

Imaging-Persistent Hardware Descriptors (PHD): persistent identification of instrument instances and hardware configurations

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James Chambers



David Grunwald



Nate Herzog



Josh Moore



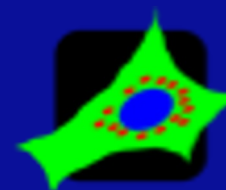
Judith Lacoste



Adrian Zai



2026-1-27 Digital Resource Alliance of Canada –
Discovery and Metadata Expert Group



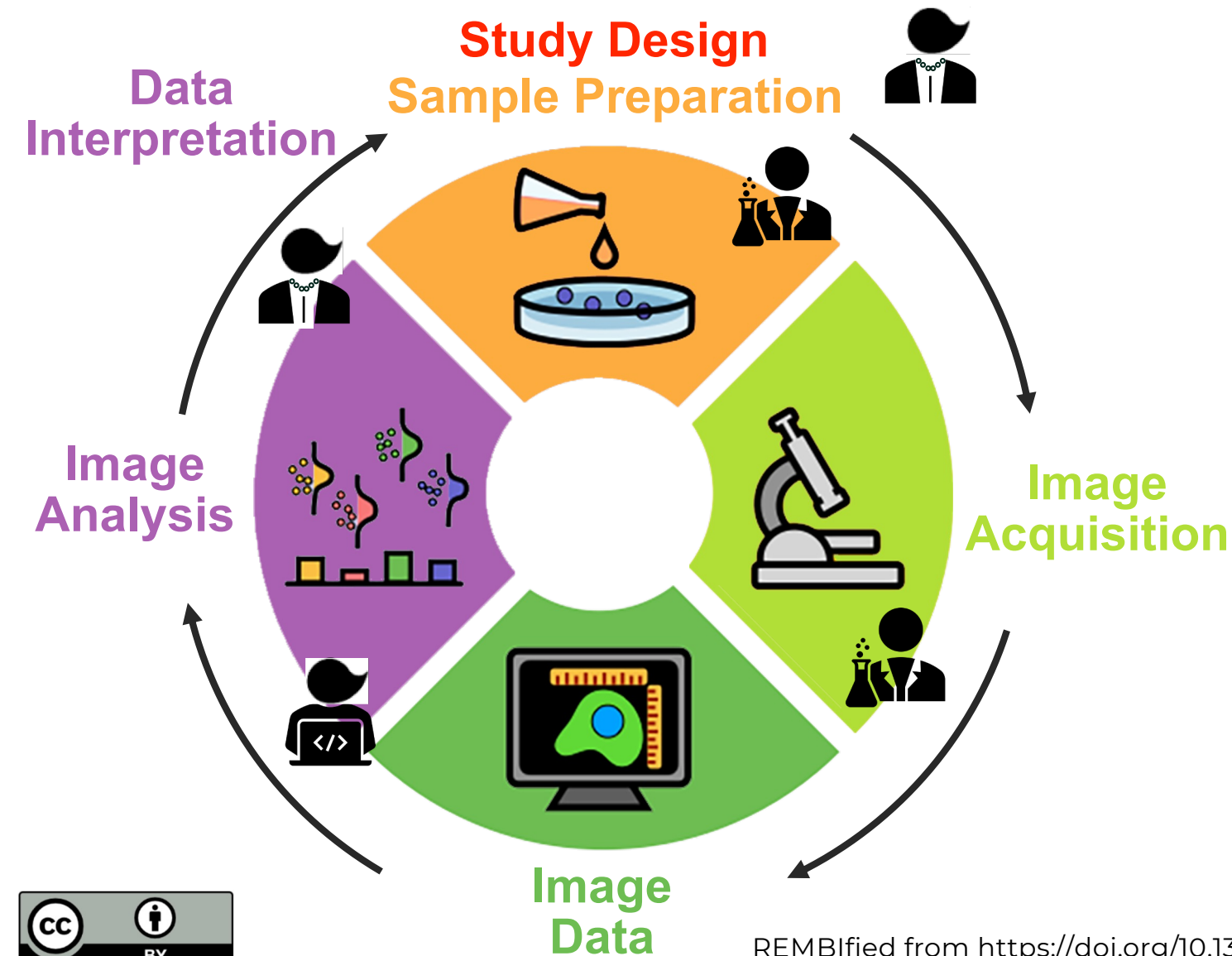
Outline

- What is bioimage data and why it is important to manage it and share it
- What is bioimage metadata
- Communities working to build standards for bioimage data and metadata
- Existing standards
- Imaging-PHD project

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Imaging experiments contain multiple related steps - starting with **PLANNING**



- Steps are mutually interconnected
- Data and Metadata produced at each step **affect** subsequent steps
- Desired outcomes **determine** how previous steps should be performed

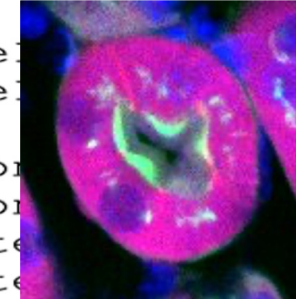
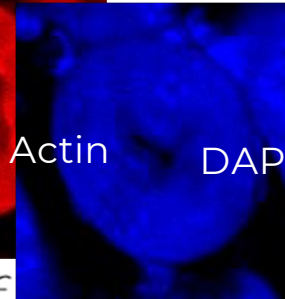
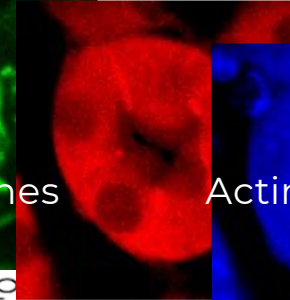
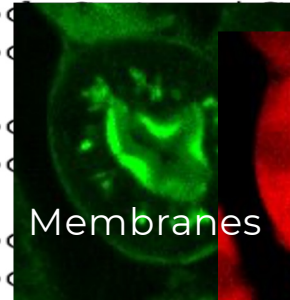
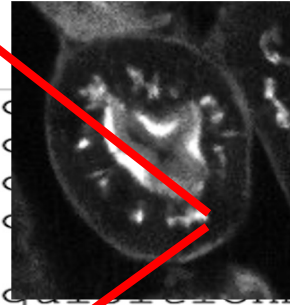


Biolmage Data

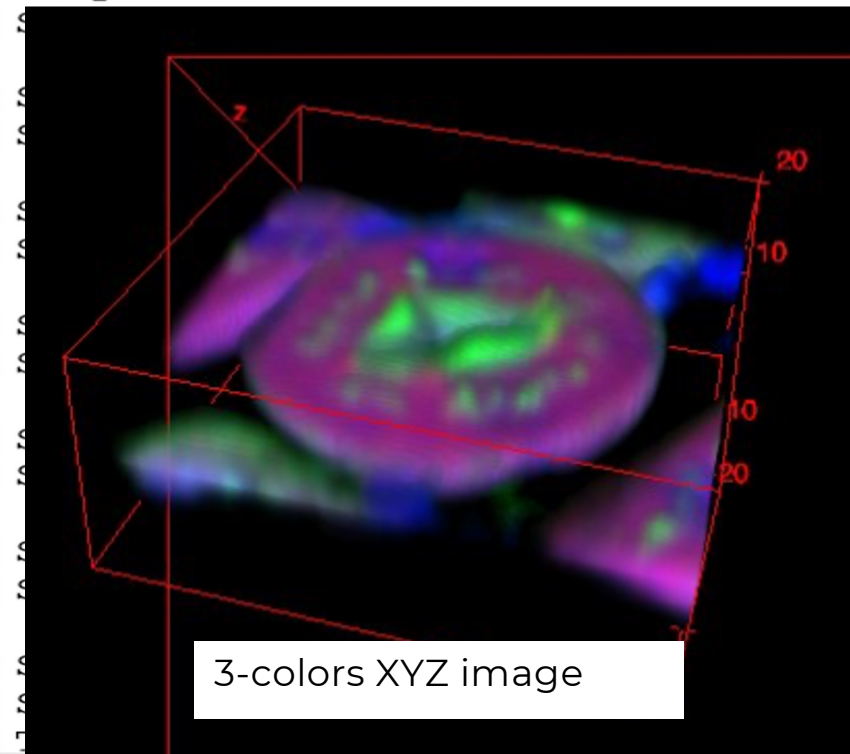
Kidney, 1.5
microns

11866 levels of gray

2119 levels of gray

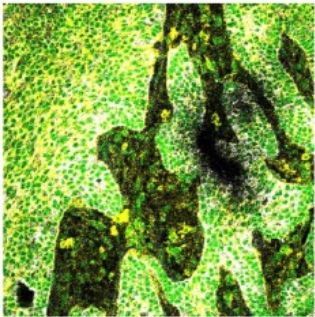


- Multi-dimensional (XYZCT)
- COMPLEX experimental set-ups
- Proprietary file formats/lack of standards
- TB to PB (continue adding zeros...)
- VISUALIZATION is mandatory
- COMPUTING POWER and SPEED necessary for:
 - 3D VISUALIZATION
 - PROCESSING and ANALYSIS (including AI/ML)
- **METADATA is essential**

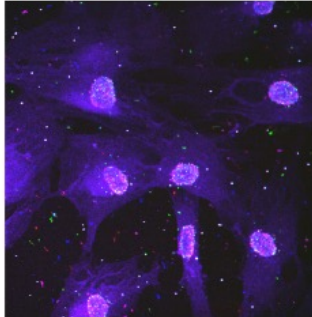


Bioimages: complex data and metadata

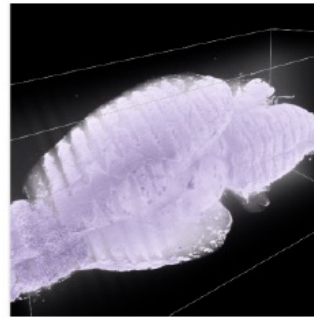
Diversity in imaging applications/modalities



Multiplexed



Spatial tx



Light-sheet



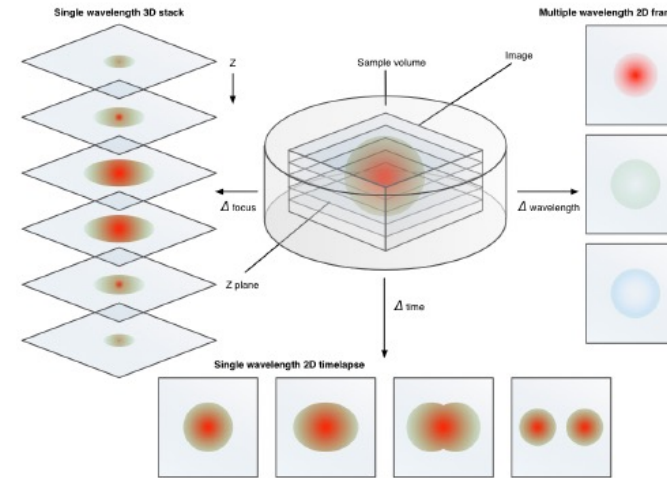
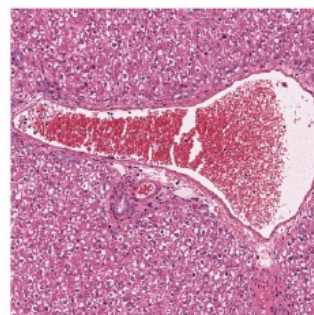
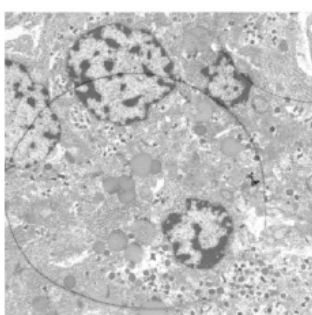
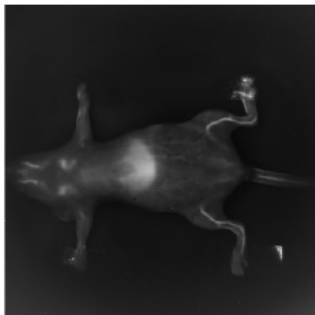
Infrared



Scanning EM



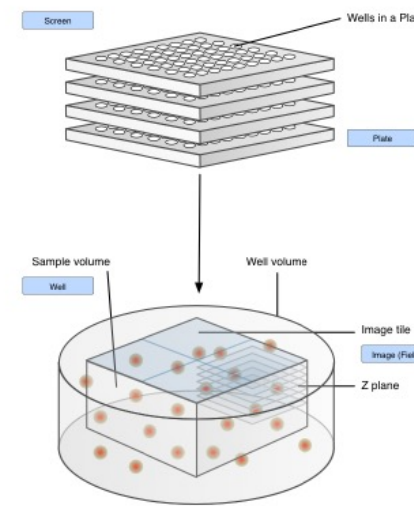
Digital pathology



5D Images

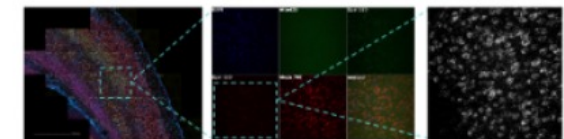
3D, multi-color, movies, or any combination

<https://ome-model.readthedocs.io/>



High-content Screen

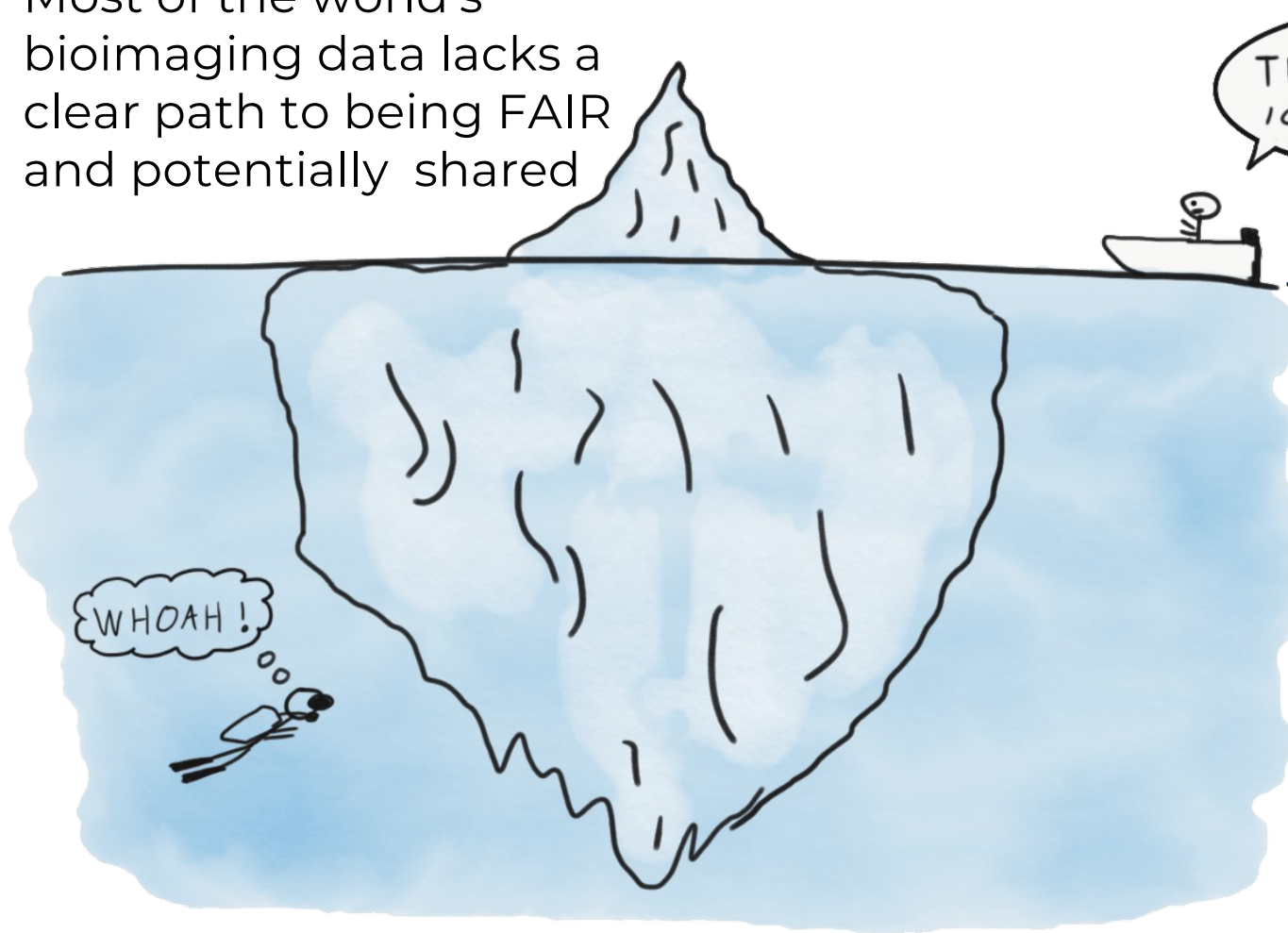
Complex Acquisitions



Single-cell tissue

Most of the world's bioimage data is not FAIR and is not ready to be shared

Most of the world's bioimaging data lacks a clear path to being FAIR and potentially shared



**Available FAIR
bioimage data...**

... hidden treasure

- Lost/Misplaced/Fragmented
- Poorly annotated
- Insufficient metadata
- Poorly managed

Data Management and Sharing

OPEN 2018 <https://doi.org/10.1038/s41592-018-0195-8> **comment**

2021 <https://doi.org/10.1038/s41592-021-01113-7> **Check for updates**

nature methods
Perspective <https://doi.org/10.1038/s41592-024-02585-z>

Enabling global image data sharing in the life sciences

Received: 12 February 2024
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Check for updates

Peter Bajcsy¹, **Sreenivas Bhattiprolu**², **Katy Börner**³, **Beth A. Cimini**⁴, **Lucy Collinson**⁵, **Jan Ellenberg**⁶, **Reto Fiolka**⁷, **Maryellen Giger**⁸, **Wojtek Goscinski**⁹, **Matthew Hartley**¹⁰, **Nathan Hotelling**¹¹, **Rick Horwitz**¹², **Florian Jug**¹³, **Isabel Kemmer**¹⁴, **Anna Kreshuk**⁵, **Emma Lundberg**^{15,16}, **Aastha Mathur**¹⁴, **Kedar Narayan**^{17,18}, **Shuichi Onami**¹⁹, **Anne L. Plant**¹, **Fred Prior**²⁰, **Jason R. Swedlow**²¹, **Adam Taylor**²² & **Antje Keppler**¹⁴✉

