

The Original Data Repository and other OME/OMERO applications at the Stowers Institute

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Stowers Institute for Medical Research, Kansas City, USA

The Stowers Institute for Medical Research



- **22 Principle Investigators**

- Chromatin and Regulation of Gene Expression
- Chromosome Structure and Cell Division
- Computational Biology, Modeling and Technology
- Developmental Genetics and Cell Biology
- Developmental Neuroscience
- Stem Cells and Regeneration

- **11 Core Technology Centers and Facilities**

- Microscopy
- Screening
- Molecular Biology
- Proteomics
- Animal Facilities

- **Graduate Program**

- **2 Billion US\$ Endowment**

- **Kansas City, Missouri, USA**

Stowers Microscopy Center: Staff of 13

Services

4 People

- Daily Maintenance
- Training
- Assisted Use
- Imaging Service
- Confocal Microscopy (10 systems, 4 NLO, 2 FCS)
- Spinning Disk
- Super-Resolution
- Laser Microdissection
- FLIM, FRAP
- TIRF
- Widefield Microscopy
- Image Processing
- Code Development

Application Development

4 People

Requested by PI lab

- Localized heat-shock activation
- Screening of Planaria
- Micro fabrication
- Original Data Repository
- Image analysis on fly embryos and Planaria

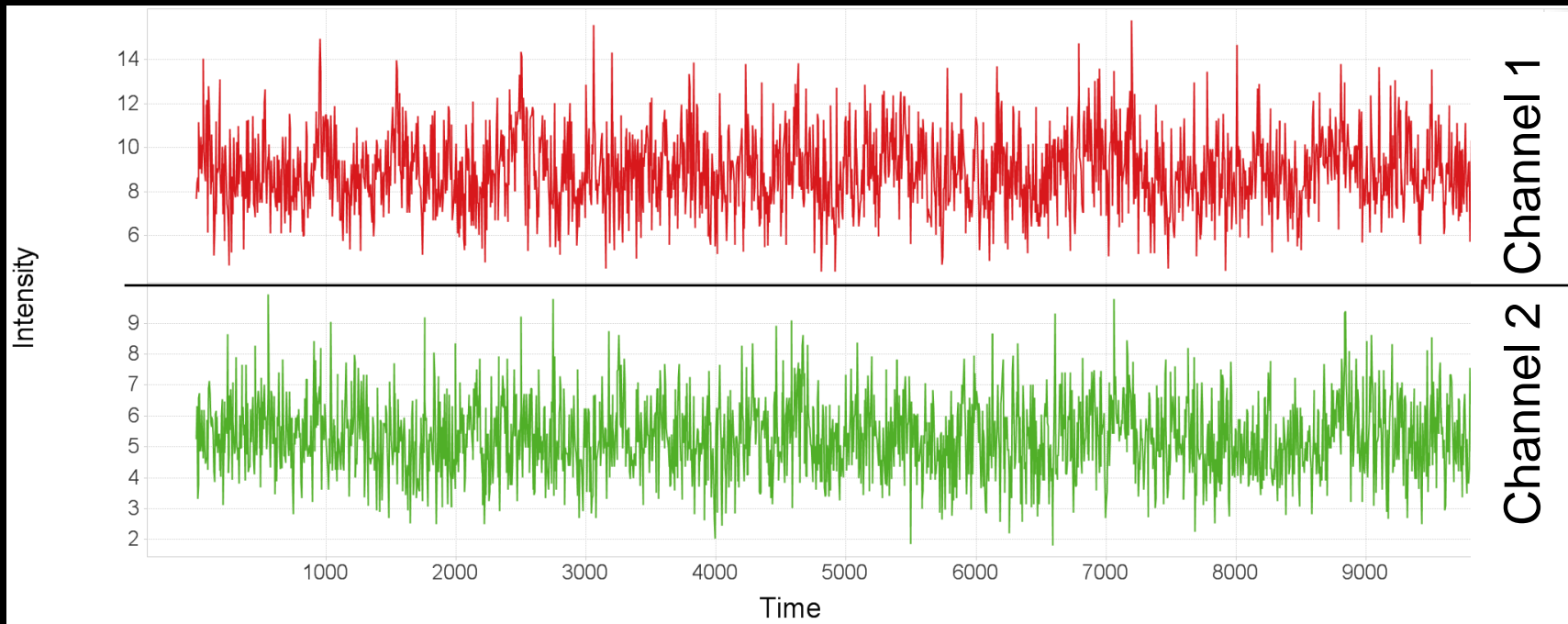
Technology Development

3 People

Initiated by Microscopy Center

- High-Content FCS
- Sheet plane illumination
- Fluorescence protein evaluation
- Quality control of microscopes
- OMERO

Fluorescence Cross-Correlation Spectroscopy (FCCS)



Data Acquisition in HCS-FCS



Take an overview and find cells

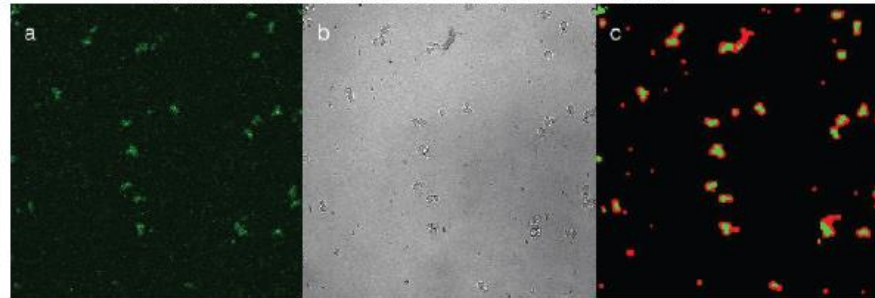
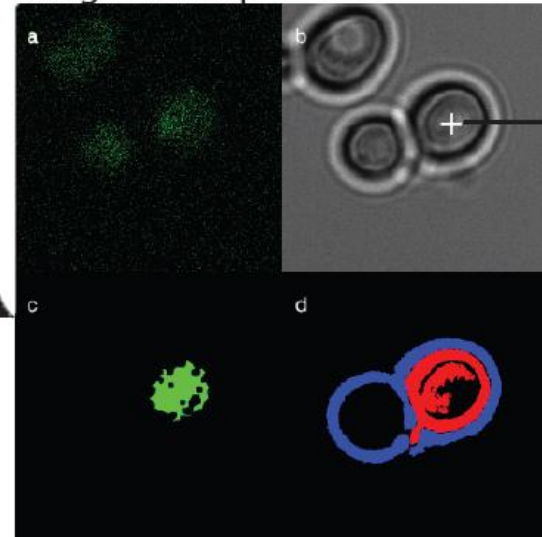
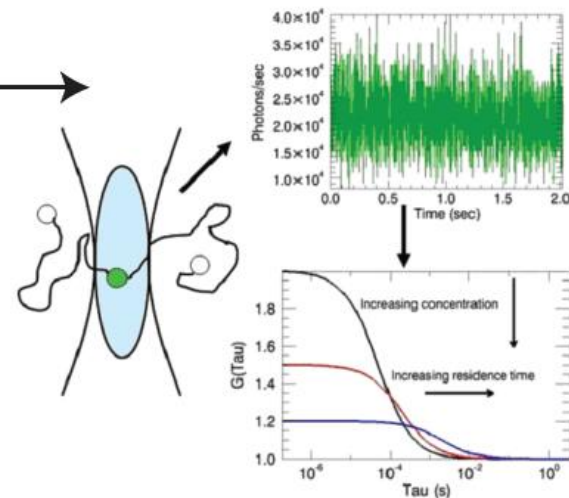


