



NFDI4
BIOIMAGE

Publication-ready figures with OMERO

Workshop: **Bioimage data management and analysis with OMERO**

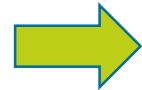
May 13th, 2024, Module 4

Trainers: Michele Bortolomeazzi, Riccardo Massei, **Christian Schmidt**



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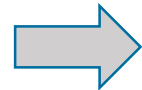
Programme



Module 1 (9 am - 10.15 am):
Basics of OMERO, data structuring and annotation
(Christian)

Module 2 (10.45 am - 12.45 pm):
OMERO and Fiji
(Michele)

Time for Lunch



Module 3 (1.45 pm - 3.45 pm):
OMERO and Jupyter Notebooks
(Riccardo)



Module 4 (4.15 pm - 6. pm):
Publication-ready figures and data with OMERO
(Christian, Riccardo, Michele)

What makes a figure publication-ready?

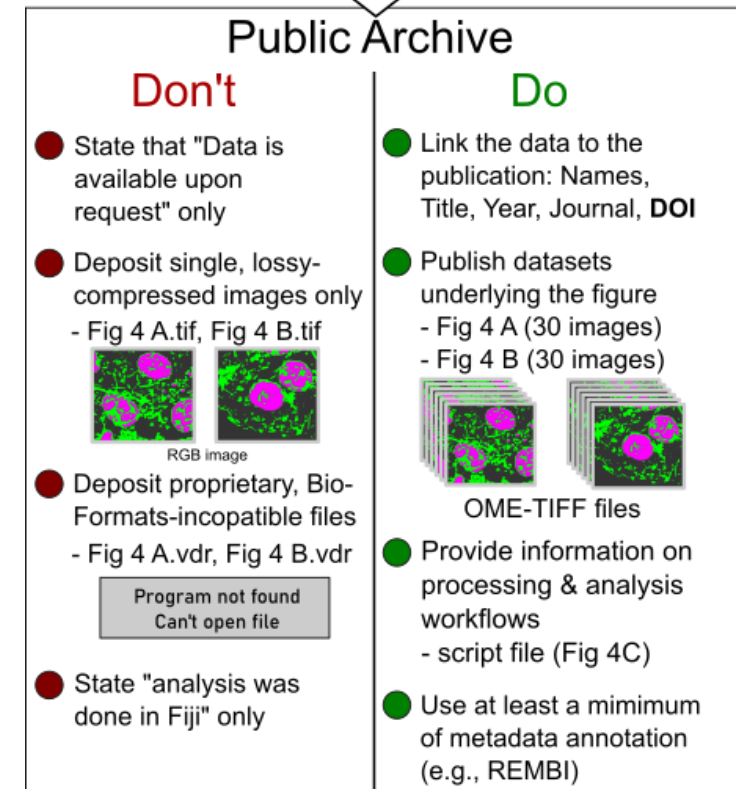
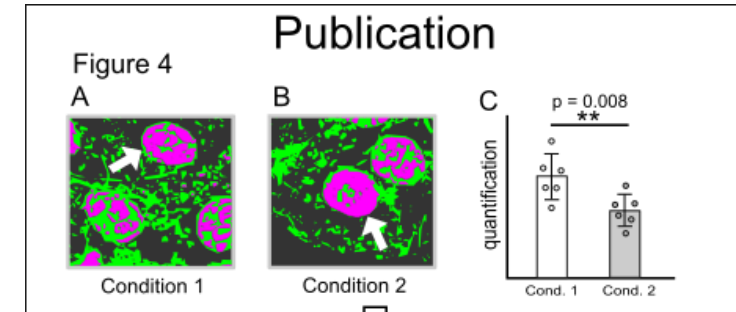
- **Representation of the results**

- Faithful
- Complete
- Allowed manipulations only
- Easy to understand
- Well described

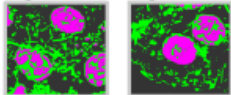
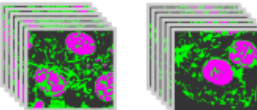
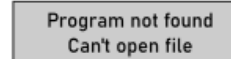
- **Publishing the images?**

- Not at all?
- Only in the manuscript?
- Public repositories:
 - BioImage Archive
 - Image Data Resource
 - others

Schmied, C., Nelson, M.S., Avilov, S. *et al.* Community-developed checklists for publishing images and image analyses. *Nat Methods* **21**, 170–181 (2024). <https://doi.org/10.1038/s41592-023-01987-9>



Public Archive

Don't	Do
<ul style="list-style-type: none">• State that "Data is available upon request" only	<ul style="list-style-type: none">• Link the data to the publication: Names, Title, Year, Journal, DOI
<ul style="list-style-type: none">• Deposit single, lossy-compressed images only - Fig 4 A.tif, Fig 4 B.tif  <p>RGB image</p>	<ul style="list-style-type: none">• Publish datasets underlying the figure - Fig 4 A (30 images) - Fig 4 B (30 images)  <p>OME-TIFF files</p>
<ul style="list-style-type: none">• Deposit proprietary, Bio-Formats-incompatible files - Fig 4 A.vdr, Fig 4 B.vdr 	<ul style="list-style-type: none">• Provide information on processing & analysis workflows - script file (Fig 4C)
<ul style="list-style-type: none">• State "analysis was done in Fiji" only	<ul style="list-style-type: none">• Use at least a minimum of metadata annotation (e.g., REMBI)

<https://gerbi-gmb.de/2023/05/31/introducti-on-to-image-data-repositories-and-public-archives/>

Focus for Module 4

Recommended Metadata for Biological Images (REMBI)

(Ontologies)

OMERO.figure

The following slides are taken from:

Fuchs, V. A. F., Schmidt, C., & Boissonnet, T. (2024, Mai 6). [Workshop] FAIR data handling for microscopy: Structured metadata annotation in OMERO. Zenodo. <https://doi.org/10.5281/zenodo.11109616>

REMBI provides guidelines for metadata for biological images

Metadata collected in 8 modules

See Sarkans et al., 2021,
<https://doi.org/10.1038/s41592-021-01166-8>

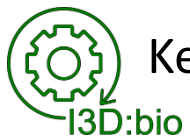
“Fig. 2: Different categories of metadata that are covered by REMBI.”

REMBI module 1: Study

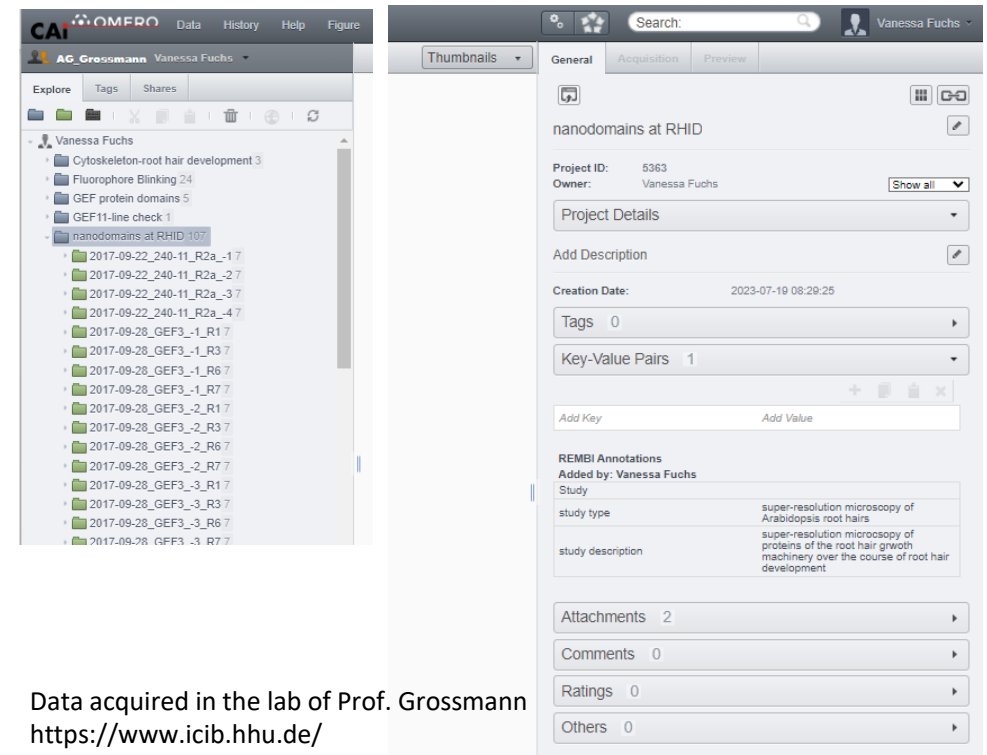
“Study is the highest level metadata, describing your project, including funding and publications.”

