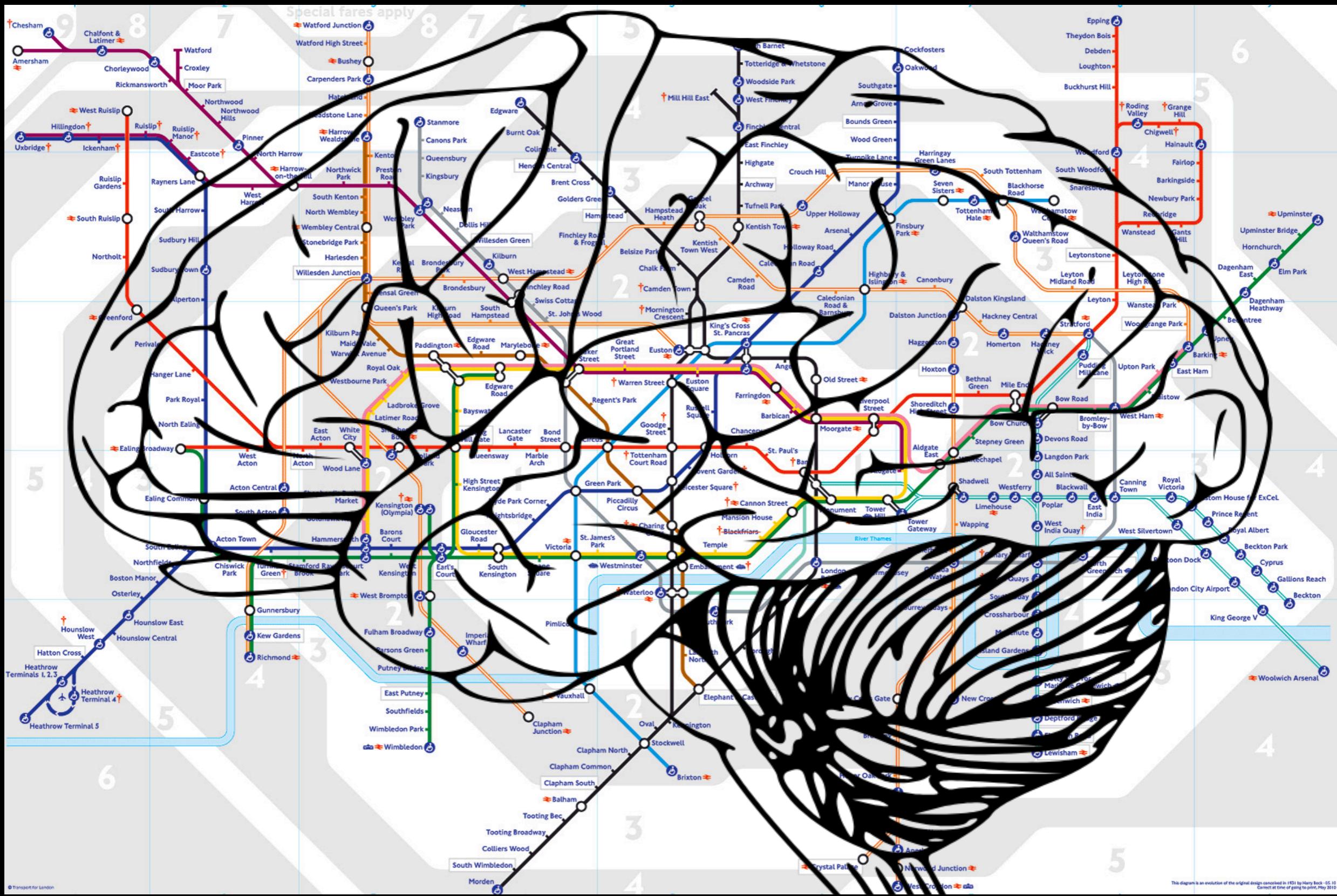


Using OMERO, OMERO.Figure & Zegami

**Josh Titlow
Ilan Davis Lab
University of Oxford**

30 May 2018

Mapping gene expression in the brain



Typical OMERO dataset- Information overload

OMERO Data History Help Tag Search Figure

davisgroup Joshua Titlow

Explore Tags Shares Add filter

OMERO.Figures ProbeTesting 1 smFISH_Axons 6 Syncrip_glia 1 Syp_IF_Nucleus 1 Syto 3 ...50813_OrR_SyN_Scrib_Nesprin_FISH 95 20160406_camKII_ATTO_FISH 24 20160430_actin5c_FISH 79 20160514_sggYFP_Act5c_FISH 37 20160929_Gal80_FISH 95 20161210_Dlg_smFISH_2Channel 81 20161220_Ok371Gcamp_DVupright 53 20161222_Ok371Gcamp_DVupright 24 20161223_Ok371Gcamp_DVupright 11 20161224_OK371GCamp6s_sggFISH 144 ...ISH_dlg_5xKstim_1_p1_lCal.ome.tif ...ISH_dlg_5xKstim_1_p1_rCal.ome.tif ...dlg_5xKstim_1_p1_rMedLobe.ome.tif ...gFISH_dlg_5xKstim_1_p1s3l.ome.tif ...gFISH_dlg_5xKstim_1_p1s3r.ome.tif ...ISH_dlg_5xKstim_1_p1VNC1.ome.tif ...ISH_dlg_5xKstim_1_p1VNC2.ome.tif ...ISH_dlg_5xKstim_1_p2_lCal.ome.tif ...ISH_dlg_5xKstim_1_p2_rCal.ome.tif ...gFISH_dlg_5xKstim_1_p2s3l.ome.tif ...gFISH_dlg_5xKstim_1_p2s4l.ome.tif ...gFISH_dlg_5xKstim_1_p2s4r.ome.tif ...gFISH_dlg_5xKstim_1_p2s5l.ome.tif ...gFISH_dlg_5xKstim_1_p2s5r.ome.tif ...ISH_dlg_5xKstim_1_p2VNC1l.ome.tif ...ISH_dlg_5xKstim_1_p2VNC2.ome.tif ...ISH_dlg_5xKstim_1_p3_lCal.ome.tif ...ISH_dlg_5xKstim_1_p3_rCal.ome.tif

Thumbnails General Acquisition Preview Full viewer

20161224_OK371GCamp_sggFISH_dlg_5>

Image ID: 215863 Owner: Joshua Titlow Show all

Image Details

Add Description

Import Date: 2016-12-28 17:48:24
Dimensions (XY): 512 x 512
Pixels Type: uint16
Pixels Size (XYZ) (µm): 0.14 x 0.14 x 0.30
Z-sections/Timepoints: 65 x 1
Channels: FarRed, GFP, DAPI, RFP
ROI Count: 0