Image closeup



Fluctuation measurement

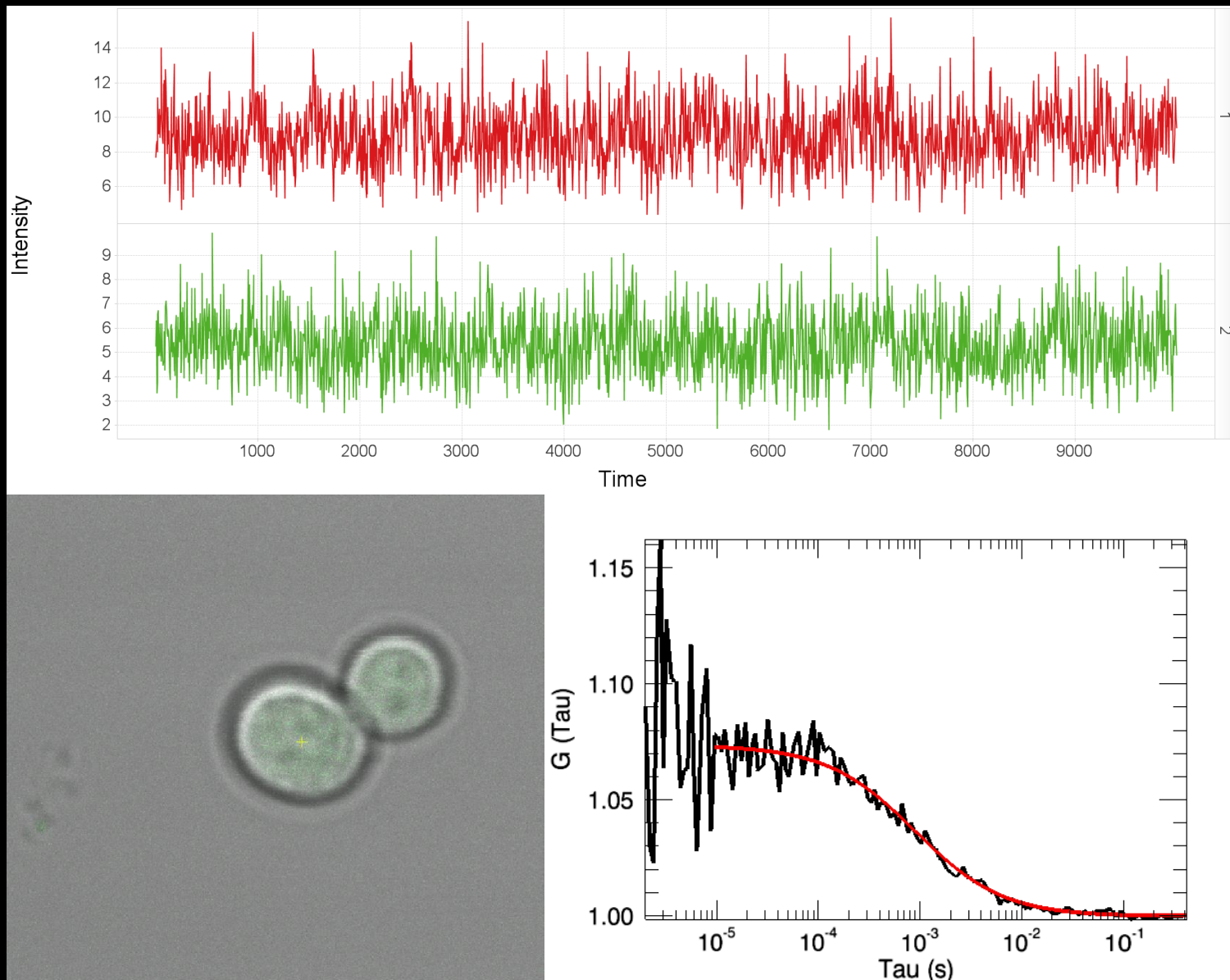


Process image for measurement position

Image another cell, overview, or well

C. Wood *et al.*, Proc. SPIE, (2011).

116,284 Fluctuation, Image, and Correlation Data Sets

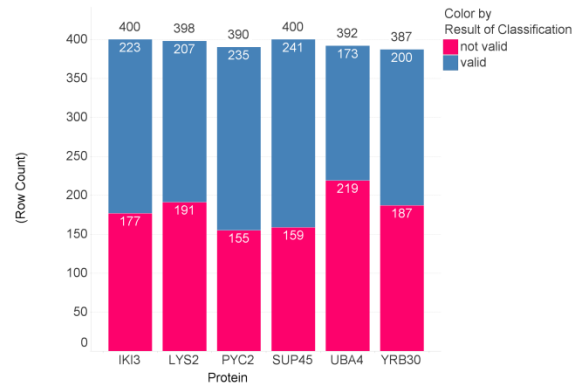
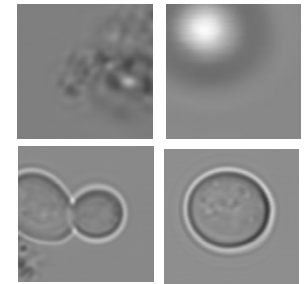
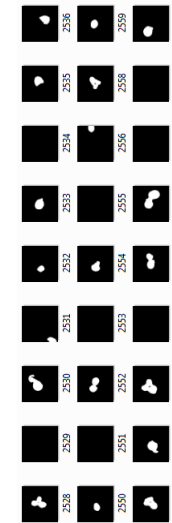
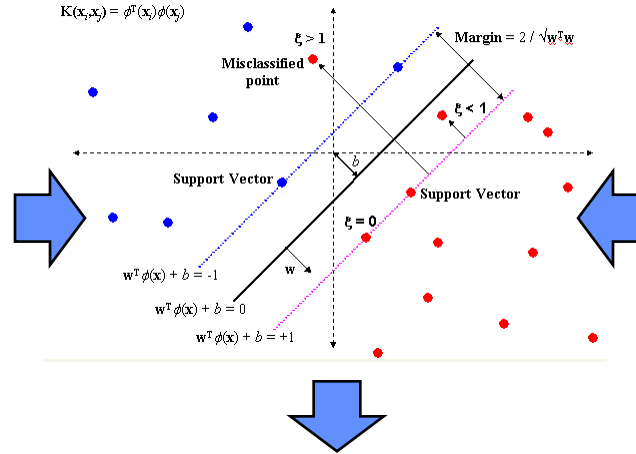
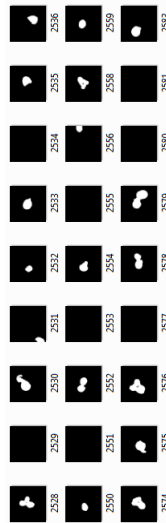
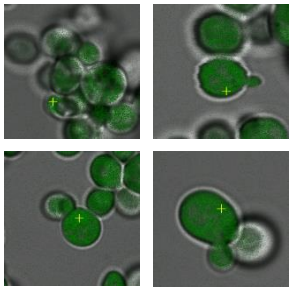