Cornell University We gratefully acknowledge support from member institutions

arXiv > q-bio > arXiv:2401.13022 **Search...** **Help | Adv**

Quantitative Biology > Other Quantitative Biology

[Submitted on 23 Jan 2024 (v1), last revised 30 Aug 2024 (this version, v5)]

Harmonizing the Generation and Pre-publication Stewardship of FAIR Image Data

Nikki Bialy, Frank Alber, Brenda Andrews, Michael Angelo, Brian Beliveau, Lacramioara Bintu, Alistair Boettiger, Ulrike Boehm, Claire M. Brown, Mahmoud Bukar Maina, James J. Chambers, Beth A. Cimini, Kevin Eliceiri, Rachel Errington, Orestis Faklaris, Nathalie Gaudreault, Ronald N. Germain, Wojtek Goscinski, David Grunwald, Michael Halter, Dorit Hanein, John W. Hickey, Judith Lacoste, Alex Laude, Emma Lundberg, Jian Ma, Leonel Malacrida, Josh Moore, Glyn Nelson, Elizabeth Kathleen Neumann, Roland Nitschke, Shuichi Onami, Jaime A. Pimentel, Anne L. Plant, Andrea J. Radtke, Bikash Sabata, Denis Schapiro, Johannes Schöneberg, Jeffrey M. Spraggins, Damir Sudar, Wouter-Michiel Adrien Maria Vierdag, Niels Volkmann, Carolina Wählby, Siyuan (Steven) Wang, Ziv Yaniv, Caterina Strambio-De-Castillia

Together with the molecular knowledge of genes and proteins, biological images promise to significantly enhance the scientific understanding of complex cellular systems and to advance predictive and personalized therapeutic products for human health. For this potential to be realized,

Federated Network
of Image Data
Repositories

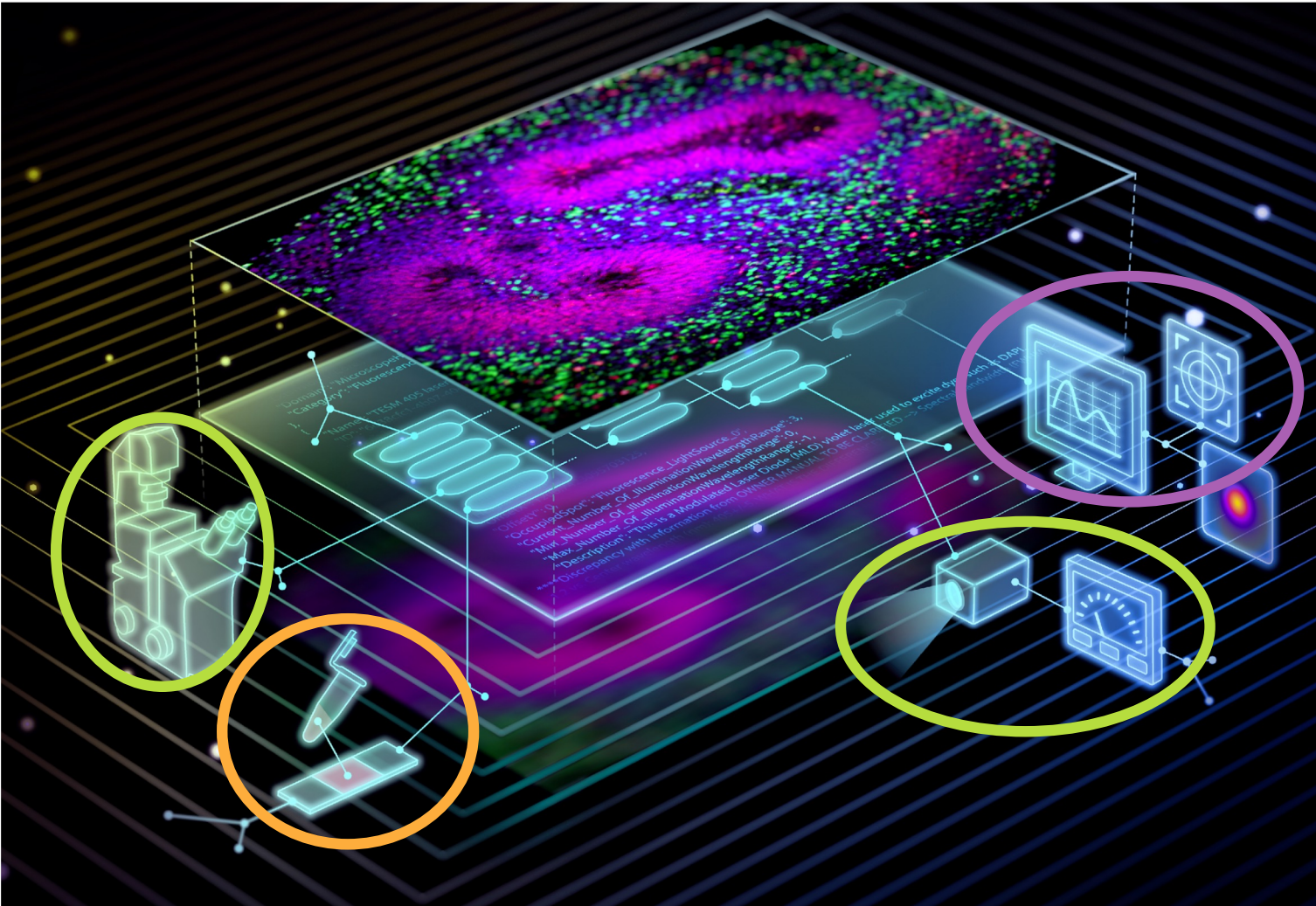
Image
Data
Internet

Generation of
bioimage data that
is FAIR from the
ground-up

Outline

- What is bioimage data and why it is important to manage it and share it
- **What is bioimage metadata**
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Image Metadata



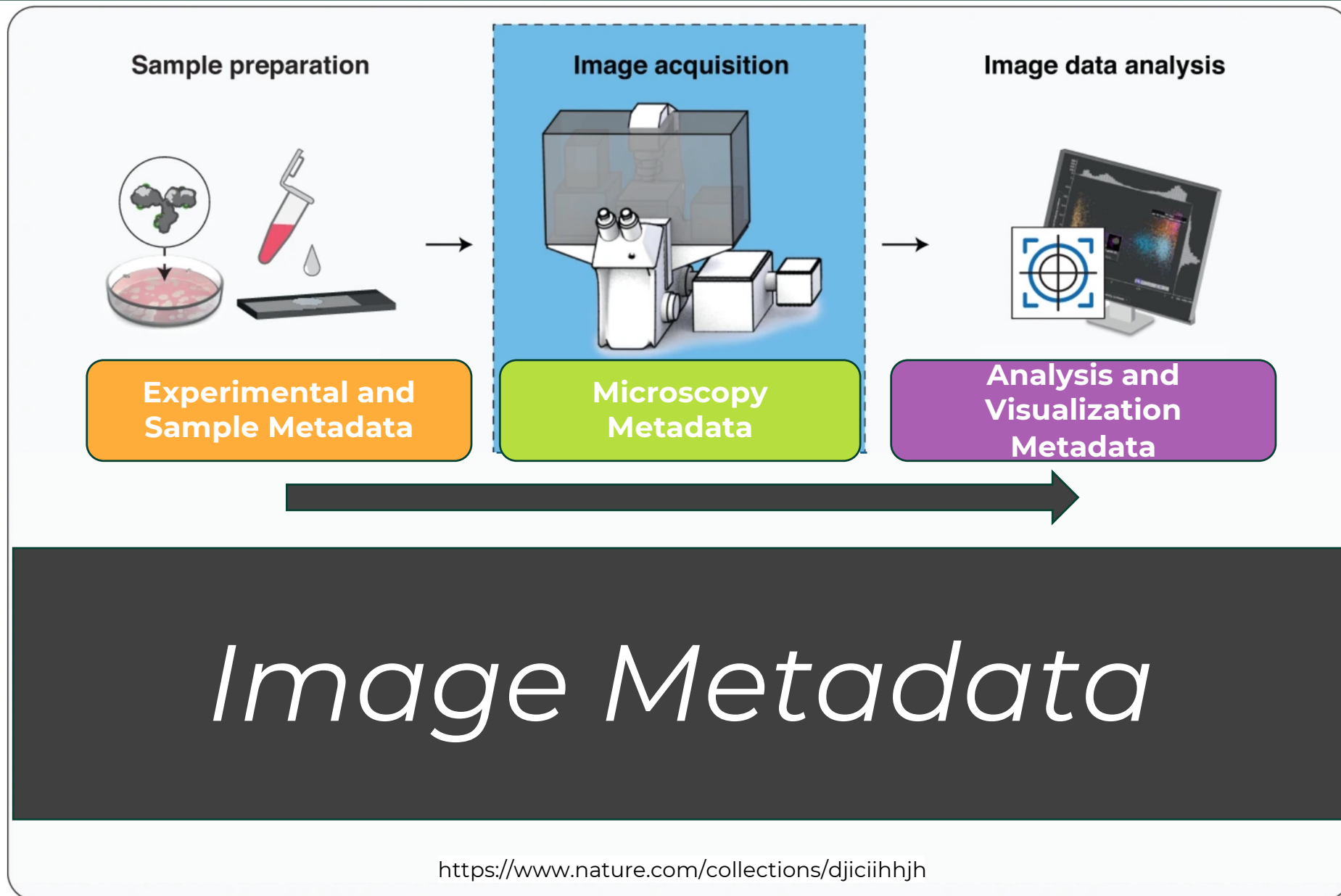
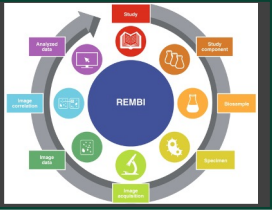
All information that is
needed to interpret,
evaluate the quality
reproduce and share
microscopy images

- Sample preparation
- Image Acquisition
 - Hardware configuration
 - Acquisition setting
 - Quality Control
- Image data processing and analysis

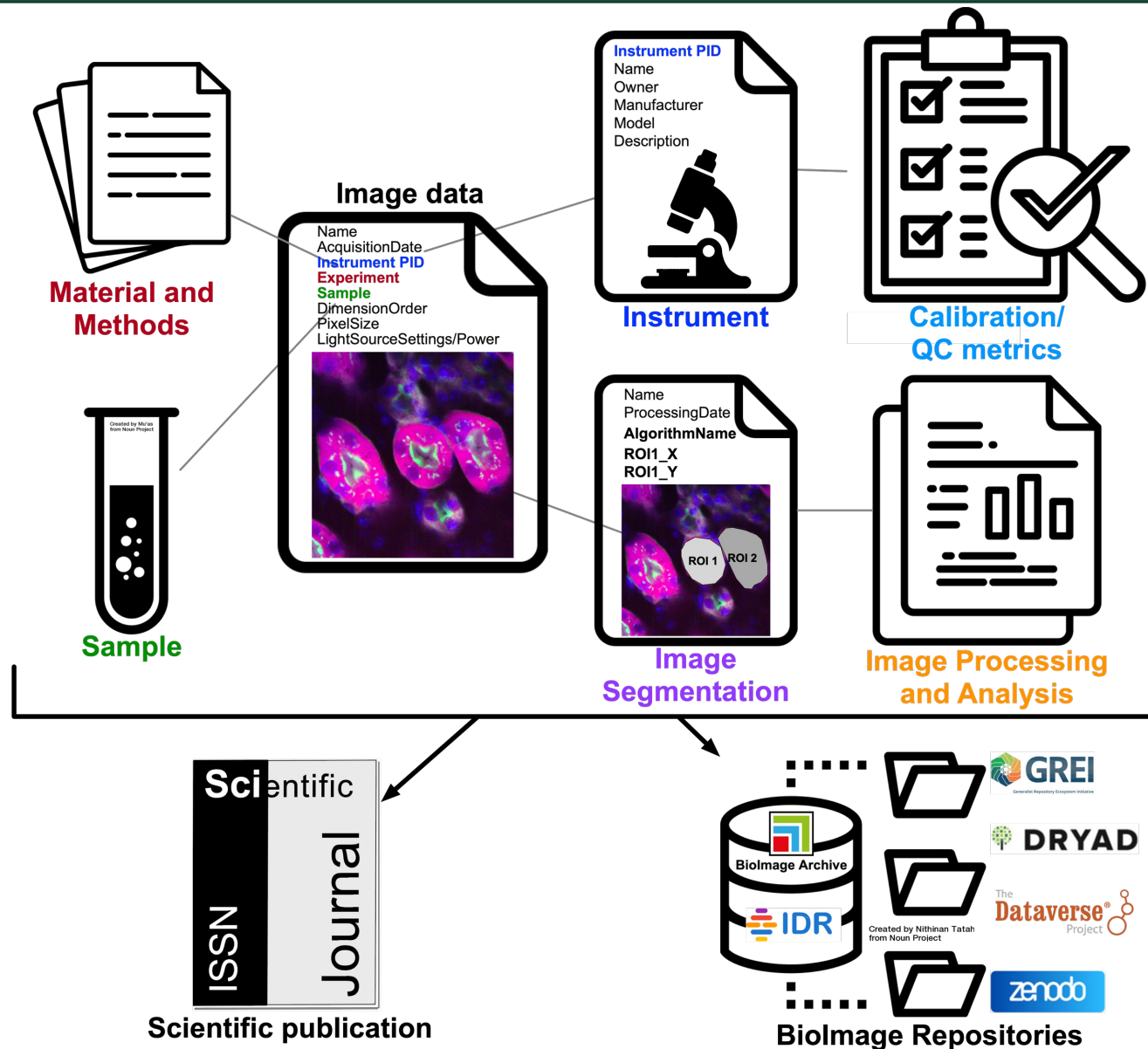
© Thao Do (Allen Institute, Seattle, WA, USA)
Nature Methods FOCUS issue on Reporting and Reproducibility in Microscopy:
<https://www.nature.com/collections/djicihhjh>



Image Metadata is key for producing high-quality FAIR data

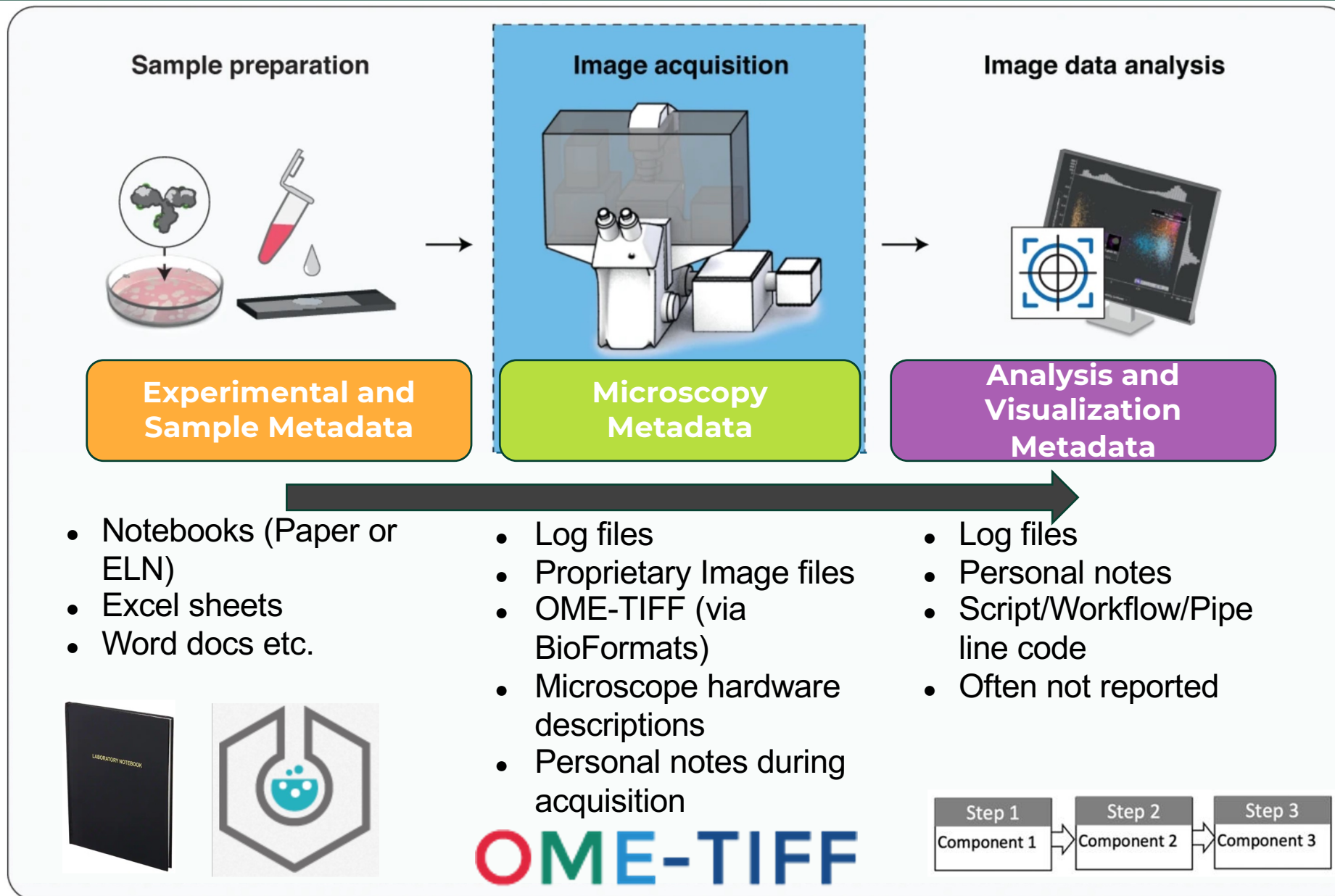


Where is bioimage metadata?



