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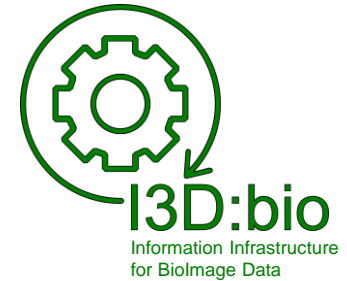
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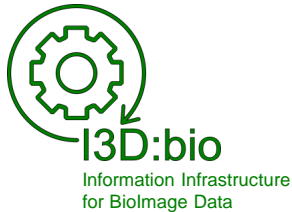
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Research Data Management for Bioimage Data at the **ADD INSTITUTE HERE**

Data Organization in OMERO



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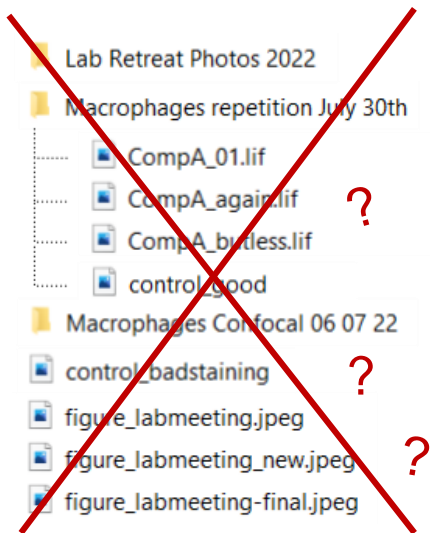


Questions/considerations around data organization and management

- Local computer vs. shared drives (Where?)
- Backed-up network drives vs. safety copies on hard drives (Where? Who?)
- Version control software vs. manual versioning (file names) (How?)
- Arbitrary file naming vs. (any level) of standardization (How? Who?)
- Management software vs. file folder hierarchies (How?)
- Documentation in paper notebook vs. electronic lab notebook (How? Who?)
- Original data vs. derived data (What? How?)
- Automatic recording, sample barcoding, etc.
- ...

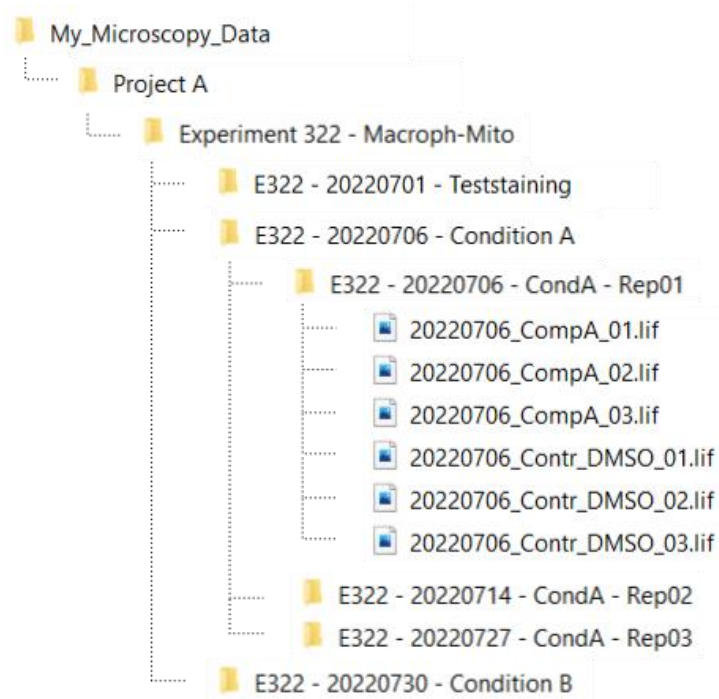
Managing data in classical file folder hierarchies

Not managed



Understanding the data is only possible for the data producer (if at all)

Managed in a file system hierarchy (arbitrary example)



Understanding the data is possible based on the researcher's documentation

Hierarchy structure standardization?