Additional Data for Image Classification

Training

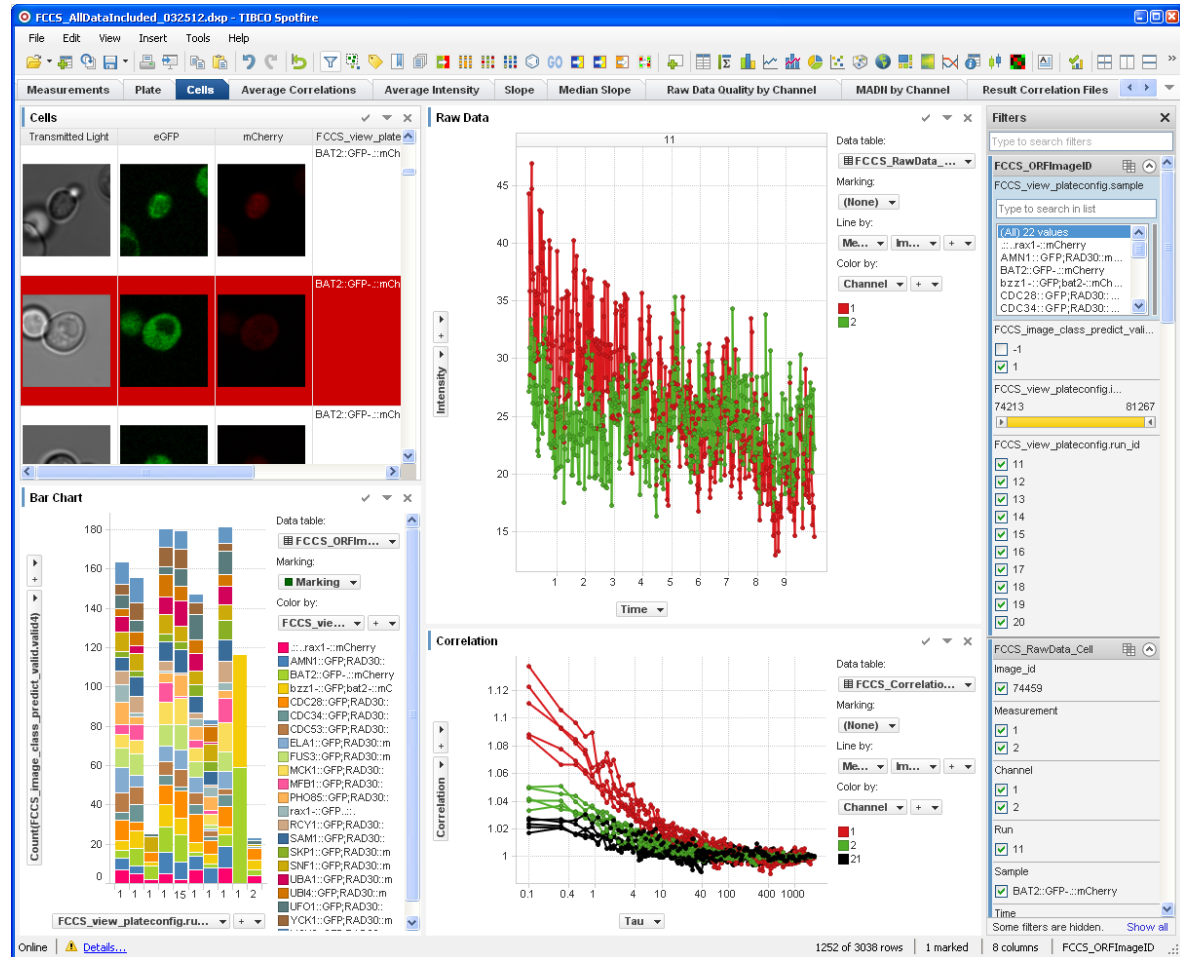
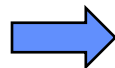
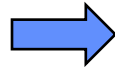
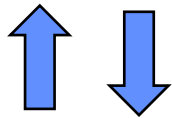
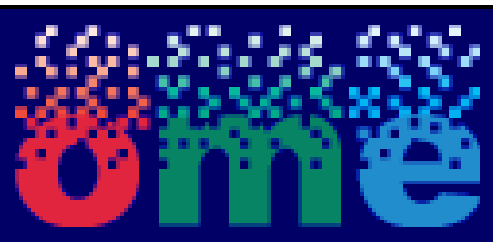
Support Vector Machine

Data



Classification

OME as Central Storage Location



What We Like and What We Miss (OME)

