

The Open Microscopy Environment:

8th Annual User's Meeting

Institut Pasteur, Paris

Jason Swedlow



Centre for Gene Regulation & Expression
College of Life Sciences, University of Dundee
Dundee, Scotland, UK



Talk Outline

- Thank you!
- The Problem
- This Meeting...
- Our Progress
- Priorities

Thank you!!!

- *Institut Pasteur*

- Christiane Pacaud
- Nathalie Aulner
- Anne Danckaert

- *University of Dundee*

- Wilma Woudenberg
- Joyce Walsh

- *The OME Consortium*

Thank you!!!

wellcometrust

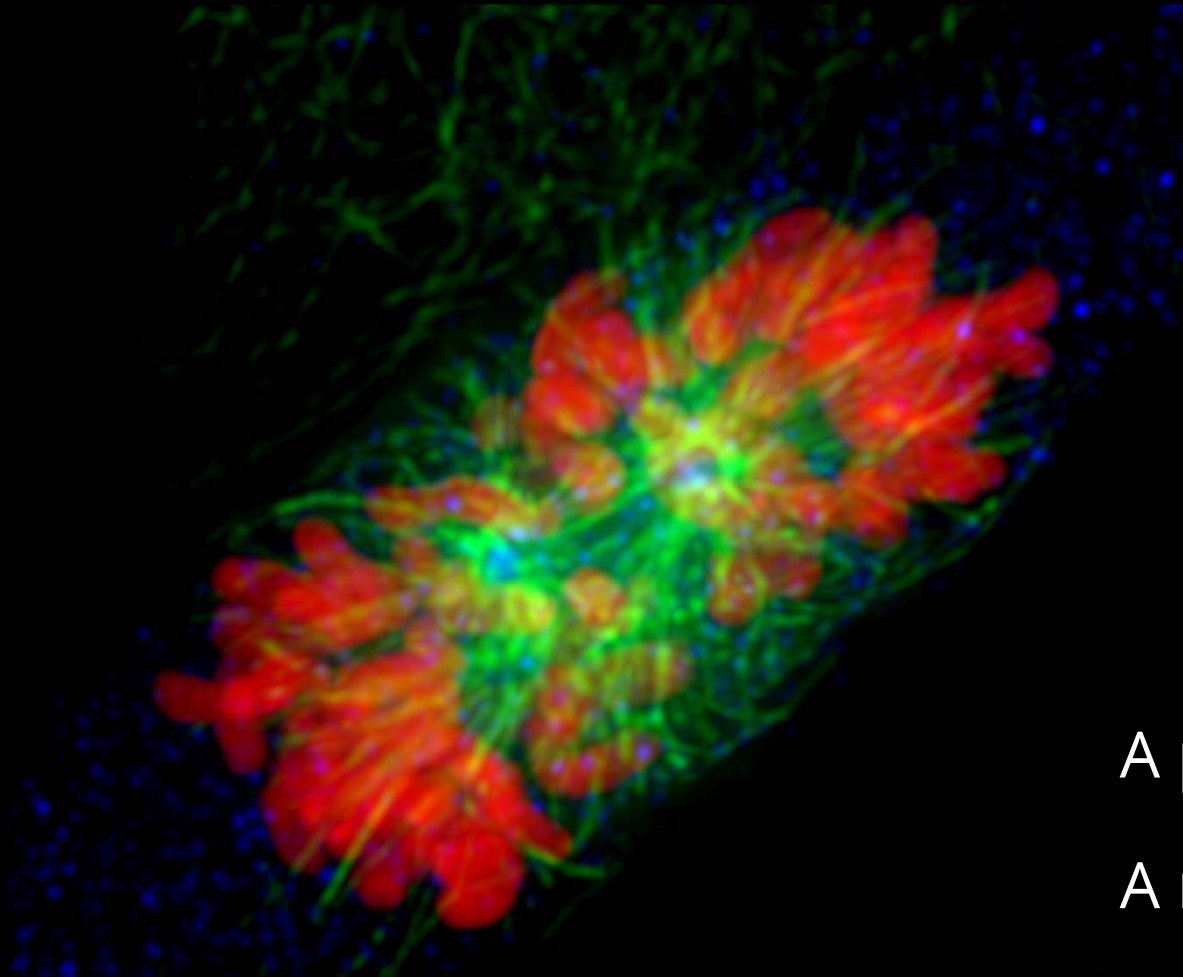


OME Consortium

- Dundee - Colin Blackburn, Jean-Marie Burel, Mark Carroll, Gus Ferguson, Helen Flynn, Kenny Gillen, Roger Leigh, Simon Li, Josh Moore, Will Moore, Andrew Patterson, Blazej Pindelski, Aleksandra Tarkowska, Petr Walczysko
- University of Wisconsin, Madison (LOCI) - Kevin Eliceiri, Curtis Rueden, Mark Hiner
- Harvard Medical School – Gaudenz Danuser, Sebastian Besson
- Oxford – Ilan Davis, Douglas Russell, Graeme Ball
- CRS4 - Gianuigi Zanetti, Gianmauro Cucurru
- Carnegie-Mellon – Robert Murphy, BK Cho, Ivan Cao-Berg
- Edinburgh – Richard Baldock, Bill Hill, Jianguo Rao
- Imperial – Paul French, Chris Dunsby, Ian Munro
- NIA, NIH – Ilya Goldberg, Chris Coletta
- Pasteur – Spencer Shorte, Sebastien Simard, Julien Jorde
- EBI – Gerard Kleywegt, Ardan Patwardhan, Ingvar Lagerstedt
- Glencoe Software – Chris Allan, Sam Hart, Niko Klaric, Andreas Knab, Laura Koneval, Melissa Linkert, Chris MacLeod, Josh Moore, Carlos Neves, Liza Unson, Wilma Woudenberg

THE PROBLEM

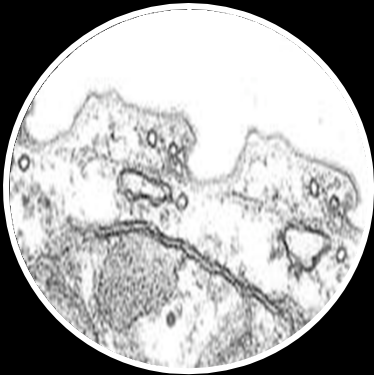
The Image Problem...



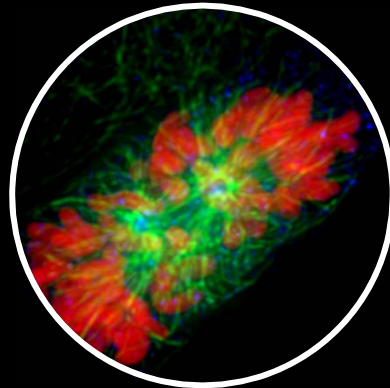
A pretty picture?

A measurement?

