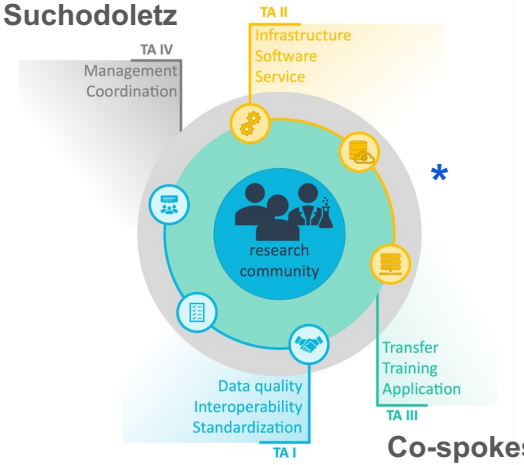
Towards OMERO and ARC interoperability for RDM-compliant bio-image data

Niraj Kandpal, & Andrea Schrader (University of Cologne)

DataPLANT - NFDI4plants

Co-spokesperson:
Dr. Dirk v. Suchodoletz

Co-spokesperson:
Dr. Jens Krüger



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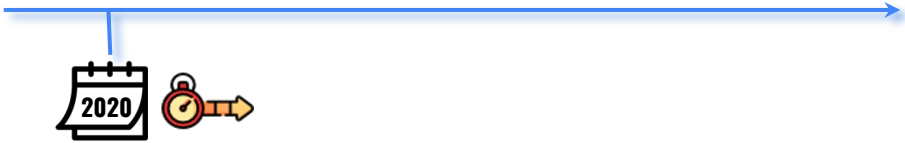
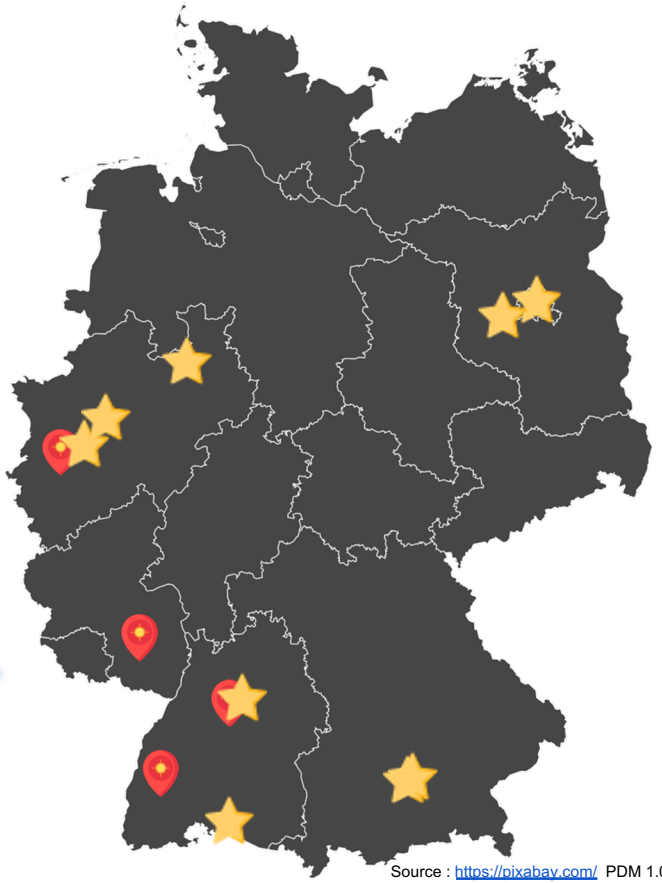
Co-spokesperson:
Prof. Dr. Björn Usadel