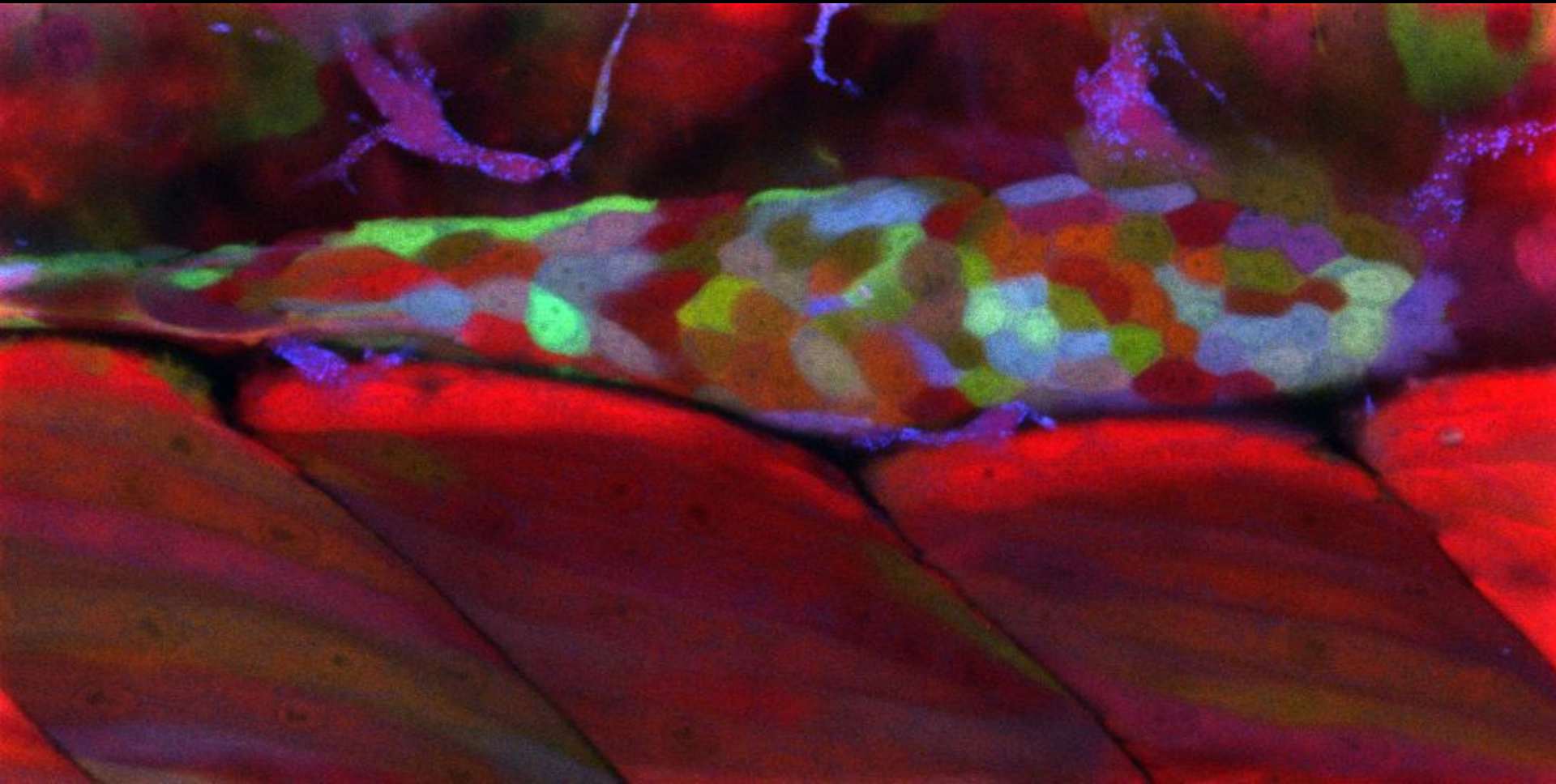
We like:

- Access to images is fast
- Download original images with URL
- Easy access of data using SQL and Java
- Easy addition of schema
- Low demands on memory and processing power

We miss:

- Fast image import
- Simple mapping between original image and OME image
- Import of Zeiss LSM meta data

Zebrafish Database (OMERO)



XML for Annotations in Left Pane

OMERO Data History

Microscopy Chris Wood

Explore Tags Public

Filter Images

Chris Wood

- 2012 2
- MyFirstProject 1
- Publication 1
- Spim 2
- TestCopy 1
- Yeast 1
- ZebraFish 1
 - atp1b2b 11
 - ...mposite.tif_merged_z01_t01.png
 - ...5dpf A1.tif_merged_z01_t01.png
 - ...dpf A10.tif_merged_z01_t01.png
 - ...dpf A11.tif_merged_z01_t01.png
 - ...dpf A12.tif_merged_z01_t01.png
 - ...dpf A13.tif_merged_z01_t01.png
 - ...dpf A14.tif_merged_z01_t01.png
 - ...dpf A15.tif_merged_z01_t01.png
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 - ...dpf A17.tif_merged_z01_t01.png
 - ...dpf A18.tif_merged_z01_t01.png
 - ...dpf A19.tif_merged_z01_t01.png
 - ...5dpf A2.tif_merged_z01_t01.png
 - ...dpf A20.tif_merged_z01_t01.png
 - ...dpf A21.tif_merged_z01_t01.png
 - ...dpf A22.tif_merged_z01_t01.png
 - ...dpf A23.tif_merged_z01_t01.png
 - ...dpf A24.tif_merged_z01_t01.png
 - ...dpf A25.tif_merged_z01_t01.png