Tags 0

Key-Value Pairs 0

Tables

Attachments 0

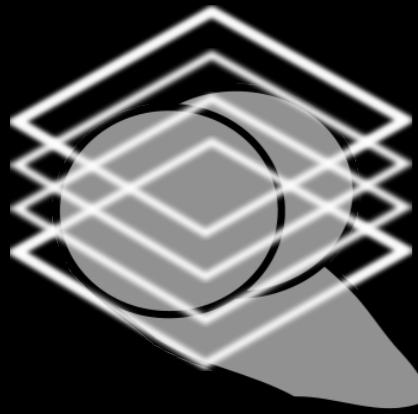
Comments 0

Ratings 0

Others 0

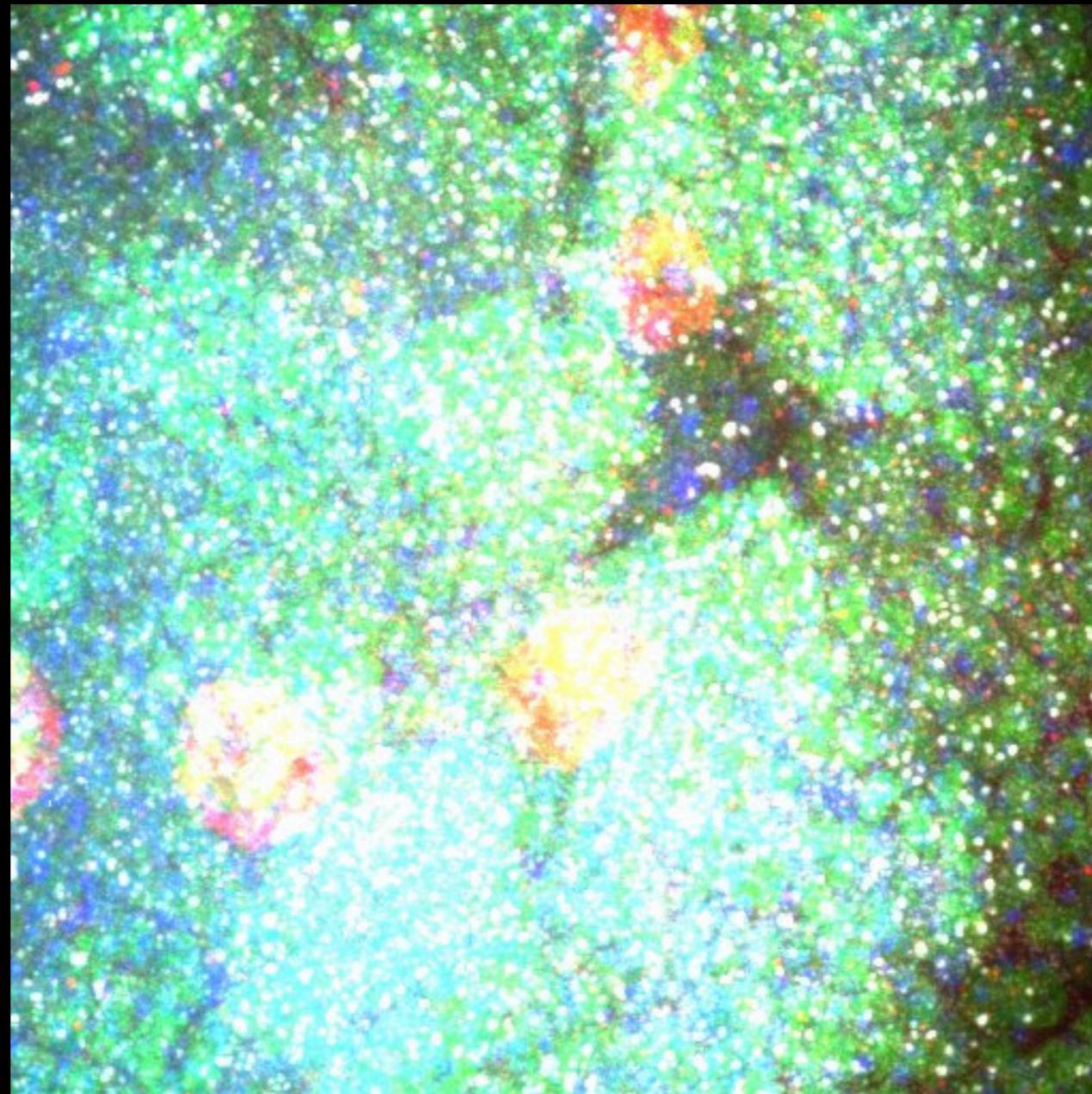
The screenshot displays the OMERO software interface. On the left, a sidebar shows a hierarchical file structure of datasets and files. The main area features a large grid of microscopy images (thumbnails) representing individual frames or sections. To the right of the thumbnails, a detailed information panel is open for a specific image, showing fields for 'General' (Image ID: 215863, Owner: Joshua Titlow), 'Acquisition' (Import Date: 2016-12-28 17:48:24, Dimensions: 512 x 512, etc.), and 'Preview' (Thumbnail view). Below these are sections for 'Image Details', 'Add Description', and various metadata categories like Tags, Key-Value Pairs, Tables, Attachments, Comments, Ratings, and Others.