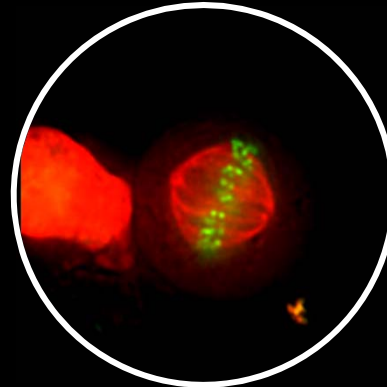
The Image Problem... is Ubiquitous



Organelles



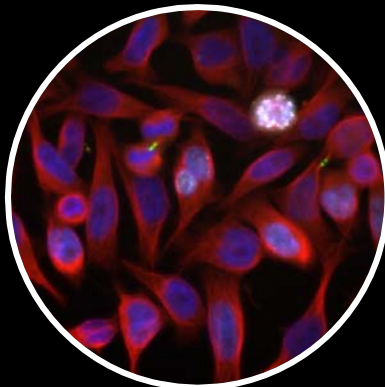
Cells



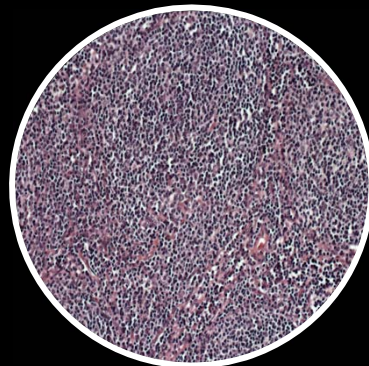
Dynamics