General Acquisition Annotate Preview

ID: 731

NAME: atp1b2b 5dpf A4.tif_merged_z01_t01.png

ANIMAL: ZEBRAFISH

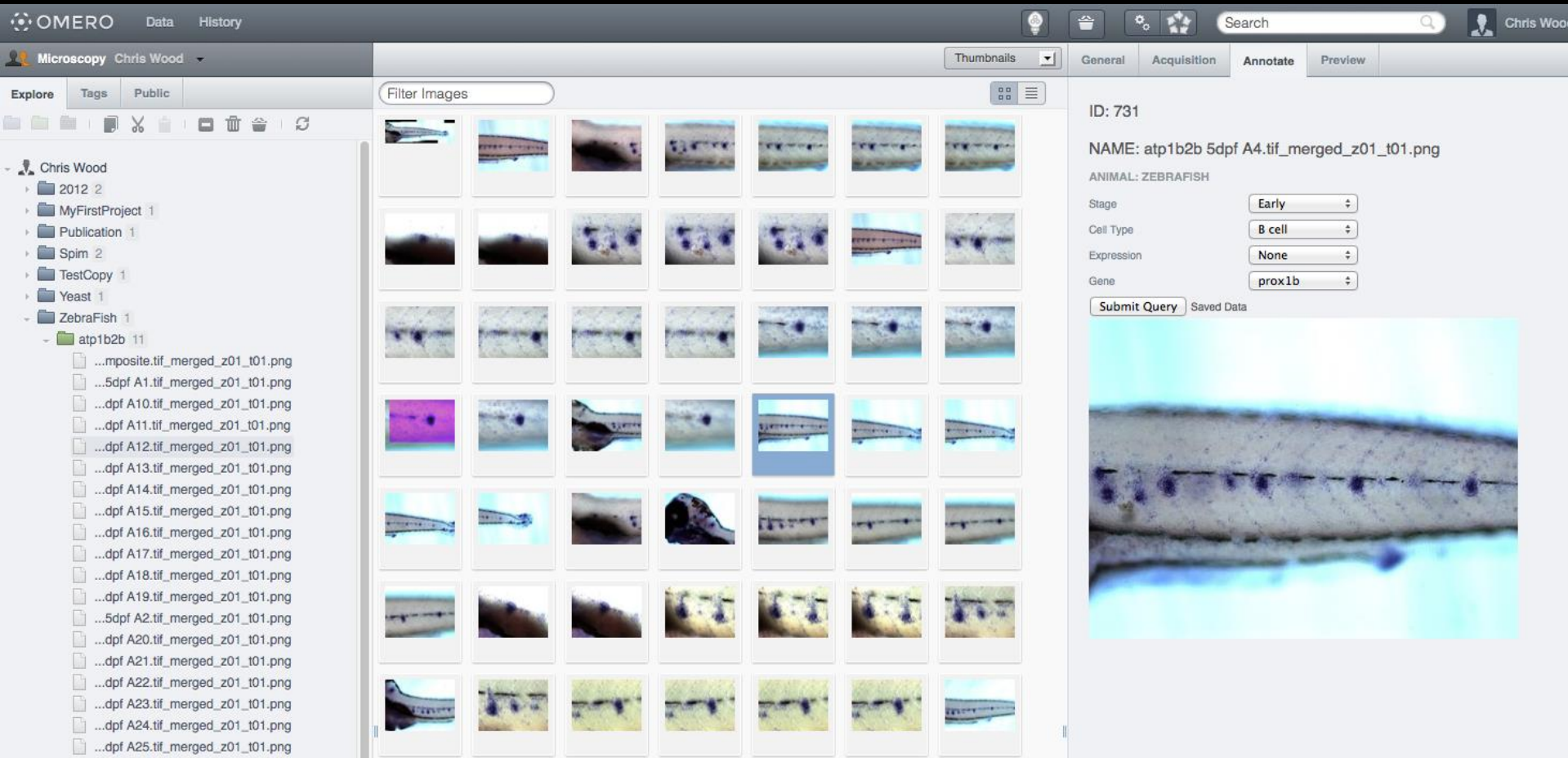
Stage: Early

Cell Type: B cell

Expression: None

Gene: prox1b

Submit Query Saved Data



What We Like and What We Miss (OMERO)

We like:

- XML schema for more powerful tagging
- Enables cross-institutional collaboration

We miss:

- Search within XML annotation by property
- More flexible permission handling

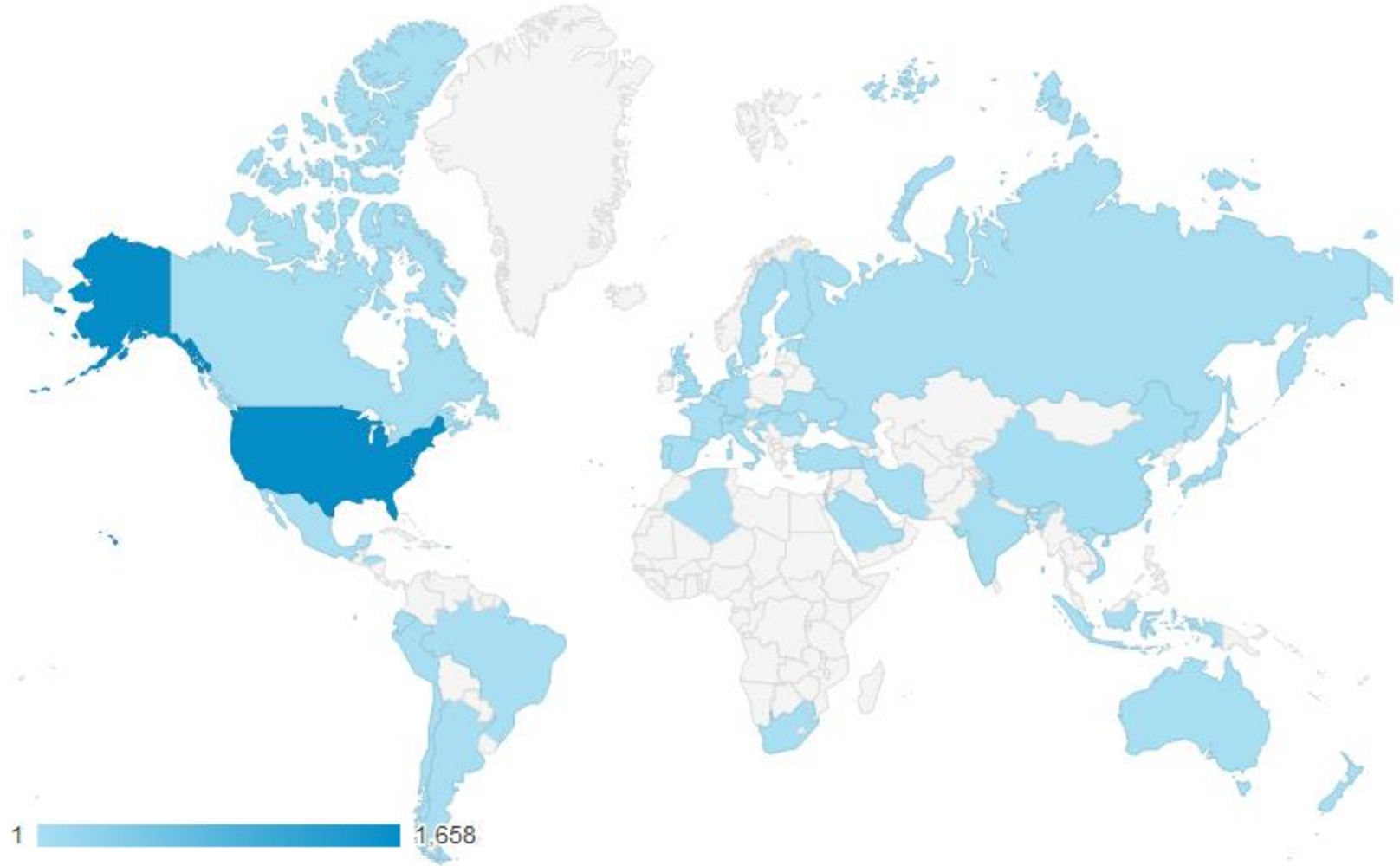
Stowers Original Data Repository



- Original data for all papers
- Active since November 2012
- 43 papers
- 371 GB Files
- 151 GB Pixels
- 3109 Images
- 2330 Other files (Proteomics, Cytometry, Excel)

Over 2000 Visits since November 2012

Google Analytics



LIMS Library Module

Library Services: Edit Publi x

limskc01/zanmodules/libsvcs/pub_editOrder.php?o=524

☆ ☰

Manuscript Information

Internal Compliance Check ⓘ In Process

Submitting SIMR Author ⓘ

Additional SIMR Authors ⓘ

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Publication Type ⓘ

Journal/Book Title ⓘ

Date Submitted ⓘ N/A

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Original Data ⓘ

Add Original Data Group

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Figure 1_Top_Left ▾

Description	Supporting Information
  Figure 1_Top_Left	Book: 2015-01468-002-001 / Page(s): 105-111 Add Supporting Information
 	File Name Plot Values07.csv Add Supporting Files (optional)