Brain images don't project well in 2D



Drosophila
larva brain

max projection



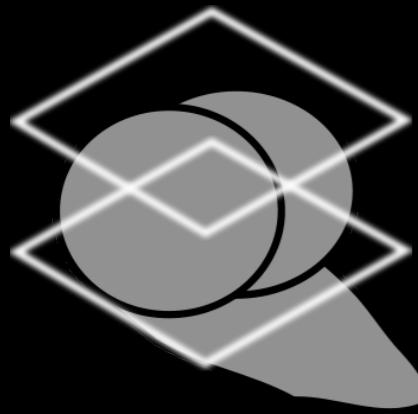
RNA
protein

neuroblast
marker

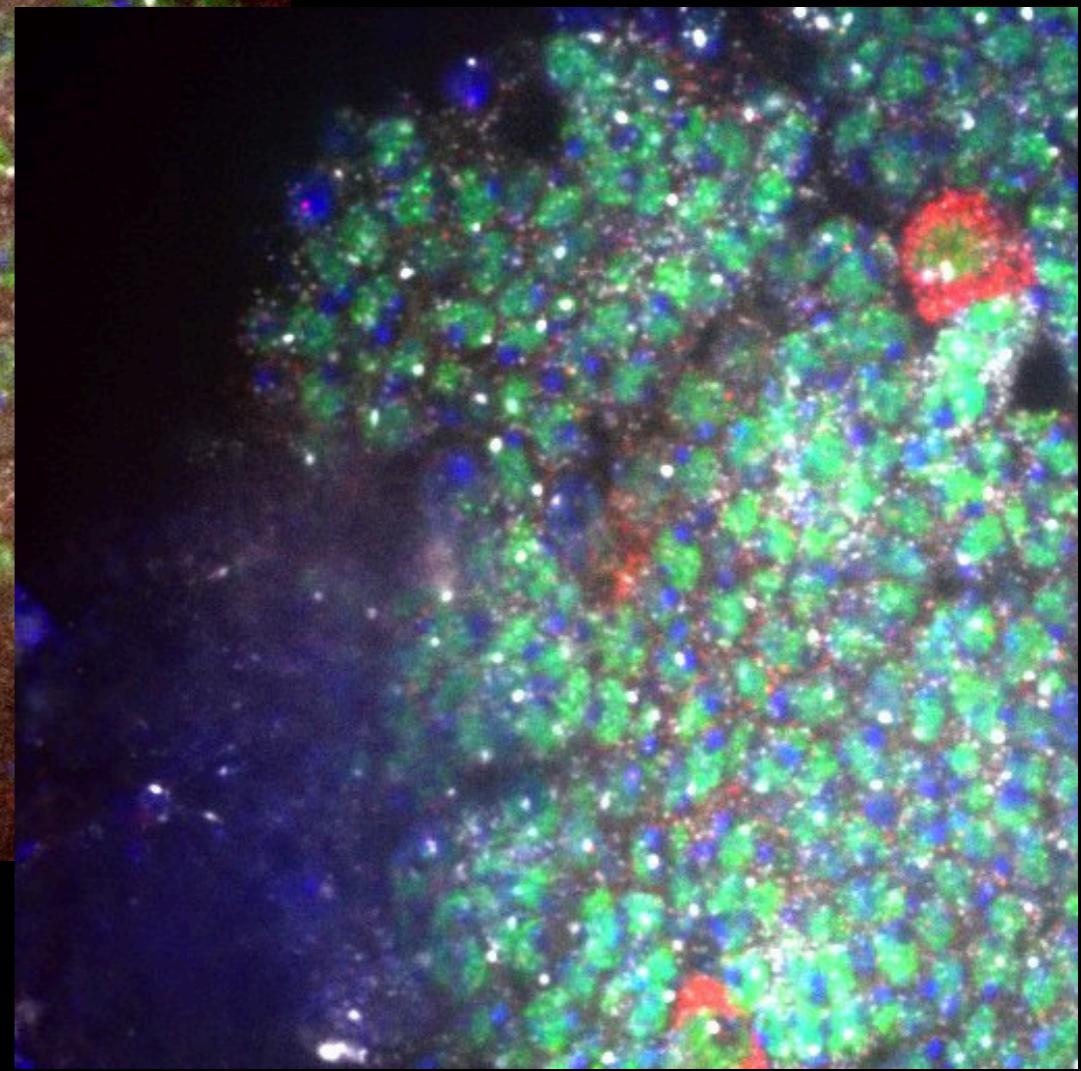
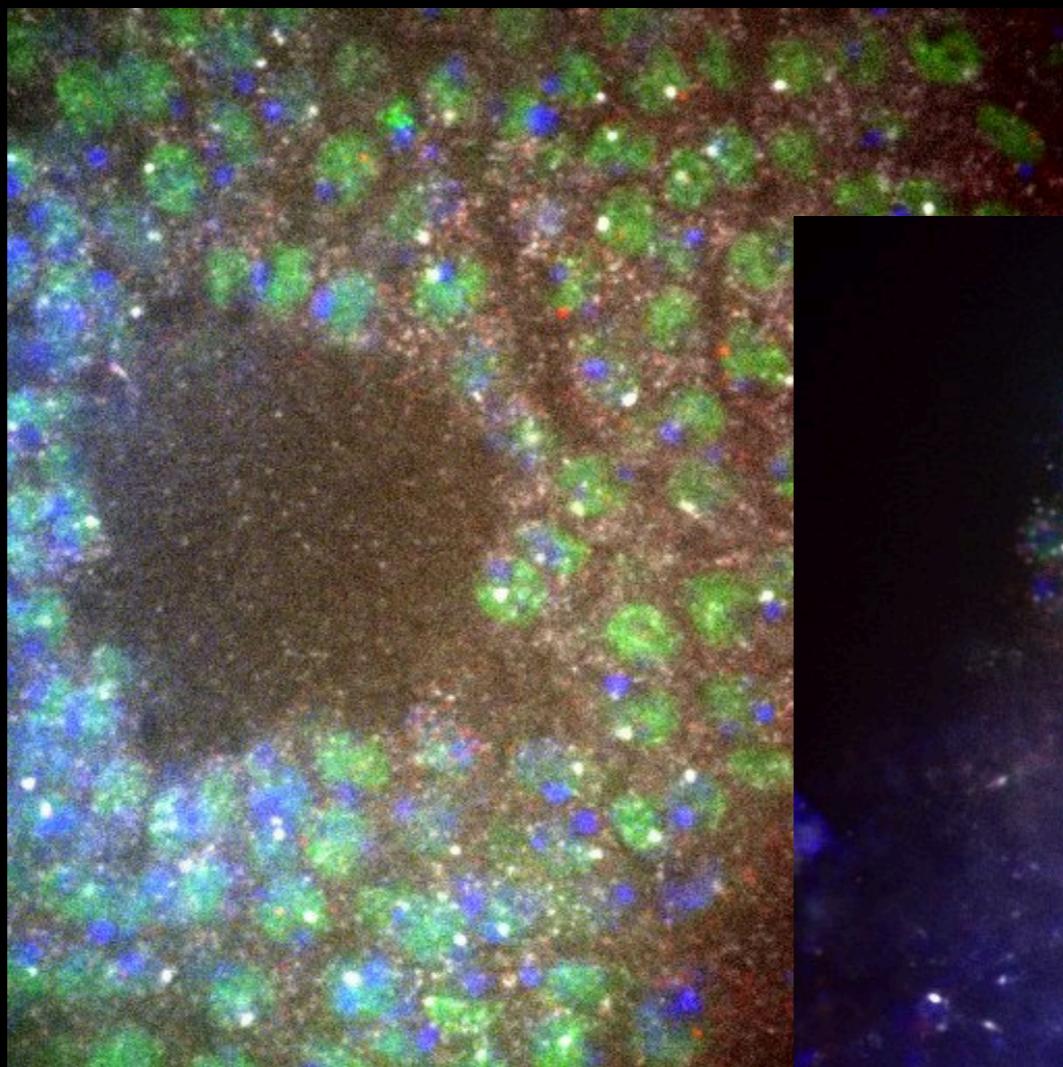
DNA
marker