Study			
<i>(contains 1 or more</i>	Study type	Type of the overall study, which may include	text, ontology
	Study description	Study description, e.g., title of published paper	text
	General dataset info	Authors, publications, licenses etc	misc.

Recommendation by I3D:bio:



Key-Value pairs in OMERO at the “Project”-level:



The screenshot shows the OMERO web interface. On the left, a file browser displays a project structure under 'Vanessa Fuchs', including folders like 'Cytoskeleton-root hair development 3', 'Fluorophore Blinking 24', 'GEF protein domains 5', 'GEF11-line check 1', and 'nanodomains at RHID:107'. The 'nanodomains at RHID:107' folder contains numerous sub-folders with names like '2017-09-22_240-11_R2a_1 7'. On the right, the 'General' tab for the project 'nanodomains at RHID' is shown. It displays the Project ID (5363), Owner (Vanessa Fuchs), and Creation Date (2023-07-19 08:29:25). The 'Key-Value Pairs' section shows one pair: 'study type' with the value 'super-resolution microscopy of Arabidopsis root hairs'. The 'REMBI Annotations' section shows 'Study' with 'study type' and 'study description' (super-resolution microscopy of proteins of the root hair growth machinery over the course of root hair development). Other sections include Attachments (2), Comments (0), Ratings (0), and Others (0).

Data acquired in the lab of Prof. Grossmann
<https://www.icib.hhu.de/>

I3D:bio project: <https://www.i3dbio.de/>

Original publication: <https://doi.org/10.1038/s41592-021-01166-8>

<https://www.ebi.ac.uk/bioimage-archive/rembi-help-overview/>



REMBI module 2: Study component

Study Component acts as a container that helps you organise your data, based on experiment types or samples etc. A Study Component contains one or more of the following components: biosample, specimen, image acquisition, image correlation, image analysis (latter two are only required if relevant).

Study component

<i>(contains Image data</i>	Imaging method	Technique used to acquire image data	ontology
	Study component description	Description specific to this image dataset	text

Recommendation by I3D:bio:



One per Dataset (Key-Value Pairs in OMERO at the Dataset-level)

I3D:bio project: <https://www.i3dbio.de/>

Original publication: <https://doi.org/10.1038/s41592-021-01166-8>

<https://www.ebi.ac.uk/bioimage-archive/rembi-help-overview/>

REMBI module 3: Biosample

Biosample describes what you have imaged, for example: the species, the organism, a particular cell line, genetic background etc.

Biosample		
Identity	Internal unique ID	
Biological entity	What is being imaged	text and/or ontology entry (multiple possible)
Organism	Species (multiple possible)	taxonomy
Intrinsic variable	Intrinsic (e.g. genetic) alteration if applicable	text and/or ontology entry (multiple possible)
Extrinsic variable	External biosample treatment (e.g. reagent) if applicable	text and/or ontology entry (multiple possible) or associated file
Experimental variables	What is intentionally varied (e.g. time) between multiple entries in this study component	text and/or ontology entry (multiple possible)

Recommendation by I3D:bio:

One per Dataset (Key-Value Pairs in OMERO at the Dataset-level)



I3D:bio project: <https://www.i3dbio.de/>

Original publication: <https://doi.org/10.1038/s41592-021-01166-8>

<https://www.ebi.ac.uk/bioimage-archive/rembi-help-overview/>



REMBI module 4: Specimen

Specimen metadata describes how your sample was prepared for imaging.

Specimen <i>(linked to Biosample)</i>			
Experimental status	Test/ control		
Location within Biosample	Plate/dish coordinate or tissue location		text or associated file
Preparation method	Sample preparation protocol		text, file, ontology, or widget for specific method types
Signal/contrast mechanism	How is the signal generated by this sample		text, ontology
Channel - content	Specific specimen staining (e.g. IEM, DAB)		text
Channel - biological entity	What molecule is stained		text, ontology entries



Recommendation by I3D:bio:

One per Dataset (Key-Value Pairs in OMERO at the Dataset-level)

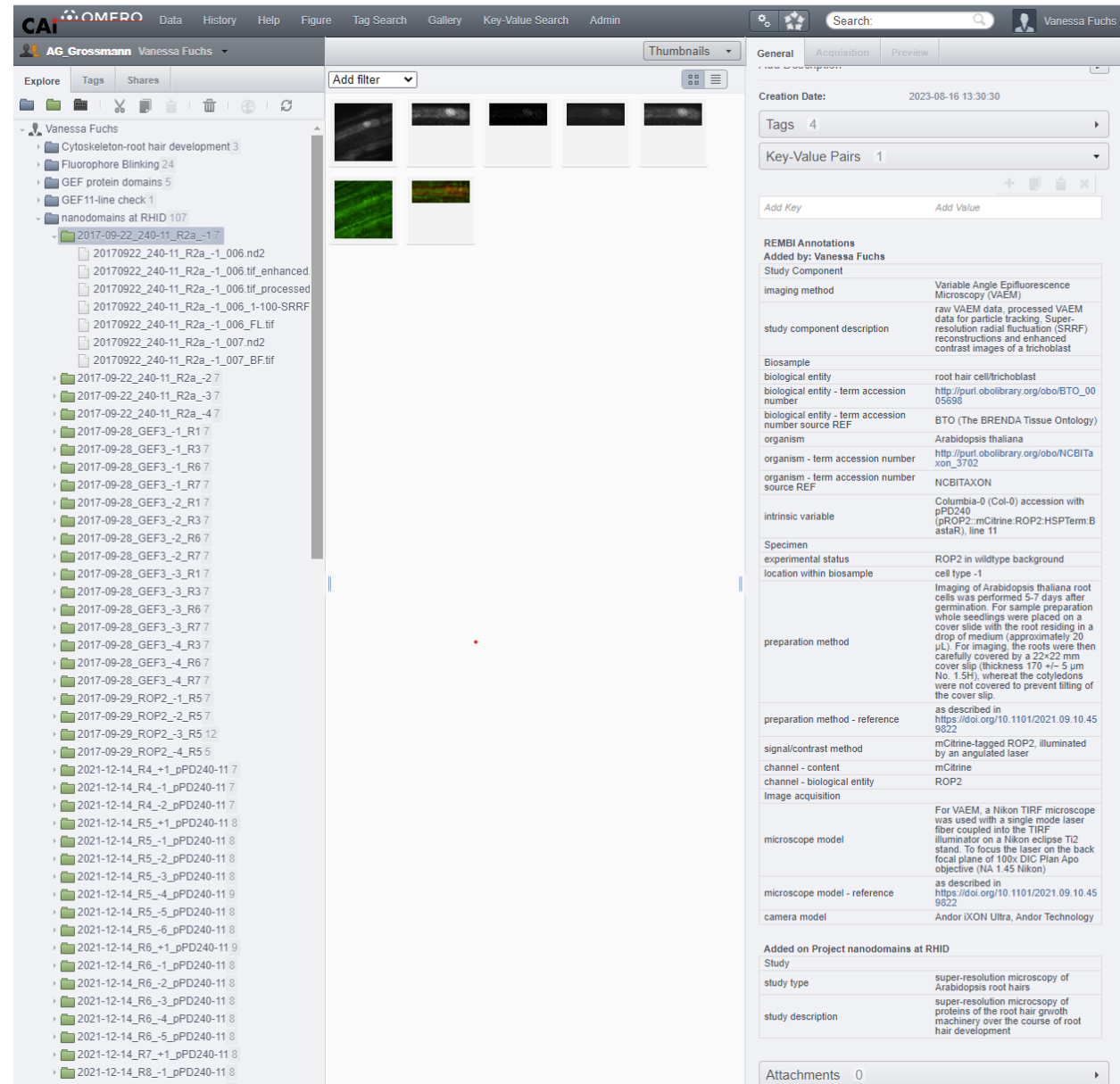
I3D:bio project: <https://www.i3dbio.de/>