Add file(s) from 'Projects' folder

Figure 1_Top_Right ▾

Description	Supporting Information
  Figure 1_Top_Right	Book: 2015-01468-002-001 / Page(s): 105-111 Add Supporting Information
 	File Name Plot Values02.csv Add Supporting Files (optional)

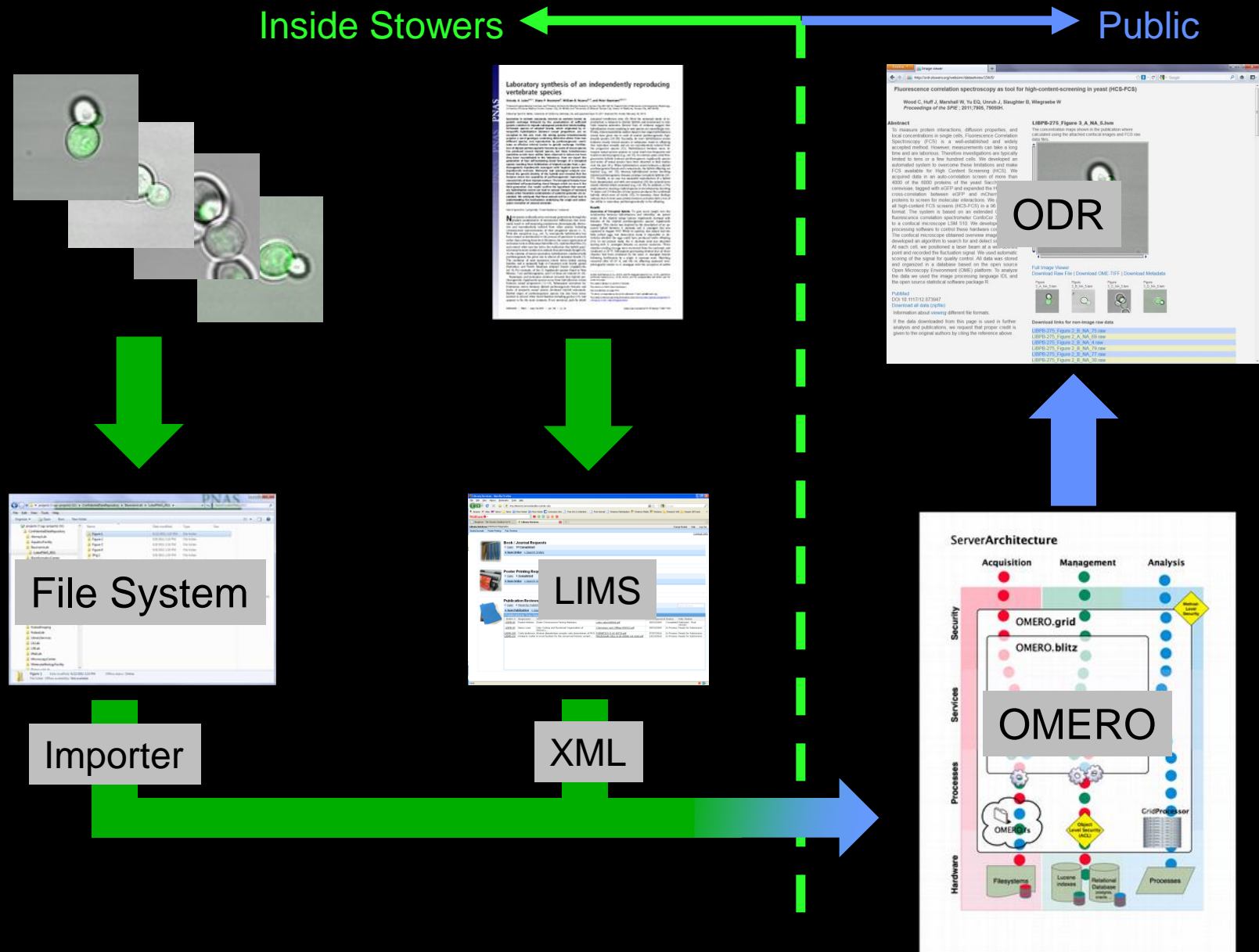
Add file(s) from 'Projects' folder

Figure 2_NA_NA ▾

Description	Supporting Information
  Figure 2_NA_NA	Book: 2015-01468-002-001 / Page(s): 105-111 Add Supporting Information

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Original Data Repository: Data Flow



Customized OMERO Web Interface

Browse

Original Data

odr.stowers.org/websimr/datasetview/558/0/

STOWERS INSTITUTE FOR MEDICAL RESEARCH

Original Data Repository

Search

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Notch2 Regulates BMP Signaling and Epithelial Morphogenesis in the Ciliary Body of the Mouse Eye

Zhou Y, Tazzie C, Yan Z, Chen S, Duncan M, Gaudenz K, Li H, Seidel C, Lewis B, Moran A, Libby RT, Kiernan AE, Xie T
Proc Natl Acad Sci U S A. 2013.

Basket Status: 0 items in the basket

[Open the Download Basket](#) [Empty the basket](#)

Figure 1

Figure 1 - B -

Image Information

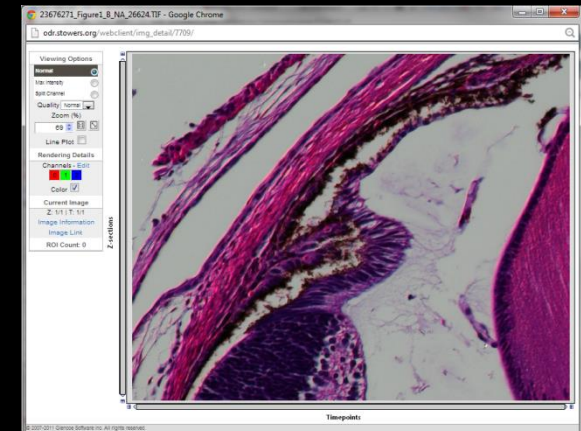
Dimensions (X,Y): 1300 X 1030
Z-sections/Timepoints: 1 / 1
Channels: 3
File Size: 3.8 MB

Viewing Options:
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Thumbnails for Figure 1

Figure 1-A Figure 1-B Figure 1-C Figure 1-D Figure 1-E

View



Download

Basket

Please enter your email address, an email will be sent with a link when the files are ready

E-Mail *

Name

Notes

The selected original data files:

Figure	Type
	Figure Figure_1Ome-Tiff Image File, 7709

[Process](#) [Empty Basket](#) [Close](#)