Physiology



Lead Discovery
Target Validation



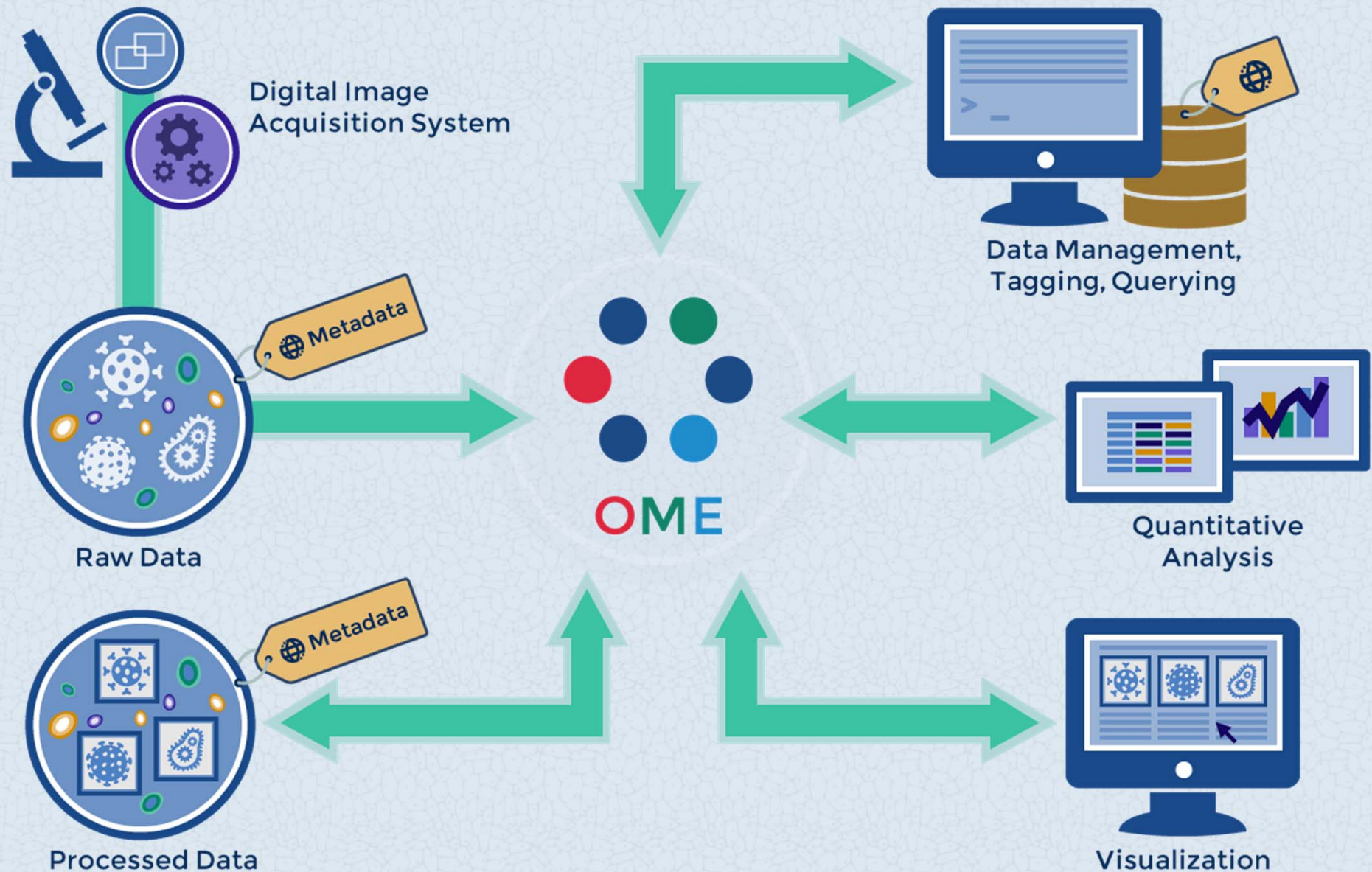
Pathology



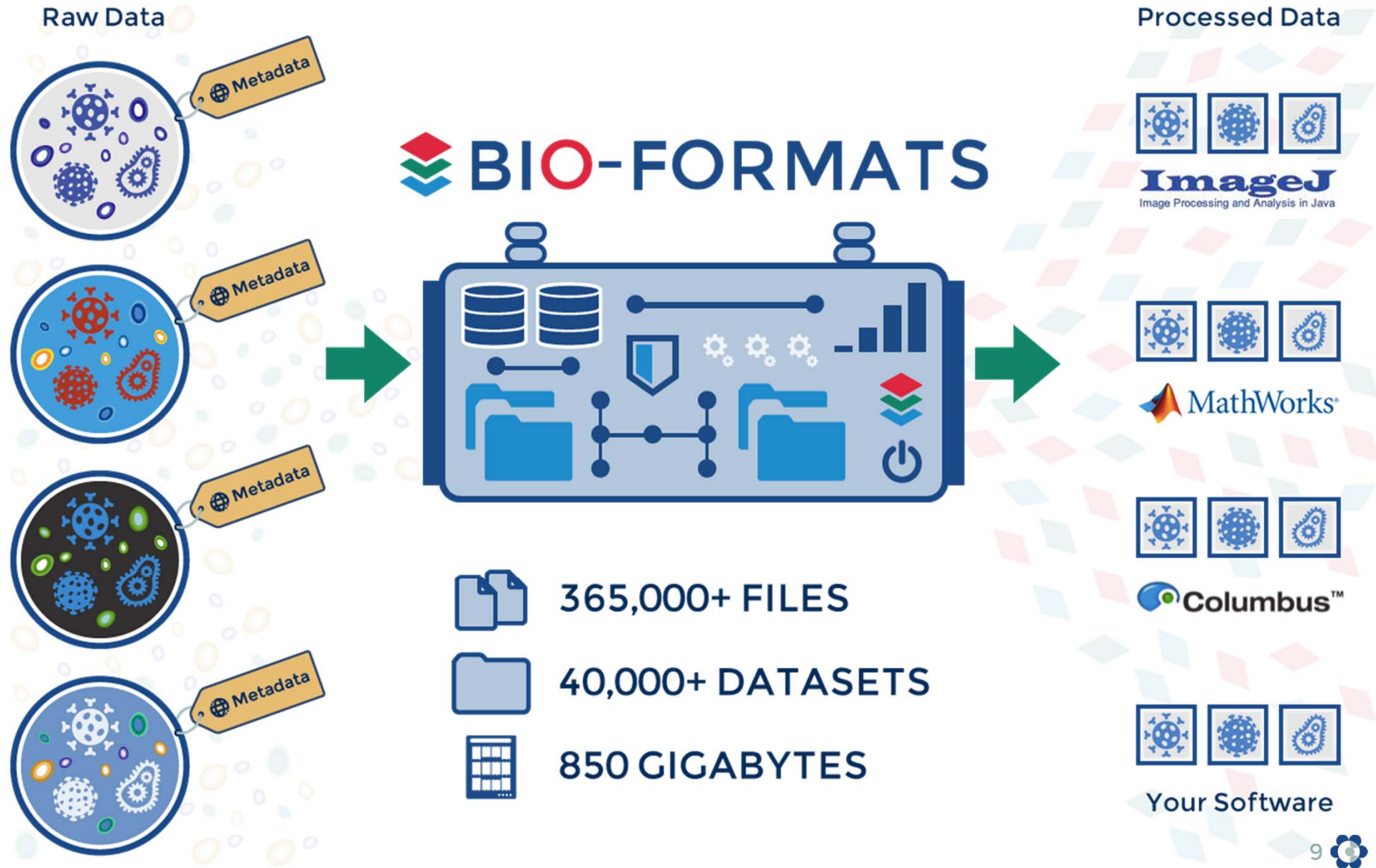
In Vivo

A pretty picture?
A measurement?
A resource?