Co-spokesperson:
Prof. Dr. Timo Mühlhaus





4 (Co-)Applicant Institutes

9 Participating Institutions

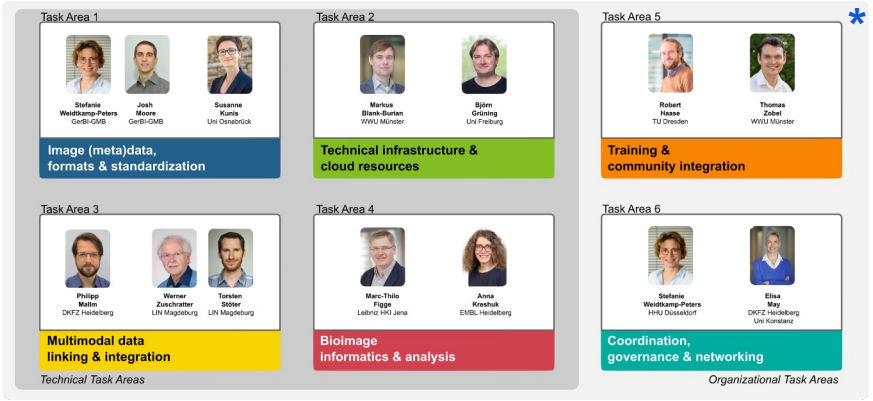
Source : https://pixabay.com/ PDM 1.0

* modified from (TA3) - DataPLANT

NFDI4Bioimage

de.NBI GERMAN NETWORK FOR BIOINFORMATICS INFRASTRUCTURE

elixir GERMANY



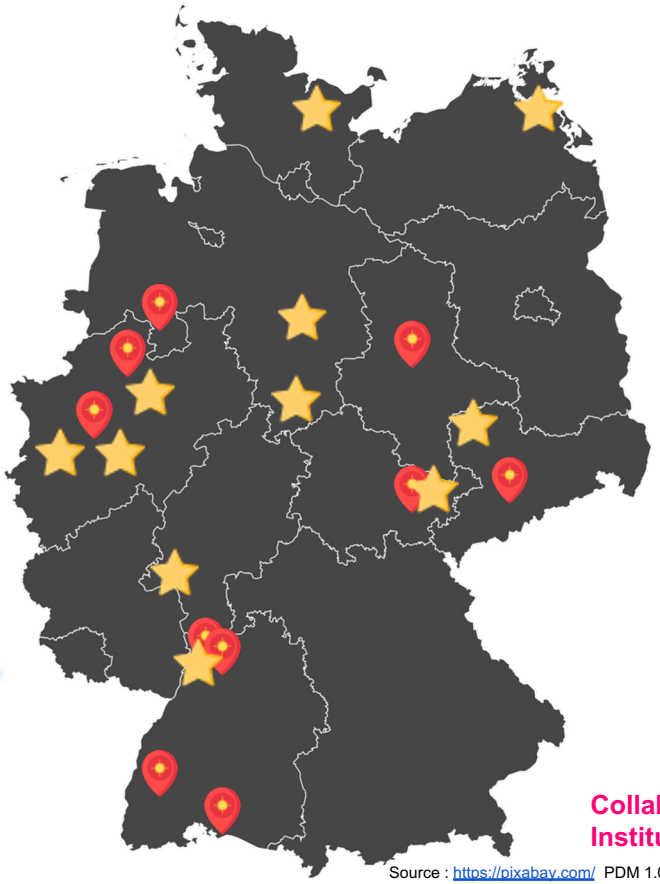
Technical TAs

Organizational TAs

2nd BioHackathon Germany
(de.NBI / ELIXIR Germany)

