Research Data Management for Bioimage Data at the HHU

More functions, extensions, and ways to use OMERO

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I3D:bio
Information Infrastructure for BioImage Data

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Review: OMERO for Bioimaging Data Management

- OMERO is an open-source software to allow centralized, secure, collaborative, and interactive storage and management of microscopy data.
- Data is well organized, and groups (with different permission levels) can access and edit data collaboratively.
- OMERO can be accessed by users via clients (e.g., desktop client or web client) and combined with other software (Fiji, QuPath, etc.).
- Structured metadata annotation allows for flexible data organization and enrichment. In particular, Tags and Key-Value-Pairs add value to the data.
- OMERO can be used with scripts and extensions for many different functions.

What more can you do with OMERO?

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More Extensions, Scripts, and Plugins

- OMERO.iviewer – Explore images and adjust settings
- OMERO.figure – Create publication figures in OMERO
- OMERO.parade – Data Mining in metadata and analysis results in OMERO
- OMERO.table – attach tabular results to your images/datasets/projects
- OMERO.downloader – retrieve original files from the OMERO server
- OMERO.openLink – share access to your data in OMERO and download data from the web

More extensions (not shown in this slideshow):

- OMERO.mapr – Standardize search fields in the OMERO instance
- OMERO.FPBioimage – a 3D volume rendering tool for images in OMERO
- ezomero („easy OMERO“) – a collection of command line tools for OMERO

Note: These extensions, scripts, and plugins may or may not be installed in your OMERO instance. Please check for their availability. Contact your OMERO administrator if the required features are missing.

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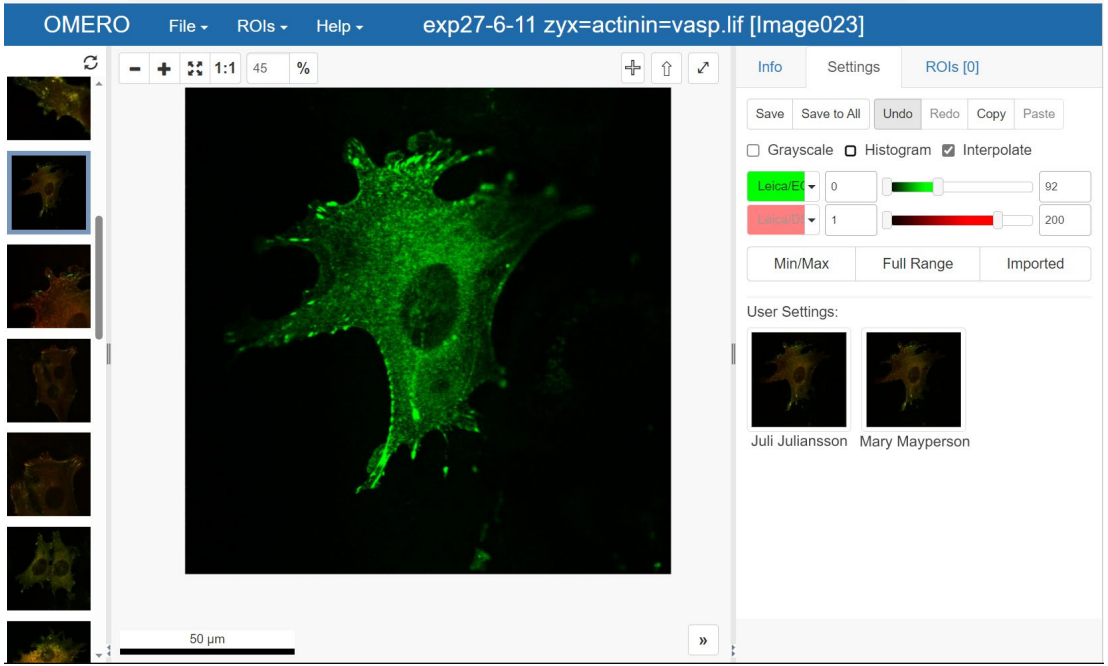
OMERO.iviewer – Explore your images and adjust settings



Learn how to use OMERO.iviewer:

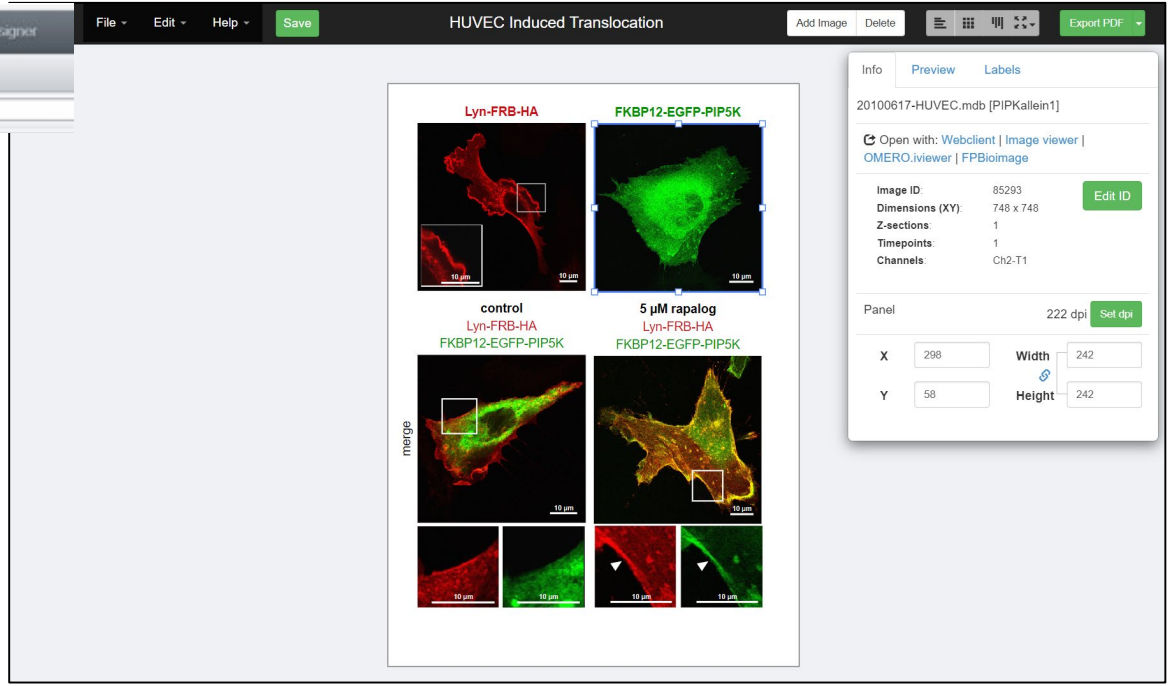
OMERO.iviewer for beginners introduction (P. Walczysko): https://www.youtube.com/watch?v=xshaOwmoqe0 (~8 min)

OMERO.iviewer guide: https://omero-guides.readthedocs.io/en/latest/iviewer/docs/index.html (read online)

https://www.openmicroscopy.org/omero/iviewer/ (last access: 2023-08-24)

OMERO.figure – create publication-ready figures in OMERO

- Images are linked to original files (no JPEG/TIFF/PNG exports!)
- Export your figure to a vector pdf
- Access the original images from the figure at any time
- Automatize inset creation and labelling



Learn how to use OMERO.figure:

OMERO.figure for beginners introduction (P. Walczysko): https://www.youtube.com/watch?v=i3jXplmD81s (~20 min)
OMERO.figure workshop (W. Moore): https://www.youtube.com/watch?v=E0Fgw1uUAXA&t=1440s (~35 min)
EPFL BIOP OMERO Wiki: https://wiki-biop.epfl.ch/en/Image_Storage/OMERO/OMEROFigure (online read & video demo)
OMERO.figure demo by E. Ratamero: https://www.youtube.com/watch?v=YeCFaB7VAAQ (~10 min)