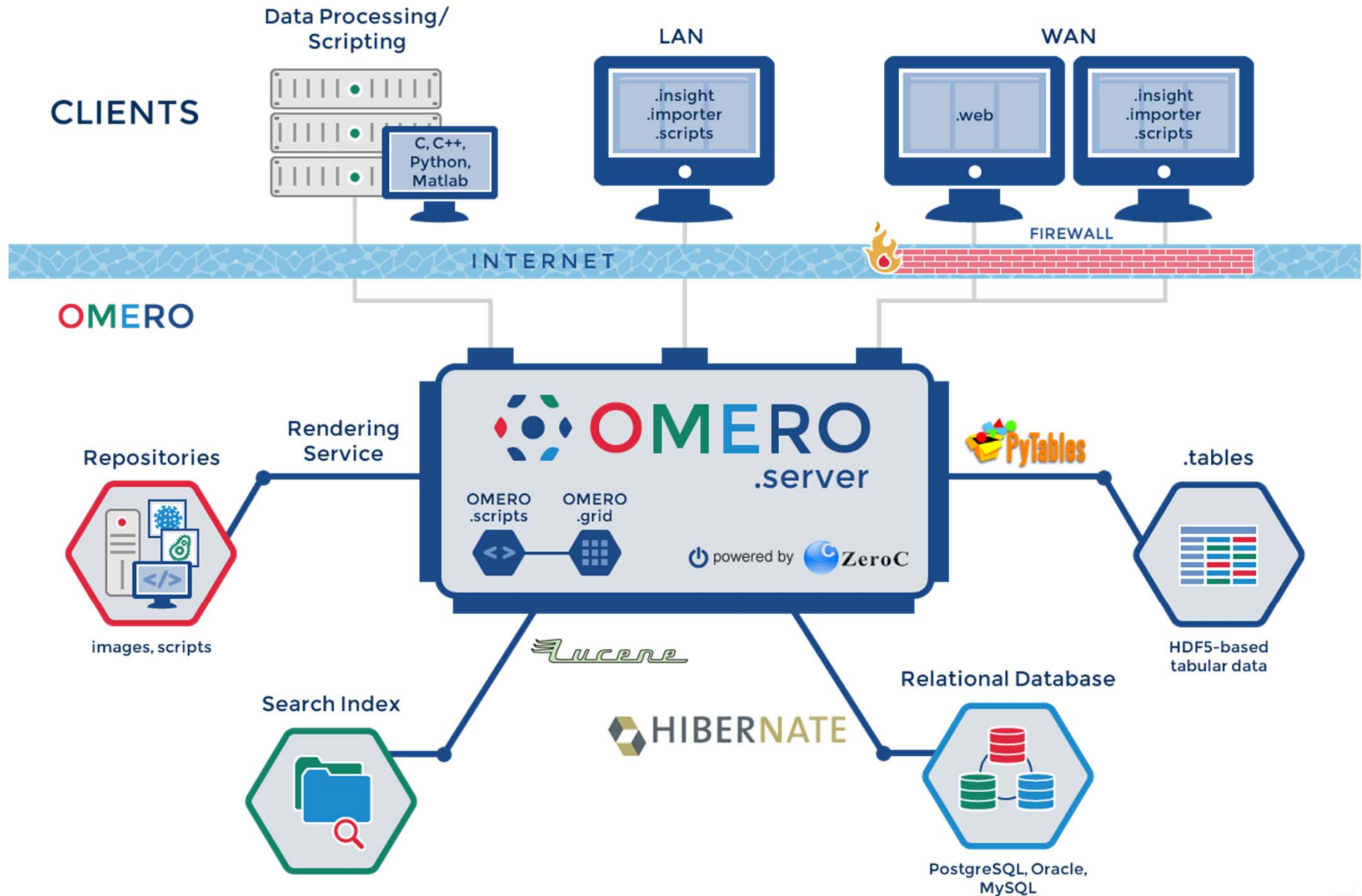
...Towards Image Informatics



BIO-FORMATS: Proprietary File Conversion



The OMERO Platform







OMERO & BIO-FORMATS: OMERO.web Client

The screenshot displays the OMERO.web Client interface. The top navigation bar includes 'OMERO', 'Data', and 'History' tabs, along with a search bar and a user profile for 'Jason Swedlow'. The main interface is divided into several sections:

- Left Panel (File Tree):** Shows a hierarchical view of data. Under 'Alexia Ferrand', there is a folder 'Analysis MCAK - GFP-MCAK cell line 8'. Inside this folder, there is a sub-folder '101026-siCTL_LPM_M_total 11'. This sub-folder contains a list of files, including '...MCAK_SKIP_ACA_02_01_R3D_D3D.dv' through '...MCAK_SKIP_ACA_02_12_R3D_D3D.dv'. Other folders like '101026-siHP1a_LPM_M_total 11' and 'Analysis MCAK_CENPAcells 4' are also visible.
- Top Right Panel (Thumbnails):** Displays a row of five small thumbnail images of the selected file.
- Center Panel (Image Viewer):** Shows a large microscopy image of cells. The image is titled 'Z:/aferrand/HP1/101026-siRNA/101026-siCTL-GFPMCAK_SKIP_AC...'. Below the title is a URL: 'https://nightshade.openmicroscopy.org/webclient/img_detail/3840635/#'. To the left of the image is a vertical 'Z-sections' slider. Below the image is a horizontal 'Timepoints' slider. The image itself shows several cells with red and green fluorescence.
- Bottom Left Panel (Viewing Options):** Contains controls for the image display. It includes a 'Normal' view selector, 'Max Intensity' and 'Split Channel' options, a 'Quality' dropdown set to 'Normal', a 'Zoom (%)' slider set to 50, and a 'Line Plot' checkbox. Under 'Rendering Details', there are 'Channels - Edit' buttons for 'DAPI' (green) and 'FITC' (red), and 'Color' checkboxes for 'RD-TR-PE' (red) and 'CY-5' (blue). The 'Current Image' section shows 'Z: 32/60 | T: 1/1' and 'Image Information' and 'Image Link' links. The 'ROI Count: 3' is also displayed.