2020 **DataPLANT**

2023 **NFDI4Bioimage**



11 Co-Applicant Institutes + German BioImaging

12 Participating Institutes + OME

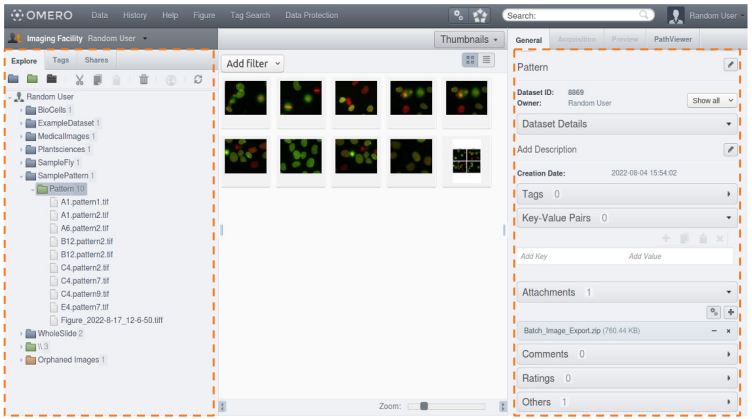
Collaboration b/w Multiple Institutes.

Source : https://pixabay.com/ PDM 1.0

* NFDI4Bioimage

OMERO

Web Application

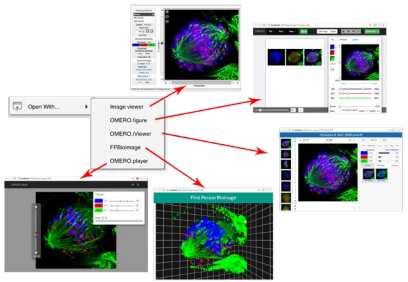


Data Structure

Thumbnails

Metadata

Visualization



Multiple Viewer Plugins

Integration

from RDMkit by **ELIXIR** (https://rdmkit.elixir-europe.org/omero_assembly.html)

