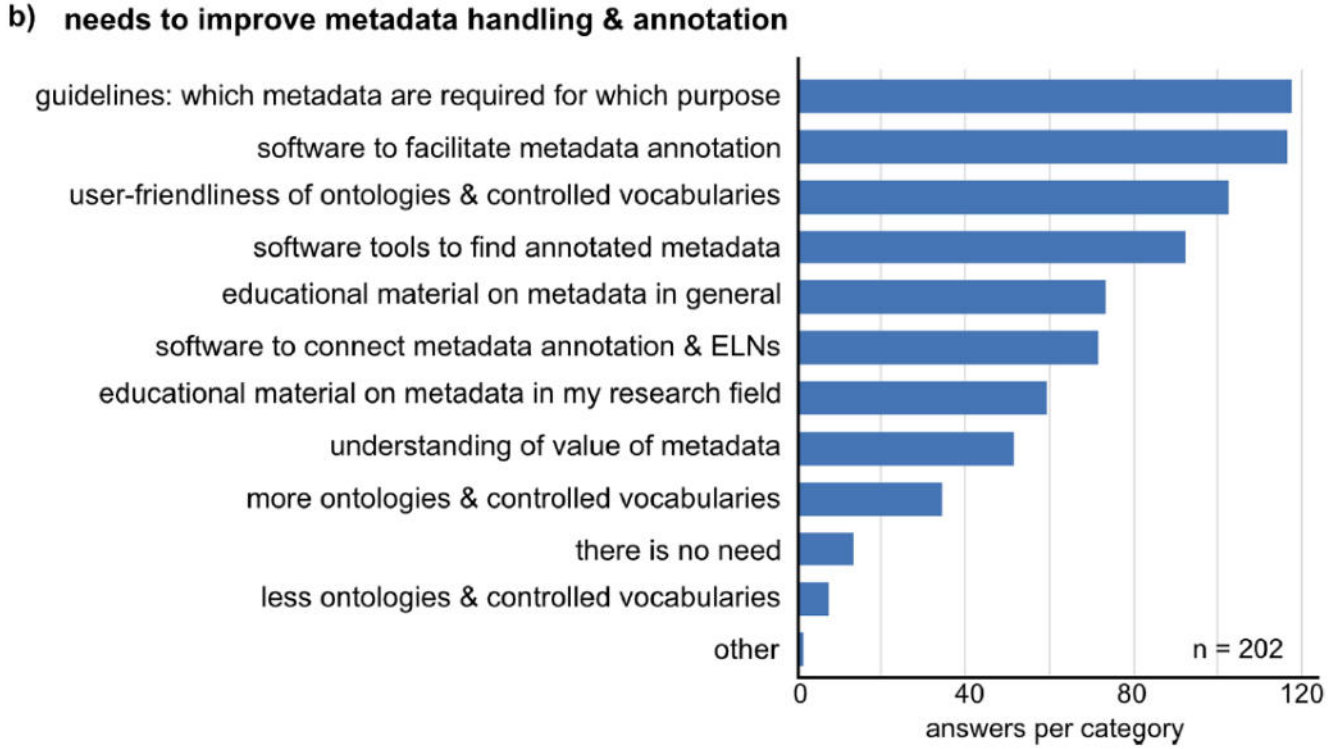


Figure 5. **The role of metadata for research data management and the needs for metadata annotation.**

- Expertise - MDEmic (Susanne)
- Quarep-LiMi (Roland and many GerBI members)
- GerBI contributed to REMBI (Nadine)
- Metadata is essential for FAIR bioimaging data

Schmidt C, Hanne J, Moore J et al. Research data management for bioimaging: the 2021 NFDI4BIOIMAGE community survey [version 2; peer review: 2 approved]. F1000Research 2022, 11:638 (https://doi.org/10.12688/f1000research.121714.2)
PMID: 36405555, CC-BY 4.0 (http://creativecommons.org/licenses/by/4.0)