- Right Panel (Metadata):** Provides detailed information about the image. It includes the file path 'Z:/aferrand/HP1/101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_02_07_R3D_D3D.dv', the 'IMAGE ID: 3840635', and a 'Launch full viewer' button. Below this, a table lists metadata: Owner (Alexia Ferrand), Acquisition Date (2010-10-26 13:55:25), Imported Date (2010-10-26 14:06:41), Dimensions (XY): 512 x 512, Pixels Type: uint16, Pixels Size (XYZ) (μm): 0.1001 x 0.1001 x 0.2000, Z-sections/Timepoints: 60 x 1, and Channels: DAPI, FITC, RD-TR-PE, CY-5. There are also sections for 'RATING' (No ratings), 'TAGS', 'ATTACHMENTS', 'OTHERS', and a 'COMMENT' section with a user profile and text: 'Alexia Ferrand at 2010-11-09 14:16:33 for fig siCTL VS siMCAK'.

THIS MEETING.....

Meeting Purpose

8th Annual User's Mtg

- Attendees
 - OME Consortium
 - Broad cross-section of users
- *Day 1: Presentations*
 - Consortium developers
 - Users
 - Guests
- *Day 2: Workshops & demos*
- Progress Report
- Future development priorities & planning

OUR PROGRESS

OME : 2011- 2014

- OME Consortium (Wellcome Trust Strategic Award)
 - Development, Integration, Support, Outreach, Testing, Admin
 - Dundee: Jason Swedlow
 - Edinburgh: Richard Baldock
 - Oxford: Ilan Davis
 - Imperial: Paul French
 - Pasteur: Spencer Shorte
 - CRS4: Gianluigi Zanetti
 - Harvard Med: Gaudenz Danuser
 - CMU: Robert Murphy
 - NIH: Ilya Goldberg
 - Madison: Kevin Elcieri
- Collaborations (BBSRC BBR Fund)
 - EBI: Kleywegt (EMDB/PDBe)
 - Edinburgh: Atkinson (Rapid)