- At the individual's level
- At the group's level
- At the collaboration level
- Discipline-specific standards

No preview and limited direct access to metadata

A data management system helps to organize data (here: OMERO)

Example:
Access with
OMERO.web

Example: A file with a
„multi-scene image“

- Managed data
- Preview available
- Access to metadata
- User-friendly but machine-accessible

The screenshot displays the OMERO.web webclient interface. The browser address bar shows <https://my-local-omero.server>. The interface is organized into several panels:

- Left Panel (Explore):** Shows a tree view of data under the group 'Mary Mayperson'. It includes folders like 'ExampleData_BioImageArchive_WSI' and 'BIA_Accession_S-BSST110', with a list of files including '14 08943 8_A1APOBEC3A_1.czi [0]', '14 08943 8_A1APOBEC3A_1.czi [label image]', and '14 08943 8_A1APOBEC3A_1.czi [macro image]'. There is also an 'Orphaned Images' section.
- Center Panel:** Displays three preview thumbnails of the selected image. The first is a blue-tinted micrograph of cells. The second is a grayscale image with handwritten text '14 08943 8', 'APOBEC3A', and 'H15 844'. The third is a green-tinted micrograph.
- Right Panel (Metadata):** Contains detailed information about the selected image '14 08943 8_A1APOBEC3A_1.czi [0]'. It includes fields for 'Image ID' (15201), 'Owner' (Mary Mayperson), 'Acquisition Date' (2017-05-17 16:33:20), 'Import Date' (2022-07-20 12:52:05), 'Dimensions (XY)' (148200 x 109017), 'Pixels Type' (uint8), 'Pixels Size (XYZ) (µm)' (0.11 x 0.11 x 1), 'Z-sections/Timepoints' (1 x 1), 'Channels' (TL Brightfield, TL Brightfield, TL Brightfield), 'ROI Count' (0), 'Tags' (0), 'Key-Value Pairs' (1), 'MDE' (Added by: Mary Mayperson), 'Tables' (0), 'Attachments' (0), 'Comments' (0), 'Ratings' (0), and 'Others' (0).

Annotations on the screenshot include:

- An orange box labeled 'Example: A file with a „multi-scene image“' with an arrow pointing to the file list in the left panel.
- An orange box labeled 'Preview thumbnails' with an arrow pointing to the center panel.
- An orange box labeled 'Metadata' with an arrow pointing to the right panel.

Data organization in OMERO – part 1

OMERO.web offers a tree-view data hierarchy in the **Explore** tab



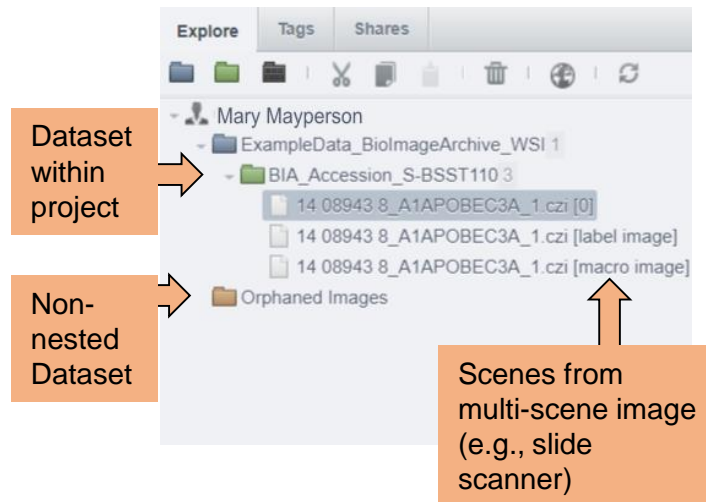
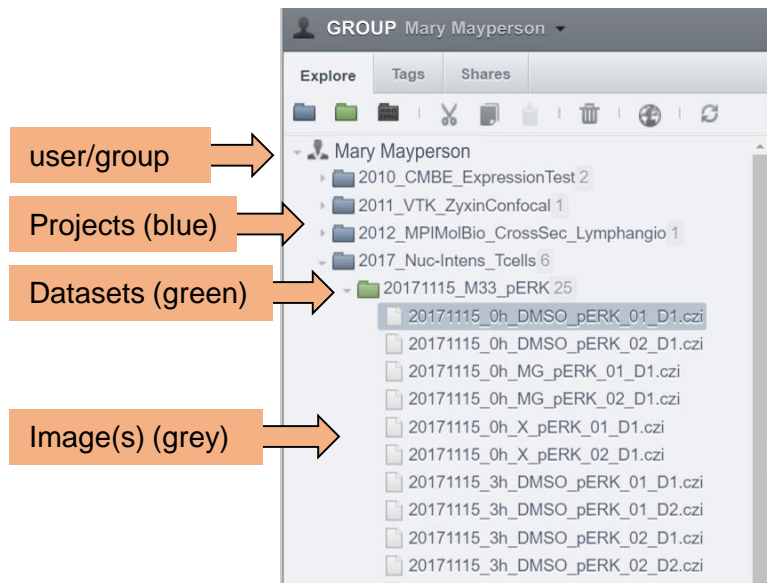
Projects