Tangible results from I3D:bio for the community

German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

I3D:bio

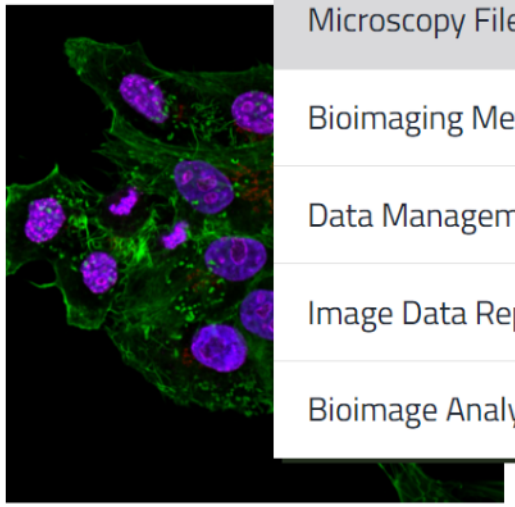
I3D:bio – Information Infrastructure for BioImage Data

A Microscopy Research Data Management Resource

ABOUT I3D:bio | About Bioimaging Data | Teaching Material & Events | Guides & Resources | Help Desk & Contact

Welcome to I3I

- Data Life Cycle
- Microscopy File Formats
- Bioimaging Metadata
- Data Management Platforms
- Image Data Repositories
- Bioimage Analysis



gement resource for bioimaging with a focus on light microscopy

resource to aid with...

and teaching about microscopy research data management?

ng your microscopy research data?

sharing and archiving your images?

our image data with experimental protocols and analysis results?

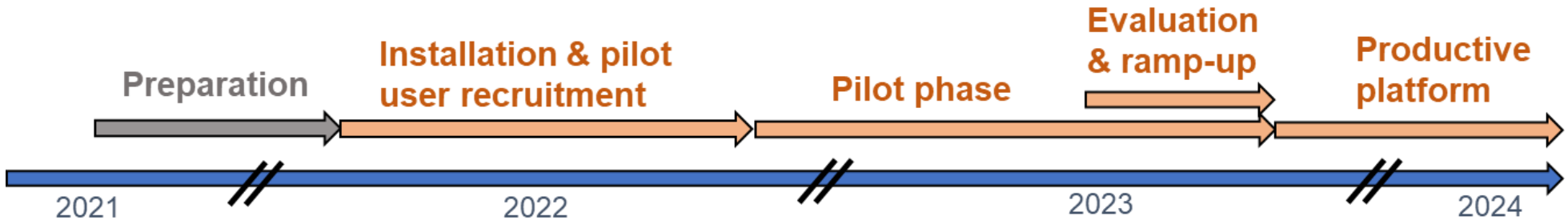
p microscopy reasearch data management at your institute or facility?

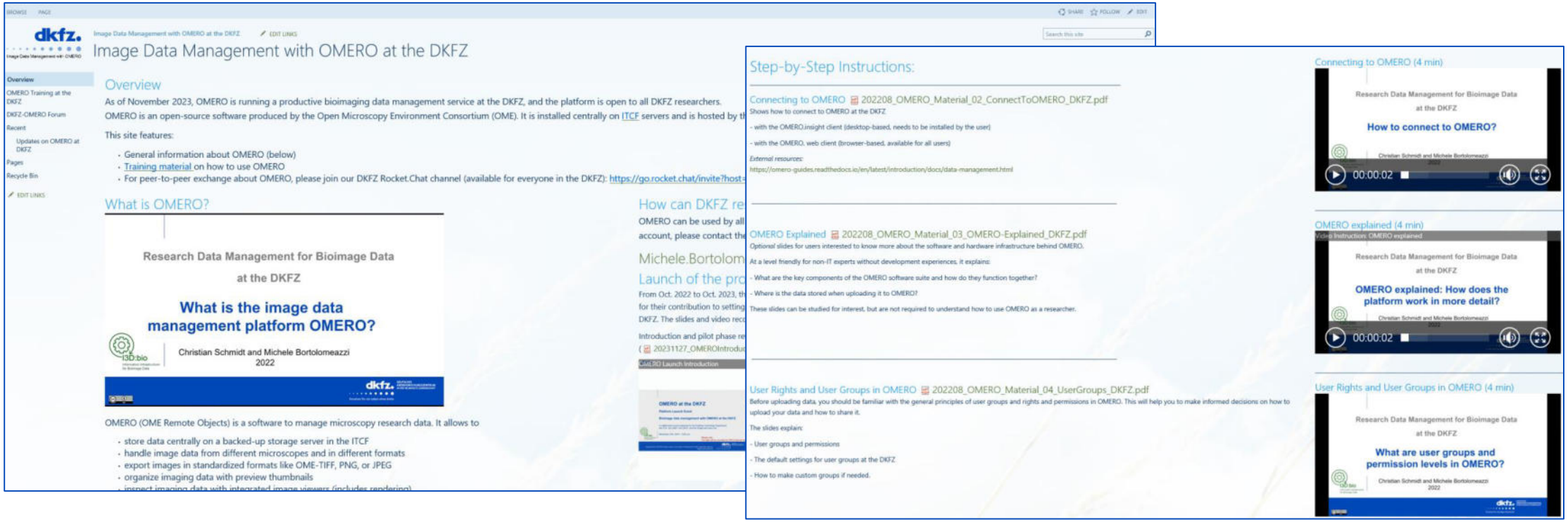
se I3D:bio project pages and contact us for questions and support.