A single 2D image doesn't tell the whole story

single plane

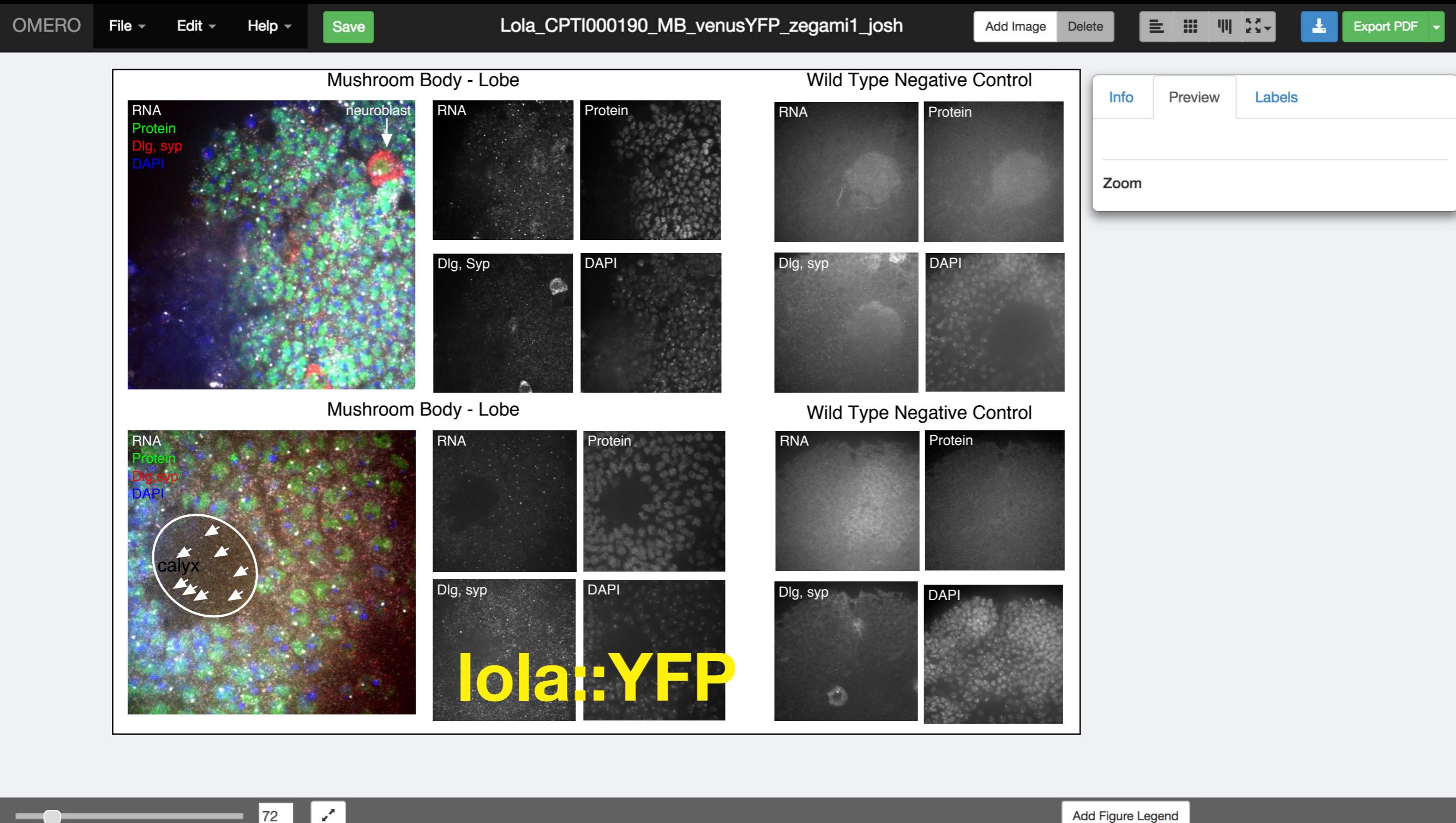


50µm

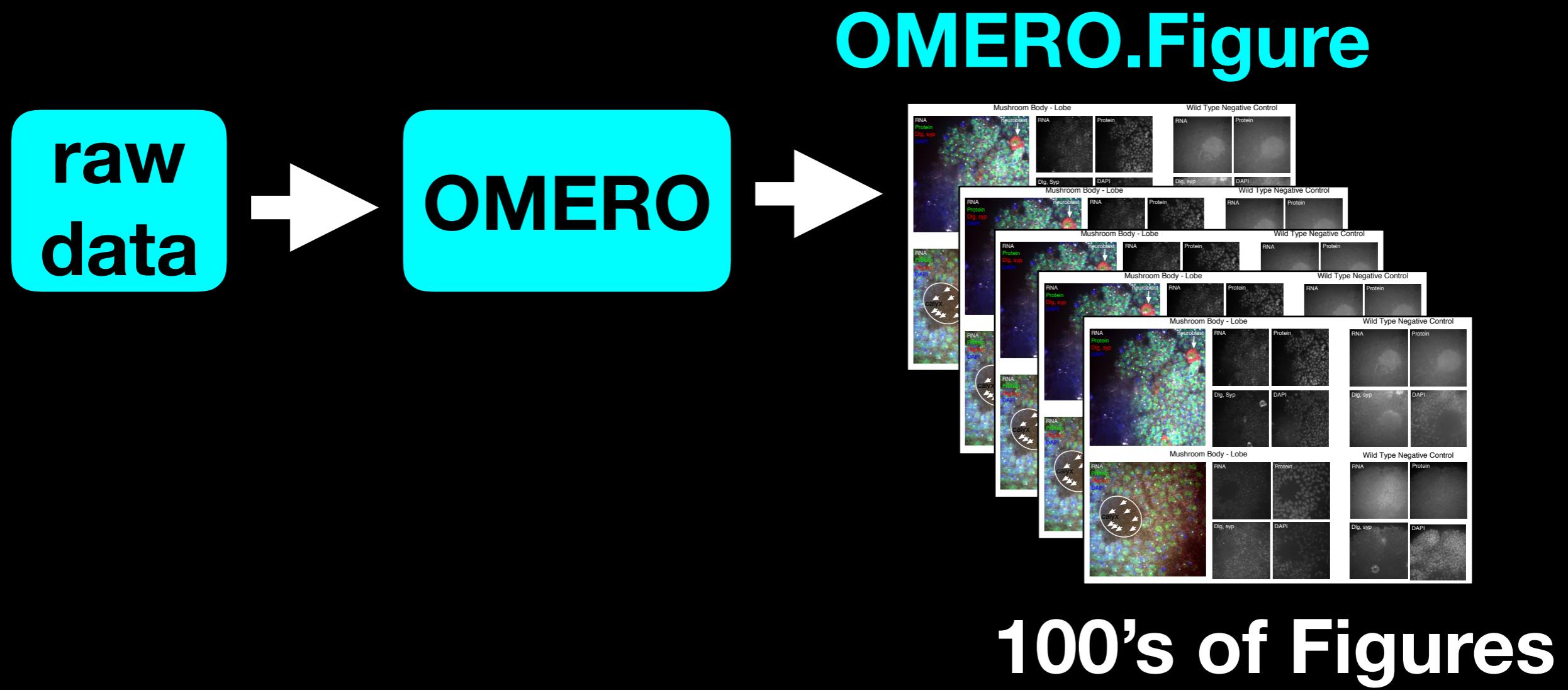


RNA protein neuroblast marker DNA marker

OMERO.Figure provides an elegant solution for summarising complex data



Data management workflow for a microscopy screen



Search tool for OMERO. Figure is limited

OMERO File ▾ Edit ▾ Help ▾ Save Add Image Delete Export PDF ▾

Open Preview Labels

Name	Created	Owner
Lola_CPTI000190_MB_venusYFP_zegami1_josh	2018-05-28 22:04	Joshua Titlow
Aurox_testing_Josh	2018-05-25 09:51	Joshua Titlow
20180521_Fran_sgg_smFISH	2018-05-21 10:50	Joshua Titlow
ZAP3_CPTI004292_NMJ_venusYFP_zegami3	2018-05-16 13:25	Joshua Titlow
CG9265_CPTI004298_NMJ_venusYFP_zegami3	2018-05-16 13:25	Joshua Titlow
Argk_CPTI004299_NMJ_venusYFP_zegami3	2018-05-16 13:25	Joshua Titlow
Figure_2018-5-8_18:8:52	2018-05-08 17:08	Joshua Titlow
SypMS_sypKD_smFISH	2018-05-08 12:15	Joshua Titlow