OME : 2012/2013 Progress

- *Software:*
 - OME Consortium: Ten teams
 - Bio-Formats & OMERO 4.4.x & 5.0 releases
 - Good adoption
 - >60k Bio-Formats, ~2K server, ~4K client, ~1K web server
 - Consortium releases: FLIMfit, U-Track, PSLID OMERO.searcher, ImageJ2, ...
- *Papers:*
 - OMERO Nature Methods
 - OMERO.searcher Nature Methods
 - Eliceiri et al Nature Methods
 - Cucurro et al Galaxy Comm Conf
- Several external examples of our work
 - Harvard LINCS
 - JCB DataViewer
 - Stowers ODR
 - EMDataBank- 134 3D tomograms
 - Dundee Histology Teaching
 -

THE PRIORITIES

OME 4: 2012 -2014

OMERO 4.4.x (*currently, 4.4.8*)

- New UI Features
 - Permissions
 - Data Sharing & Publication
 - Search
 - Tagging
- Analysis...
- All bugs
- Consortium requirements
- *No API Breakage*
 - API Additions Possible
 - » OMERO.tables (for .searcher, WND-CHRM, .biobank, ...)
 - » Modulo (for FLIM, LSFM,...)
- Aim: 18-24 months of support



OMERO & BIO-FORMATS: OMERO.insight Java Client

Jason Swedlow's Data Manager

[ID: 3840635] ...101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_02_0...

Compression: None

Projects

- Jason Swedlow
- Iain Porter
- Michael Porter
- Alexia Ferrand
 - Analysis MCAK - GFP-MCAK cell line [8]
 - 101026-siCTL_LPM_M_total [11]
 - ...101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_02_0...
 - ...101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_01_0...
 - ...101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_03_0...
 - ...101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_04_0...
 - ...101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_05_0...
 - ...101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_06_0...
 - ...101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_07_0...
 - ...101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_08_0...
 - ...101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_09_0...
 - ...101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_10_0...
 - ...101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_11_0...
 - 101026-siHP1a_LPM_M_total [11]
 - 101026-siHP1b_LPM_M_total [11]
 - 101026-siHP1g_LPM_M_total [12]
 - 101216-siCTL_LPM_M_total [12]
 - 101216-siHP1a_LPM_M_total [12]
 - 101216-siHP1b_LPM_M_total [9]
 - 101216-siHP1g_LPM_M_total [11]
 - Analysis Sgo2 [24]
 - Analysis Sgo2 PP2A-A a/b [12]
 - Analysis siSgo2_Sgo1RD_Sgo2Cy5 [6]
 - DYRK1A-lbr [2]
 - DYRK1A_Ab test [3]
 - DYRK1A_fragments [5]
 - Embryos [1]
 - Flp-In cell lines [5]
 - HeLaSPM_MNB [1]
 - HeLaMNB [19]
 - HP1 [47]
 - Jenny [6]

Screens

Attachments

Tags

Images

Search

Workspace: 11 of 11 images

...101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_02_0...

filter images

Image's details

Image ID: 3840635

...GFPMCAK_SKIP_ACA_02_0...

Description

Acquired Imported Dimensions (XY) Pixel Type Pixels Size (XYZ) (µm) z-sections/timepoints Channels

Annotations

All rate ★★★★★ tag tag attachment attachment

Comments

Image

Split

Projection

DAPI

FITC

RD-TR-PE

CY-5

Z=32 (6.2µm)/60 T=1/1 6s 32s 1min10s 1min54s x1.0

Alexia Ferrand 11/9/10 2:16 PM for fig siCTL VS siMCAK

Alexia Ferrand 11/9/10 2:13 PM gfp 6000 instead of 1000s

Contained in Datasets

Measurement Tool [ID: 3840635] ...101026-siRNA/1...

Manager Inspector Results

ROI	id	T	Z	Type	Text	Visible
▶	5662	[1,1]	[1,60]			✓
▶	5663	[1,1]	[1,60]			✓
▶	5664	[1,1]	[1,60]			✓

Ready.

OMERO & BIO-FORMATS: Data Publication

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Jason Swedlow



Position:	Professor of Quantitative Cell Biology
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Telephone:	385819
Email:	jason@lifesci.dundee.ac.uk
Website:	Open Microscopy Environment
Related Links:	Glencoe Software Incorporated

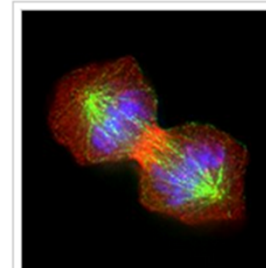
▼ Research Overview

Mitotic chromosome dynamics

During cell division, the two copies of a cell's genetic material are completely separated and delivered to a pair of new daughter cells. Proper chromosome segregation requires the formation of correct attachments between the genetic material, assembled into chromosomes, and ends of microtubules. Our research is focussed on establishing the molecular mechanisms that mediate and monitor the correct attachment of chromosomes to microtubule at a special structure known as the kinetochore. To achieve this, we make use of advanced tools for imaging the components of cell division, especially in living cells and specialised mass spectrometry methods to probe the molecular machinery of cell division. Recently, we used these tools to discover a new protein, Bod1, that plays a critical role in the formation of correct attachments between microtubules and chromosomes by modulating the activity of Aurora B protein kinase. We recently installed a newly developed OMX microscope and are using this system to probe the inner workings of the centromere and kinetochore of the mitotic chromosome.