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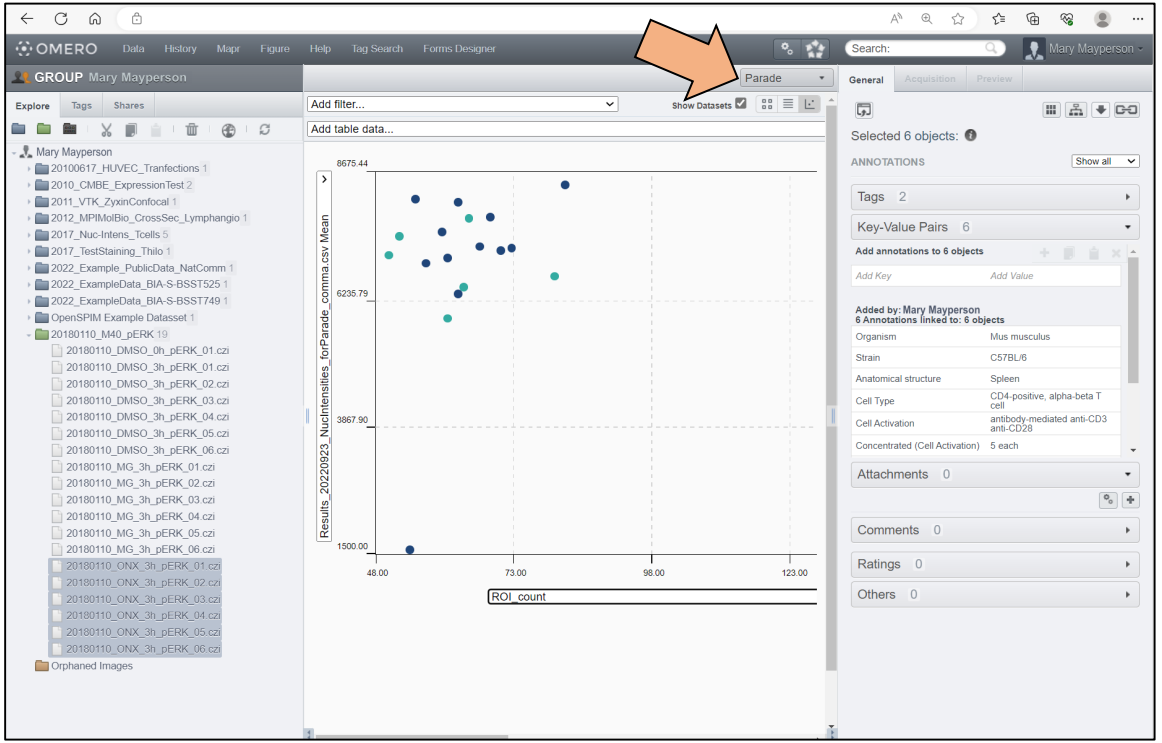
Official guide: https://omero-guides.readthedocs.io/en/latest/figure/docs/index.html

OMERO.parade – data mining in metadata and analysis results

- Review pooled metadata, annotation quantifications, or csv-table based analysis results in dot-plots or tables within OMERO.
- Access the original linked image directly from the dots in the dot-plot
- NOTE:
  - Specific formatting requirements for csv attachments from analysis results must be met! (e.g., use “,“ and not “;“ as the delimiter!)
  - Datasets must be outside of Projects for the analysis to work.



Learn how to use OMERO.parade:

OMERO.parade introduction (P. Walczysko): https://www.youtube.com/watch?v=Bmi31J04A_E (~20 min)

EPFL BIOP OMERO wiki: https://wiki-biop.epfl.ch/en/Image_Storage/OMERO/OmeroParade (read online)

Official Guide: https://omero-guides.readthedocs.io/en/latest/parade/docs/index.html

OMERO.table – attach tabular results to your images/datasets/projects

- Attach analysis results to your data in an OMERO.table-compatible format
- Add the Table as „Bulk Annotations“ linking results to images in OMERO via the „Populate_metadata“ script
- Use the table in OMERO.parade
- NOTE:
  - Specific formatting requirements for csv attachments from analysis results must be met! (e.g., use “,“ and not “;“ as the delimiter!)

bulk_annotations

Download as CSV: Whole Table
Show current page as: CSV | JSON

To filter rows you can use a query based on named columns. For example, to filter for rows where **Area** is greater than **1531.937** add ?query=Area>1531.937 to the URL.
For a more complex example, try ?query=(Area>1531.937)&(Area<2332.331)