Refresh Cancel

76 Add Figure Legend

A user-friendly data browser

Taylor and Noble, 2014- *Bioinformatics*

NMJ_brain_collection Showing 17987 / 17987 items (100%)

FILTERS

- Gene
- Collection
- Compartment
- Probe
- Image
- Figure_name
- Figure_id
- Flybase_ID
- 3prime UTR Length
- FlyAtlas Expression
- GO Biological Process
- GO Molecular Function
- Neural RNAi Phenotype
- Common Axon
- Motor Axon
- Drg Axon
- L3 CNS
- NMJ_Protein
- NMJ_RNA
- Brain_RNAseq
- Brain_Syp_RIP_seq

Snapshots Download Export table

zegami

A user-friendly data browser

Taylor and Noble, 2014- *Bioinformatics*

NMJ_brain_collection Showing 17987 / 17987 items (100%)

FILTERS

- Gene
- Collection
- Compartment
- Probe
- Image
- Figure_name
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- L3 CNS
- NMJ_Protein
- NMJ_RNA
- Brain_RNAseq
- Brain_Syp_RIP_seq

Snapshots Download Export table

GISH

HDAC4

HEPH

KST

LOLA

MNT

PIWI

PKAR2

zegami

A user-friendly data browser

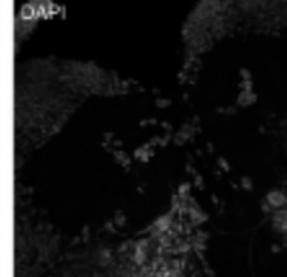
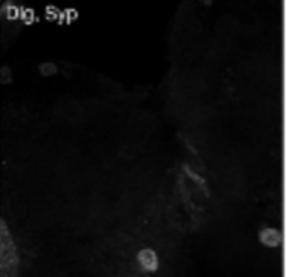
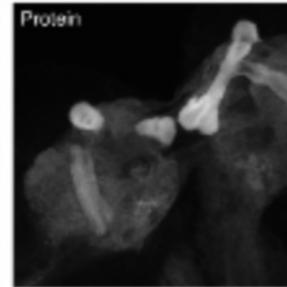
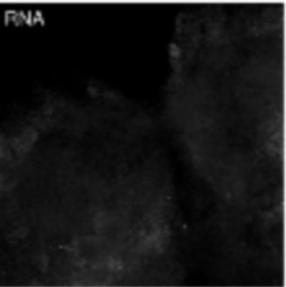
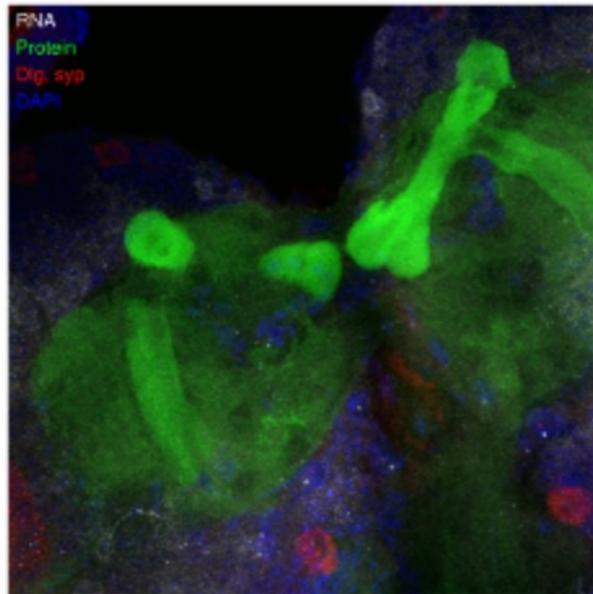
Taylor and Noble, 2014- *Bioinformatics*

NMJ_brain_collection Showing 17987 / 17987 items (100%)

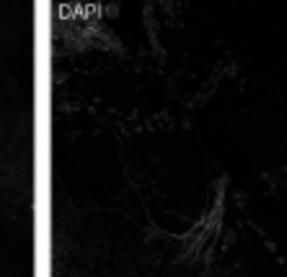
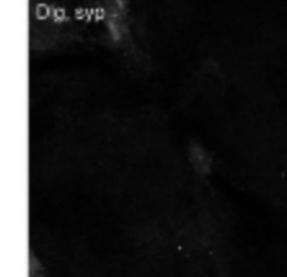
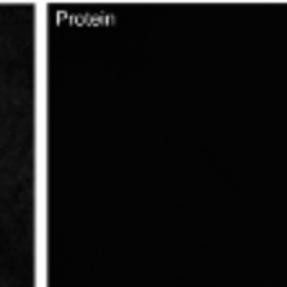
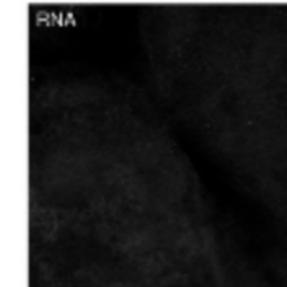
FILTERS

- Gene
- Collection
- Compartment
- Probe
- Image
- Figure_name
- Figure_id
- Flybase_ID
- 3prime UTR Length
- FlyAtlas Expression
- GO Biological Process
- GO Molecular Function
- Neural RNAi Phenotype
- Common Axon
- Motor Axon
- Drg Axon
- L3 CNS
- NMJ_Protein
- NMJ_RNA
- Brain_RNAseq
- Brain_Syp_RIP_seq

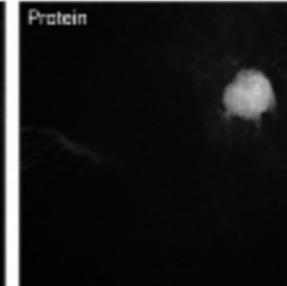
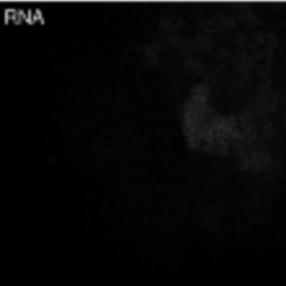
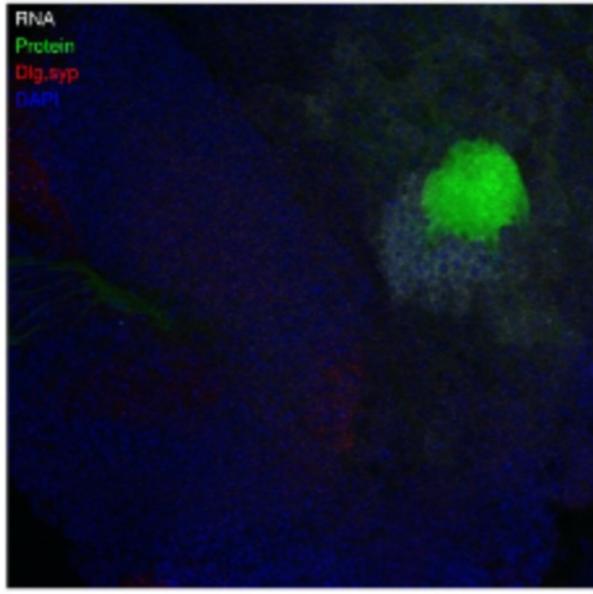
Mushroom Body - Lobe