Challenges with ODR Process and Potential Solutions

Challenges	Ideas
Locate original data	<ul style="list-style-type: none">• OMERO server• Improved annotation technologies• Annotation policies• Links to lab notebook pages etc.• Link processed data to original data file
Combine original data with bibliographic information	<ul style="list-style-type: none">• OMERO – LIMS integration
Handling and display of non-imaging data. Data might or might not be linked to image.	<ul style="list-style-type: none">• Viewers for non-image data

What We Like and What We Miss (OMERO)

We like:

- Customized Web Interface
- Handles non-Image Data
- Public Web Access

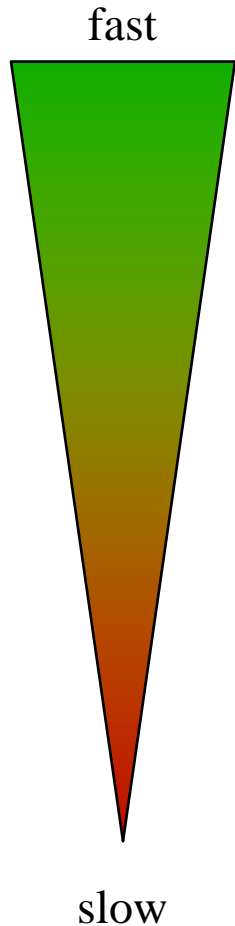
We miss:

- Display of non-Image Data
- Bulk download of Data
- Some Meta –Data not included in OME-TIFF (e.g. Volocity)

Stowers OMERO Server



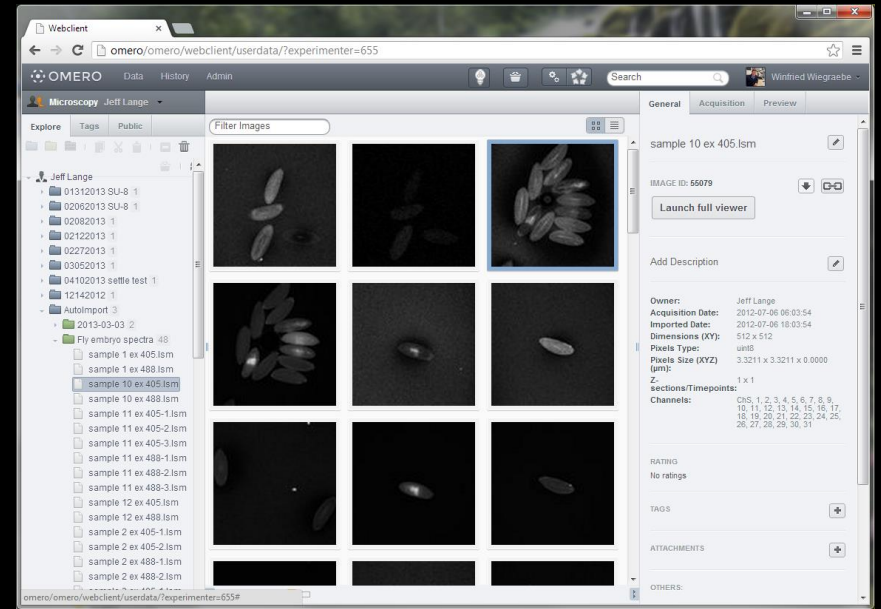
OMERO Server



Content	Technology	Capacity
Omero server	2 quad core processors Omero Version 4.4.5	24GB RAM
CentOS Linux and OMERO software	2 X 240 SSD raid mirror	178G
New and frequently accessed data	SAS 15k Drives (SAN)	1.6T
Long term storage	SATA 10k Drives (SAN)	8.2T
Offsite backup	SATA 7.5k Drives (SAN)	3.4T

Total: 10 TB expandable storage
Service agreement with Glencoe Software

Auto-Import into OMERO



Local

- Laboratory 1
 - User 1
 - Project 1
 - Dataset
 - Filename
 -
 -
 -
 -

Cobian

Script using
OMERO importer

Images per Year (2 Years ago)

Source	Images	Tbytes
Published Data	4,320	0.3
Microscopy Center	400,000	3
Lab light microscopes	400,000	3
Electron Microscopy		4
HCS		4
Gel scanners	4,200	0.4
Total		15

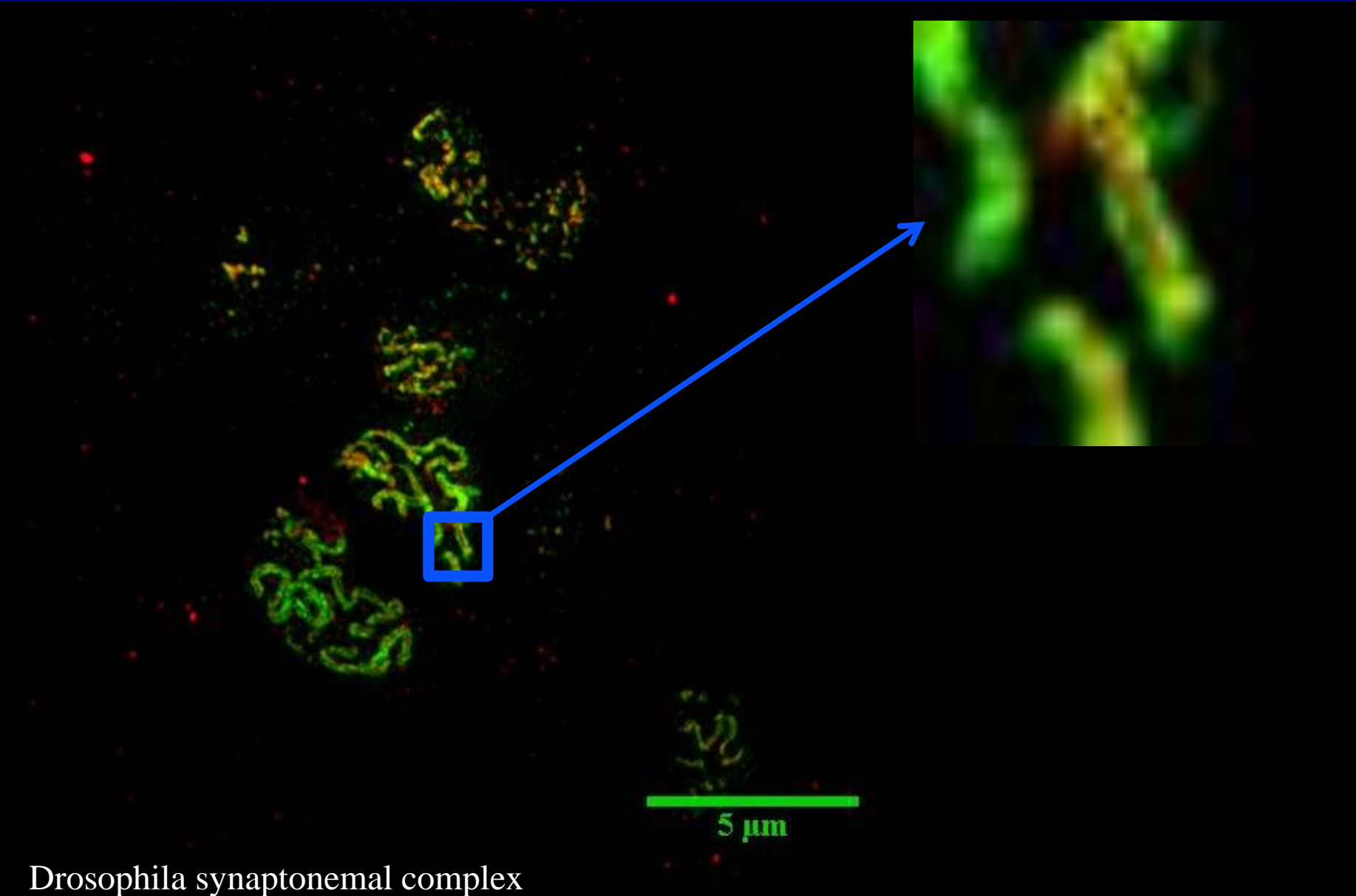
Data without spinning disk, super-resolution, and sheet plane illumination microscopy.