Original publication: <https://doi.org/10.1038/s41592-021-01166-8>

<https://www.ebi.ac.uk/bioimage-archive/rembi-help-overview/>



REMBI at CAi



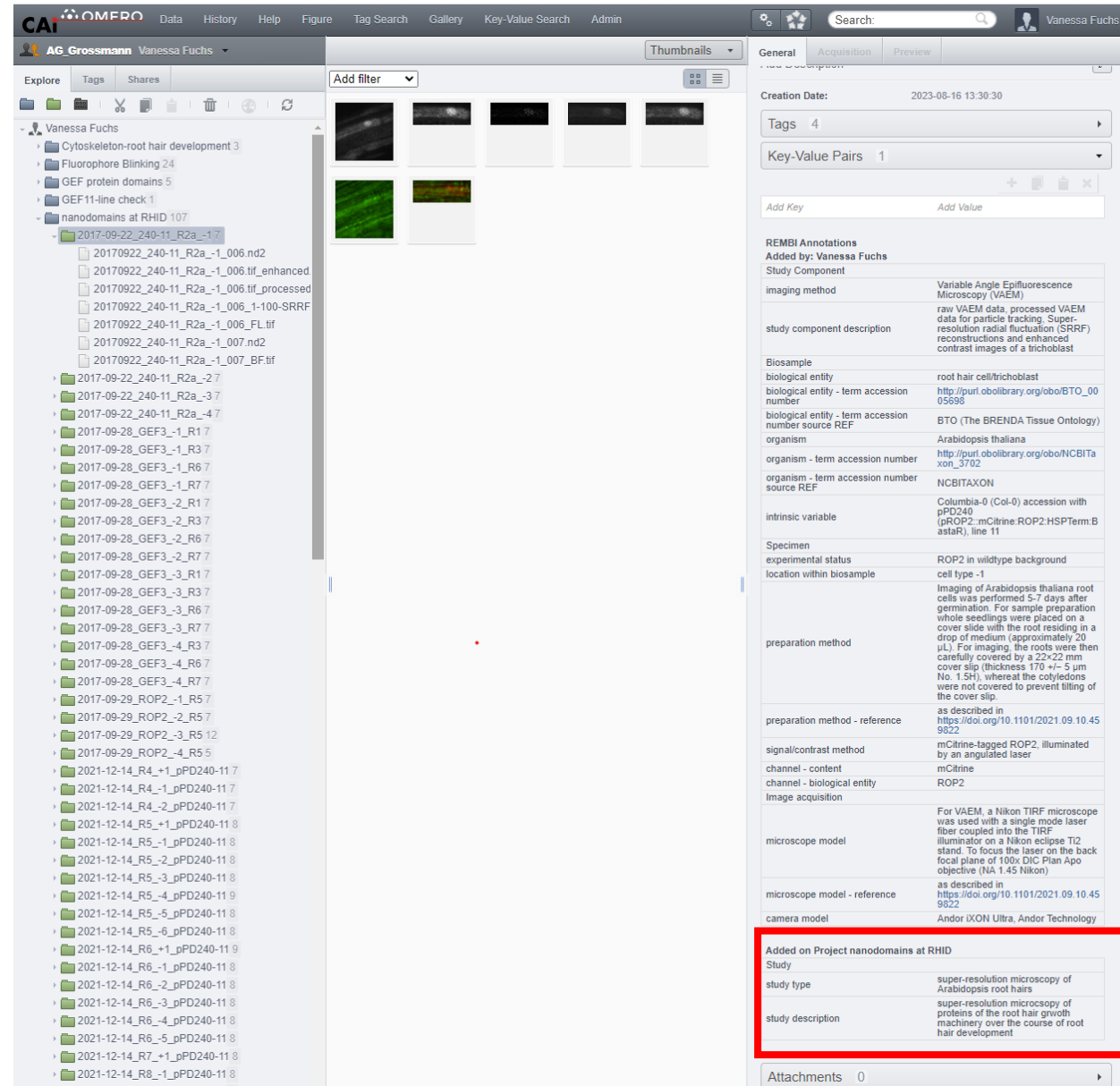
The screenshot displays the OMERO web interface. On the left, a file browser shows a hierarchical tree of folders and files under the user 'Vanessa Fuchs'. The central area contains a grid of image thumbnails, with one larger image selected. The right-hand panel is titled 'REMBI Annotations' and contains a table of metadata for the selected image.

REMBI Annotations	
Added by: Vanessa Fuchs	
Study Component	Variable Angle Epifluorescence Microscopy (VAEM)
imaging method	raw VAEM data, processed VAEM data for particle tracking, Super-resolution radial fluctuation (SRRF) reconstructions and enhanced contrast images of a trichoblast
study component description	
Biosample	
biological entity	root hair cell/trichoblast
biological entity - term accession number	http://purl.obolibrary.org/obo/BTO_0005698
biological entity - term accession number source REF	BTO (The BRENDA Tissue Ontology)
organism	Arabidopsis thaliana
organism - term accession number	http://purl.obolibrary.org/obo/NCBITaxon_3702
organism - term accession number source REF	NCBITAXON
intrinsic variable	Columbia-0 (Col-0) accession with pPD240 (pROP2::mCitrine:ROP2:HSPTerm:BetaStar), line 11
Specimen	
experimental status	ROP2 in wildtype background
location within biosample	cell type -1
preparation method	Imaging of Arabidopsis thaliana root cells was performed 5-7 days after germination. For sample preparation whole seedlings were placed on a cover slide with the root residing in a drop of medium (approximately 20 µL). For imaging, the roots were then carefully covered by a 22x22 mm cover slip (thickness 170 +/- 5 µm No. 1.5H), whereat the cotyledons were not covered to prevent tilting of the cover slip.
preparation method - reference	as described in https://doi.org/10.1101/2021.09.10.459822
signal/contrast method	mCitrine-tagged ROP2, illuminated by an angled laser
channel - content	mCitrine
channel - biological entity	ROP2
Image acquisition	
microscope model	For VAEM, a Nikon TIRF microscope was used with a single mode laser fiber coupled into the TIRF illuminator on a Nikon eclipse Ti2 stand. To focus the laser on the back focal plane of 100x DIC Plan Apo objective (NA 1.45 Nikon)
microscope model - reference	as described in https://doi.org/10.1101/2021.09.10.459822
camera model	Andor IXON Ultra, Andor Technology
Added on Project nanodomains at RHID	
Study	
study type	super-resolution microscopy of Arabidopsis root hairs
study description	super-resolution microscopy of proteins of the root hair growth machinery over the course of root hair development