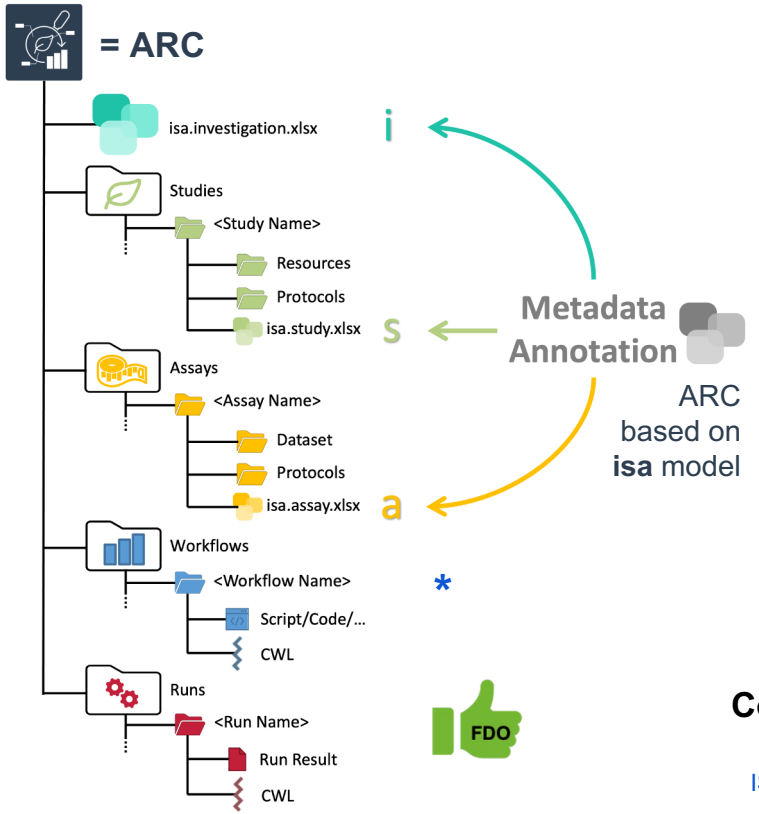
Advanced Analytics

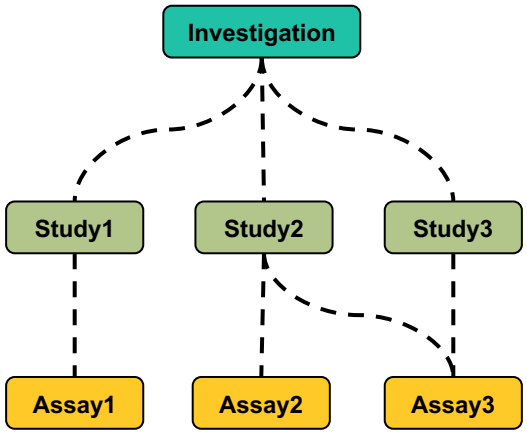
2000s

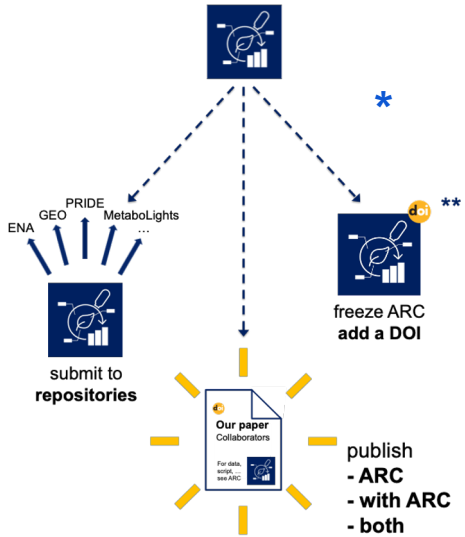
Source : openmicroscopy.org

OMERO :
RDM + Visualization + Analytics

Annotated Research Context (ARC)





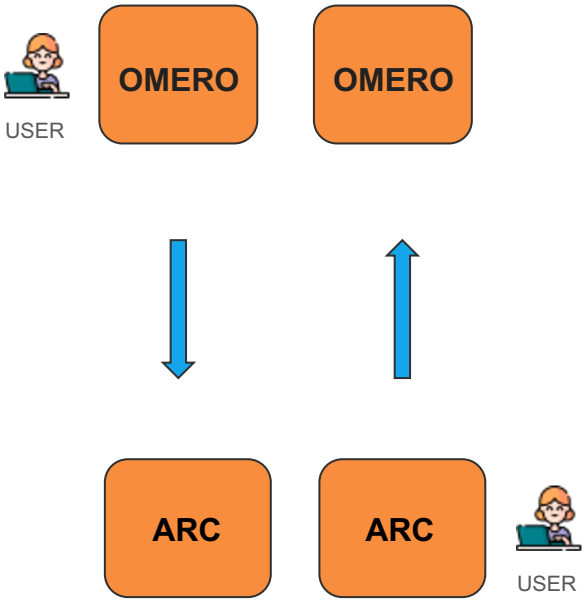


RDM-compliant bio-image data?
Using OMERO?
Consider REMBI (REcommended Metadata for Biological Images)?

ISA Model and Serialization Specification:: Sansone, S.-A. et al., 2016, doi: 10.5281/zenodo.163640
ARC specification: DataPLANT community, 2023, doi:10.5281/zenodo.10091038
REMBI: Sarkans et al., 2021, doi: 10.1038/s41592-021-01166-8