PIDs can help maintain links between different essential information

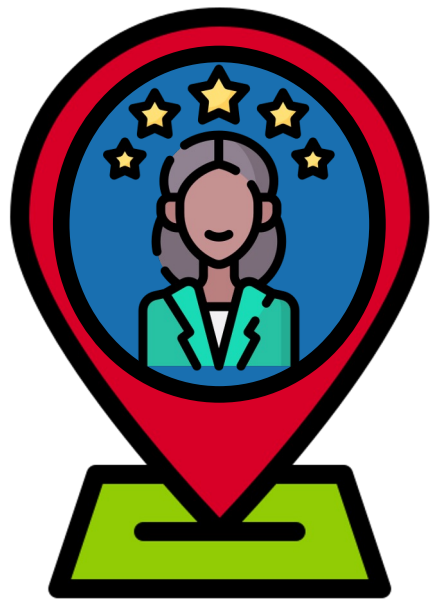
Fragmentation is the enemy



Outline

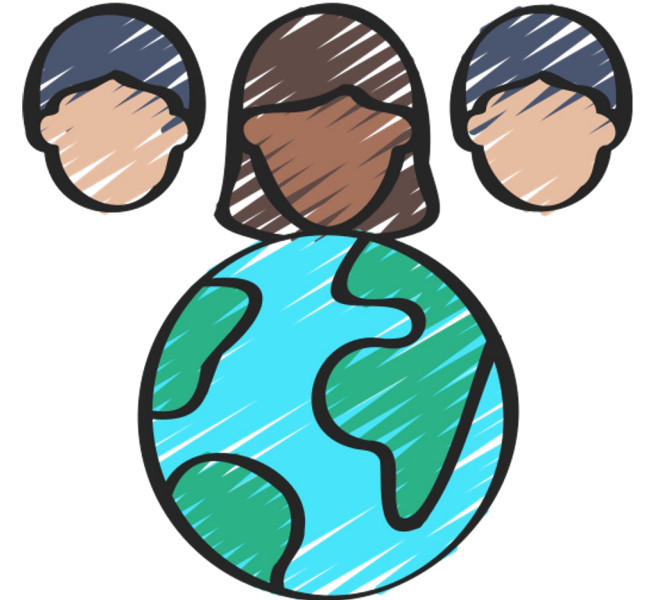
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Take home: data FAIR-ification cannot be done in isolation



Local
expertise

Community
Guidelines,
Specifications
and Tools



BINA belongs to a network of international organizations spanning the globe



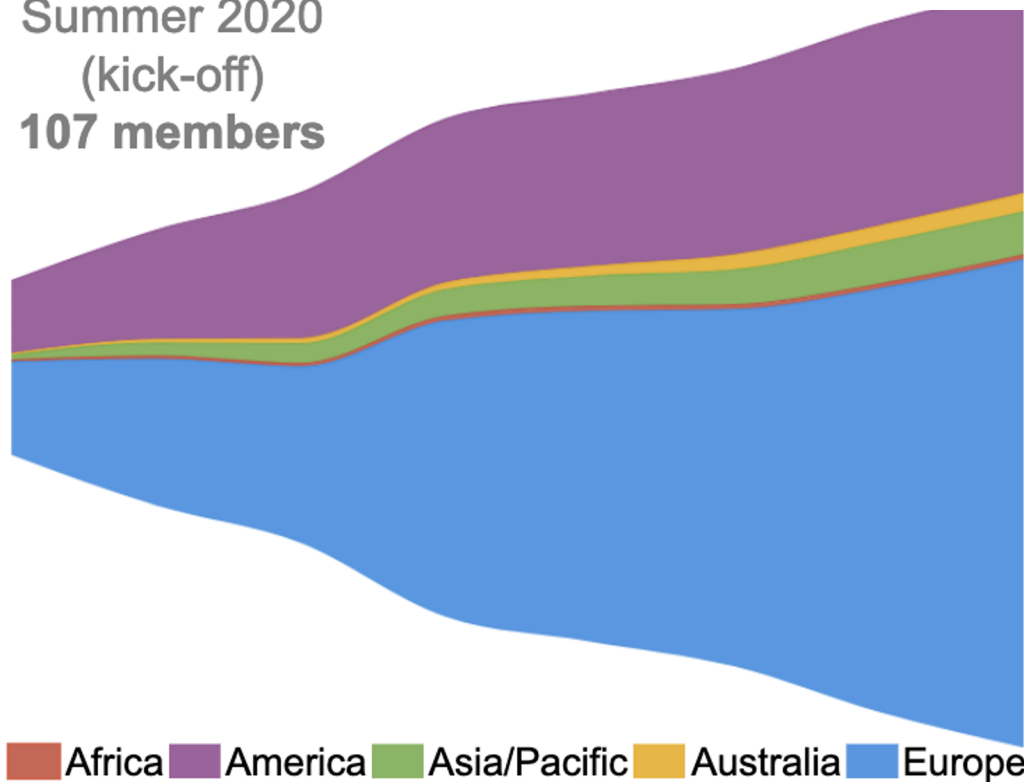
QUAREP-LiMi: industry and academia to promote quality, reproducibility and sharing-value



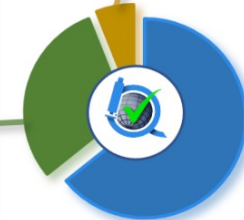
Membership growth

2025
> 600 members

Summer 2020
(kick-off)
107 members



Membership composition



Advocacy efforts: promoting strong policies and sufficient funding



Request for Information: NIH Common Fund is Soliciting Ideas for NIH-wide Challenges and Opportunities

Notice Number:

NOT-RM-23-013

Enabling interoperable, FAIR image data generation, storage, sharing and analysis



arXiv > q-bio > arXiv:2401.13022

Quantitative Biology > Other Quantitative Biology

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arXiv > q-bio > arXiv:2401.13023

Quantitative Biology > Other Quantitative Biology

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Enabling Global Image Data Sharing in the Life Sciences

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Microscopy metadata: describing image acquisition

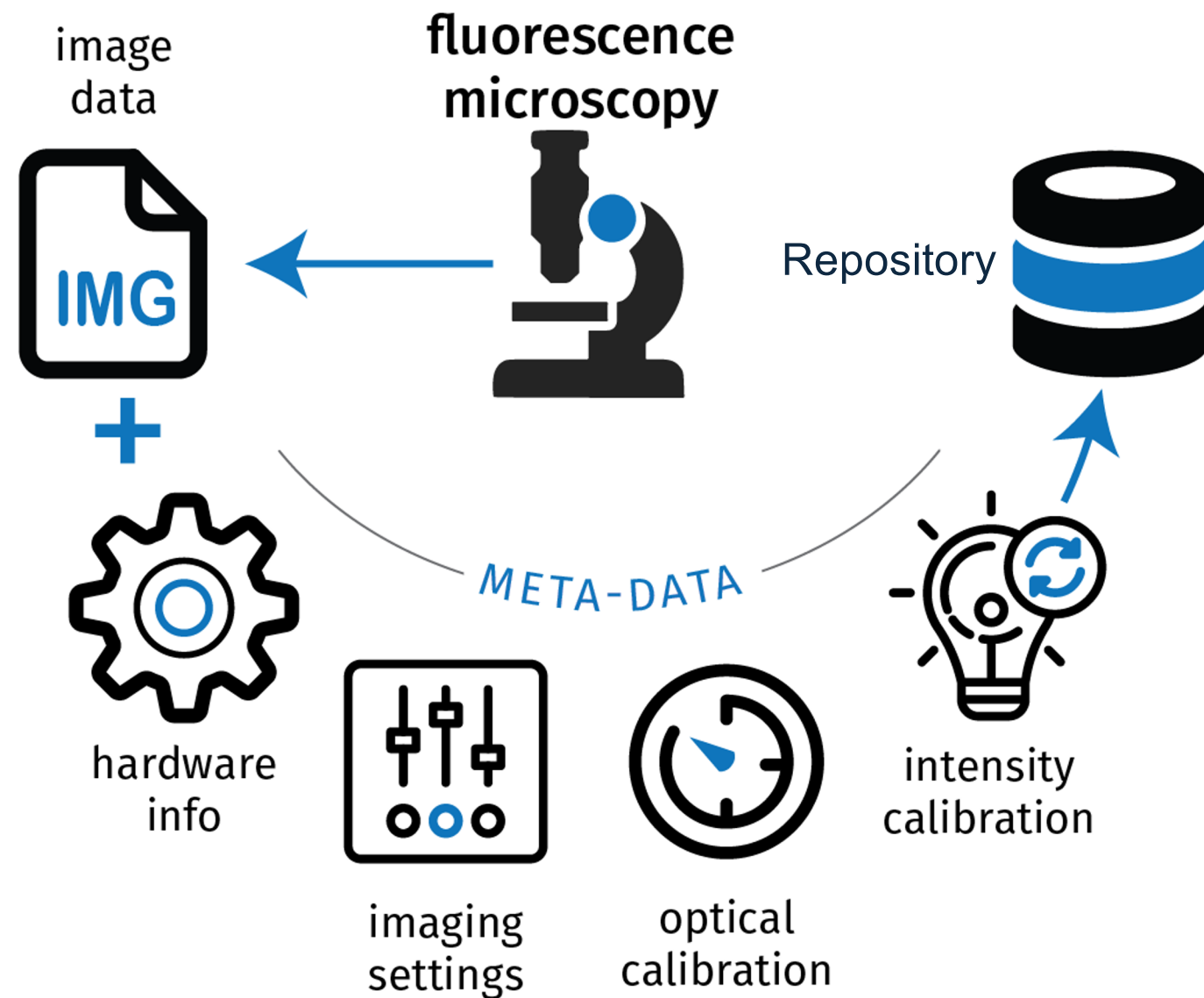
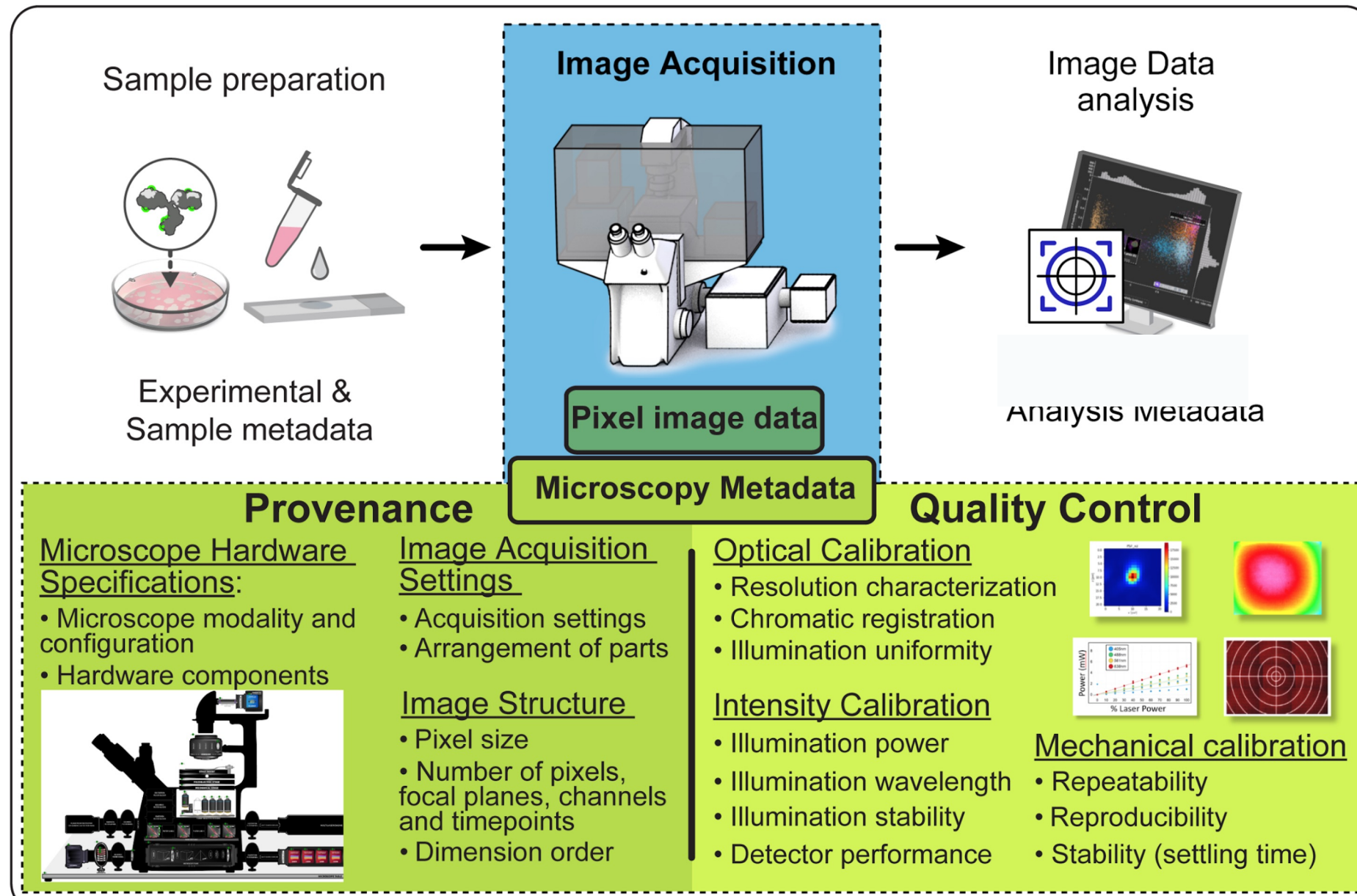
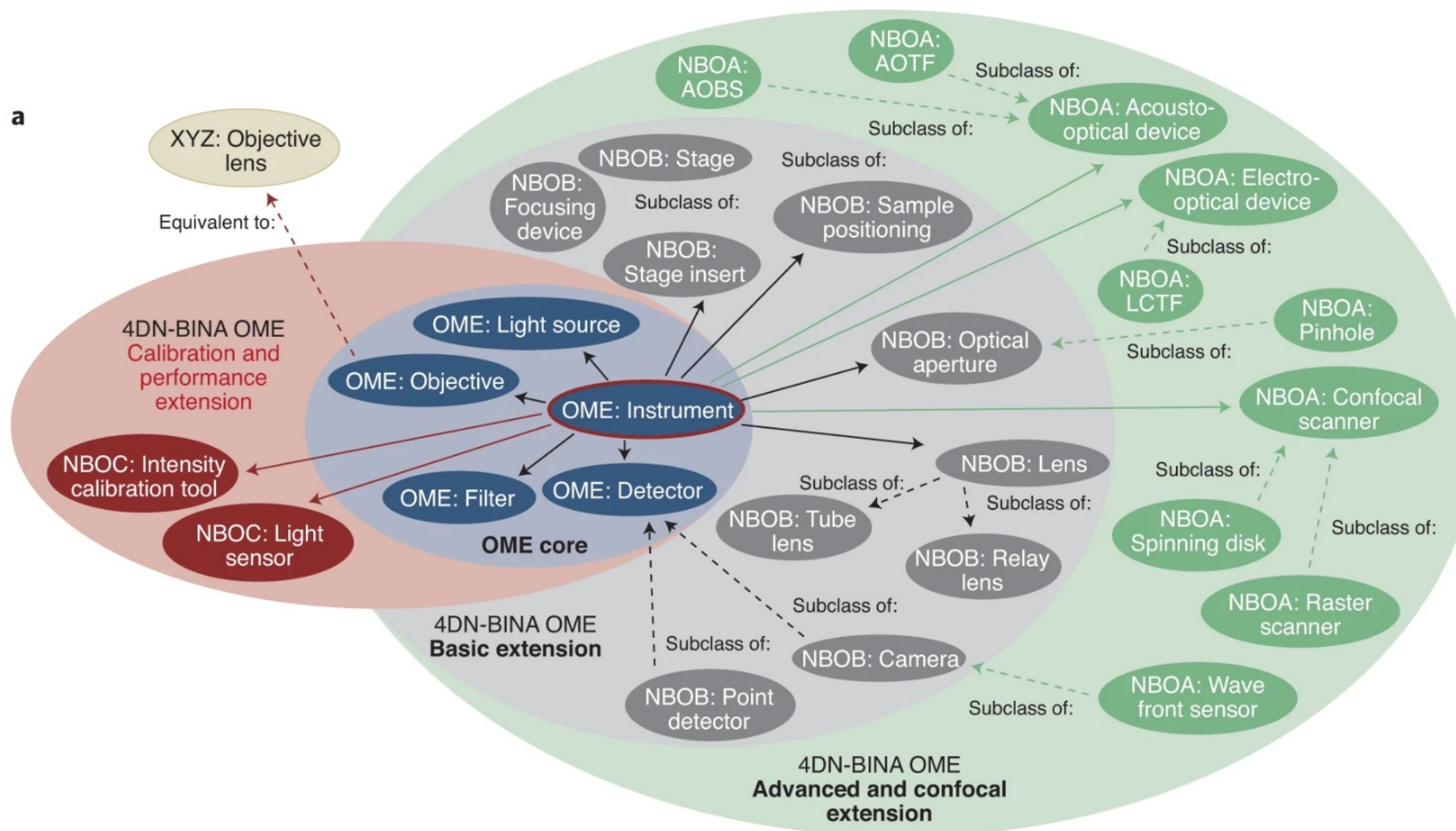


Image Acquisition Metadata: Hardware, Settings and QC



Community standards: LiMi-Model Metadata Specifications to expand the OME-data model



Community standards: Light Microscopy Model (LiMi-Model) Metadata Specifications to expand the OME-data model



LiMi-Model of Metadata Specifications

- Hosted and maintained by QUAREP-LiMi
- Covers hardware configuration, image acquisition settings and quality control metadata
- Revision process codified by Best Practices document
- Large community of imaging scientists, microscopy experts, manufacturers and standards organizations stakeholders

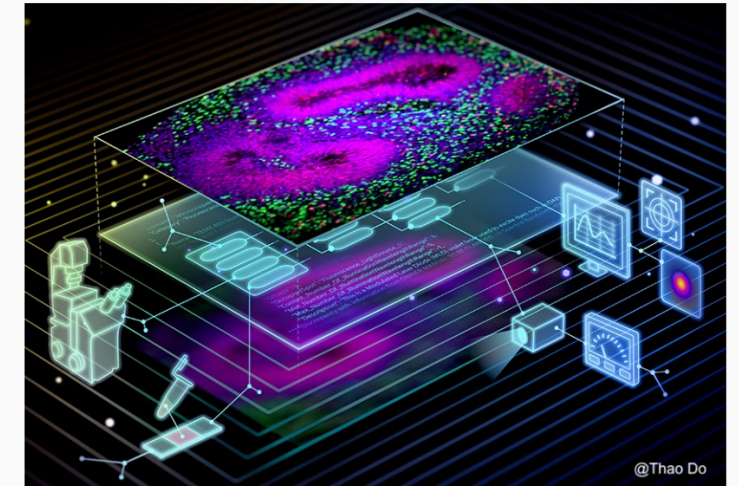
NBO-Q

Home / Working Groups / WG 7 – Metadata / NBO-Q

NBO-Q

Harmonize the description of light microscopy hardware, acquisition settings, and quality-control metrics in order to enhance image quality, reproducibility, and to fulfill the **FAIR** (Findable, Accessible, Interoperable, and Reusable) data principles.