Data acquired in the lab of Guido Grossmann
<https://www.icib.hhu.de/>

REMBI at CAi



CAi OMERO Data History Help Figure Tag Search Gallery Key-Value Search Admin

AG Grossmann Vanessa Fuchs

Explore Tags Shares Add filter

Vanessa Fuchs

- Cytoskeleton-root hair development 3
- Fluorophore Blinking 24
- GEF protein domains 5
- GEF11-line check 1
- nanodomains at RHID 107
 - 2017-09-22_240-11_R2a_1-7
 - 20170922_240-11_R2a_1_006.nd2
 - 20170922_240-11_R2a_1_006.tif_enhanced
 - 20170922_240-11_R2a_1_006.tif_processed
 - 20170922_240-11_R2a_1_100-SRRF
 - 20170922_240-11_R2a_1_006_FL.tif
 - 20170922_240-11_R2a_1_007.nd2
 - 20170922_240-11_R2a_1_007_BF.tif
 - 2017-09-22_240-11_R2a_2-7
 - 2017-09-22_240-11_R2a_3-7
 - 2017-09-22_240-11_R2a_4-7
 - 2017-09-28_GEF3_1_R1 7
 - 2017-09-28_GEF3_1_R3 7
 - 2017-09-28_GEF3_1_R6 7
 - 2017-09-28_GEF3_1_R7 7
 - 2017-09-28_GEF3_2_R1 7
 - 2017-09-28_GEF3_2_R3 7
 - 2017-09-28_GEF3_2_R6 7
 - 2017-09-28_GEF3_2_R7 7
 - 2017-09-28_GEF3_3_R1 7
 - 2017-09-28_GEF3_3_R3 7
 - 2017-09-28_GEF3_3_R6 7
 - 2017-09-28_GEF3_3_R7 7
 - 2017-09-28_GEF3_4_R3 7
 - 2017-09-28_GEF3_4_R6 7
 - 2017-09-28_GEF3_4_R7 7
 - 2017-09-29_ROP2_1_R5 7
 - 2017-09-29_ROP2_2_R5 7
 - 2017-09-29_ROP2_3_R5 12
 - 2017-09-29_ROP2_4_R5 5
 - 2021-12-14_R4_+1_pPD240-11 7
 - 2021-12-14_R4_1_pPD240-11 7
 - 2021-12-14_R4_2_pPD240-11 7
 - 2021-12-14_R5_+1_pPD240-11 8
 - 2021-12-14_R5_1_pPD240-11 8
 - 2021-12-14_R5_2_pPD240-11 8
 - 2021-12-14_R5_3_pPD240-11 8
 - 2021-12-14_R5_4_pPD240-11 9
 - 2021-12-14_R5_5_pPD240-11 8
 - 2021-12-14_R5_6_pPD240-11 8
 - 2021-12-14_R6_+1_pPD240-11 9
 - 2021-12-14_R6_1_pPD240-11 8
 - 2021-12-14_R6_2_pPD240-11 8
 - 2021-12-14_R6_3_pPD240-11 8
 - 2021-12-14_R6_4_pPD240-11 8
 - 2021-12-14_R6_5_pPD240-11 8
 - 2021-12-14_R7_+1_pPD240-11 8
 - 2021-12-14_R8_1_pPD240-11 8

Creation Date: 2023-08-16 13:30:30

Tags 4

Key-Value Pairs 1

REMBI Annotations

Added by: Vanessa Fuchs

Study Component	Variable Angle Epifluorescence Microscopy (VAEM)
imaging method	raw VAEM data, processed VAEM data for particle tracking, Super-resolution radial fluctuation (SRRF) reconstructions and enhanced contrast images of a trichoblast
study component description	
Biosample	
biological entity	root hair cell/trichoblast
biological entity - term accession number	http://purl.obolibrary.org/obo/BTO_0005698
biological entity - term accession number source REF	BTO (The BRENDA Tissue Ontology)
organism	Arabidopsis thaliana
organism - term accession number	http://purl.obolibrary.org/obo/NCBITaxon_3702
organism - term accession number source REF	NCBITAXON
intrinsic variable	Columbia-0 (Col-0) accession with pPD240 (pROP2::mCitrine:ROP2:HSPTerm:BetaStar), line 11
Specimen	
experimental status	ROP2 in wildtype background
location within biosample	cell type -1
preparation method	Imaging of Arabidopsis thaliana root cells was performed 5-7 days after germination. For sample preparation whole seedlings were placed on a cover slide with the root residing in a drop of medium (approximately 20 µL). For imaging, the roots were then carefully covered by a 22x22 mm cover slip (thickness 170 +/- 5 µm No. 1.5H), whereat the cotyledons were not covered to prevent tilting of the cover slip.
preparation method - reference	as described in https://doi.org/10.1101/2021.09.10.459822
signal/contrast method	mCitrine-tagged ROP2, illuminated by an angled laser
channel - content	mCitrine
channel - biological entity	ROP2
Image acquisition	
microscope model	For VAEM, a Nikon TIRF microscope was used with a single mode laser fiber coupled into the TIRF illuminator on a Nikon eclipse T2 stand. To focus the laser on the back focal plane of 100x DIC Plan Apo objective (NA 1.45 Nikon)
microscope model - reference	as described in https://doi.org/10.1101/2021.09.10.459822
camera model	Andor iXON Ultra, Andor Technology

Added on Project nanodomains at RHID

Study	
study type	super-resolution microscopy of Arabidopsis root hairs
study description	super-resolution microscopy of proteins of the root hair growth machinery over the course of root hair development