Datasets

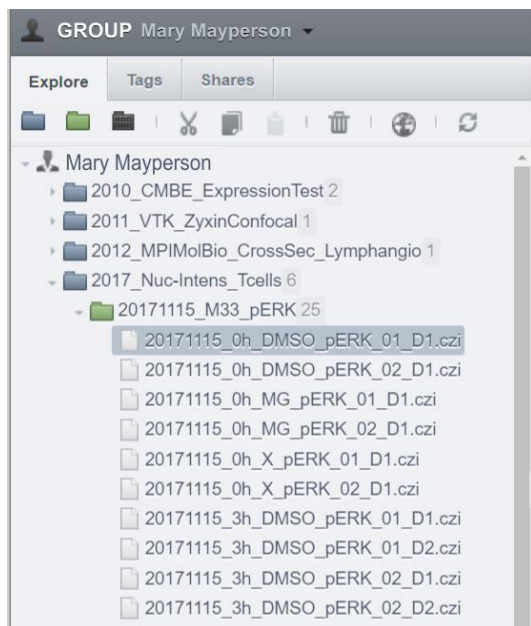


Screens (multi-well plates)

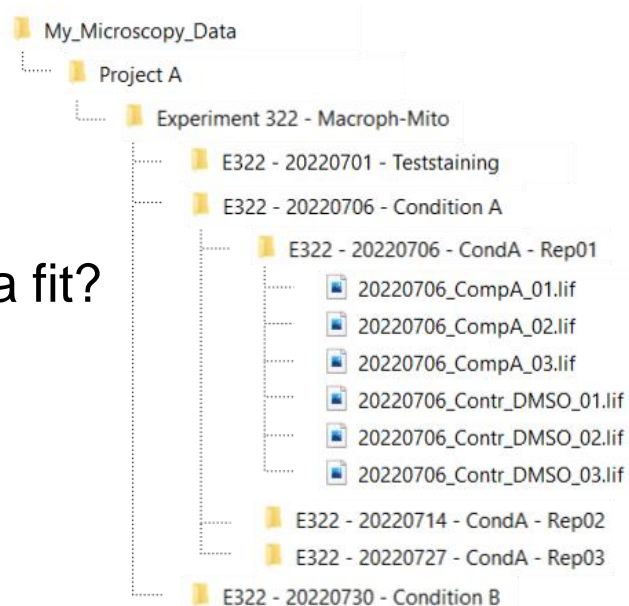


Re-think data organization: File folder hierarchy vs. object-oriented data structure in OMERO?

If OMERO offers only a two-folder deep hierarchy...