Join QUAREP WG7 (Metadata)



Microscopy metadata is essential for image data QC, interpretation, analysis and sharing. @Thao Do

Purpose

- Promote the harmonized generation and pre-publication management of image datasets from the ground up.
- Facilitate the deposition of microscopy datasets to public image data repositories (e.g., [BioImage Archive](#), [OME-Image Data Resource](#), RIKEN [SSBD](#), [Brain Image Library](#), etc.).
- Facilitate data reuse and the extraction of quantitative information from image data using advanced bioimage analysis techniques, including AI/ML.
- Define the light-microscopy implementation of the Image Acquisition module of the [Recommended Metadata for Biological Images](#) (REMBI) guidelines.

Deliverables

- A flexible and adaptable community-agreed vocabulary to describe microscopy hardware, image acquisition settings, and their associated quality control measurements.
- A metadata model to structure the vocabulary and organize the data.
- A set of machine-actionable representations of the metadata model leveraging the latest Linked Data technology.

<https://quarep.org/working-groups/wg-7-metadata/>

QUAREP-LiMi: WG2 and WG7 partnership

WG 2 – Detection system performance

Home / Working Groups / WG 2 – Detection system performance

WG 2 - Objectives

WG2 focuses on the detection system, comprising the detection path and its detector(s), and how it measures the signal from the sample.

Members of WG2 aim to standardize the characterization of the detection system performance and create standard procedures for monitoring it over time, thereby revealing performance issues that could affect data reproducibility. Therefore, WG2 will define universal, externally measurable parameters applicable to any type of detector (e.g., photons, linearity, noise), together with measurement tools and protocols for measuring these parameters from common detector types. These universal parameters will be specified according to each distinct type of detector's internal parameters, which have already been defined by the community. They will enable the evaluation and comparison of different detection systems, thus pinpointing the most suitable technology for given applications.

WG 2 - Co-Chairs



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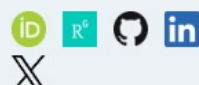


Britta Schroth-Diez

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WG 7 - Objectives

The Work Group 7 focuses on various aspects of [Image Metadata](#) (initially primarily Microscopy Metadata but also Sample and Analysis Metadata). These span from defining and continually revising the [4DN-BINA-OME \(NBO\) Microscopy Metadata](#) model, to facilitating metadata capture through user-friendly tools, to integrating the captured metadata into cloud-ready storage containers such as the newly developed [Open Microscopy Environment](#) (OME) [Next-Generation File Format](#) (NGFF). To promote the uptake of metadata tools and models, educational material and outreach strategies are also developed.

To carry on these tasks, **WG7 is organized into four Subgroups** (see "Subgroup" tab below), each of which carries out specific objectives. These subgroups are created, paused, or dissolved on a needs basis as agreed by the WG7 as a whole.

The **general meeting serves as a space for reporting back** on the progress that has been achieved within the Subgroups, **connecting the dots, strategic planning, and general discussions**.

The **Subgroups** (see "Subgroup" tab below) **identify specific tasks** to be carried out to move our work forward. To participate, please first fill in the general [QUAREP-LiMi membership form](#) and then enter your name [here](#). **Still confused?** No worries, we have a specific [list of tasks](#) that you can check out to know exactly how you can lend a hand.

WG 7 - Co-Chairs



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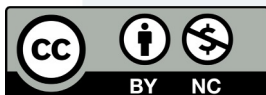


Caterina Strambio De Castillia

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Community standards: Light Microscopy Model (LiMi-Model) Metadata Specifications to expand the OME-data model

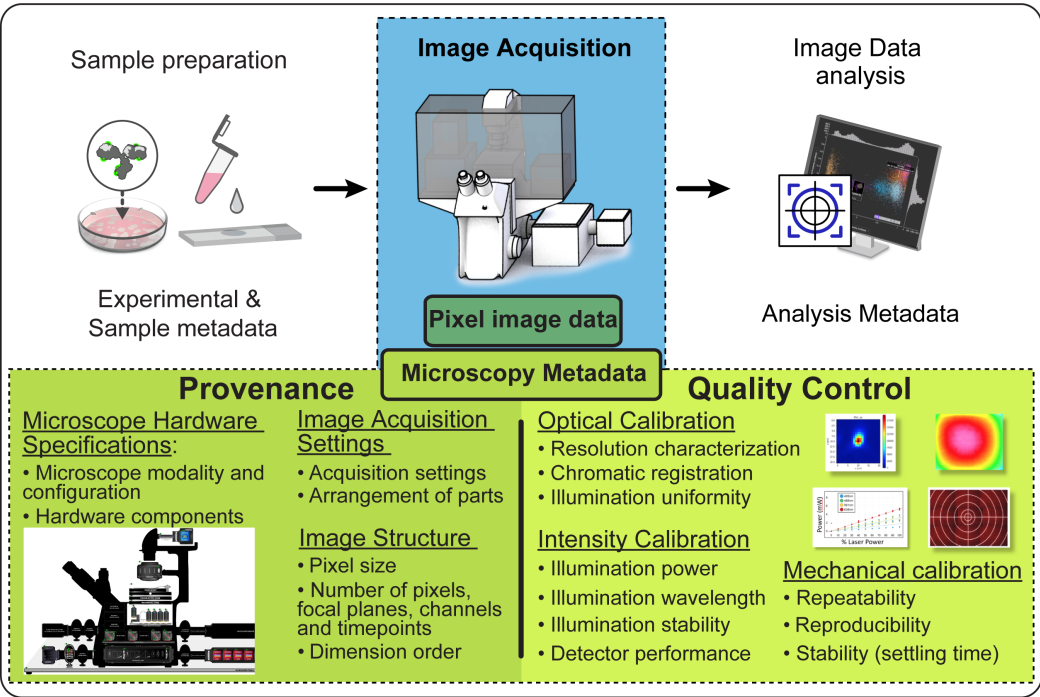
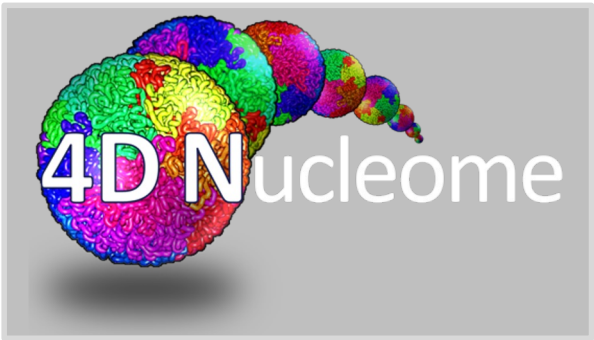
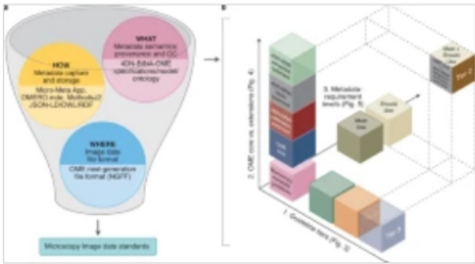
Comment
3 Dec 2021
[Nature Methods](#)



Towards community-driven metadata standards for light microscopy: tiered specifications extending the OME model

Rigorous record-keeping and quality control are required to ensure the quality, reproducibility and value of imaging data. The 4DN Initiative and BINA here propose light Microscopy Metadata Specifications that extend the OME Data Model, scale with experimental intent and complexity, and make it possible for scientists to create comprehensive records of imaging experiments.

Mathias Hammer, Maximiliaan Huisman ... Caterina Strambio-De-Castillia



Hammer et al. (2021) *Nat Methods*;
<https://doi.org/10.1038/s41592-021-01327-9>



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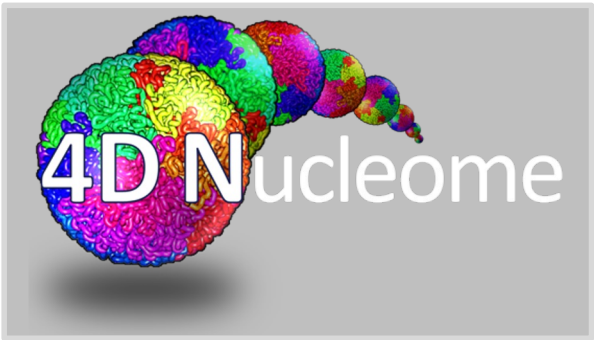
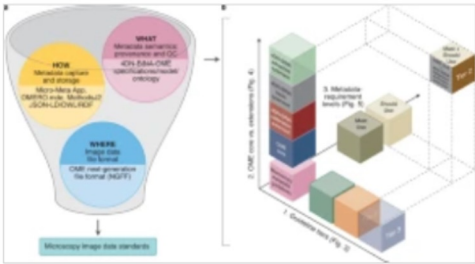
Comment
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Mathias Hammer, Maximiliaan Huisman ... Caterina Strambio-De-Castillia



Sample

Image Acquisition LiMi-Model (aka NBO-Q)

Hardware, Acquisition
Settings and QC

Microscope Specifications

- Microscope configuration
- Hardware components

Image Structure

- Pixel size
- Number of pixels, focal planes, channels and timepoints
- Dimension order

Intensity Calibration

- Illumination power
- Illumination wavelength
- Illumination stability
- Detector performance

Mechanical calibration

- Repeatability
- Reproducibility
- Stability (settling time)



Hammer et al. (2021) *Nat Methods*;
<https://doi.org/10.1038/s41592-021-01327-9>



Community tools: Micro-Meta App can be used to capture NBO-Q Image Acquisition metadata



Brief Communication

Open Access

3 Dec 2021

[Nature Methods](#)



Micro-Meta App: an interactive tool for collecting microscopy metadata based on community specifications

Micro-Meta App is an intuitive, highly interoperable, open-source software tool designed to facilitate the extraction and collection of relevant microscopy metadata as specified by recent community guidelines.

Alessandro Rigano, Shannon Ehmsen ... Caterina Strambio-De-Castillia

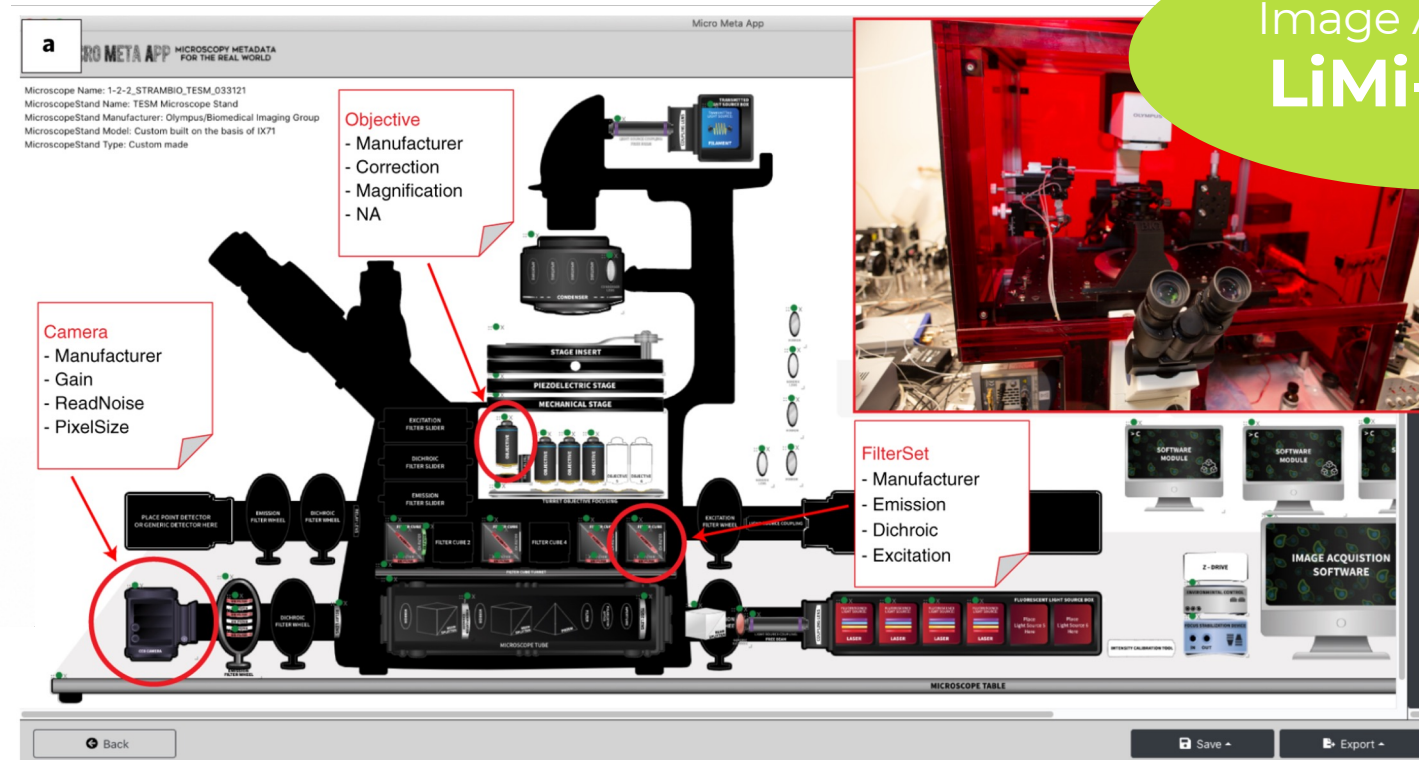
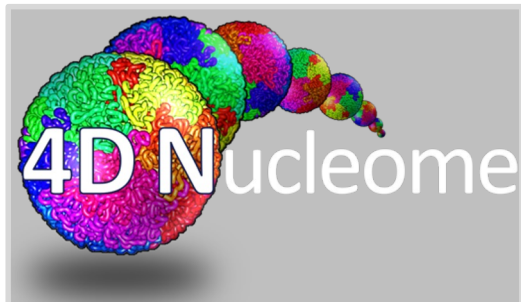
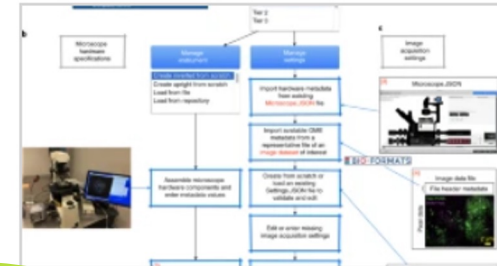
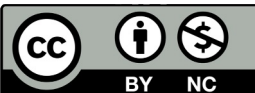


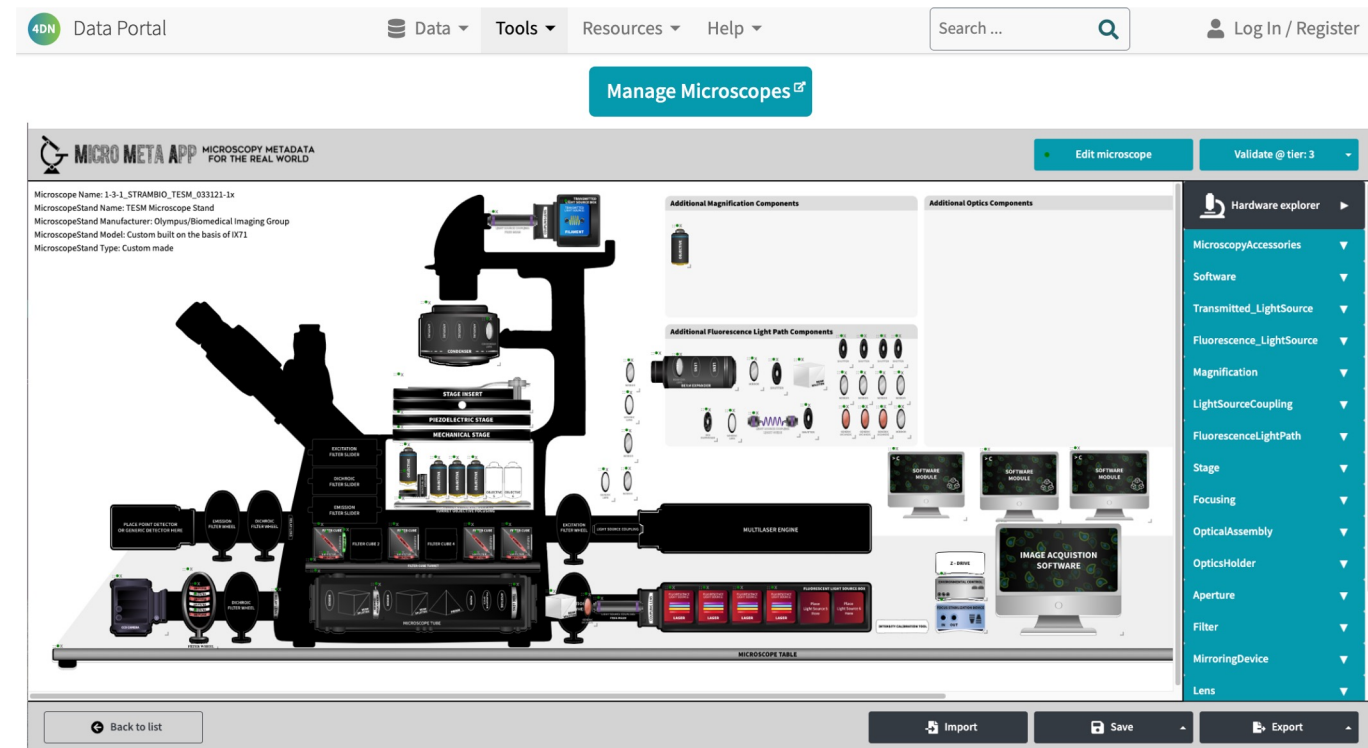
Image Acquisition
LiMi-Model



Who is using LiMi-Model and/or Micro-Meta App?