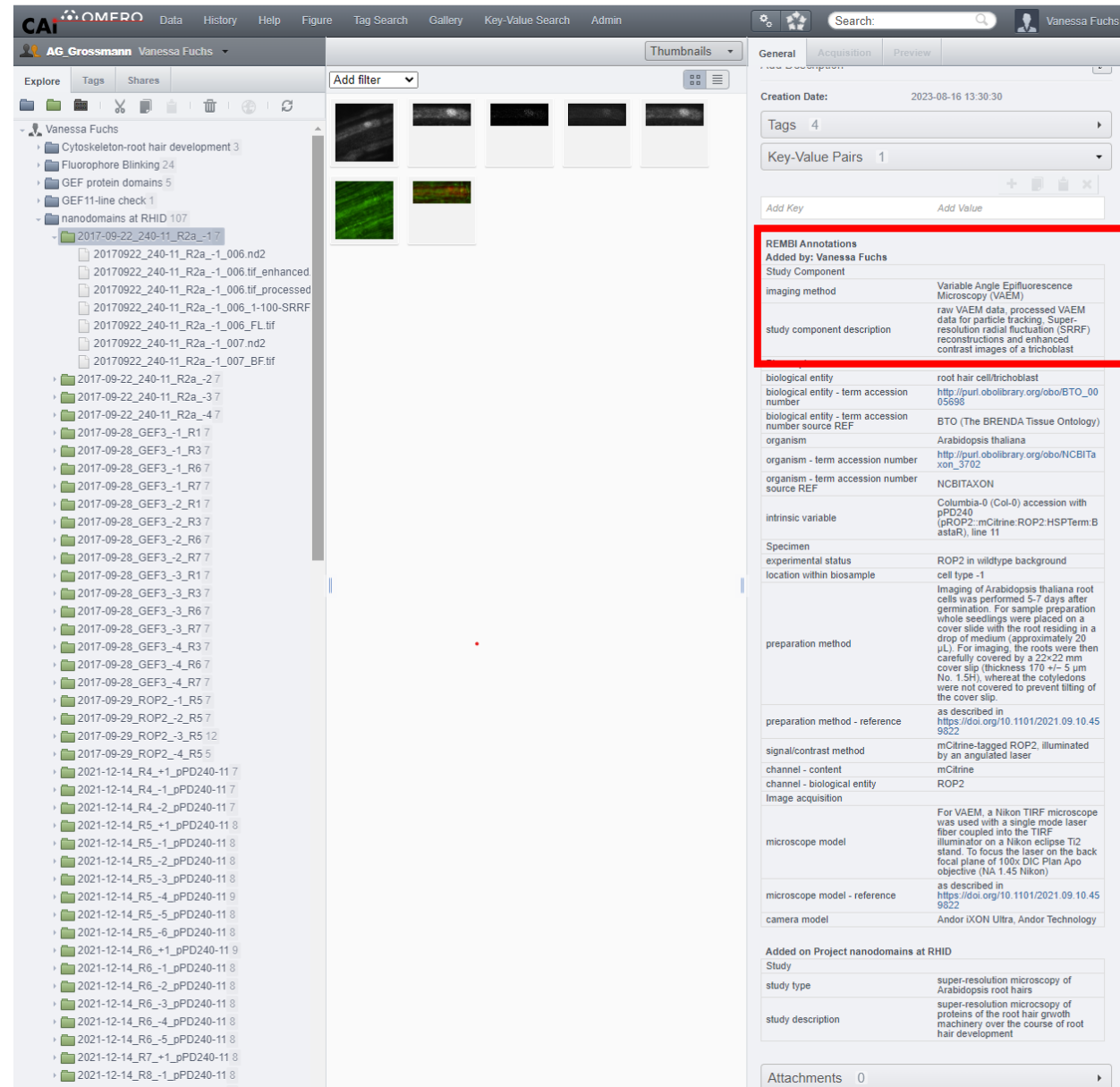
Attachments 0

Module1: Study –
project level



Data acquired in the lab of Guido Grossmann
<https://www.icib.hhu.de/>

REMBI at CAi



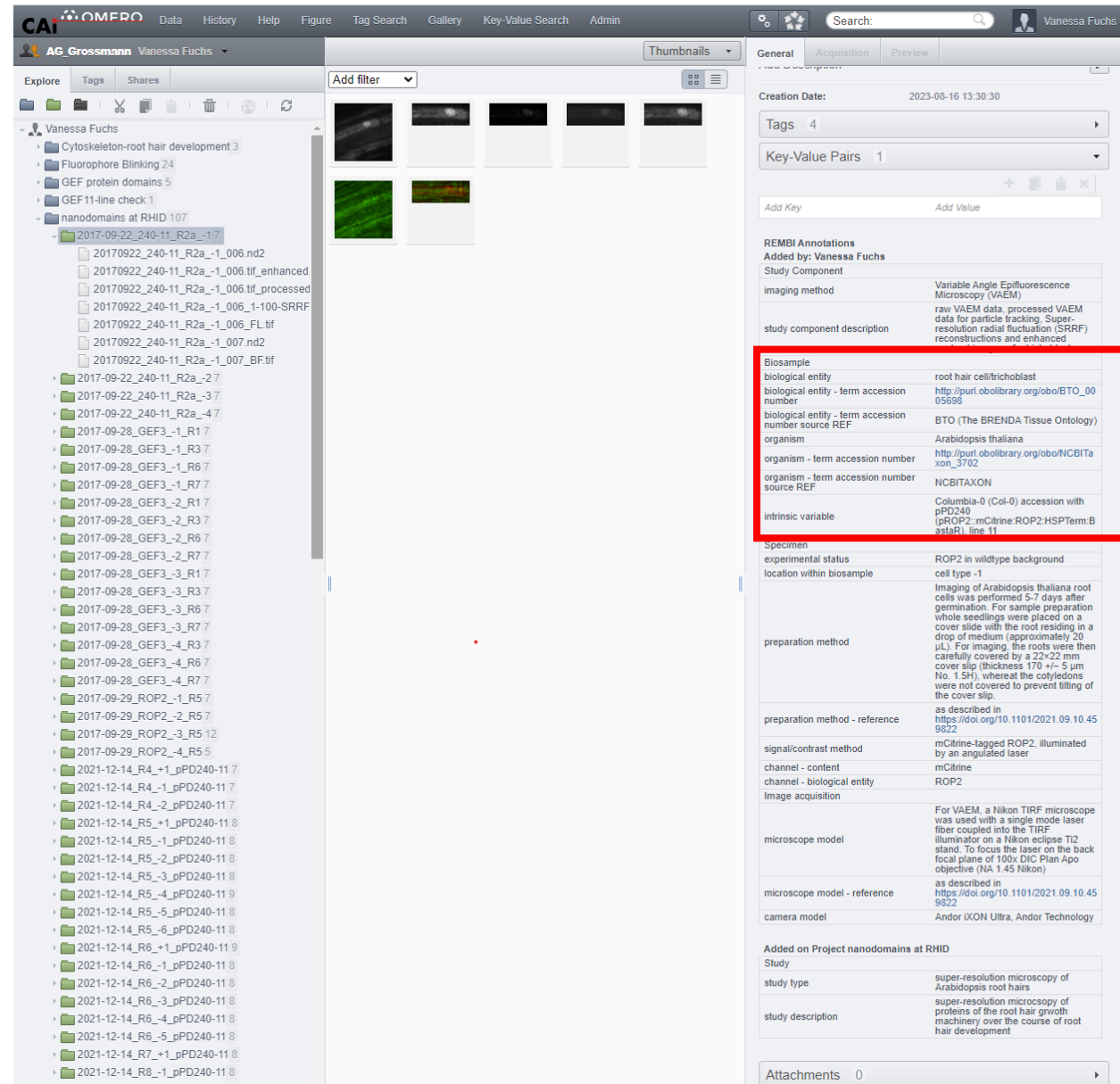
The screenshot displays the OMERO web interface. On the left, a tree view shows a dataset named 'nanodomains at RHID 107' with a sub-entry '2017-09-22_240-11_R2a_1-7'. The main area shows a grid of image thumbnails. On the right, the 'General' tab of the metadata panel is open, with a red box highlighting the 'REMBI Annotations' section. This section contains a table with the following data:

REMBI Annotations	
Added by: Vanessa Fuchs	
Study Component	
imaging method	Variable Angle Epifluorescence Microscopy (VAEM)
study component description	raw VAEM data, processed VAEM data for particle tracking, Super-resolution radial fluctuation (SRRF) reconstructions and enhanced contrast images of a trichoblast

Below the highlighted section, other metadata fields are visible, including biological entity (root hair cell/trichoblast), organism (Arabidopsis thaliana), and preparation method (imaging of Arabidopsis thaliana root cells).