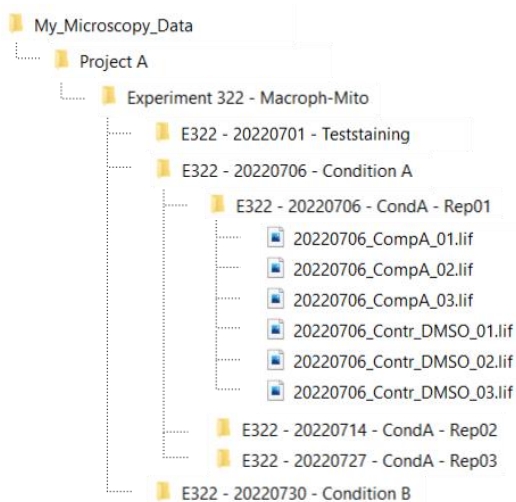


... how does my data fit?

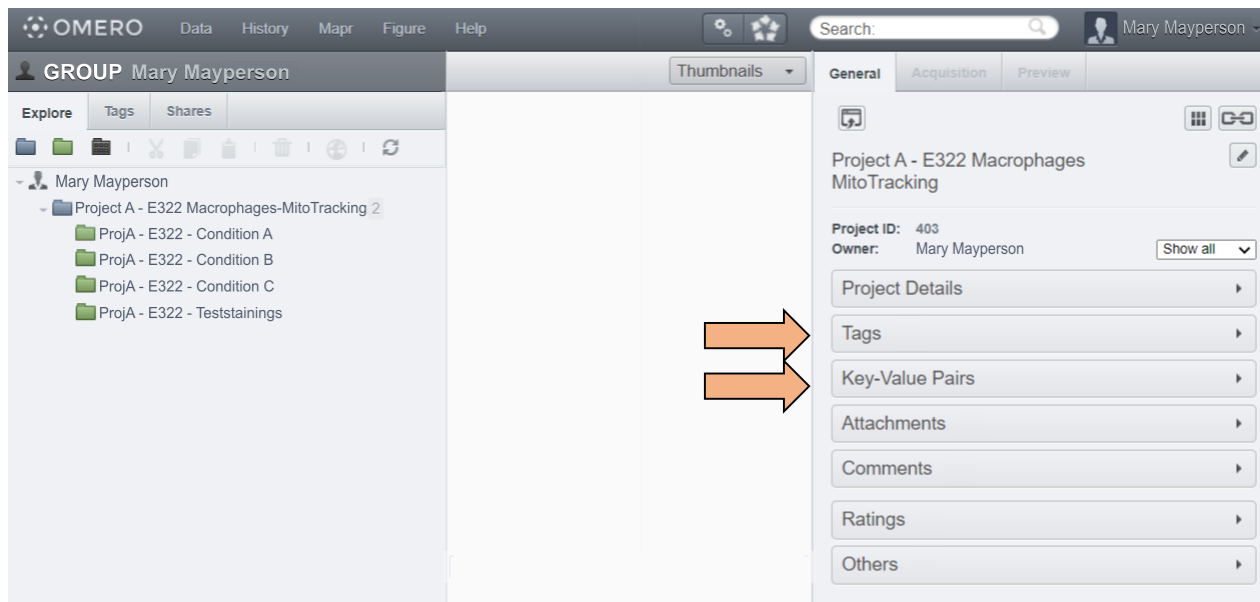


File folder hierarchy in explorer vs object-based data structure