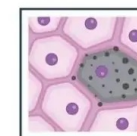
- NIH 4D Nucleome
- BINA
- Canada BioImaging
- NIH HuBMAP & SenNet
- RIKEN
- Inscoper
- Pending: Brain Image Library, others?



**BioImaging
North America**



HuBMAP
Human BioMolecular Atlas Program



SenNet

Data Resource Center @
PSC



Governance gives a path forward: new version LiMi-Model in partnership with key stakeholders



The making of microscope camera standards

Cameras are a crucial part of microscopes and are also built into many kinds of instruments. To make their output comparable takes standards.

Vivien Marx

The academics and company scientists in the group Quality Assessment and Reproducibility for Instruments & Images in Light Microscopy (QUAREP-LiMi) are developing standards for microscopy camera output.

As in other areas of standards development, working with companies is crucial; "after all they are the expert of the hardware they are producing," says Caterina Strambio-de-Castillia, a researcher at the University of Massachusetts Medical School's Program in Molecular Medicine and a Chan Zuckerberg Imaging Scientist, who spearheads this effort within QUAREP-LiMi. A separate story in this issue of *Nature Methods* about emerging standards in microscopy can be found in this issue.

Part of the work in developing standards for cameras in microscopy and imaging is about creating common definitions as a public resource. "The QUAREP-ers are moving on all that quite well," says Jason Swedlow of the University of Dundee, who



Cameras are a crucial part of microscopes and imaging systems. Agreeing on standards to provide defined descriptions for aspects such as gain or readout speed is tricky. Credit: W. Bulgar/Science Photo Library

technology feature

Check for updates

Imaging standards to ease reproducibility and the everyday

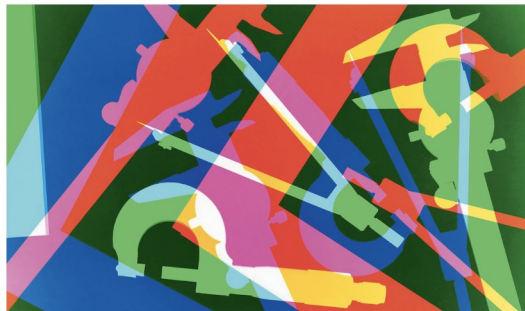
Imaging and microscopy technology advances in leaps and bounds. To address accumulated pain points, academics and companies are making headway on standards.

Vivien Marx

With a view to transparency and reproducibility in microscopy, scientists are hammering out standards to address, for instance, the surprises of fluctuating illumination power, the jungle of file formats, the mysteries of missing metadata and the diversity of camera outputs. A second story in this issue of *Nature Methods* focused on camera standards can be found here.

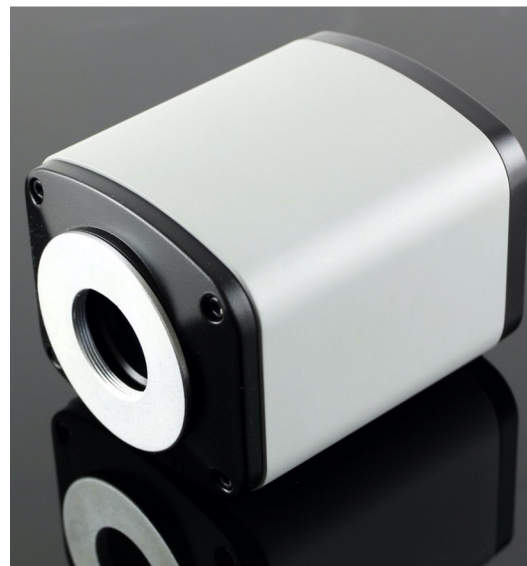
"We need standards," says Roland Nitschke of the University of Freiburg. Developing standards in imaging is a noble deed that can make some eyes glaze over even beyond the glaze arising from long hours at the microscope. Those who feel they lack the time to pitch in on standards might be glad to hear that some not-so-distant developments stand to help microscopy users pull out their hair a bit less. Here's a peek at how some emerging standards could address real-world pain points.

Standards development is not a task for



Emerging standards in microscopy are being set up to address many pain points in the field. Credit: TEK Image/Science Photo Library

- **January – August 2022:** 10+ focused feedback sessions to build consensus
- **Completed first parsing of camera hardware specifications and image acquisition settings!**
- **Due soon:** Revision of **4DN-BINA-OME-QUAREP** Camera Metadata model + vocabulary



Camera

- Manufacturer: *XYZ*
- Catalog Nr: *0000*
- Mount: *C-mount*
- FrameRate: *20 fps*
- ReadOutRate: *30 MHz*



EVIDENT
OLYMPUS

ZEISS

Leica
MICROSYSTEMS

Nikon **pco.**

Ψ Scientifica

OXFORD **ANDOR**
INSTRUMENTS

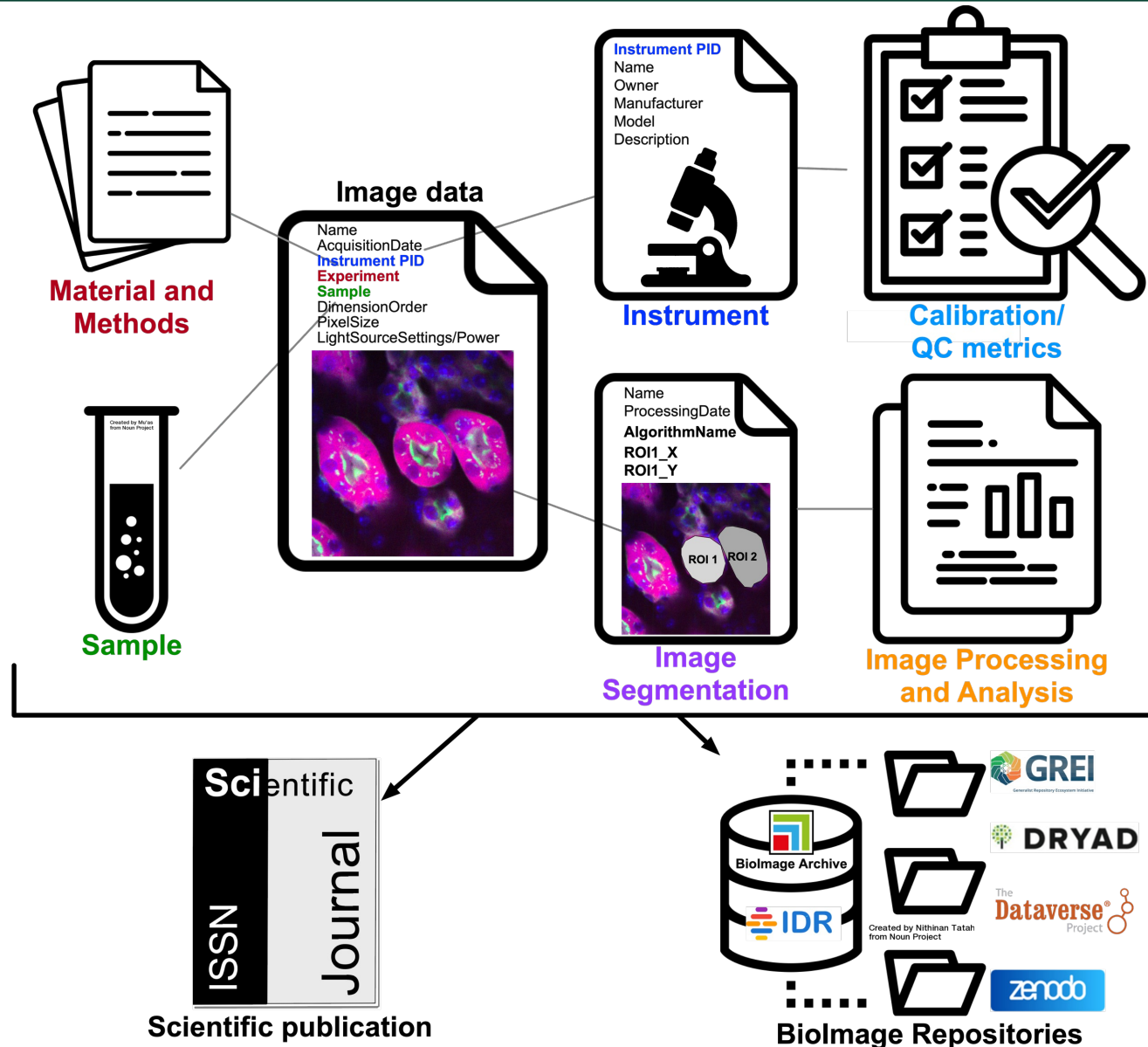
TELEDYNE
PHOTOMETRICS

HAMAMATSU
PHOTON IS OUR BUSINESS

Outline

- What is bioimage data and why it is important to manage it and share it
- What is bioimage metadata
- Communities working to build standards for bioimage data and metadata
- Existing standards
- **Imaging-PHD project**

Where is bioimage metadata?



PIDs can help maintain links between different essential information





“Research labs and facilities
create a LOT of data”

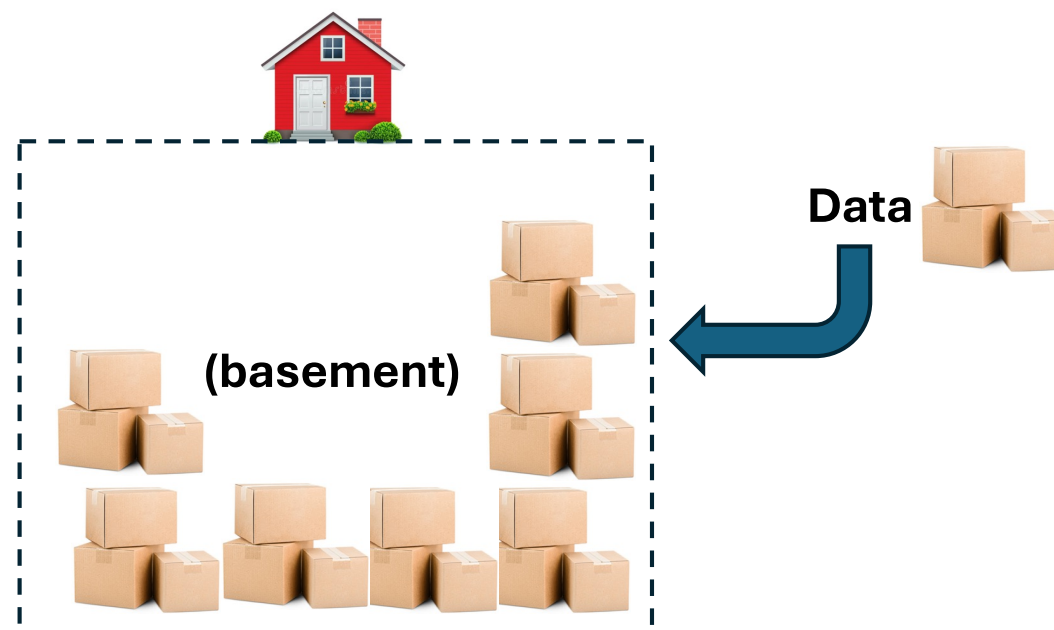
Data often goes into the basement

(Badly labeled, lucky if it gets its
own bin, often sharing space with
unrelated data)

Facilities have “meta-basements”

- Digital drives
- Physical spaces
- Internet spaces

Data is easily stored, not so easily remembered and retrieved



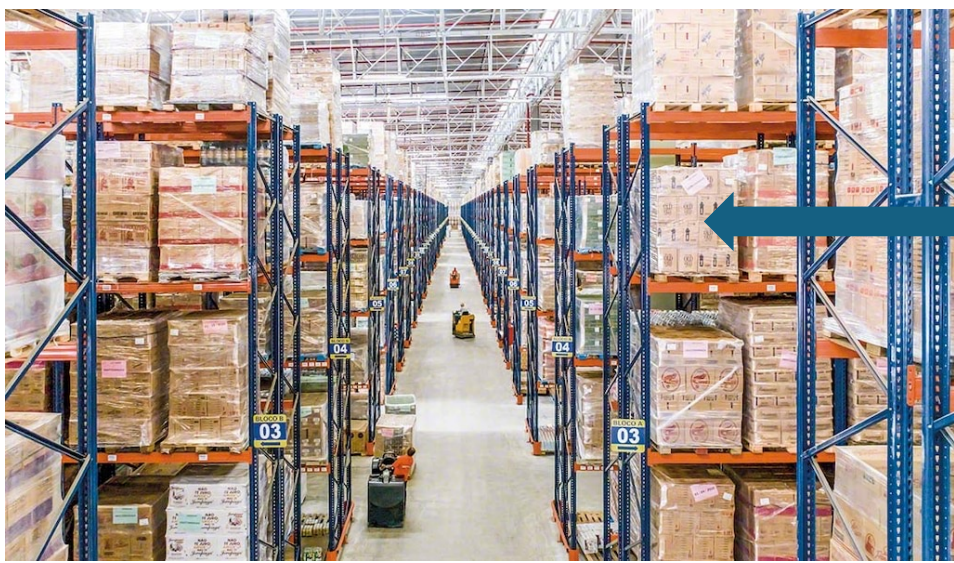


“PIDs as the primary Instrument for Discovering and Accessing data”



Persistent Identifiers (PIDs)

Like an inventory system: everything you need to find gets labeled



Product Number
Serial Number
Location

Product Number
(Class)
Multiple instances

Serial Number
(Object)
Specific Instance

Location
(Category)
Specific/Reusable





“PIDs as the primary
Instrument for
Discovering and
Accessing data”



PID

Persistent Identifier

Persistence: works beyond a given system or platform

Examples: RRID, ROR, ORCID, DOI, ARK, etc.

“FAIR Facilities and Instruments” Project:

- U.S. National Science Foundation (NSF) Findable Accessible Interoperable Research Open Science (FAIROS) Research Coordination Network (RCN) (NSF Awards 2226397, 2226398)



What are Persistent Identifiers?



Institutions **ROR**



Research
activities



People **iD**



Core Facilities/
Tools/Reagents



RRID



Instruments **PiD**



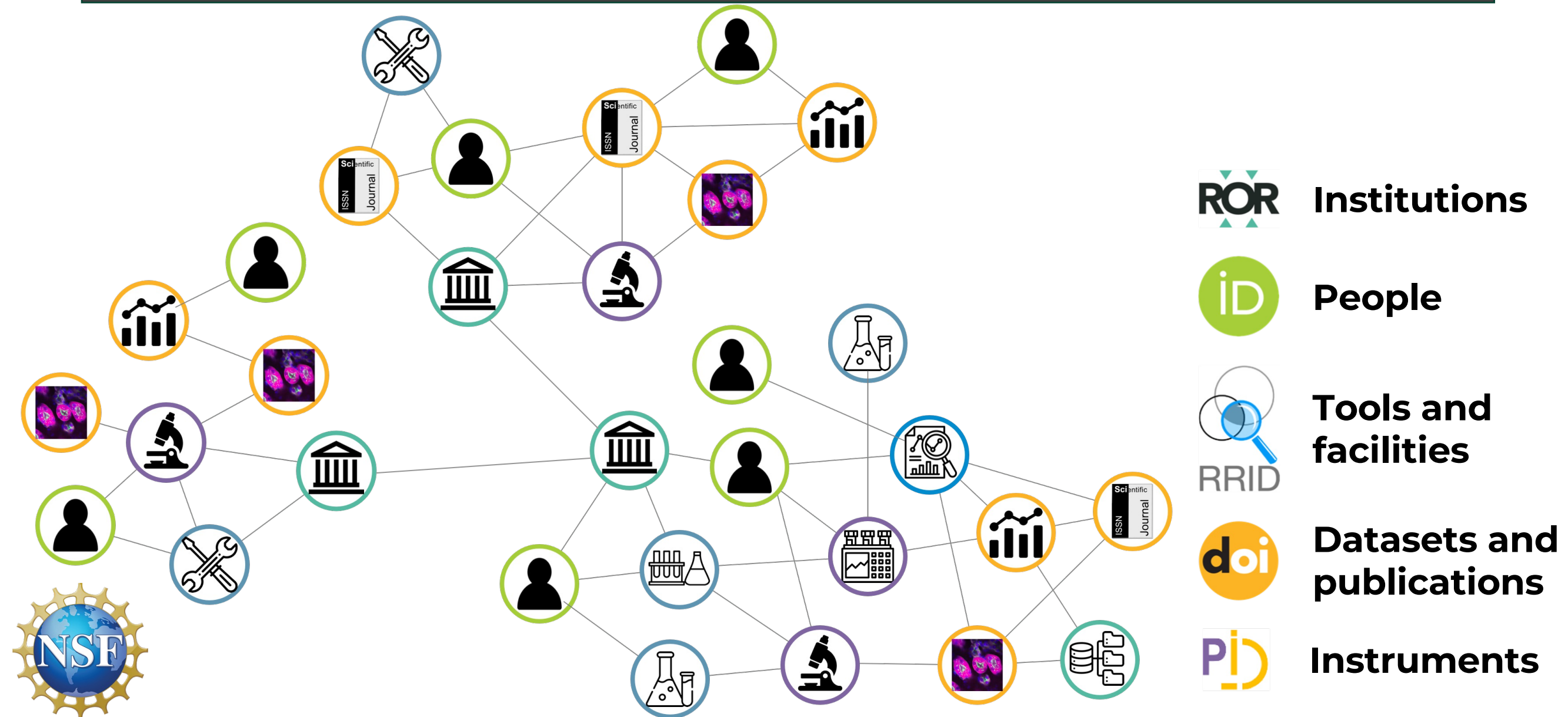
Data/
Publications/



- PIDs are **unique alphanumeric codes** that can be assigned to individual resources.
- They are often associated with **metadata registries** describing the entities they refer to.
- They are often “**minted**” by an **authority** that is responsible for their preservation.
- They resolve to **lasting landing pages**.
- **Different PIDs** are recommended for different types of resources