Module2: Study component – dataset level

REMBI at CAi



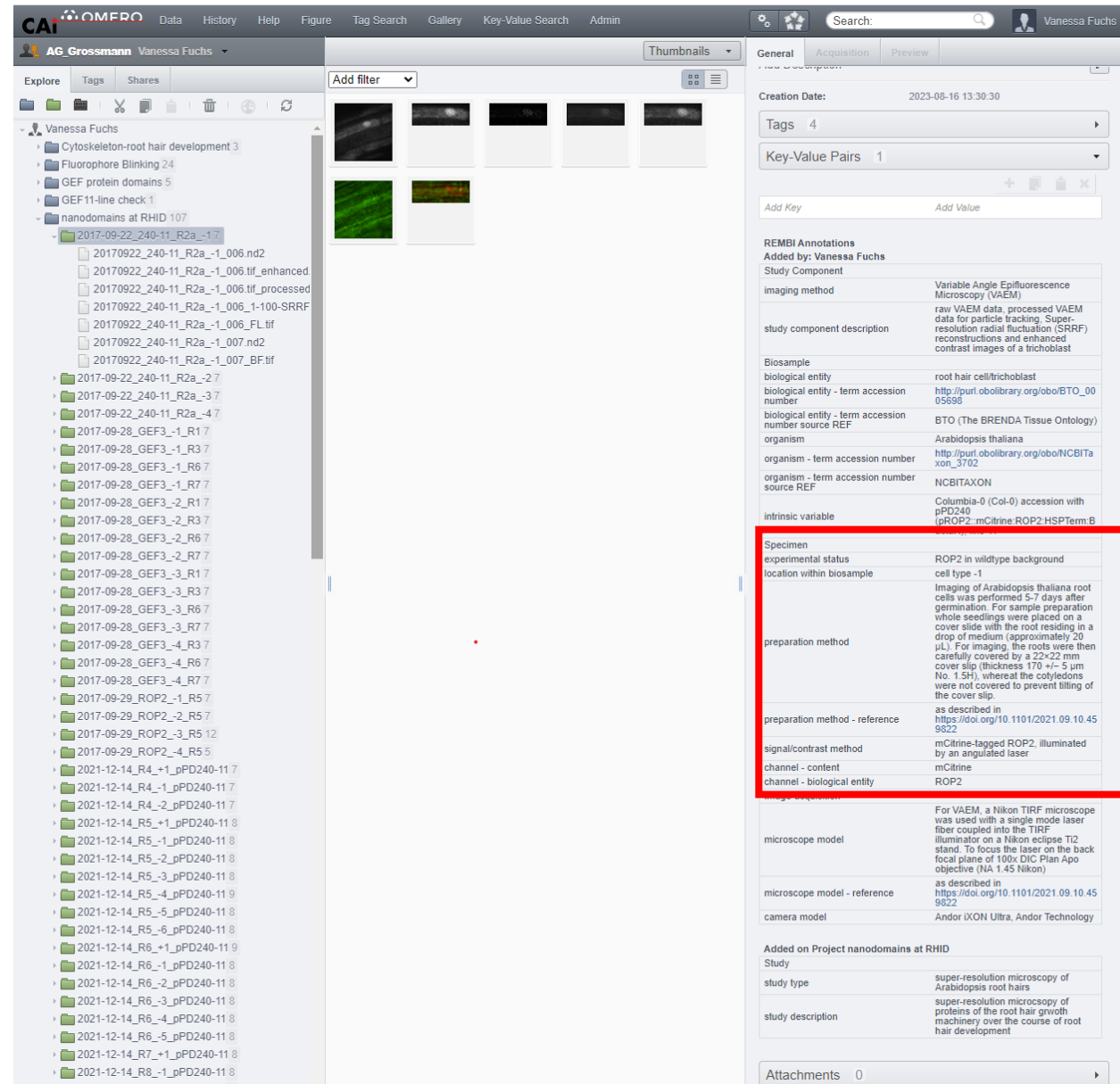
The screenshot shows the OMERO web interface. On the left is a file explorer showing a tree structure of datasets. The main area displays a grid of image thumbnails. On the right, the 'General' tab is active, showing metadata for a dataset. A red box highlights the 'REMBI Annotations' section, specifically the 'Biosample' table.

REMBI Annotations	
Added by: Vanessa Fuchs	
Study Component	Variable Angle Epifluorescence Microscopy (VAEM)
imaging method	raw VAEM data, processed VAEM data for particle tracking, Super-resolution radial fluctuation (SRRF) reconstructions and enhanced
study component description	
Biosample	
biological entity	root hair cell/trichoblast
biological entity - term accession number	http://purl.obolibrary.org/obo/BTO_0005698
biological entity - term accession number source REF	BTO (The BRENDA Tissue Ontology)
organism	Arabidopsis thaliana
organism - term accession number	http://purl.obolibrary.org/obo/NCBITaxon_3702
organism - term accession number source REF	NCBITAXON
intrinsic variable	Columbia-0 (Col-0) accession with pPD240 (pROP2; mCitrine:ROP2:HSPTerm:BastaR), line 11

Module 3:
Biosample –
dataset level



REMBI at CAi



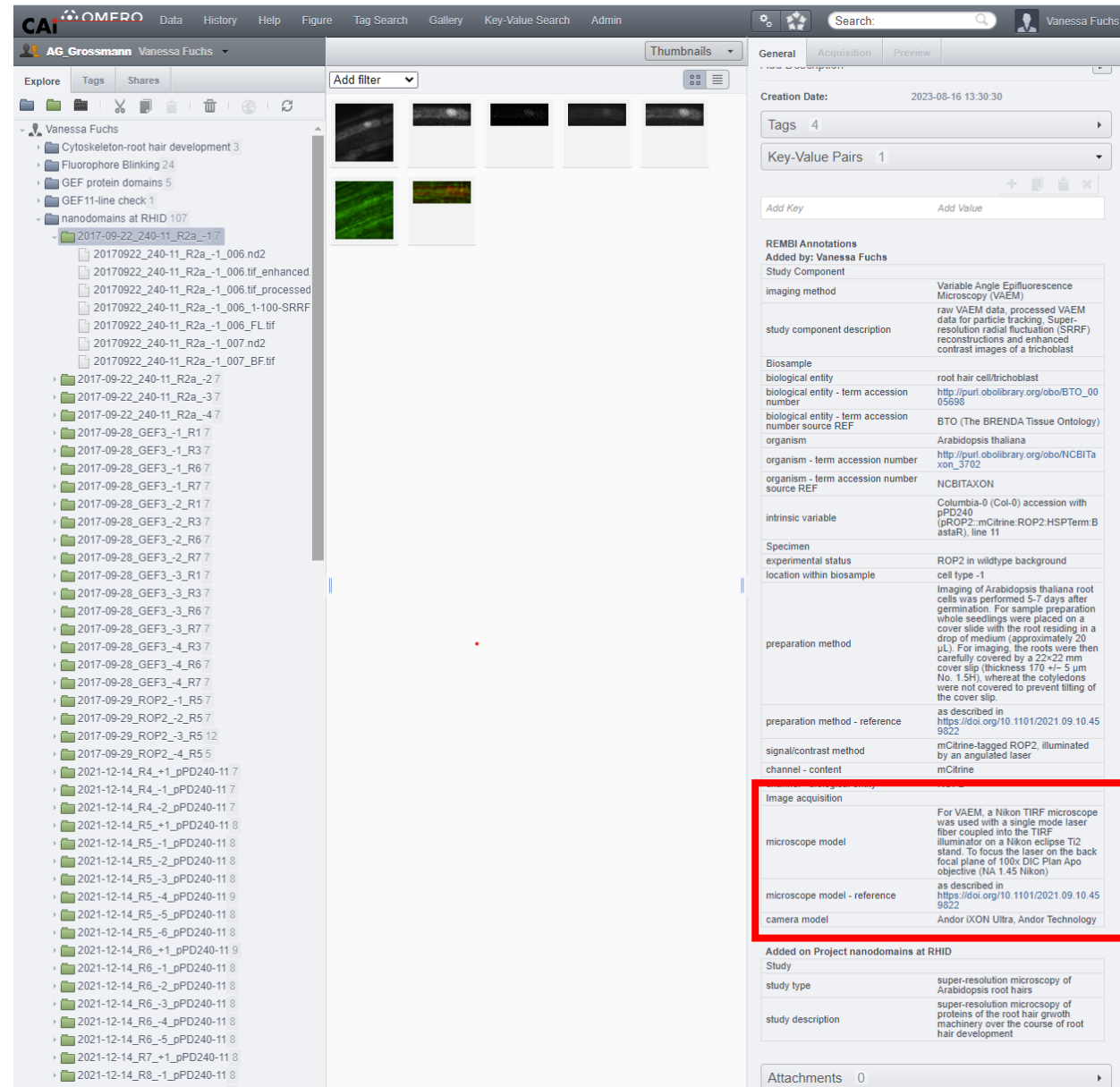
The screenshot shows the OMERO web interface. On the left, a tree view displays a dataset hierarchy under 'Vanessa Fuchs', including folders like 'nanodomains at RHID 107' and '2017-09-22_240-11_R2a_1-7'. The main area shows a grid of image thumbnails. On the right, the 'General' tab is active, displaying a metadata table. A red box highlights the 'Specimen' section of this table.