*modified from (TA3) - DataPLANT | **International DOI Foundation

OMERO-ARC interoperability

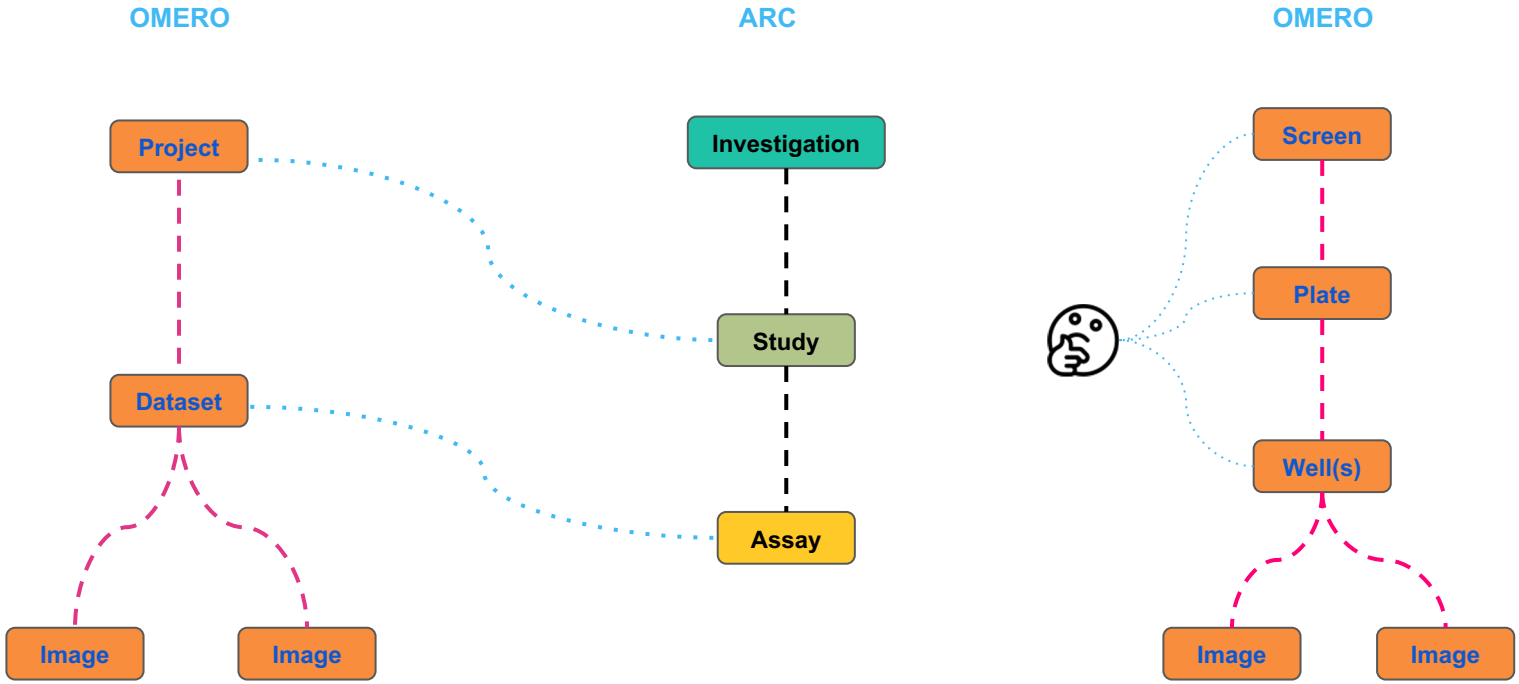


Bi - Directional :