2-15 GB: Spinning Disk Tile Scan



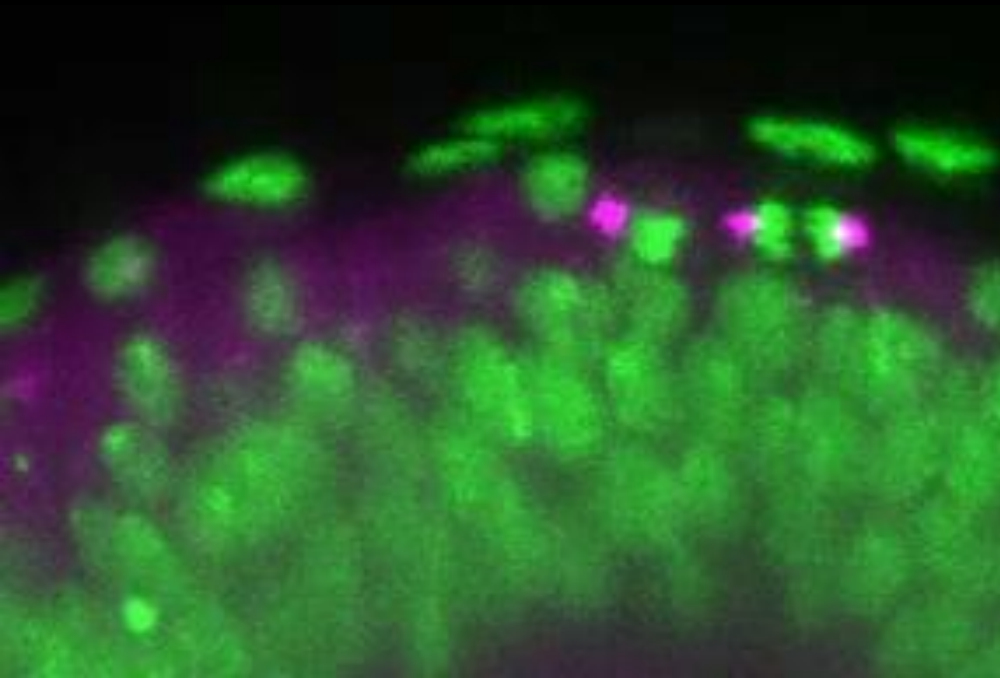
Mouse brain

1 GB: Structured Illumination Super-Resolution Microscopy

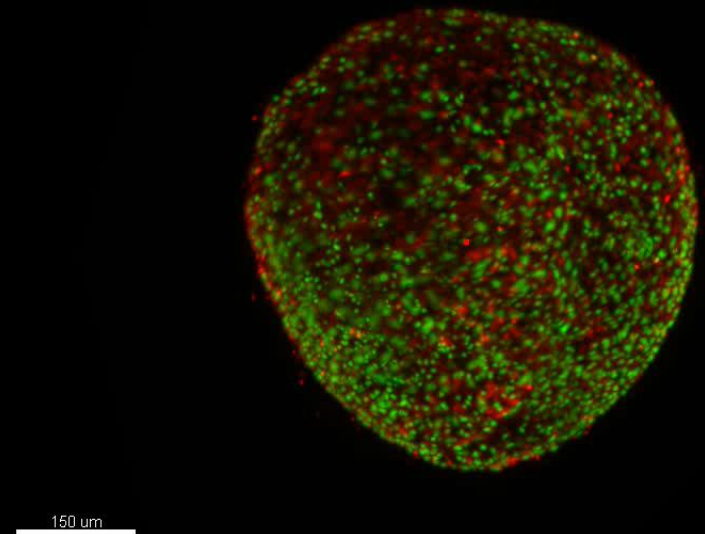


Drosophila synaptonemal complex

1-40 GB: Sheet Plane Illumination Microscopy



Drosophila Wing Disk



Planaria Embryo

Joint R&D Tasks



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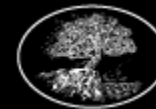
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STOWERS INSTITUTE
FOR MEDICAL RESEARCH

- Integration of LIMS and OMERO
- Track relationship between images
- Display of non-image data

What We Like and What We Miss

We like:

- Web interface
- Data organization
- One viewer for all file formats
- PI can see all data acquired by lab

We miss:

- Deeper folder structure
- Data upload through OMERO.web
- Convenient image processing tools
- Server side 3D rendering

Additional Ideas

- Batch processing
- Multi-user thumbnail view
- User control of thumbnail view for each organization level
- Search for tags across users and groups
- Permissions across groups
- Project centric permissions
- Moving data from one user to another
- Migration of annotations and meta information between databases
- Link to Evernote (and similar electronic notebooks)

Acknowledgements:



<u>Stowers</u> <u>Microscopy</u> <u>Center</u>	<u>Information</u> <u>Management</u>	<u>Research</u> <u>Systems</u>	<u>Library</u> <u>Services</u>	<u>ODR Working</u> <u>Group</u>
Christopher Wood Lucinda Maddera Richard Alexander Sean McKinney	Brandon Young Dirk Hacker Dustin Dietz Mike Newhouse	Darren Wright Jessica Witt	Michael Gaffney Judy Zimmerman	Brian Slaughter Eric Ross Jeff Haug Laurence Florence