Knowledge Hub

www.i3dbio.de

Use Case DKFZ Heidelberg





Reusable training material requested by the RDM4mic group (2022)

Tangible results from I3D:bio for the community

German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

zenodo | Search records... | Communities | My dashboard | Log in | Sign up

Published November 13, 2023 | Version v1

I3D:bio's OMERO training material: Re-usable, adjustable, multi-purpose sli… user training

Schmidt, Christian[1, 2]; Bortolomeazzi, Michele[1, 3]; Boissonnet, Tom[4, 5]; Fortmann-Grote, Carsten[6]; Dohle, Julia[7]; Zentis, Peter[8, 9]; Kandpal, Niraj[8, 9]; Kunis, Susanne[7]; Zobel, Thomas[10]; Weidtkamp-Peters, Stefanie[4, 5]; Ferrando-May, Elisa[1, 2]

The open-source software OME Remote Objects (OMERO) is a data management software that allows storing, organizing, and annotating bioimaging/… OMERO has become one of the best-known systems for bioimage data management in the bioimaging community. The Information Infrastructure for Bi… project facilitates the uptake of OMERO into research data management (RDM) practices at universities and research institutions in Germany. Since the… into researchers' daily routines requires intensive training, a broad portfolio of training resources for OMERO is an asset. On top of using the OMERO g… Open Microscopy Environment Consortium (OME) team, imaging core facility staff at institutions where OMERO is used often prepare additional materi… applicable for their own OMERO instances. Based on experience gathered in the Research Data Management for Microscopy group (RDM4mic) in Ger… cases in the I3D:bio project, we created a set of reusable, adjustable, openly available slide decks to serve as the basis for tailored training lectures, vid… guided instruction manuals directed at beginners in using OMERO. The material is published as an open educational resource complementing the exist… OMERO contributed by the community.

Notes

Funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation), project I3D:bio, grant number 462231789

Notes

Supported by German BioImaging - Society for Microscopy and Image Analysis (GerBI-GMB)