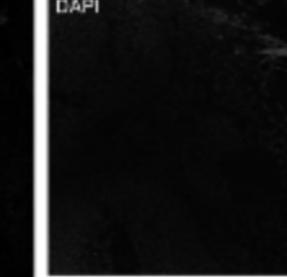
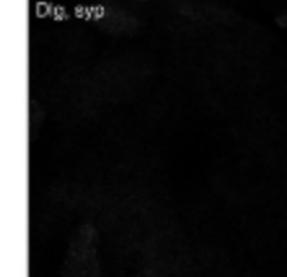
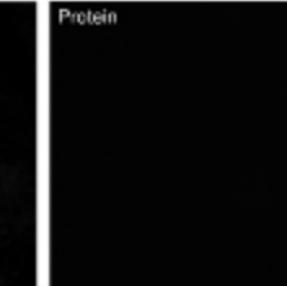
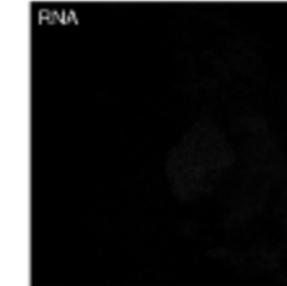
Wild Type Negative Control



Mushroom Body - Cell Bodies



Wild Type Negative Control



PKAR2

Browsing bioinformatics AND microscopy data with one tool

NMJ_brain_collection Showing 17987 / 17987 items (100%)

FILTERS

- Gene
- Collection
- Compartment
- Probe
- Image
- Figure_name
- Figure_id
- Flybase_ID
- 3prime UTR Length
- FlyAtlas Expression
- GO Biological Process
- GO Molecular Function
- Neural RNAi Phenotype
- Common Axon
- Motor Axon
- Drg Axon
- L3 CNS
- NMJ_Protein
- NMJ_RNA
- Brain_RNAseq
- Brain_Syp_RIP_seq

Snapshots Download Export table

zegami



Browsing bioinformatics AND microscopy data with one tool

Browsing bioinformatics AND microscopy data with one tool

NMJ_brain_collection Showing 75 / 17987 items (<1%)

FILTERS reset all

- Figure_name
- Figure_id
- Flybase_ID
- 3prime UTR Length
- FlyAtlas Expression
- GO Biological Process
- GO Molecular Function
- Neural RNAi Phenotype
- Common Axon
- Motor Axon
- Drg Axon
- L3 CNS
- NMJ_Protein
- NMJ_RNA
- Brain_RNAseq reset

brain_Syp_RIP_seq

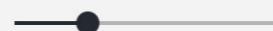
range

scatter

expand

[Empty]

13



Snapshots



Download



Export table



LOLA



TAGS

GENE

LOLA

[OMERO.Figure link](#)[FlyBase link](#)

COLLECTION

CPTI000190

COMPARTMENT

OVERVIEW

PROBE

VENUSYFP

IMAGE

LOLA_CPTI000190_OVERVIEW_VENUSYFP_ZEG
AMI1.png

FIGURE_NAME

LOLA_CPTI000190_OVERVIEW_VENUSYFP_ZEG
AMI1

FIGURE_ID

2106143

Integrating images with genome-wide metadata



1) Select datasets with web interface

A screenshot of the FlyMine web interface. The title is "Gene → GO terms". Below it says "Search for GO annotations for a particular gene.". There are several buttons: "Manage Columns", "Manage Filters", "Manage Relationships", "Save as List", and "Generate Python code".

2) Use Python API to collect data

```
from intermine.webservice import Service
service = Service("http://www.flymine.org/flymine/service")
query = service.new_query("Gene")
query.add_view(
    "symbol", "secondaryIdentifier", "goAnnotation.ontologyTerm.identifier",
    "goAnnotation.ontologyTerm.name", "goAnnotation.evidence.code.code",
    "goAnnotation.ontologyTerm.namespace", "goAnnotation.qualifier"
)
```



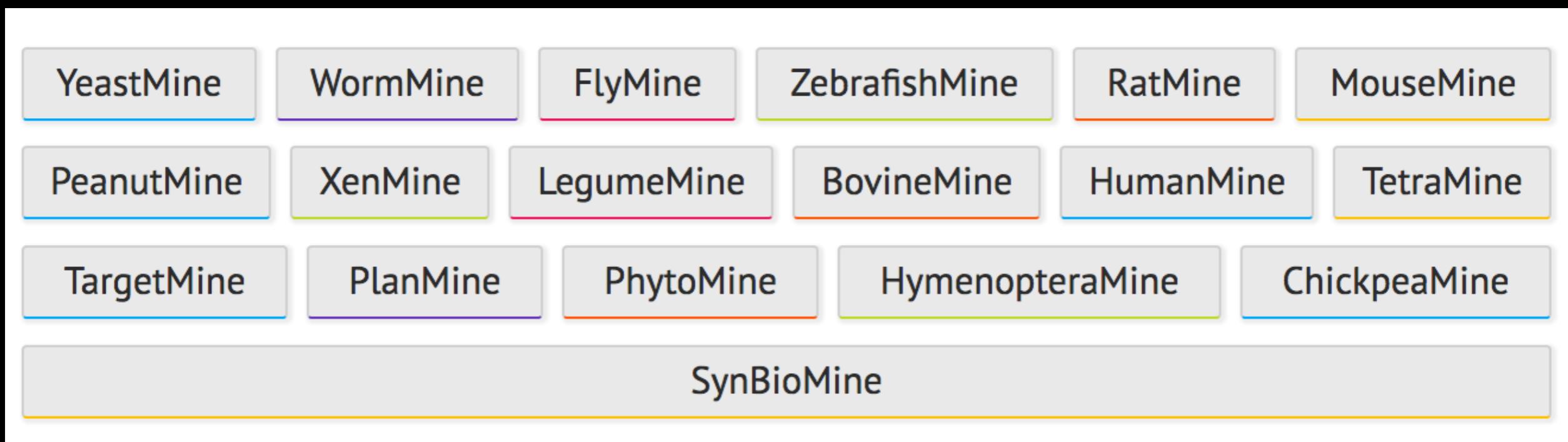
<https://zegami.com/>

3) Merge with Zegami collection

Mary Thompson

Integrating images with genome-wide metadata

There's an InterMine for (almost) anyone.