Like many cell biology labs, we generate large sets of image data. To manage, analyse and understand this data, we, long with our collaborators, formed the Open Microscopy Environment Consortium. OME develops data specifications, file format translators and data management software for imaging applications. OME tools are used in thousands of labs around the world. For more info on OME, see the [Consortium's web site](#).

OMERO is used to store and visualise data for this project. An example of the image data can be viewed in OMERO by clicking on the thumbnail.



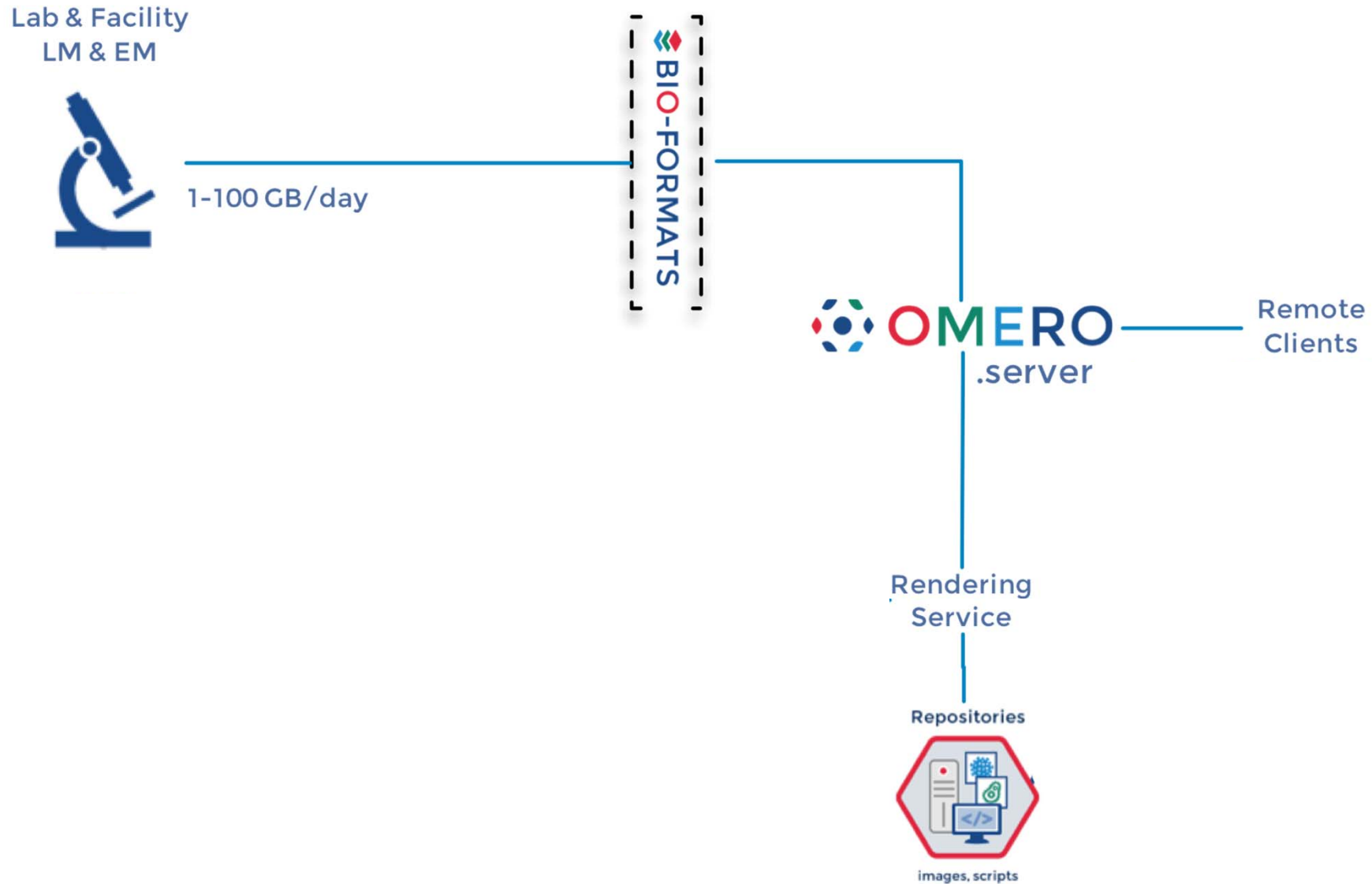
INCENP (red) localization in a dividing cell, also stained for microtubules (green) and DNA (blue). Click on the thumbnail to view and manipulate the image in OMERO.