Files

2023_Schmidt_etal_I3Dbio_OMERO_Training_Material_10.5281_zenodo.8323588.pdf

Video tutorials on YouTube

Tangible results from I3D:bio for the community

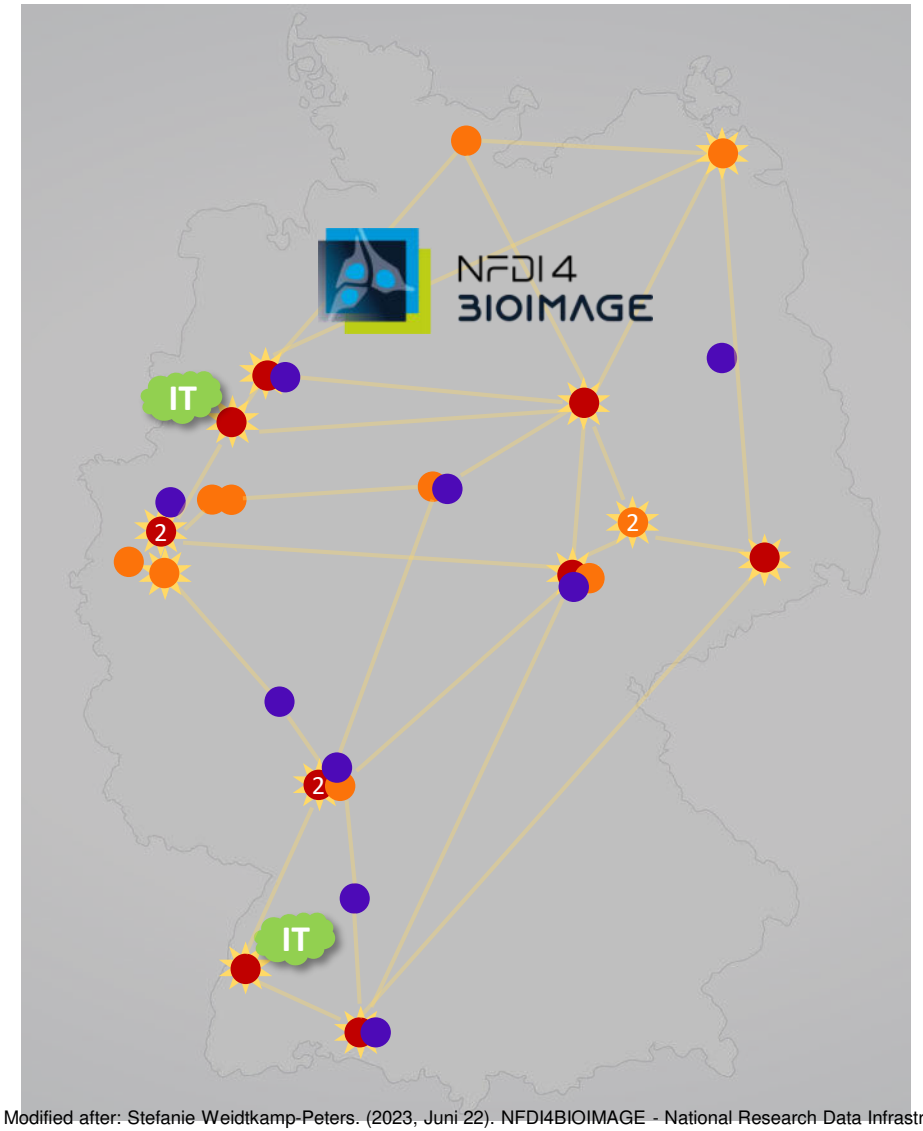
https://www.youtube.com/watch?v=BNZKMiuK7kg&list=PL2k-L-zWPoR7SHjG1HhDIwLZj0MB_stlU&index=14

- Optimized annotation strategies for image analysis (Tom)
- Contributions to the software source code and best practices for OMERO integration with Fiji (Tom & Michele)
- Improving OMERO.web & OMERO.figure (Tom)

Use Case TU Dresden Medical Faculty CFCI

- AxioScan was purchased. Concept: start using OMERO with the new system
  - How and where to start?
- Steps:
  - Discussing system requirements and examples of installations (T. Zobel, S. Kunis)
  - The request to install OMERO on the TU Dresden Medical Faculty IT servers was granted in May 2022
  - Training: OMERO server and command line usage for CF staff (Tom Boissonnet, June 2022)
  - Testing of OMERO at CFCI (pilot phase with slidescanner and EM data)
  - Discussing special data types and research use cases: How to handle data organization and annotation in OMERO? (TiM 2023)
  - Preparing data for analysis and publication (August 2023, I3D:bio and NFDI4BIOIMAGE)
  - First research paper published with REMBI-annotated bioimages in the public group of OMERO at TU Dresden Medical Faculty CFCI
    - Jannasch et al. (2024), APL Mater, https://doi.org/10.1063/5.0182672
- Next steps:
  - Rolling out to more users, enabling seamless data analysis in connection with OMERO