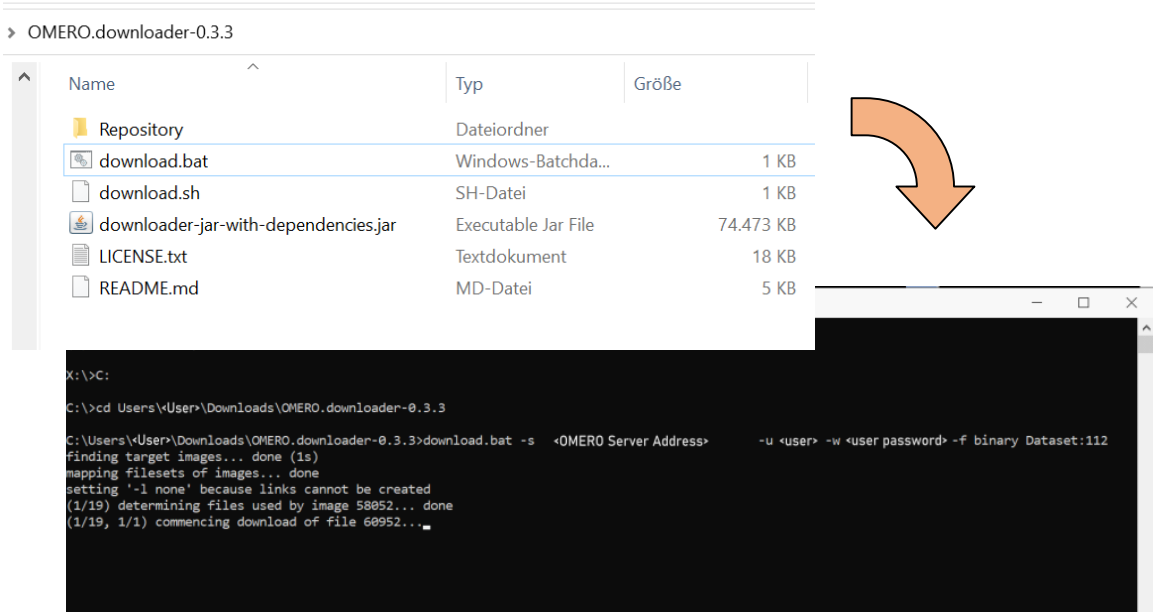
Table rows: **19**.

Image Name	Dataset Name	Area	Mean	IntDen	%Area	RawIntDen	Image
20180110_DMSO_0h_pERK_01.czi	20180110_M40_pERK	1531.937	1500.003	2297909.67	100.0	461270390.0	58052
20180110_DMSO_3h_pERK_01.czi	20180110_M40_pERK	2332.331	8675.441	20234002.93	100.0	4061668107.0	58053
20180110_DMSO_3h_pERK_02.czi	20180110_M40_pERK	1640.02	7461.195	12236507.45	100.0	2456292620.0	58054
20180110_DMSO_3h_pERK_03.czi	20180110_M40_pERK	1911.886	8056.046	15402240.06	100.0	3091765255.0	58055
20180110_DMSO_3h_pERK_04.czi	20180110_M40_pERK	1843.004	8038.236	14814501.18	100.0	2973785621.0	58056
20180110_DMSO_3h_pERK_05.czi	20180110_M40_pERK	1564.557	8333.168	13037716.03	100.0	2617123047.0	58057
20180110_DMSO_3h_pERK_06.czi	20180110_M40_pERK	1319.487	7743.036	10216837.42	100.0	2050874602.0	58058
20180110_MG_3h_pERK_01.czi	20180110_M40_pERK	1469.576	7131.149	10479765.04	100.0	2103653319.0	58059
20180110_MG_3h_pERK_02.czi	20180110_M40_pERK	1696.129	6532.553	11080049.75	100.0	2224151338.0	58060
20180110_MG_3h_pERK_03.czi	20180110_M40_pERK	1524.698	8394.195	12798616.32	100.0	2569127419.0	58061
20180110_MG_3h_pERK_04.czi	20180110_M40_pERK	1677.163	7237.418	12138331.7	100.0	2436585332.0	58062
20180110_MG_3h_pERK_05.czi	20180110_M40_pERK	1852.469	7430.122	13764072.74	100.0	2762928100.0	58063
20180110_MG_3h_pERK_06.czi	20180110_M40_pERK	1694.505	7381.379	12507780.61	100.0	2510746578.0	58064
20180110_ONX_3h_pERK_01.czi	20180110_M40_pERK	1502.077	7664.912	11513283.92	100.0	2311116504.0	58065
20180110_ONX_3h_pERK_02.czi	20180110_M40_pERK	1241.17	7289.489	9047495.852	100.0	1816147081.0	58066
20180110_ONX_3h_pERK_03.czi	20180110_M40_pERK	2210.778	6876.301	15201974.07	100.0	3051564906.0	58067
20180110_ONX_3h_pERK_04.czi	20180110_M40_pERK	1753.612	8015.073	14055332.0	100.0	2821393964.0	58068
20180110_ONX_3h_pERK_05.czi	20180110_M40_pERK	1565.444	6047.67	9467287.467	100.0	1900413858.0	58069
20180110_ONX_3h_pERK_06.czi	20180110_M40_pERK	1912.539	6667.091	12751068.42	100.0	2559582901.0	58070