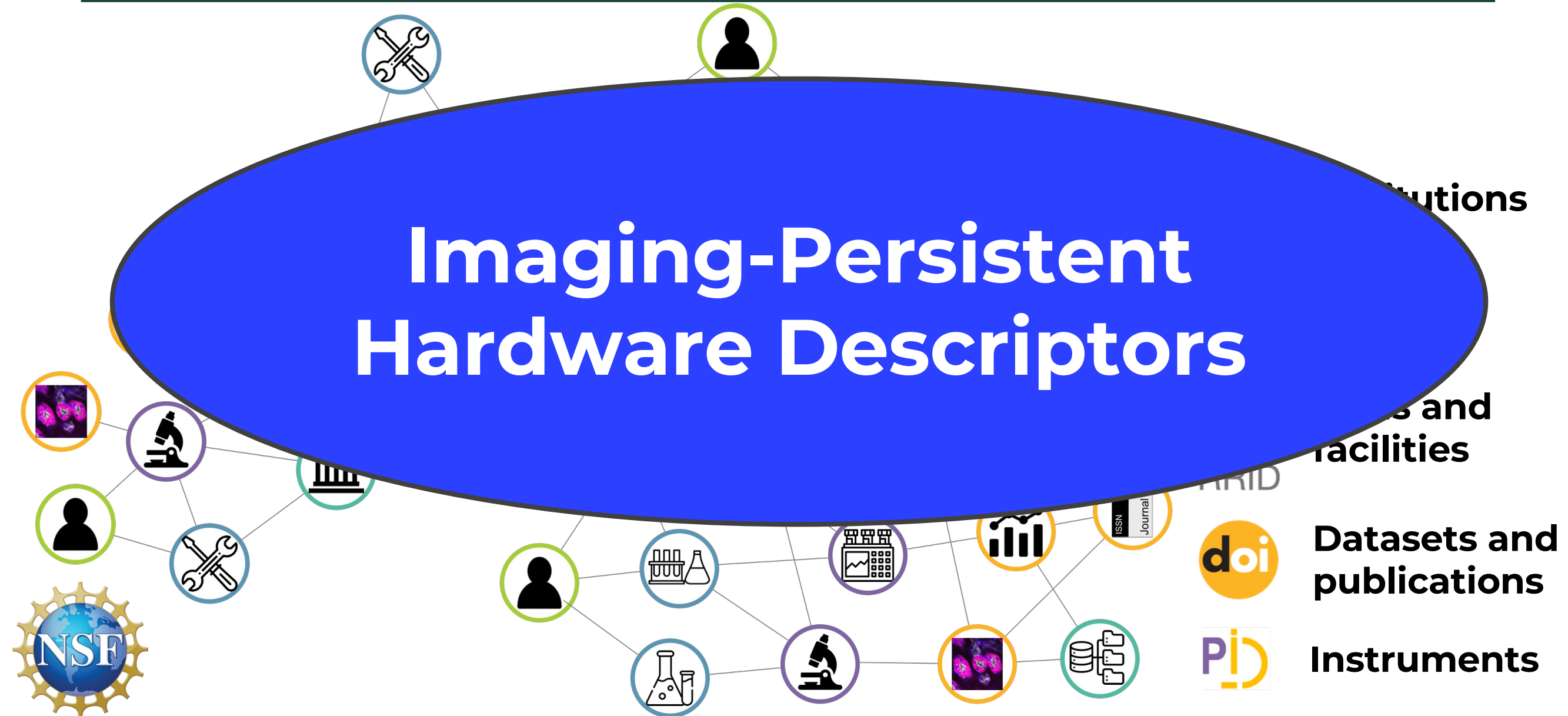
PIDs are used to link people and research resources to data and publications



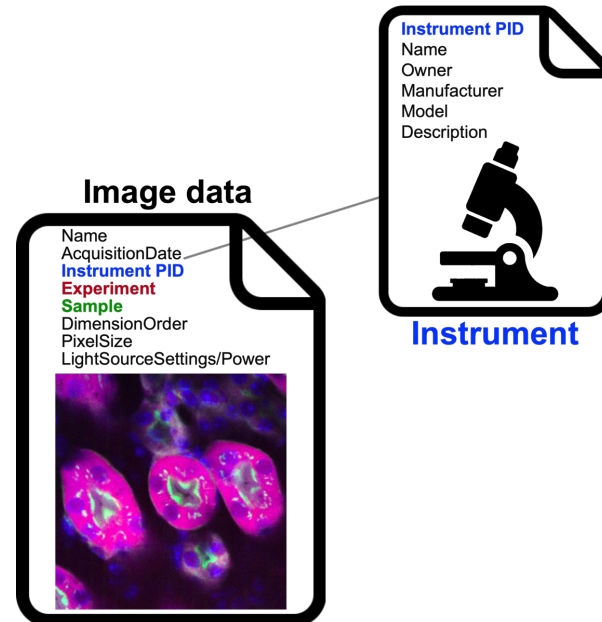
PIDs are used to link people and research resources to data and publications



Imaging-Persistent Hardware Descriptors



Persistent Hardware Descriptors help making data FAIR



Linked PIDs for

- **Instrument instance**
- **Instrument model**
- **Hardware configuration**



Core Marketplace + RRID: supporting the persistent identification of core-facilities



[SEARCH HELP](#) [POSTINGS](#) [PROFILE WIDGET](#) [NEWS](#) [MANUAL](#)



SEARCH | [ADD/EDIT MY FACILITY](#)

SEARCH THE COREMARKETPLACE



☰ COREMARKETPLACE INFO

New to the CoreMarketplace? Start here.

“ USING YOUR RRID

Learn how get more RRID mentions and increase citability for your facility.

📅 NEW FEATURE

Check out the New Contact People feature



Core Marketplace + RRID: supporting the persistent identification of core-facilities



FDI Lab
FAIR Data Informatics



SciCrunch



RESEARCH RESOURCE IDENTIFICATION PORTAL

This is the Resource Identification Portal,
supporting guidelines for Rigor and Transparency
in scientific publications.

[Learn More](#)



[Find Plasmids](#)

[Find Cells](#)

[Find Organisms](#)

PIDINST: Metadata schema for the persistent identification of instruments



Persistent Identification of Instruments

ABOUT US RESOURCES

We seek to explore a community-driven solution for globally unique identification of measuring instruments operated in the sciences. The group has developed a [Metadata Schema for Persistent Identification of Instruments](#), which is endorsed by the Research Data Alliance as a Recommendation. Our primary task is to actively engage with and support communities in schema implementations and aim, thus, at widespread adoption of the Recommendation.

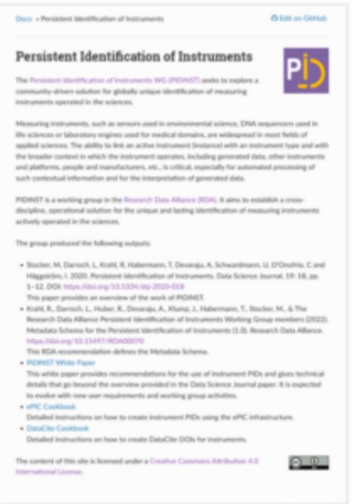
Outcomes



| Metadata Schema



| Journal Article



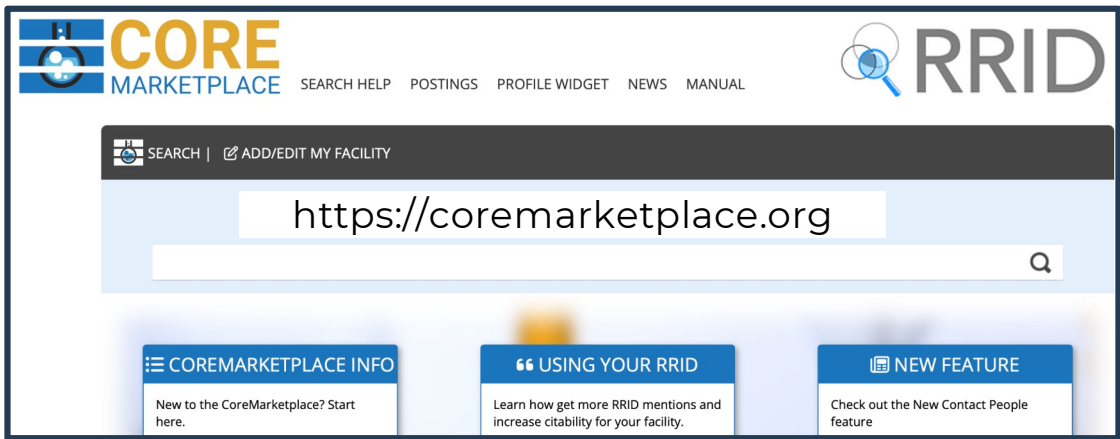
| White Paper

<https://www.rd-alliance.org/groups/persistent-identification-instruments-wg/activity/>

<https://www.pidinst.org/>



Imaging-PHD: Combining complementary resources to build new functionalities



ID	Property
1	Identifier
2	SchemaVersion
3	LandingPage
4	Name
5	Owner
6	Manufacturer
7	Model
8	Description
9	InstrumentType
10	MeasuredVariable
11	Date
12	RelatedIdentifier
13	AlternateIdentifier



<https://docs.pidinst.org/en/latest/>

<https://doi.org/10.1038/s41592-021-01327-9>

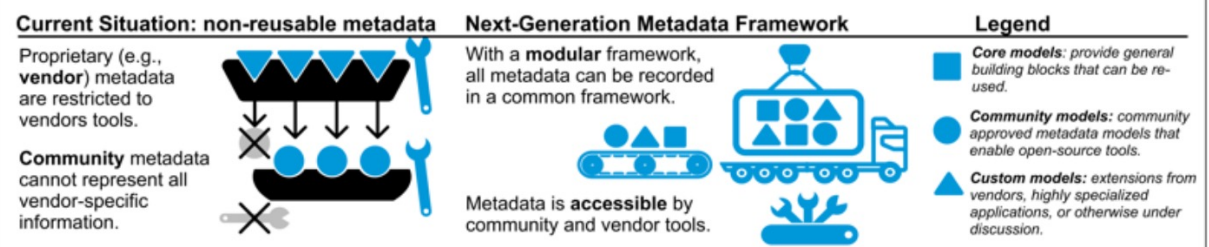
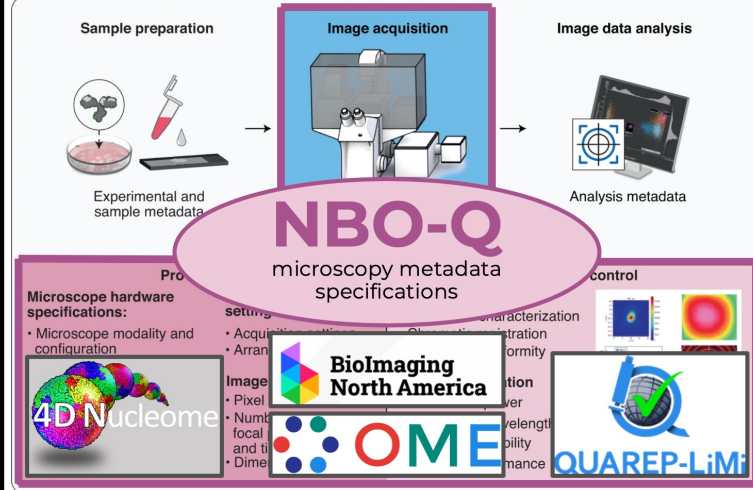


Figure 1 Next-generation metadata will provide the community a composable collection of metadata schemas to remove barriers to re-use and collaboration.

[10.5281/zenodo.11265016](https://doi.org/10.5281/zenodo.11265016)



NGM facilitates getting the full technical descriptions of microscopes from vendors

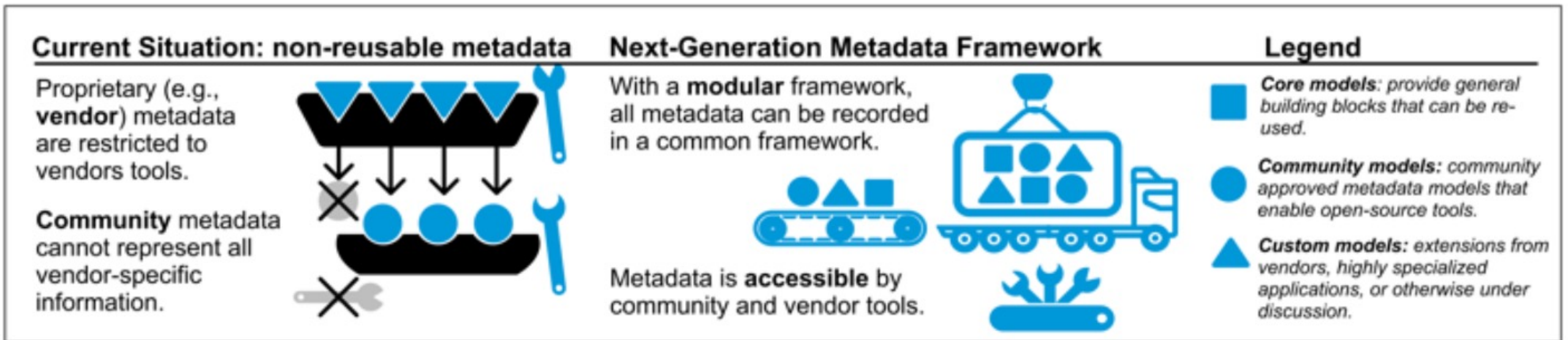


Figure 1 Next-generation metadata will provide the community a composable collection of metadata schemas to remove barriers to re-use and collaboration.

Moore and Strambio-De-Castillia, 2024;
[10.5281/zenodo.11265016](https://zenodo.org/record/11265016)