Property	Value
Creation Date	2023-08-16 13:30:30
Tags	4
Key-Value Pairs	1
REMBI Annotations	
Added by: Vanessa Fuchs	
Study Component	Variable Angle Epifluorescence Microscopy (VAEM)
imaging method	raw VAEM data, processed VAEM data for particle tracking, Super-resolution radial fluctuation (SRRF) reconstructions and enhanced contrast images of a trichoblast
study component description	
Biosample	
biological entity	root hair cell/trichoblast
biological entity - term accession number	http://purl.obolibrary.org/obo/BTO_0005698
biological entity - term accession number source REF	BTO (The BRENDA Tissue Ontology)
organism	Arabidopsis thaliana
organism - term accession number	http://purl.obolibrary.org/obo/NCBITaxon_3702
organism - term accession number source REF	NCBITAXON
intrinsic variable	Columbia-0 (Col-0) accession with pPD240 (PRO2::mCitrine:ROP2:HSPTerm B)
Specimen	
experimental status	ROP2 in wildtype background
location within biosample	cell type -1
preparation method	Imaging of Arabidopsis thaliana root cells was performed 5-7 days after germination. For sample preparation whole seedlings were placed on a cover slide with the root residing in a drop of medium (approximately 20 µL). For imaging, the roots were then carefully covered by a 22x22 mm cover slip (thickness 170 +/- 5 µm No. 1.5H), whereat the cotyledons were not covered to prevent tilting of the cover slip.
preparation method - reference	as described in https://doi.org/10.1101/2021.09.10.459822
signal/contrast method	mCitrine-tagged ROP2, illuminated by an angled laser
channel - content	mCitrine
channel - biological entity	ROP2
microscope model	For VAEM, a Nikon TIRF microscope was used with a single mode laser fiber coupled into the TIRF illuminator on a Nikon eclipse T2 stand. To focus the laser on the back focal plane of 100x DIC Plan Apo objective (NA 1.45 Nikon)
microscope model - reference	as described in https://doi.org/10.1101/2021.09.10.459822
camera model	Andor IXON Ultra, Andor Technology
Added on Project nanodomains at RHID	
Study	
study type	super-resolution microscopy of Arabidopsis root hairs
study description	super-resolution microscopy of proteins of the root hair growth machinery over the course of root hair development
Attachments	0

Module 4: Specimen – dataset level



REMBI at CAi



The screenshot displays the OMERO web interface. On the left, a tree view shows a dataset hierarchy under 'Vanessa Fuchs', including folders like 'nanodomains at RHID 107' and '2017-09-22_240-11_R2a-1.7'. The central area shows a grid of image thumbnails. The right-hand panel contains metadata for the selected dataset, including 'REMBI Annotations', 'Image acquisition', and 'Study' details. A red box highlights the 'Image acquisition' section, which contains the following information:

Image acquisition	For VAEM, a Nikon TIRF microscope was used with a single mode laser fiber coupled into the TIRF illuminator on a Nikon eclipse T2 stand. To focus the laser on the back focal plane of 100x DIC Plan Apo objective (NA 1.45 Nikon)
microscope model	as described in https://doi.org/10.1101/2021.09.10.459822
microscope model - reference	as described in https://doi.org/10.1101/2021.09.10.459822
camera model	Andor IXON Ultra, Andor Technology

Module 5: Image acquisition – dataset level



A brief glance at ontologies

What is an image?

Microsoft Bing search for „image definition“

1. a representation of the external form of a person or thing in art:
"her work juxtaposed images from serious and popular art"
Ähnlich: likeness resemblance depiction portrayal representation
2. the general impression that a person, organization, or product presents to the public:
"she strives to project an image of youth"
Ähnlich: persona profile face identity front facade mask guise
3. a simile or metaphor:
"he uses the image of a hole to describe emotional emptiness"
Ähnlich: simile metaphor metonymy figure of speech trope

Asking a microscopist

https://en.wikipedia.org/wiki/Virtual_image

In *optics*, the *image* of an object is defined as the collection of *focus points* of *light rays* coming from the object. A *real image* is the collection of focus points made by *converging* rays, while a **virtual image** is the collection of focus points made by extensions of *diverging* rays.

Asking a research software engineer...

<https://docs.docker.com/guides/docker-concepts/the-basics/what-is-an-image/>

A container image is a standardized package that includes all of the files, binaries, libraries, and configurations to run a container.

Technical terms in science

Key: „cell type“

Value: „CD4+ T cell“

Key: „disease model“

Value: „Experimental Autoimmune Encephalomyelitis“

	„cell type“	„type of cell“	„cell-type“	„cellular entity“	„cellular identity“
	„CD4+ T cell“	„CD4-positive T-lymphocyte“	„naive, CD4-positive T cell“		
	„Experimental Autoimmune Encephalomyelitis“	„CD4-positive, alpha-beta T cell“	„Th0 cell“	„CD4+ T helper cell“	
			„EAE“	„Allergic Encephalomyelitis“	

???

How to avoid ambiguity?
How to describe the data objectively?
How to make the metadata machine-interpretable?

Ontologies

An **ontology** is a conceptual framework of how specific terms are used to represent *domain knowledge* in a (research) domain.