A file folder hierarchy is itself a form of metadata



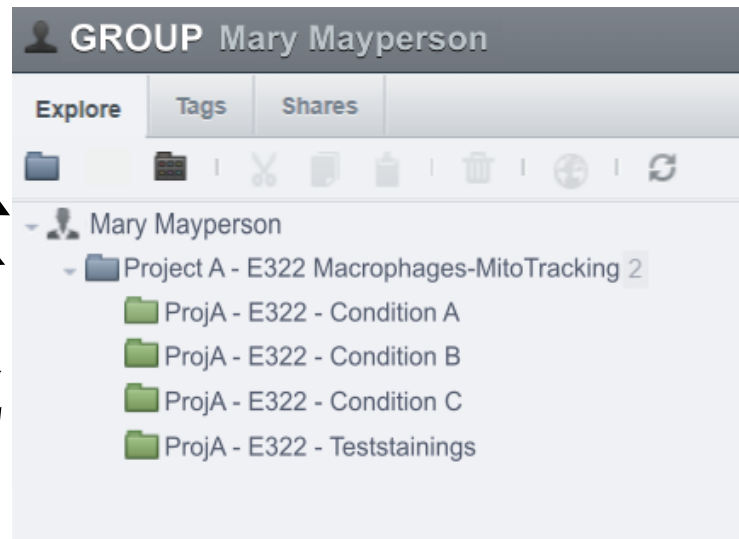
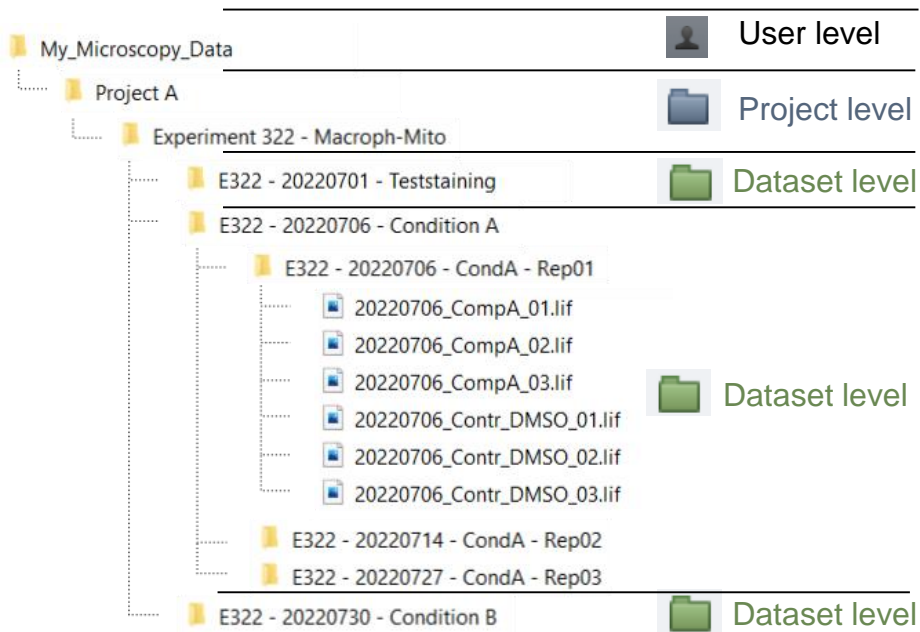
OMERO uses *structured metadata*, e.g., with **Tags** and **Key-Value Pairs**