OME 5: OMERO.fs

- Critical technology for many sites
 - Import (almost) as fast as copy
 - No data duplication
 - Original file access
 - HCS, DigPath, LSFM
- Extremely challenging
 - Performance
 - File format diversity
 - Permissions
 - Clients...
- Progress & next steps
 - Bio-Formats & OMERO 5.0.0-Beta 1 released
 - Looking for Beta sites
 - Full release later in 2013

OMERO & BIO-FORMATS:

Data Import & Access



Open Source Synergy

Open-source distribution, under the GPL license



- Freely available
- Community validated
- Online support
- No services



- Commercial licenses
- Supported, warrantied
- Customized versions
- SaaS

PerkinElmer's Columbus® : OMERO in a Box

Image Analysis - Windows Internet Explorer
http://165.88.162.72/client?id=e4a47973-3f9a-4637-932b-78a015eb127d

Image Analysis

Columbus®

Job Status Administration Help Sign out sarah

2.3.0

Sarah Piper (sarah)

Screen List

- Example #1
- Example #2a
- Example #2b
- Example #3
- page #5
- 2009-08-05 15:55:17
 - P011-N Neurite Outgrowth (2011-07-2
 - RMS Neurite Outgrowth Analysis 2 (20
 - RMS Neurite Outgrowth Analysis 2 - w
 - RMS Neurite Outgrowth Analysis 2 (20
 - RMS Neurite Outgrowth Analysis 2 - w
- STAR
- Screening - Secondary Analysis Reference

RMS Neurite Outgrowth Analysis 2 - with Cell Body Refinement

Input Image

Find Nuclei

Find Cytoplasm

Select Region (2)

Modify Population

Select Region

Find Neurites

Channel: Alexa 488

Population: Cell Bodies

Region: Body

Method: CSIRO Neurite

Output Population: Neurite Segments

Select Population

Define Results

Cell Bodies Neurite Segments

Population: Cell Bodies

Tools

Controls

Channels

Overlays

Region

border

Body

border

Neurite Tree

border

Summary Properties Cell Bodies

Download

Population - Cell Bodies Value

Number of Objects 264

Download

Property	Mean	CV %	StdDev	Median	Max	Min	Sum
Maximum Neurite Length	31.533	122.506	38.6297	24.6447	302.012	0.0	8324.7
Number of Extremities	1.12121	121.755	1.36513	1	8	0	296
Number of Roots	0.920455	105.781	0.973664	1	4	0	243
Number of Segments	1.48864	146.799	2.1853	1	16	0	393
Number of Nodes type 1	0.367424	279.496	1.02694	0	8	0	97
Number of Nodes type 2	0.280303	286.199	0.802225	0	7	0	74
Total Neurite Length	48.5227	138.82	67.3595	25	347	0	12810

Select Data Select Parameter

Well

Done

Internet | Protected Mode: On

100%

JCB Dataviewer: Access to Original Image Data

The screenshot displays the JCB DataViewer web application. At the top, there is a navigation bar with the JCB Data Viewer logo, a search bar with the placeholder text "Search the JCB DataViewer", and a "Search" button. To the right of the search bar are links for "Home", "About", "Contact", and a "JCB" logo, followed by a "log in" link. Below the navigation bar is a light blue banner with the following text: "Welcome to the JCB DataViewer! The JCB DataViewer facilitates viewing, analysis, and sharing of multi-dimensional image data associated with articles published in *The Journal of Cell Biology*." Below the banner, there is a "View" section with two tabs: "List" (selected) and "Gallery". The main content area displays a grid of six image thumbnails, each with a title and citation information. The thumbnails show various biological structures: a red-stained cell with green organelles, a cluster of white circular structures on a black background, a grayscale electron micrograph of a cell, a green and red striped pattern, a blue-stained cell, and a red and green speckled cell.

JCB Data Viewer Search the JCB DataViewer Search

Home About Contact JCB log in

Welcome to the JCB DataViewer! The JCB DataViewer facilitates viewing, analysis, and sharing of multi-dimensional image data associated with articles published in *The Journal of Cell Biology*.

View List Gallery

Notochord vacuoles are lysosome-related organelles that function in axis and spine morphogenesis
Kathryn Ellis, Jennifer Bagwell, Michel Bagnat
jcb. 2013. 200:667-679 DOI: 10.1083/jcb.201212095.

Promoter- and RNA polymerase II-dependent hsp-16 gene association with nuclear pores in *Caenorhabditis elegans*
Sabine Rohner, (...), Peter Meister
jcb. 2013. 200:589-604 DOI: 10.1083/jcb.201207024.

Conserved and divergent features of kinetochores and spindle microtubule ends from five species
J. Richard McIntosh, (...), Ekaterina L. Grishchuk
jcb. 2013. 200:459-474 DOI: 10.1083/jcb.201209154.

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- Progress Report
- Future development priorities & planning