1. OMERO to ARC
2. ARC to OMERO

Round Trip

OMERO - ARC interoperability

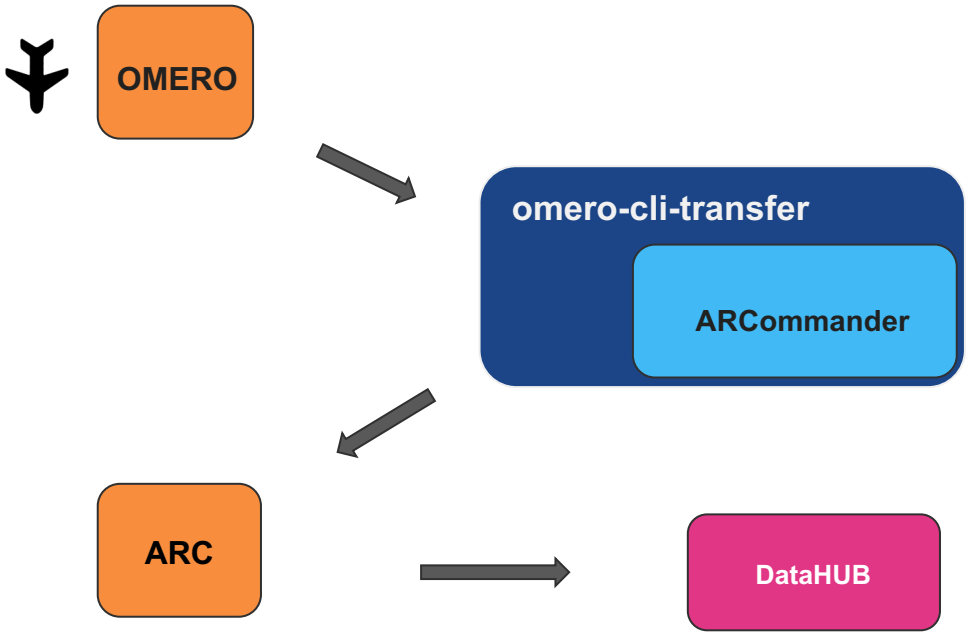


Projects-Datasets

Mapping : Multi-Modal data

High Content Screening

OMERO - ARC interoperability



Command line tool :
omero-cli-transfer-arc (Christoph Möhl)

omero-cli-transfer (Erick Martins)
ARCommander (DataPLANT)

Automatic (Meta)data :
OMERO to ARC

ARC to OMERO

Tool for OMERO to ARC

One Way : Multiple Ways

RDM-compliant bio-image data

*

REMBI?

annotated with SWATE***

Investigation

map-by-seq_CLSM-stacks

Study1

ARK1-cytoskeletal-localisation

REMBI?

Source Name	Protocol Type	Sample Name
seed1	plant growth protocol	plant1
seed2	plant growth protocol	plant2

Assay1

CLSM-stacks_oryzalin

REMBI?

Source Name	Protocol Type	Derived Data File
plant1	bioimaging protocol	image1.tiff
plant2	bioimaging protocol	image2.tiff

OMERO ID

id123

id456

Project

map-by-seq_CLSM-stacks,
ARK1-cytoskeletal-localisation

Dataset1

Image1

id123

Image2

id456

**

REMBI?

key-value pairs ?

REMBI?

Image
seedA
plant growth_protocol
plant1
bioimaging_protocol

REMBI?

Image
seedA
plant growth_protocol
plant2
bioimaging_protocol

*modified from (TA3) - DataPLANT | ** https://www.openmicroscopy.org/img/logos/ome-logomark.svg | *** DataPLANT (https://github.com/nfdi4plants/Swate)

Main areas for tasks

1. **Conceptual part:** Templates integrating with various research areas & imaging modalities within OMERO and ARCs. Designing efficient methods for transferring metadata accompanying image data stored in both ARCs and OMERO.

1. **Data curation:** Existing ARCs containing microscopy data are transferred to OMERO and vice versa. Validate the conceptual part and prepare the technical part.

1. **Technical implementation:** Enable import/export of meta(data) from and to OMERO.

Documentation / Teaching Material

Expected outcome

I. Roadmap of steps to map the two specifications.

I. Functional metadata templates to conveniently annotate data in OMERO and ARC enabling interconversion.

I. Transfer of exemplary data between ARC and OMERO.

I. Initiate tool development for automatic exchange of (meta)data and required validation procedures.

I. Connecting ARC and OMERO experts.

Documentation / Teaching Material

Expected outcome

I. Roadmap of steps to map the two specifications.
Generate the necessary representation of the OME model. Document status.

I. Functional metadata templates to conveniently annotate data in OMERO and ARC enabling interconversion.
Metadata transfer scripts (optimize), consider REMBI (terms and templates), mapping for screen & plates.