Learn how to use OMERO.table:
OMERO.table demo (P. Walczysko): https://www.youtube.com/watch?v=TigomaUmIx4&t=7586s (~ 5 min)
EPFL BIOP OMERO wiki: https://wiki-biop.epfl.ch/en/Image_Storage/OMERO/OmeroTable (read online)

OMERO.downloader – retrieve original files from OMERO in batch

- **OMERO.web** offers
  - *Download* of original image files at single image level
  - Batch *export* (e.g., to OME-TIFF) of Datasets
- **OMERO.downloader** offers:
  - *Download* of original image files in batch from the OMERO server
- NOTE:
  - OMERO.downloader is a command line tool, and it requires the user to be at least comfortable with some level of command line usage, and java installation.



Learn how to retrieve and use the OMERO.downloader:
https://github.com/ome/omero-downloader/tree/master

OMERO.openLink – batch download from OMERO.web

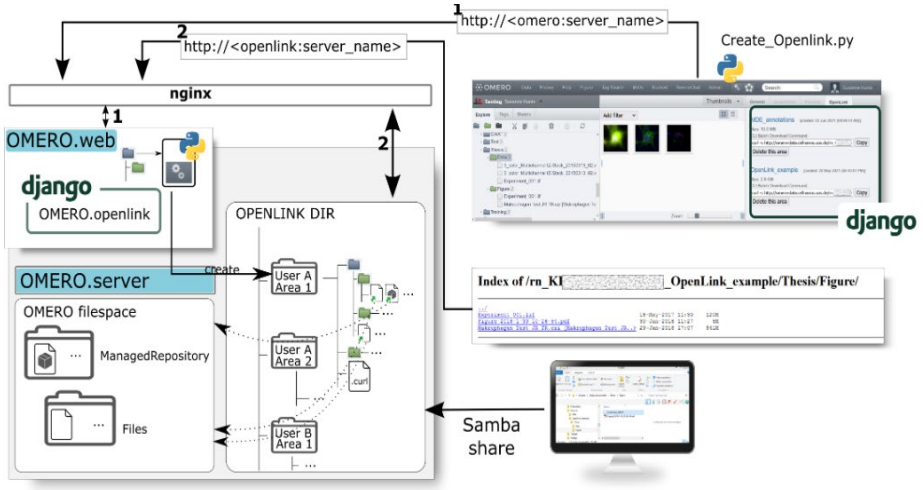
OMERO.openlink

An OMERO.web app and script for sharing data and prepare data for web download via **curl** (included in the newer Windows 10 builds).

You can generate URL's for specific data for batch web download via **curl** and to share data with other collaborates that are not in your group or member of your OMERO system. All operations are available in OMERO.web.

Features

- Create coded URL for html page with read only URL links to your data
- You can add data to an existing page
- You can delete whole pages
- Fast batch download for all data of one openlink area with **curl** (skip already downloaded files, compressed for transfer)



Learn more about OMERO.openLink:
https://github.com/sukunis/OMERO.openlink (last access: 2023-08-24)

OMERO-interoperable analysis tools

OMERO and image analysis software or platforms (examples)

- Fiji (Chapter 8)
- QuPath https://github.com/qupath/qupath-extension-omero
- Galaxy Imaging https://usegalaxy-eu.github.io/posts/2020/11/23/OMERO-post/
- Napari https://www.napari-hub.org/plugins/napari-omero
- BioImage IT Prigent et al. Nat Methods (2022) doi: 10.1038/s41592-022-01642-9
- Jupyter Notebook & Cell Profiler: https://omero-guides.readthedocs.io/en/latest/cellprofiler/docs/cellprofiler.html

See more: https://omero-guides.readthedocs.io/en/latest/external_tools.html

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OMERO for HCS

OMERO works for High-Content Screens and multi-well plate assays:

Li et al.: Metadata management for high content screening in OMERO, Methods, Volume 96, 2016, Pages 27-32, ISSN 1046-2023, https://doi.org/10.1016/j.ymeth.2015.10.006

Hosseini, R., Vlasveld, M., Willemse, J. *et al.* FAIR High Content Screening in Bioimaging. *Sci Data* **10**, 462 (2023). https://doi.org/10.1038/s41597-023-02367-w

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OMERO guide – your central knowledge resource

Check out the **OMERO guide** for all questions around OMERO:

https://omero-guides.readthedocs.io/en/latest/

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