The team and the community



David Grunwald
Physics, Photonics



UMass Chan
MEDICAL SCHOOL



James Chambers
Core Manager



Judith Lacoste
Quality-Control



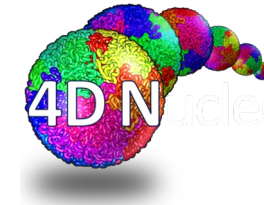
Josh Moore
Next Gen Metadata



**Biolmaging
North America**



QUAREP-LiMi



HuBMAP
Human BioMolecular Atlas Program



Adrian Zai
Research Informatics



UMass Chan
MEDICAL SCHOOL



Anita Bandrowsky
RRID



SciCrunch



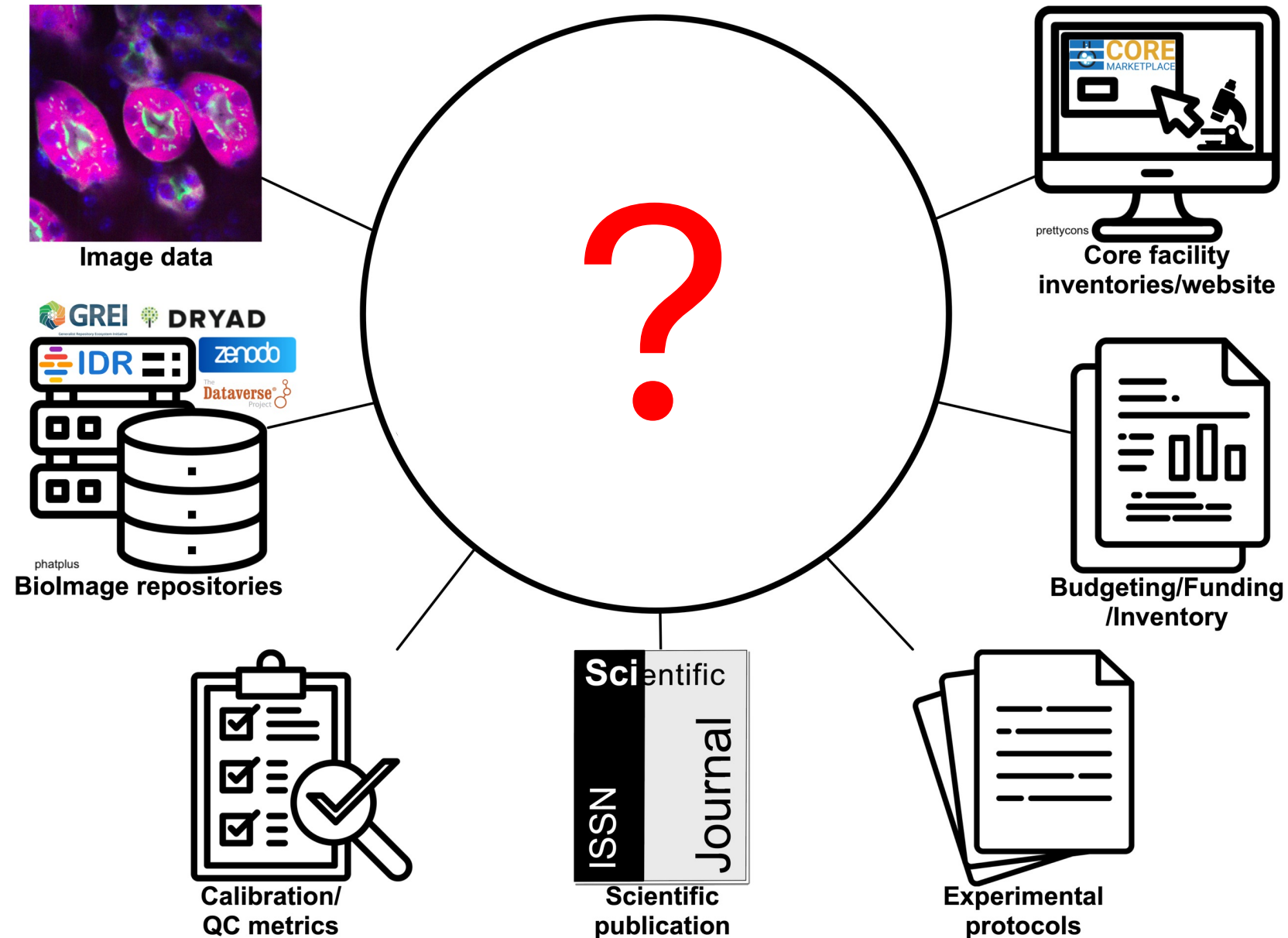
Nate Herzog
CoreMarketplace



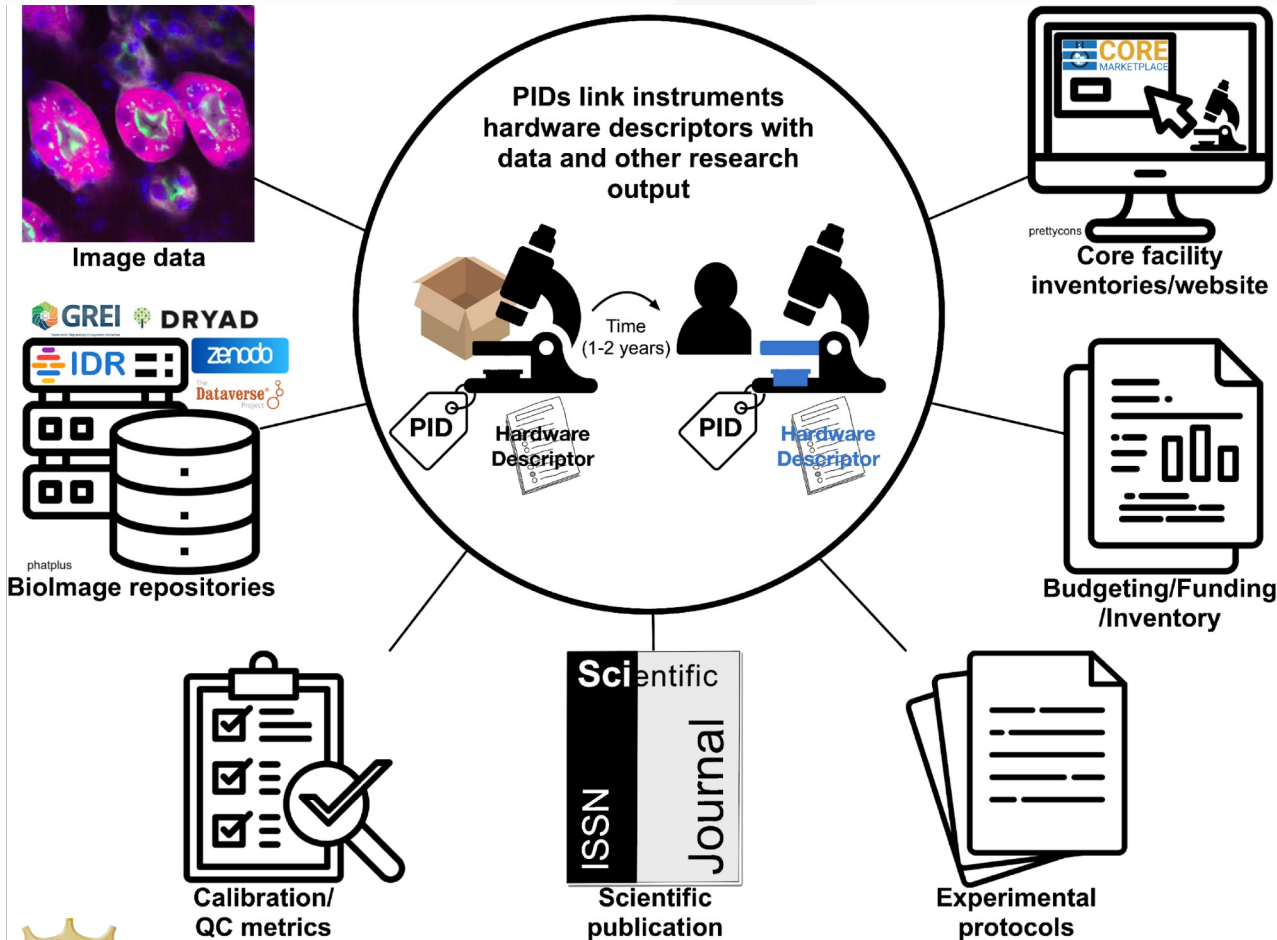
**Vermont
Biomedical
Research
Network**
An IDeA Network of Biomedical Research Excellence (INBRE)



Labs and Core Facilities have different overlapping needs for the Instrument Data Management



Persistent Hardware Descriptors: make live easier for cores and labs



Metadata is Scattered

- Critical imaging metadata is stored across disparate locations (files, devices, documents).
- This fragmentation hinders reproducibility, reuse, and proper attribution.

What Are Persistent Identifiers (PIDs)?

- Unique, long-lasting digital codes assigned to entities like instruments, datasets, and people.
- Maintained by trusted authorities and resolve to stable landing pages with rich metadata.

Why PIDs Are Essential

- **Linking:** Connect hardware, datasets, publications, and contributors.
- **Preservation:** Maintain long-term accessibility and integrity of research assets.



Christmas tree decoration



Model nr. 001



Model nr. 002



Model nr. 003



Model nr. 004



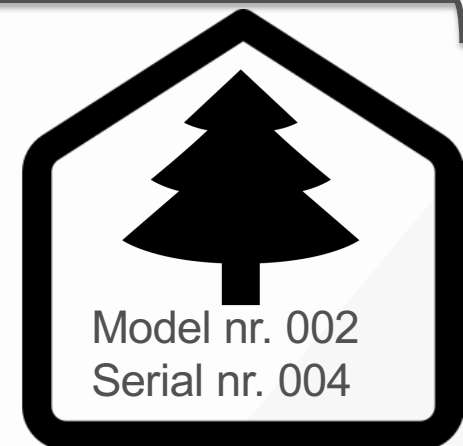
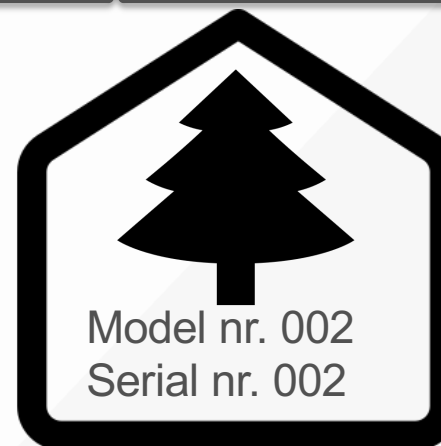
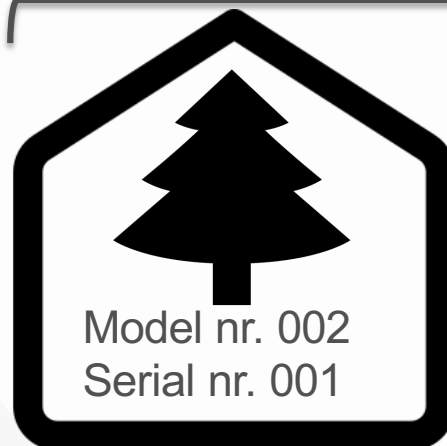
Model nr. 005



Christmas tree decoration



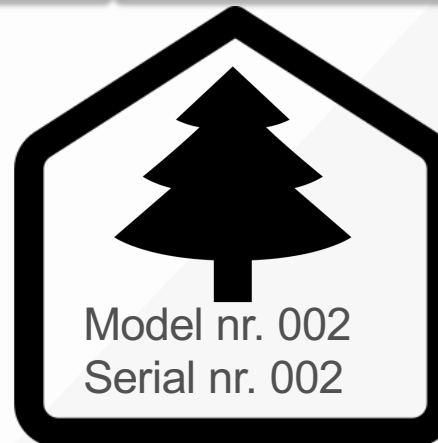
Model nr. 002



Christmas tree decoration



Model nr. 002



Model nr. 002
Serial nr. 002



Model nr. 002
Serial nr. 002
Config nr. 001

Year 2



Model nr. 002
Serial nr. 002
Config nr. 002

Year 5



Model nr. 002
Serial nr. 002
Config nr. 003

Year 10



Model nr. 002
Serial nr. 002
Config nr. 003



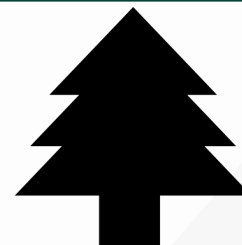
Christmas tree decoration



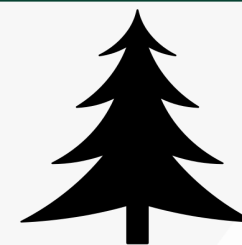
Model nr.
001



Model nr.
002



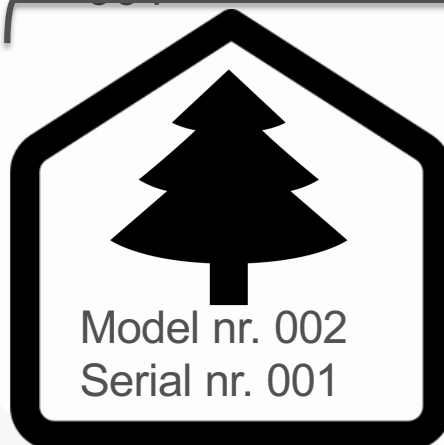
Model nr.
003



Model nr.
004



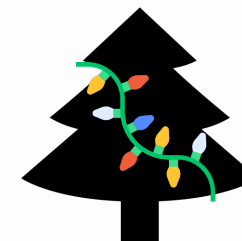
Model nr.
005



Model nr. 002
Serial nr. 001



Model nr. 002
Serial nr. 002



Model nr. 002
Serial nr. 003



Model nr. 002
Serial nr. 004





PIDINST metadata

PIDINST:0000

IDType - DOI

Name

Facility

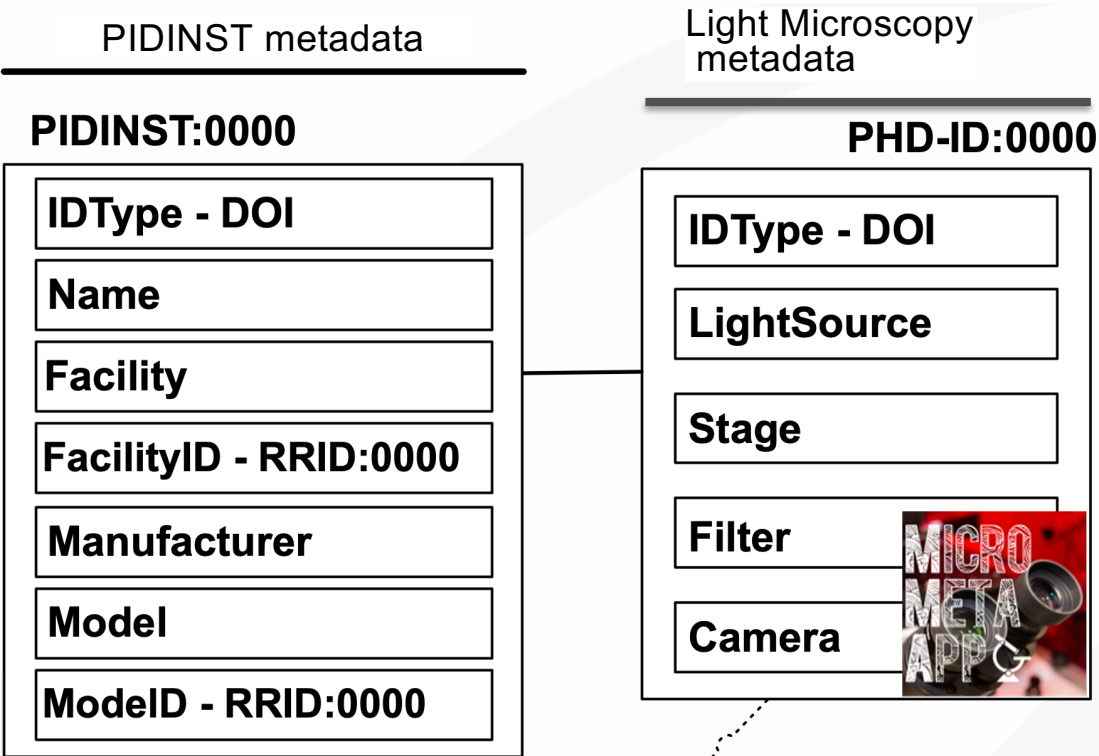
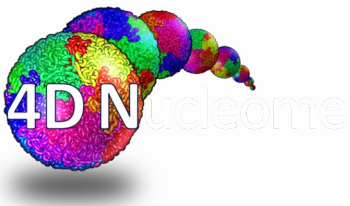
FacilityID - RRID:0000

Manufacturer

Model

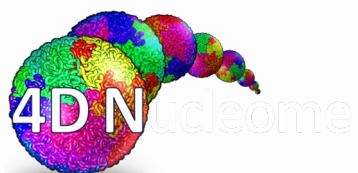
ModelID - RRID:0000







QUAREP-LiMi
LiMi-Model



PIDINST metadata

PIDINST:0000

IDType - DOI
Name
Facility
FacilityID - RRID:0000
Manufacturer
Model
ModelID - RRID:0000

Light Microscopy metadata

PHD-ID:0000

IDType - DOI

LightSource

Stage

Filter

Camera

**MICRO
META
APP**

PHD-ID:0001

```
graph TD; A[IDType - DOI] --- B[LightSource]; B --- C[Stage]; C --- D[Filter]; D --- E[Camera];
```

IDType - DOI

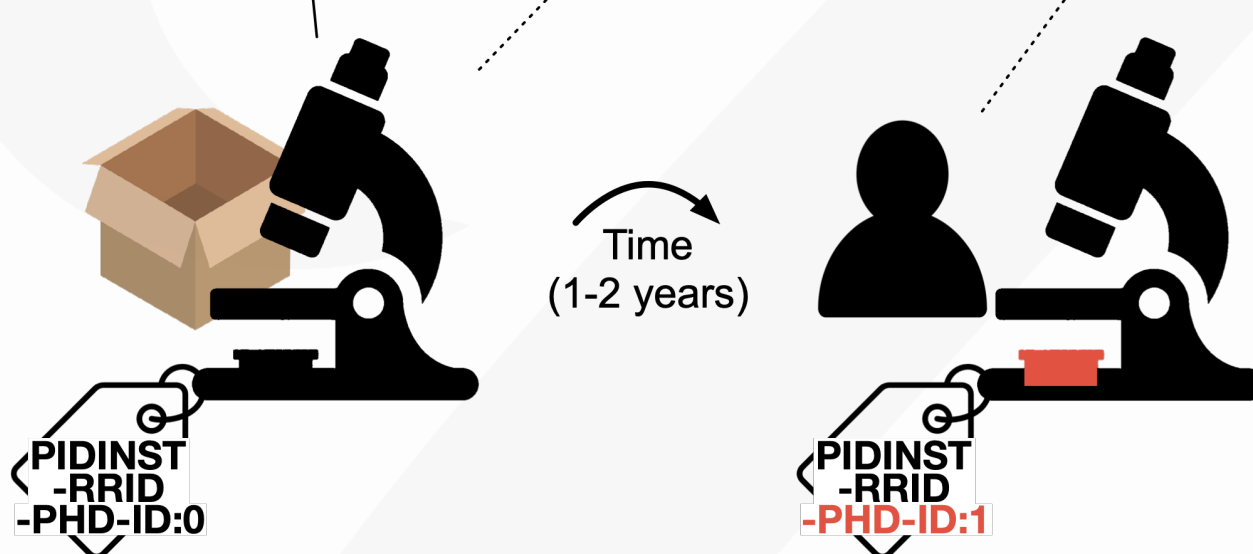
LightSource

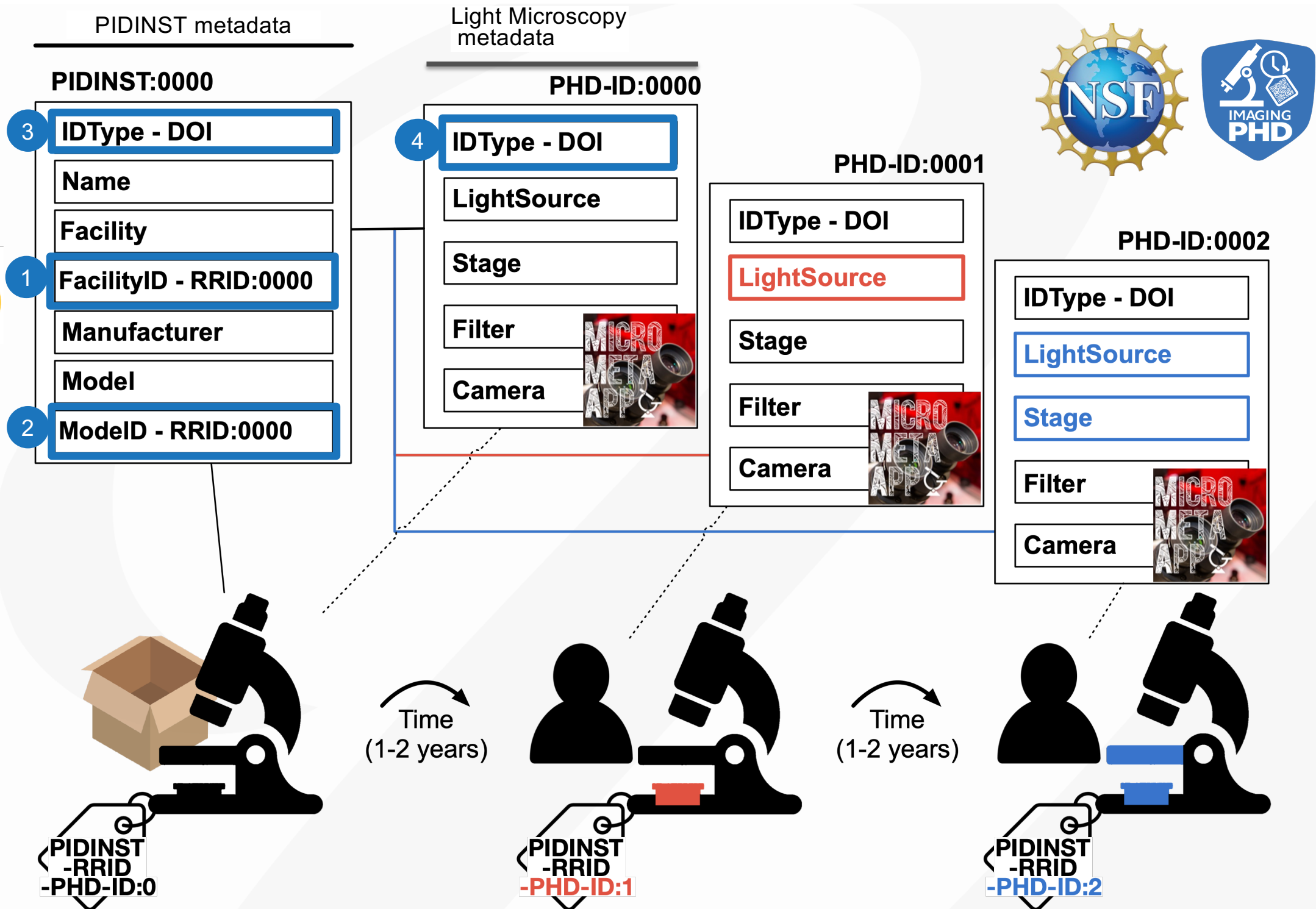
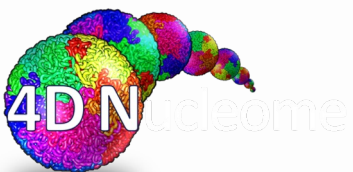
Stage