→ Annotate data with Tags and Key-Value Pairs

Re-think data organization: Object-based data organization

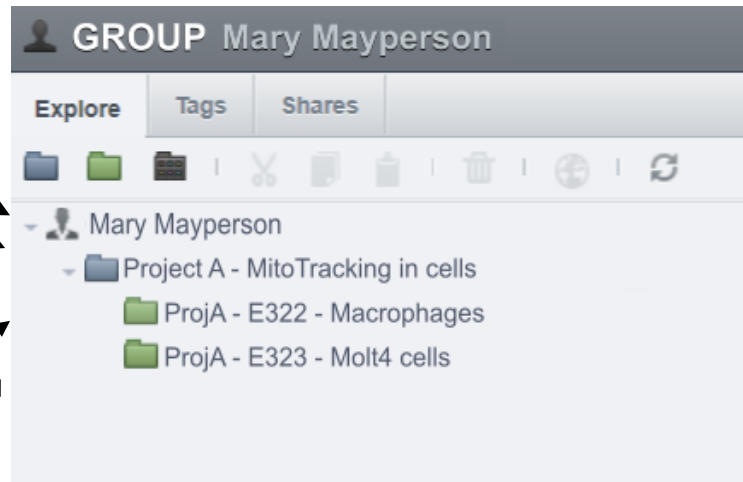
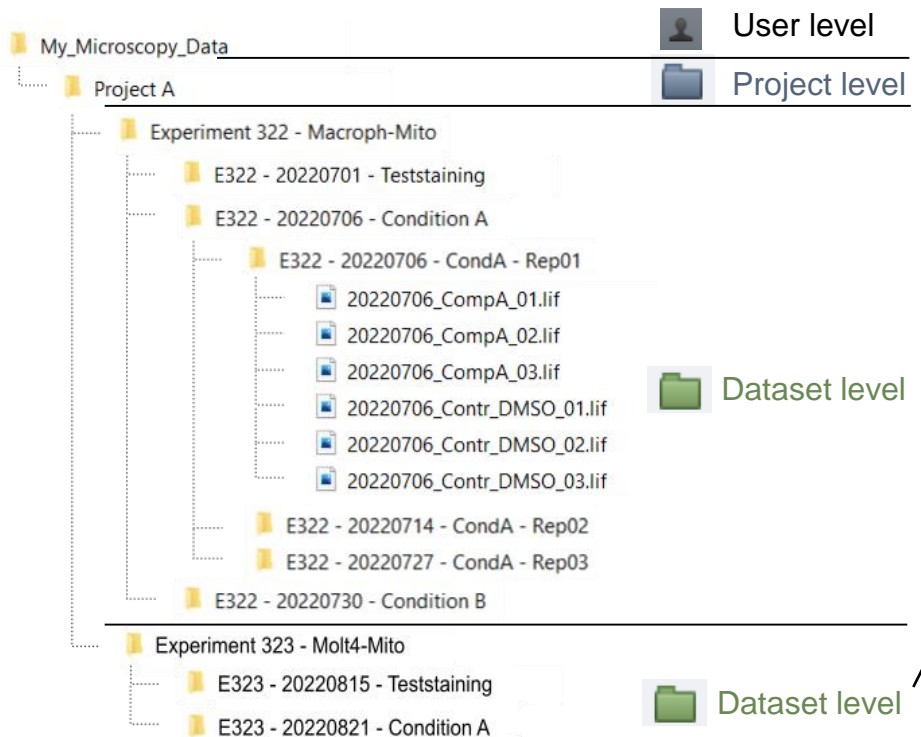
Organization example 1



Use Tags for information across datasets and to *substitute for deep folder hierarchies*
(→ How? See the following slides and chapters!)

Re-think data organization: Object-based data organization

Organization example 2



Use **Tags** for information across datasets (e.g., „Compound A“, „DMSO control“, etc.)

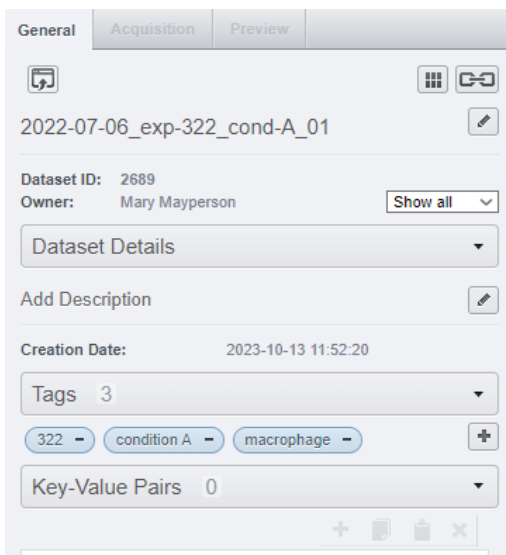
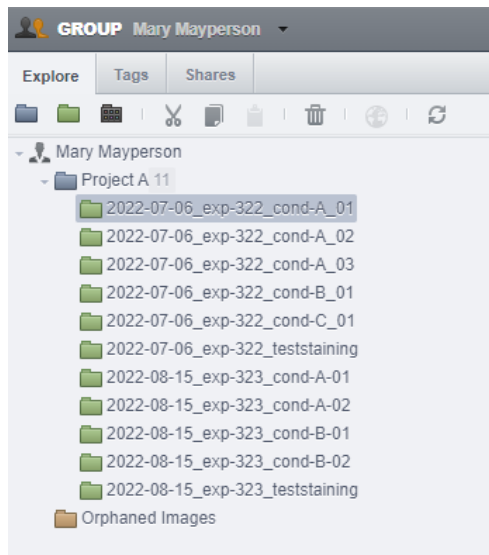
Use **Key-Value Pairs** to enrich with metadata details

(→ How? See the following slides and chapters!)