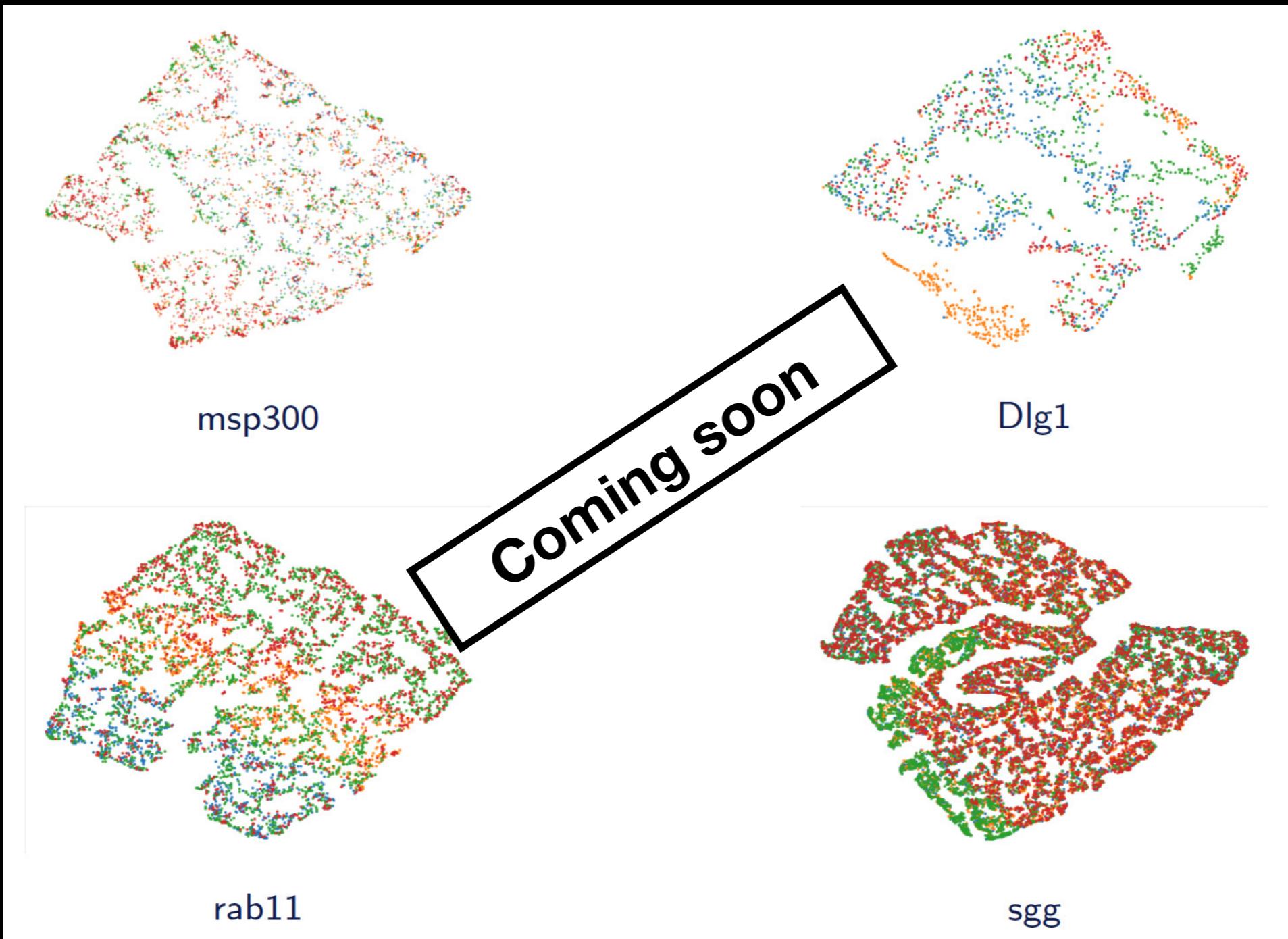


Intermine.org

Mary Thompson

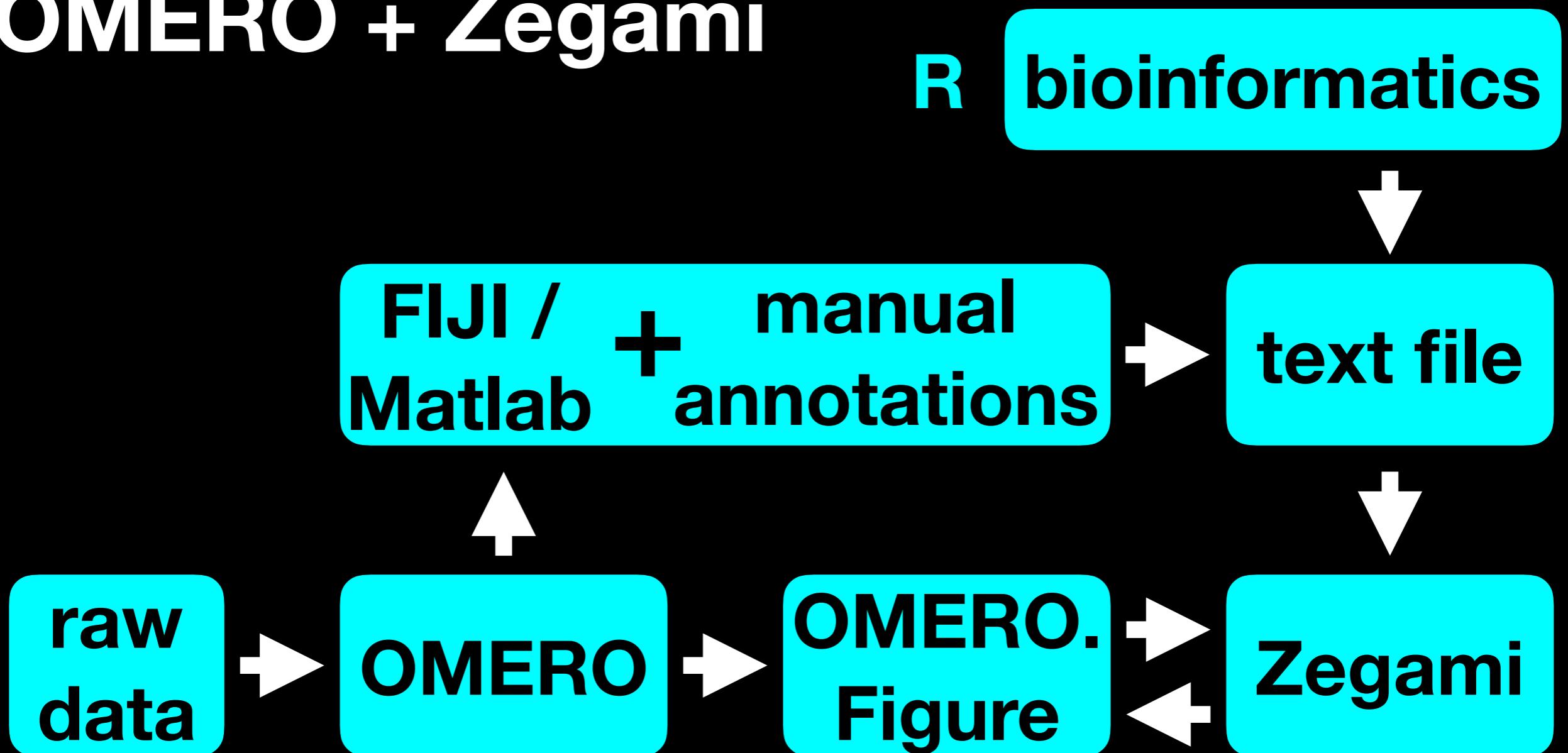
Easy-to-use machine learning analysis for microscopy data