NFDI4BIOIMAGE Data Stewardship Team



- co-applicant institutions (Task Area Leaders)
  - IT infrastructure *(storage & playground: @WWU & @ALU-FR)*

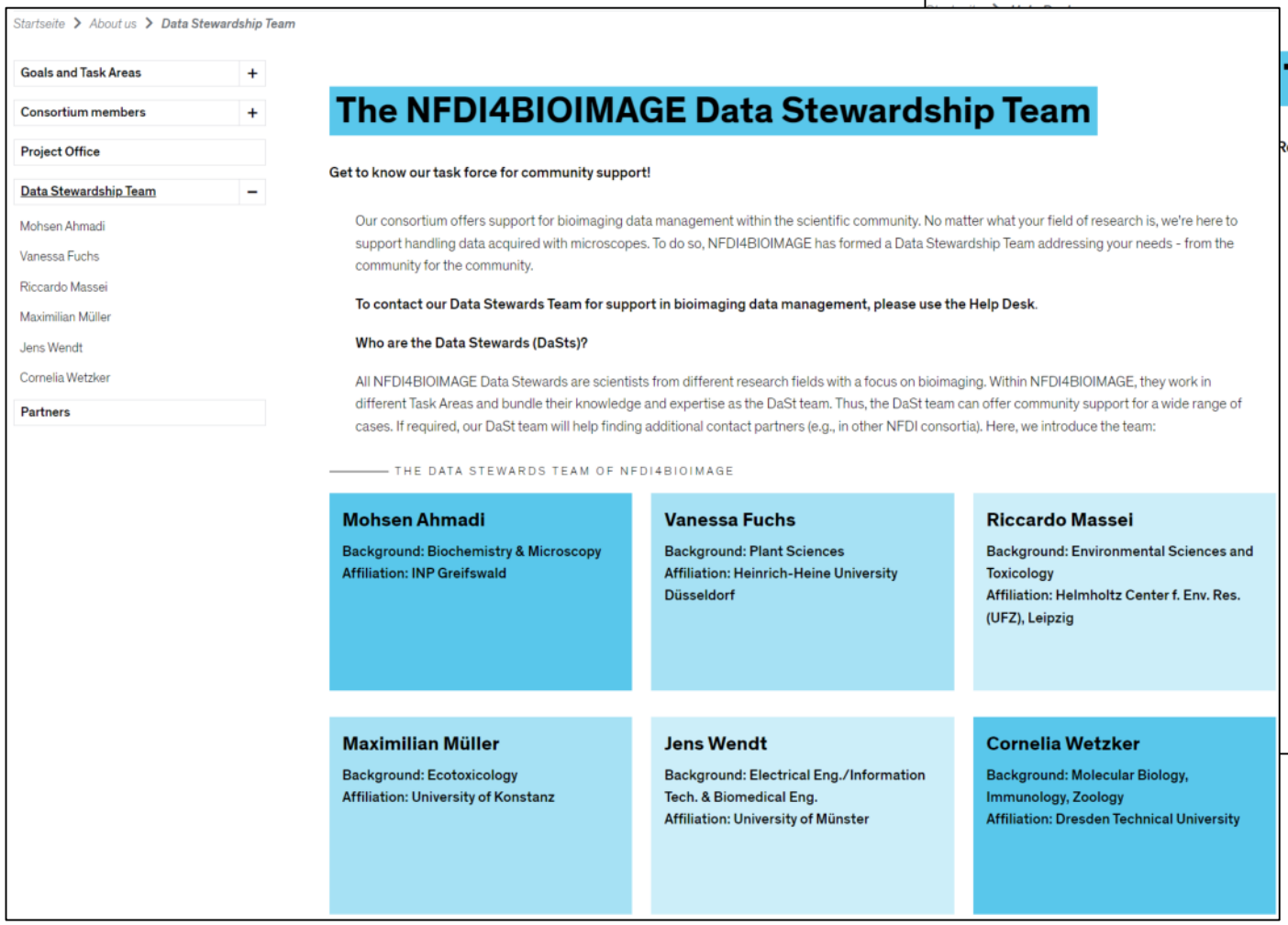
    But not: a central data archive for all bioimaging data
- participating institutions
- **data stewards (DaSts)**
- community use cases