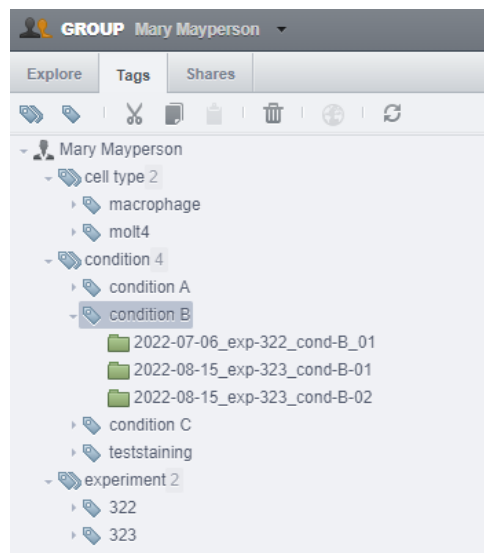
Re-think data organization: Object-based data organization

Organization example 3

Datasets on a flat list act as a "data library"



All folders are mapped to tags



- Images of an experiment are divided to obtain datasets of the same sample + condition + experiment + ...
- As the "data library" grows, the tags grant a flexible and efficient filtering
- Because images have the same "origin", they are implicitly annotated all at once (by annotating the dataset)

Re-think data organization!

This is an important concept:

OMERO is *not* intended for use as a file hierarchy system

OMERO is object-oriented

How to leverage the potential of object-oriented data organization using Tags and Key-Value-Pairs will be shown throughout the following chapters

Re-think data organization: Object-based data organization

How to organize data in OMERO?

- Structure data *according to your (group's) needs*
 - Make use of **Tags** (and/or Key-Value Pairs) for data organization (instead of deep folder hierarchies)
 - Explore ways of data organization and discuss them with your research group

→ What are Tags and Key-Value Pairs?

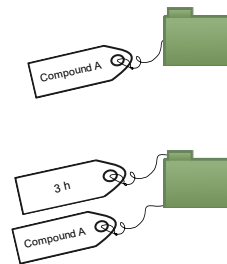
What are Tags and their advantages?

Tags denote a property of an entity, similar to a price tag in the supermarket

- Tags allow a dynamic re-representation of the data tree (Tag-based search)
- Tags can help organize data across datasets and projects (e.g., similarities, relationships)

*Examples (**Tags**):*

- „show all data treated with **compound A**“
- „show all data recorded with **instrument A**“
- etc...



Note: Tags are associated with users and groups!

- In a shared group, we recommend discussing which tags to use and potentially assigning a user who curates and manages the tags
- For private data, tags can be used based on user preference alone

What are Key-Value Pairs and their advantages?

Key-Value Pairs allow (standardized) annotation of detailed metadata

Consists of

- **Key:** Denotes a real-world object or an abstract concept that has a specific value (out of several or many possible values)
- **Value:** Number or text-string that describes the object denoted under „Key“

Examples:

Key: „cell type“ **Value:** „CD4+ T cell“

Key: „disease model“ **Value:** „experimental autoimmune encephalomyelitis“

→ Allows structured and standardized metadata details curation

Making use of the data organisation

→ see sub-chapter 6: Search Data in OMERO

Data annotation with Key-Value Pairs and Tags

→ see Chapter 07 on Metadata Curation

→ see official OMERO documentation

<https://omero-guides.readthedocs.io/en/latest/introduction/docs/index.html>