Clustering analysis (t-SNE) of RNA expression patterns

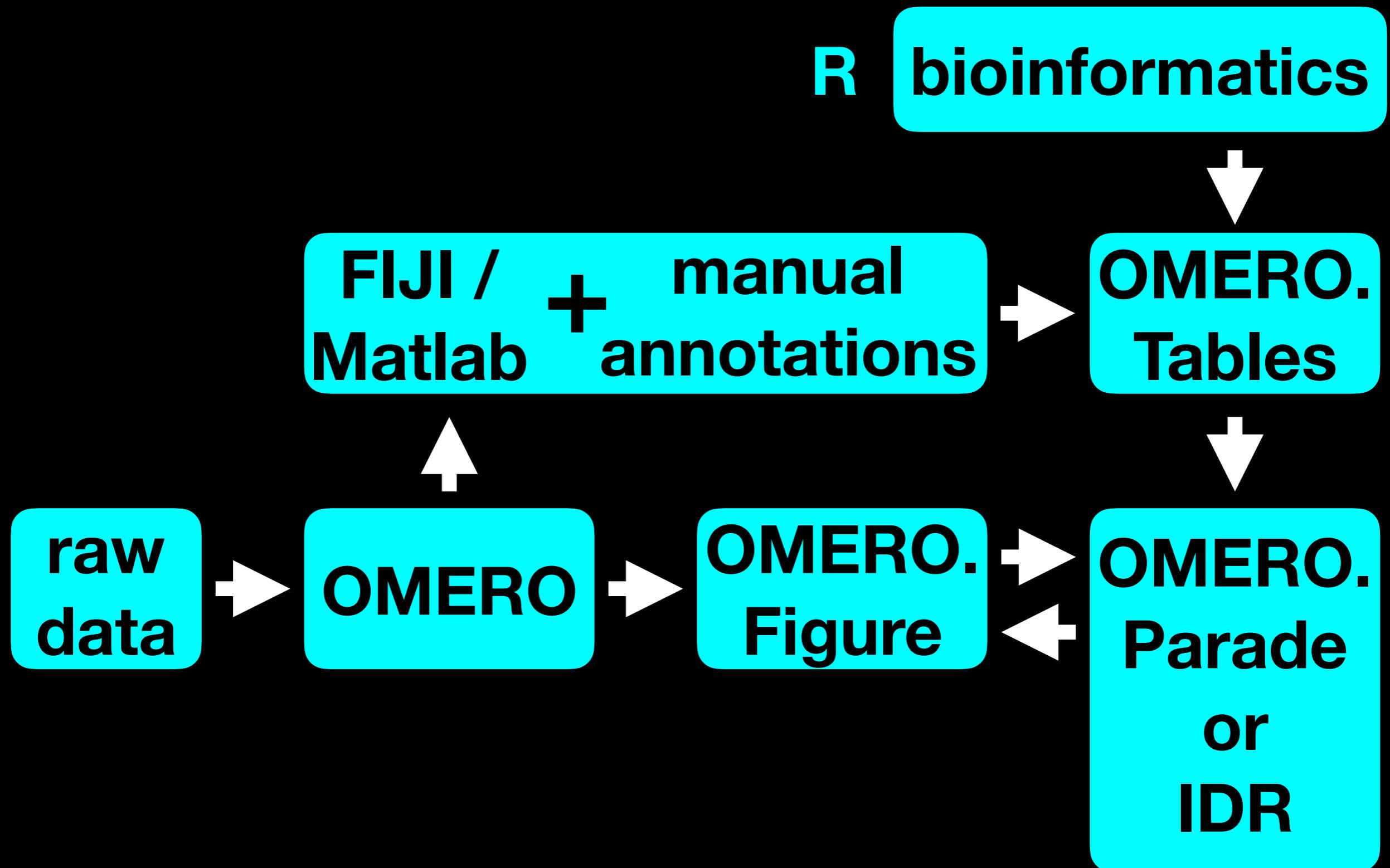


w/ Clara Pavlet- PhD rotation student

Current workflow for building a microscopy screen database with OMERO + Zegami



Fully integrated OMERO workflow



Single experiments need OMERO.Figure too

OMERO Data History Help Tag Search Figure

davisgroup Joshua Titlow

Explore Tags Shares

Add filter

Thumbnails

General Acquisition Preview

Search: Joshua Titlow

20180126_OK6_ChR2_larvae_30sSTIM_FI

Dataset ID: 15495
Owner: Joshua Titlow

Show all

Dataset Details

Add Description

Creation Date: 2018-01-26 13:20:33

Tags 0

Key-Value Pairs 0

Attachments 0

Comments 0

Ratings 0

Others 0

20180126_OK6_ChR2_larvae_30sSTIM_FISH

...126_OK6_ChR2_larvae_30sSTIM_FISH

...lolaYFP_smFISH_KC1stim_larvaBrains

20180216_CPTI_KC1stim_smFISH

20180305_CPTI_NMJ_stim_smFISH

20180309_dlgMS2_smFISH_NMJ

20180412_Gal80_smFISH_syp_msp300

20180514_BrpSNAP_qPAINT

...5_msp300_intron_spec_smFISH_probes

...msp_intron_spec_smFISH_probes_NMJ

Dlg_mEos

EM_DATA 276

Fran_sggMS2_MCPGFP 10

Graphs 1

MSPYFP_2Channel 16

OMERO.Figures 1

Orphaned Images 4

Zoom:

The screenshot displays the OMERO software interface. On the left, a sidebar shows a tree view of experiment folders, with several entries highlighted in green. The main area features a grid of microscopy images, likely fluorescence micrographs, arranged in a 7x8 pattern. Above the grid, there are buttons for 'Add filter' and 'Thumbnails'. To the right of the images, a detailed dataset view is shown for '20180126_OK6_ChR2_larvae_30sSTIM_FI'. This view includes sections for 'General', 'Acquisition', and 'Preview' tabs, and contains fields for 'Dataset ID', 'Owner', 'Dataset Details', 'Add Description', 'Creation Date', and various metadata categories like 'Tags', 'Key-Value Pairs', 'Attachments', 'Comments', 'Ratings', and 'Others'. The 'General' tab also includes a search bar and user profile information.

THMs

- 1) Integrating OMERO.Figure objects into the OMERO web client will optimise data management workflows**

- 2) Zegami provides a user-friendly image browser solution to for integrating multiple types of datasets**

Acknowledgements



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Zegami Ltd

Steve Taylor



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Advanced Bioimaging Unit