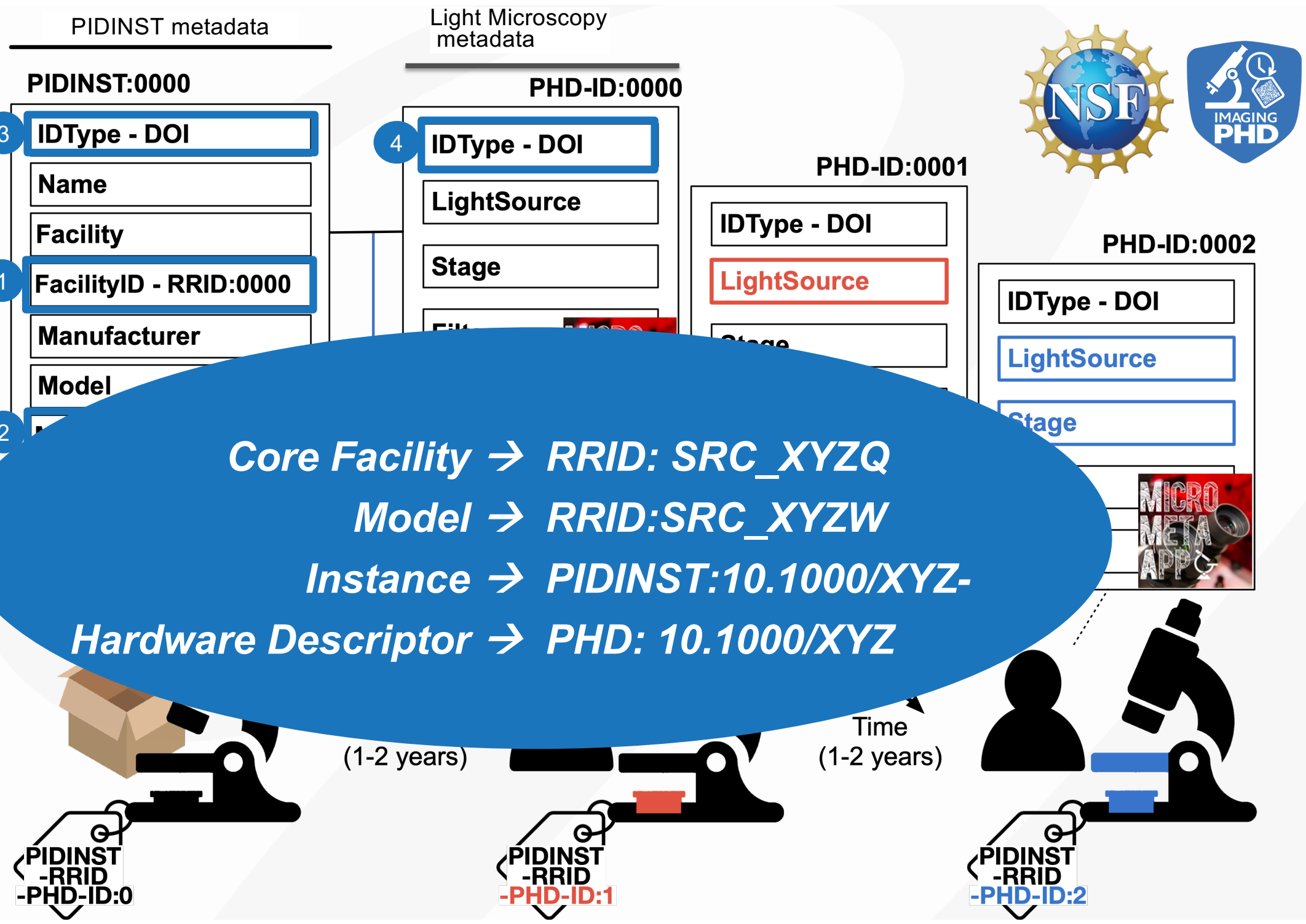
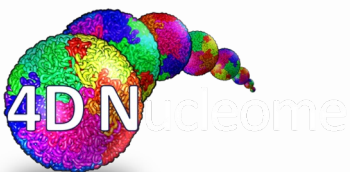
Filter

Camera

**MICRO
META
APP**



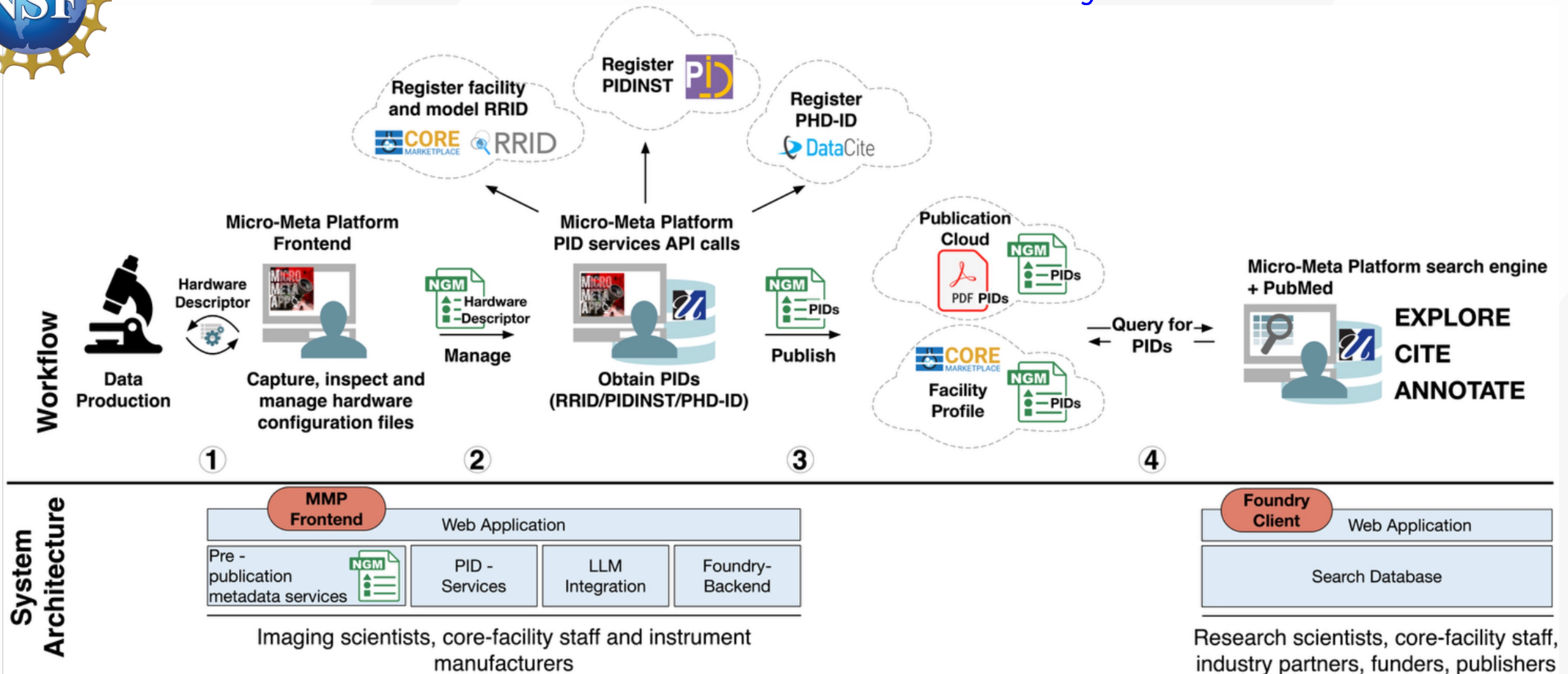




Deliverable - Micro-Meta Platform Workflow and Architecture



Capturing, registering, and reusing persistent hardware metadata across the research lifecycle.



FAIR Facilities and Instruments: PID recommendations



1. Flexible PID

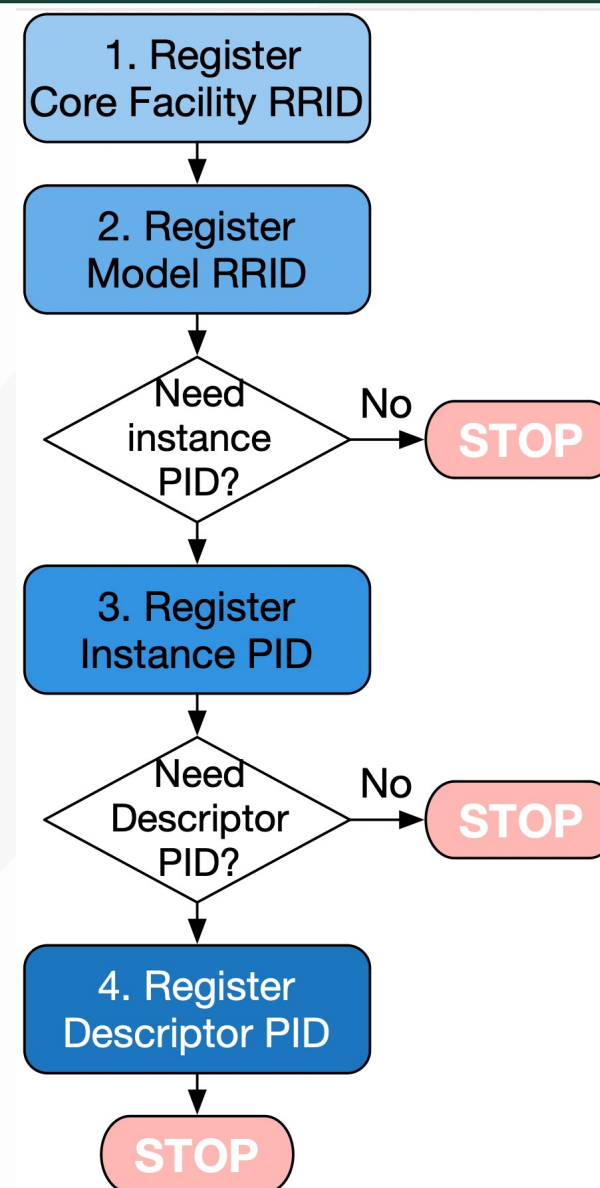
recommendations: based on the requirements of different use cases and different scientific domains

2. Capability of assigning PID in different tiers. For example:

1. Core Facilities
2. Instrument Model/Type
3. Instrument Instance
4. Descriptor (Hardware Configuration / Settings / Parameters)

3. PID concatenation

4. PID connection



FAIR Facilities and Instruments: PID recommendations



1. Flexible PID

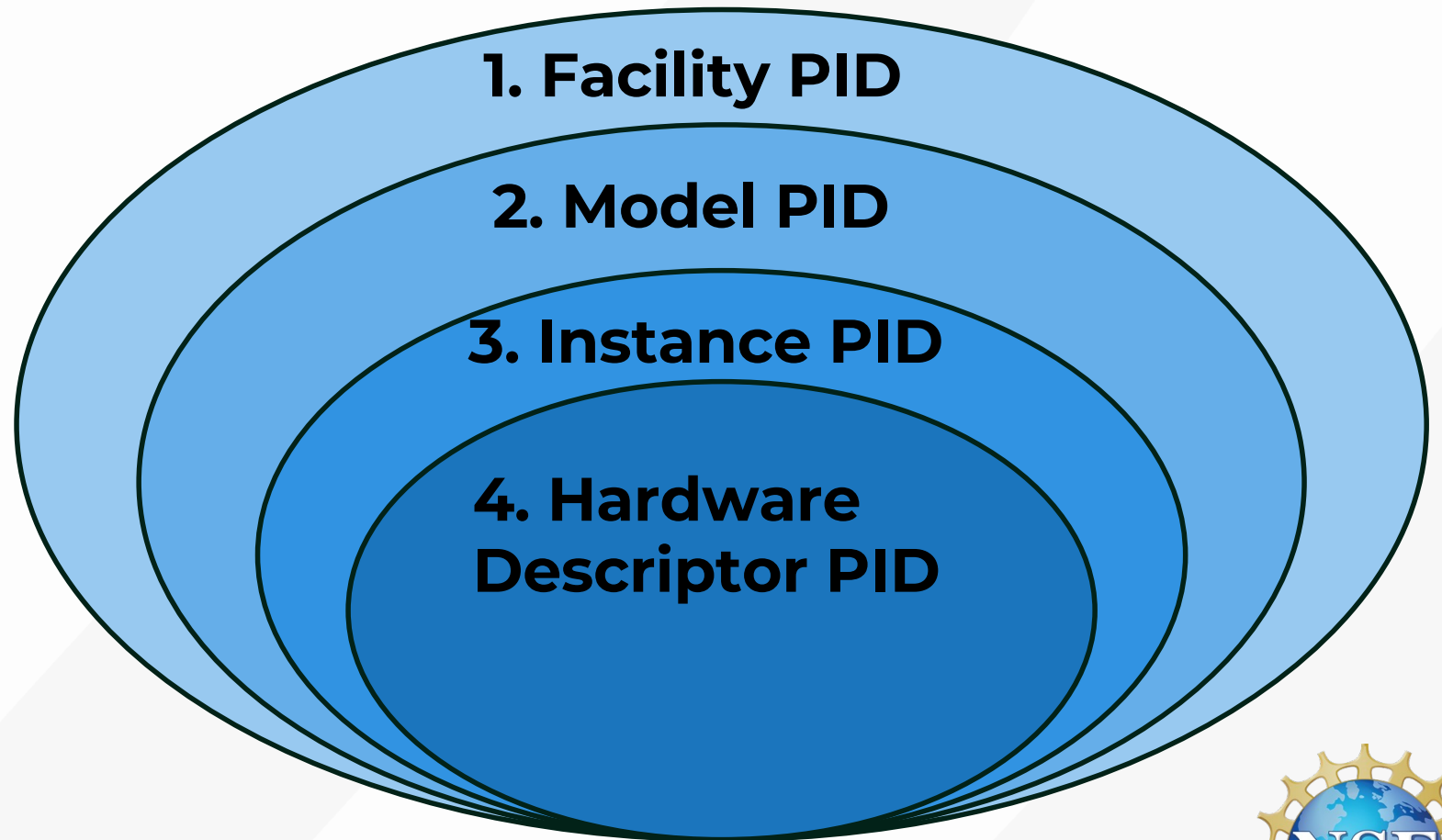
recommendations: based on the requirements of different use cases and different scientific domains

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3. PID concatenation

4. PID connection



PIDINST implementations



1. ePIC→ Handle.net

- PIDINST schema
- How does it work to request ePIC PIDs?
- What is the authority?
- What is the relation between B2INST and ePIC?

2. DOI/DataCite

- PIDINST schema mapping not ideal:
 - Issue with Model
 - No dedicated ModelIdentifier

3. Alternatives?





THANK YOU!

UMass Med + Canada Bioimaging



Judith
Lacoste



Thomas
Stroh



Claire
Brown



Pina
Colarusso



Alex
Rigano



Alice
Kang



Stephen
Ogg

BINA+QUAREP-LiMi

- Alison North, The Rockefeller University
- Roland Nitschke, Uni Freiburg
- Britta Schroth-Diez, Max Plank, Dresden
- Damir Sudar, Uni Oregon, QIS
- Caroline Miller
- Nikki Bilay + Vanessa Orr, BINA
- [BINA Quality Control and Data Management WG](#)
- [QUAREP-LiMi WG7 – Metadata](#)



Grunwald lab – UMMS-RTI

- David Grunwald
- Mathias Hammer
- Max Huisman
- Farzin Farzam



4DN Community

- 4DN IWG: Sarah Aufmkolk, Laca Bintu, Alistair Boettingerr, Steve Wang, Ting Wu
- DCIC: Burak Alver, Andrea Cosolo, Shannon Ehmsen, Koray Kirli, Rahi Navelkar, Peter Park, Andrew Schroder, Serkan Utku Ozturk



HuBMAP Community and Pittsburgh Supercomputing Center (PSC)

- Katy Borner, Phil Blood, Chris Csonka, Stephen Fisher, Brendan Honick, Ajay Pillai, Alex Ropelewski



Imaging Scientists Community

- Lisa Cameron, Duke
- Michelle Itano, CZI, UNC
- Paula Montero-Llopis, HMS
- Jennifer Waters, CZI, HMS



OME community

- Jason Swedlow, OME
- Josh Moore, OME
- Shuichi Onami, RIKEN