- Defines term attributes/properties, and relationships between the terms
- Terms with shared attributes are grouped into classes
- Terms in different ontologies are mapped to each other or adopted
- Can be extended over time with the evolving domain knowledge (i.e., an ontology is versioned)
- *Formalized*, i.e., ontologies can be expressed in ontology formats (machine-interpretable), e.g., OWL, SKOS, OBO

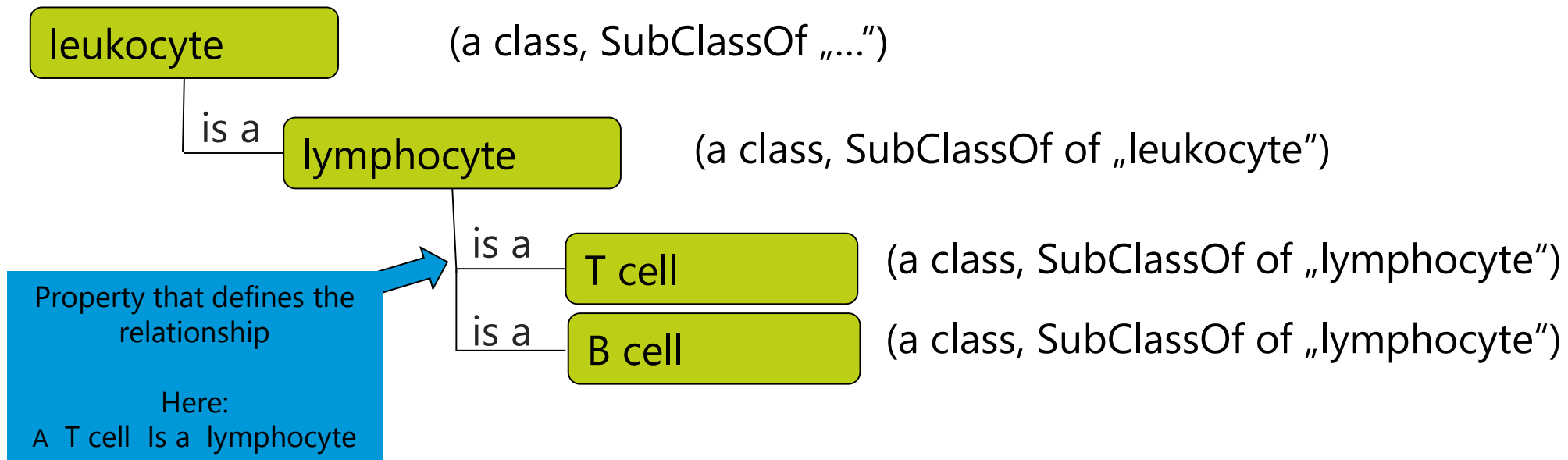
Examples of Ontologies:

- Experimental Factor Ontology (EFO) – curated by the EMBL EBI
- Biological Imaging Methods Ontology (FBbi) – curated by the Cell Image Library
- Cell Line Ontology (CLO) – community-based, curated at the University of Michigan

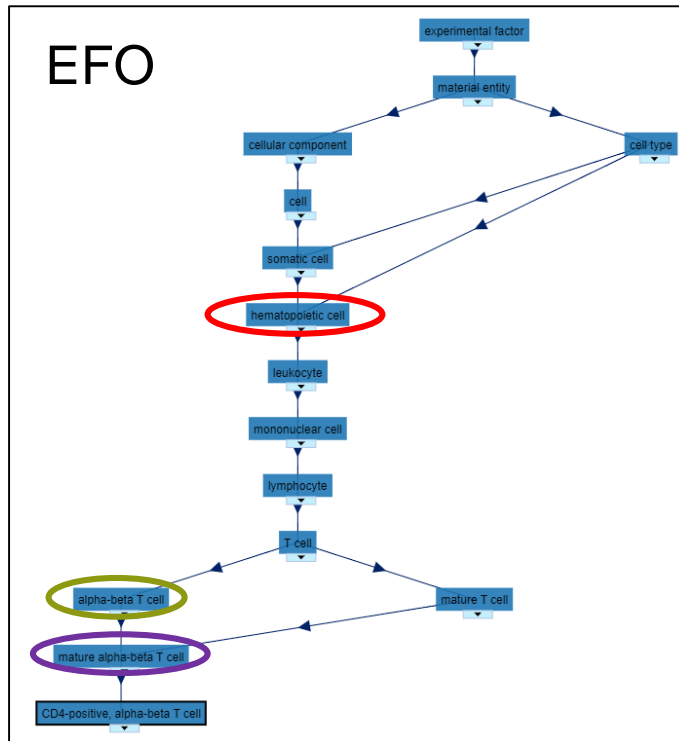
Examples of potentially useful ontologies

Different ontologies are designed to optimally **represent their respective domain knowledge** (for example, the relationship between terms)

This knowledge can be represented as a tree structure or „knowledge graph“. *Example:*



Advantage of using ontologies



A single Key-Value Pair can carry extended domain knowledge!

„CD4-positive, alpha-beta T cell“ following an ontology (here: EFO) includes more information from the domain knowledge formalized in the ontology (and cross-domain knowledge formalized by mapping):

- Is carrying a T cell receptor with $\alpha\beta$ -chains
- Has completed thymic selection (i.e., is mature)
- Is a cell of the hematopoietic system
- etc...

Due to the ontology format, a computer can read the knowledge!

Examples of potentially useful ontologies

BAO	BioAssays Ontology
EDAM (EDAM BioImaging)	Ontology of bioscientific data analysis and data management
EFO	Experimental Factor Ontology
CLO	Cell Line Ontology
CL	Cell Ontology
GO	Gene Ontology
UBERON	Uber Anatomy Ontology
FBbi	Biological Imaging Methods Ontology
ChEBI	Chemical Entities of Biological Interest

Demonstration and Group Task

Try out different ontology lookup services:

Ontology Lookup Service

<https://www.ebi.ac.uk/ols4/index>

Semantic Lookup Service

<https://semanticlookup.zbmed.de/ols/index>

BioPortal Bioontology

<https://bioportal.bioontology.org/>

Ontobee

<https://ontobee.org/>

Recommendation for Ontologies in OMERO

- Where possible, use terms that are derived from a useful ontology
- How to indicate the Ontology-compliant term choice:

Key: Biological entity

Value: CD4-positive, alpha-beta T cell

Key: Biological entity Term Accession Number

Value: http://purl.obolibrary.org/obo/CL_0000624

Key: Biological entity Term Source REF

Value: <http://www.ebi.ac.uk/efo/efo.owl> or EFO

Why this style? Because it is already used by the ISA framework, hence, close to an annotation standard

- **Ontology compliance for *all* terms???**
 - Choose the essential keywords that represent your research
 - Identify a few ontologies that you can use sustainably

Exercise – Annotate data with REMBI

Option 1:

Use the training data (just make up the biological details behind it)

Option 2:

Work silently on your own data

Option 3:

Share with colleagues what you are working on and annotate a dataset together

Exercise – Bring structure to the data

OMERO.figure
(live demonstration)

Exercise – create figures

Create OMERO.figure:

KV-pair example

1. Select two examples at Week 1 and Week 2
2. Right click -> Open the images with OMERO.figure
3. in OMERO.figure, arrange your image in a grid
4. Adjust the contrasts and add the scale bar
5. In labels dropdown menu, select "key-value pair"
6. Add all the conditions you want to display
7. (you can do this for all four images at the same time)
8. Looking at the conditions of each image, you can rearrange them
9. Rearrange the labels per row columns to match your data
10. Adjust the page size in: File-> paper setup -> crop page around panel

Create OMERO.figure:

Multi-channel example

1. Select a z-stack from the example images
2. Duplicate the panel in OMERO.figure, one per channel + 1 for all channels
3. Set the colors of individual channels to gray level (except composite one)
4. Add scalebar
5. Add a label for the active channel, (channel separate labels)
6. copy paste the row of image, set the row to a different z-slice
7. Add a label for each row, showing the displayed z-slice depth
8. Adjust the page size in: File-> paper setup -> crop page around panel

Create OMERO.figure:

Zoomed view histology example

1. Select a histology image from the example images
2. Duplicate the panel in OMERO.figure, one per zoom level you want
3. For the zoomed version, in the preview, set the region
4. For the zoomed version, copy the coordinates (bottom of preview tvb)
5. Select the non-zoomed version
6. Go to Label tab, and under ROI, paste the coordinates
7. (if bug doesn't display ROI, save your figure and reload the page)

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