I. Transfer of exemplary data between ARC and OMERO.
Use cases, test omero-arc-exporter & metadata transfer scripts.

I. Initiate tool development for automatic exchange of (meta)data and required validation procedures.
Omero-arc-exporter (functional, extend?), prepare ARC -> OMERO.

I. Connecting ARC and OMERO experts. *Done :)*

Documentation / Teaching Material

List of Participants & Guests

Susanne Kunis
(NFDI4Bioimage TA1 co-lead)
Mohamed Abdrabbou
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Andrea Schrader
Niraj Kandpal
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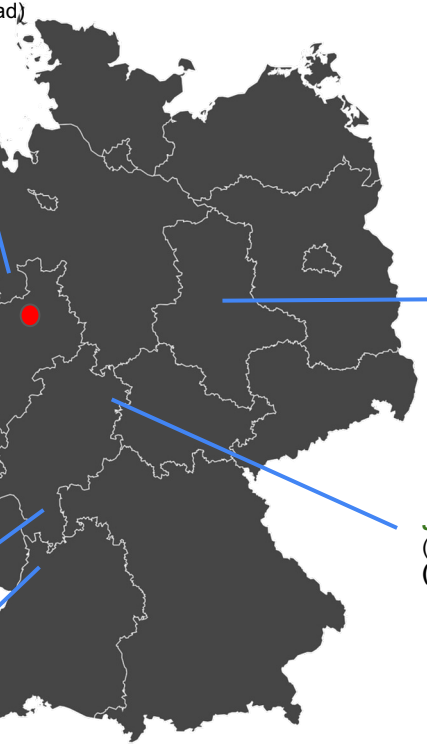

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Josh Moore
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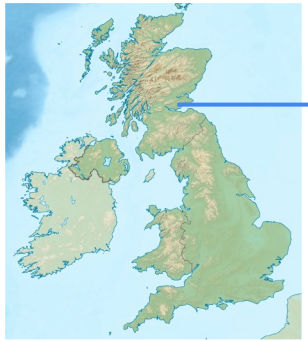
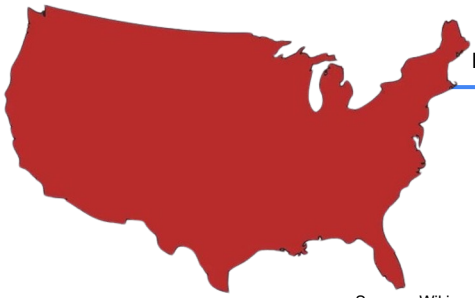
(GerBi, OME)



Jean-Marie Burel

University of Dundee



Erick Martins Ratamero

The Jackson Laboratory

◆ **In Person**

◆ Online

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Connecting OMERO and ARC experts !

Acknowledgement

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Our Cologne NFDI4Bioimage team!

We are many:
Thank you for all support enabling us to follow the OMERO-ARC project at the **2nd Biohackathon Germany** and the preparatory Hackathon projects in Cologne.

Participants at NFDI4Bioimage - TA3-Hackathon - UoC-2023

NFDI4Bioimage
- in particular: TA3, TA1, TA5, Torsten Stöter, Josh Moore

DataPLANT
- in particular: Timo Mühlhaus, Heinrich Lukas Weil, Kevin Schneider

All ***on-site*** and ***online*** participants and ***guests*** this week :)

All the organizers, supporters and participants of the **NFDI4Bioimage - TA3-Hackathon - UoC-2023 :**

Mohamed Abdrabbou, Mehrnaz Babaki, Tom Boissonnet, Michele Bortolomeazzi, Eik Dahms, Vanessa Fuchs, Moritz Hövels, Niraj Kandpal, Christoph Möhl, Josh Moore, Astrid Schauss, Andrea Schrader, Torsten Stöter, Julia Thönnißen, Monica Valencia-Schneider, Heinrich Lukas Weil, Jens Wendt, Peter Zentis