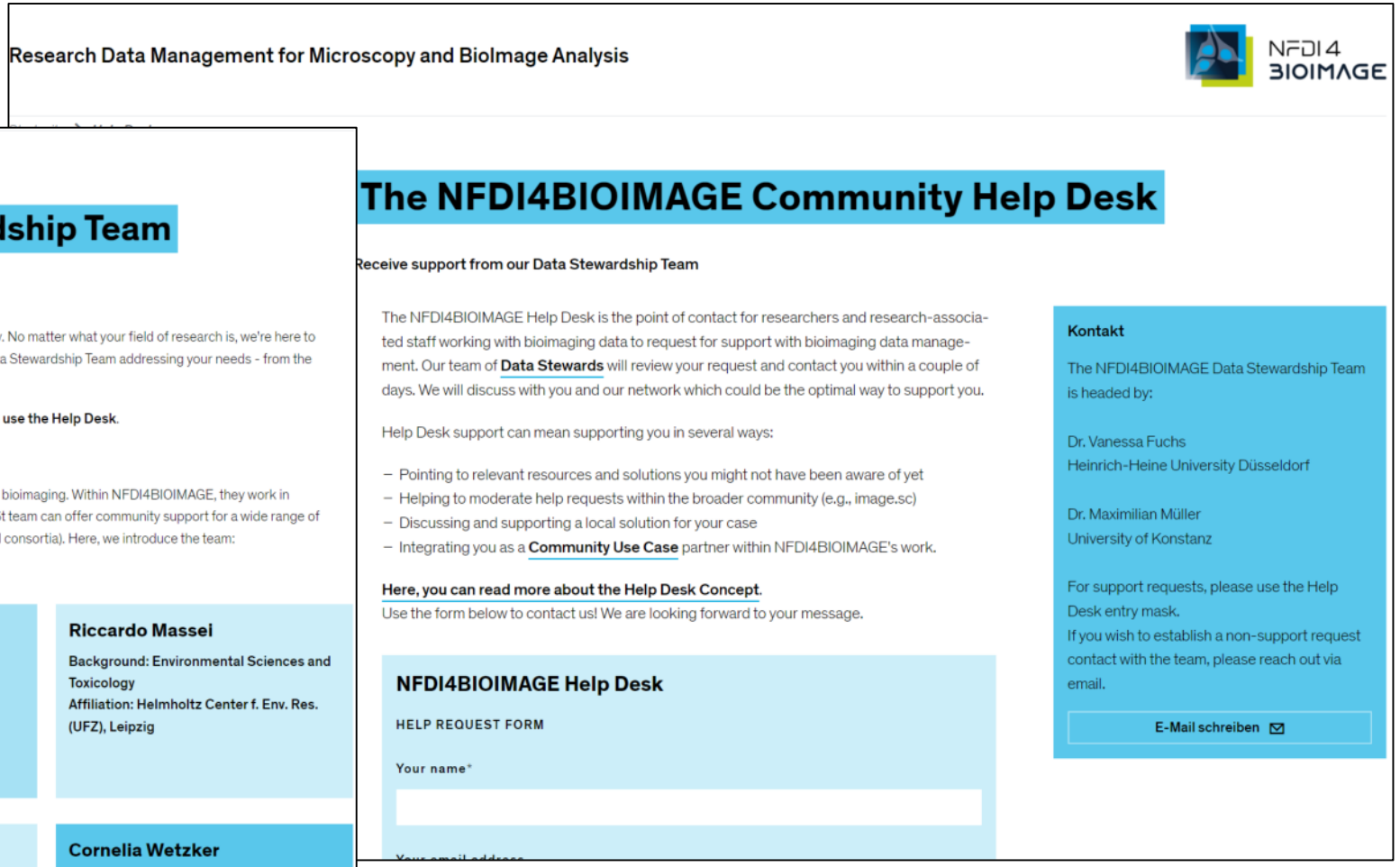
- 20+ FTE to work on practical RDM solutions and training
- help desk for emerging RDM issues
- close collaboration with other NFDI consortia
- Collaborate with Industry (via Quarep-LiMi & others)

Modified after: Stefanie Weidtkamp-Peters. (2023, Juni 22). NFDI4BIOIMAGE - National Research Data Infrastructure for Microscopy and BioImage Analysis - Online Kick-Off 2023. Zenodo. https://doi.org/10.5281/zenodo.8070038

NFDI4BIOIMAGE Data Stewardship Team

German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

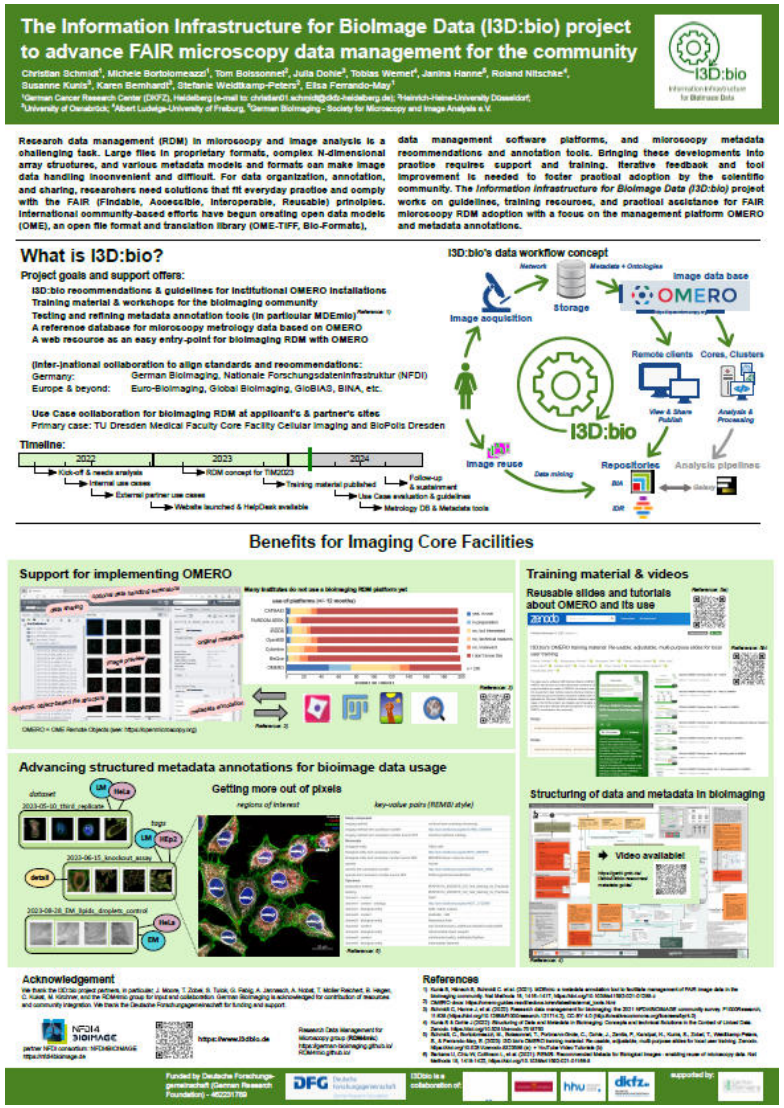




https://nfdi4bioimage.de

Meet us at our poster!

https://zenodo.org/doi/10.5281/zenodo.10805203



Christian Schmidt
Scientific Project Manager
Project Coordinator of I3D:bio
Networking and Outreach
Coordinator of NFDI4BIOIMAGE
GerBI member since 2022