

# OMERO

## at EastBio Imaging Workshop

### Dundee, January 2018

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University of Dundee  
The OME Consortium



Open Microscopy Environment  
Centre for Gene Regulation & Expression  
School of Life Sciences, University of Dundee  
Dundee, Scotland, UK

# Programme of the workshop

- Short introduction to OMERO
- Viewing and managing images using OMERO plugins (OMERO.web, OMERO.iviewer)
- Data search, analysis using Fiji features (OMERO.insight plugin for Fiji, Workflow – timelapse images)
- Publishing with OMERO (OMERO.figure – Workflow - timelapse continued)

# Outline

- Scientific Data paradigm
- What is OMERO
- Analyzing with OMERO
- Sharing data with OMERO
- Publishing with OMERO
- Questions

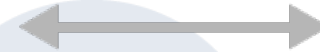
# The Standard Paradigm



You



Applications



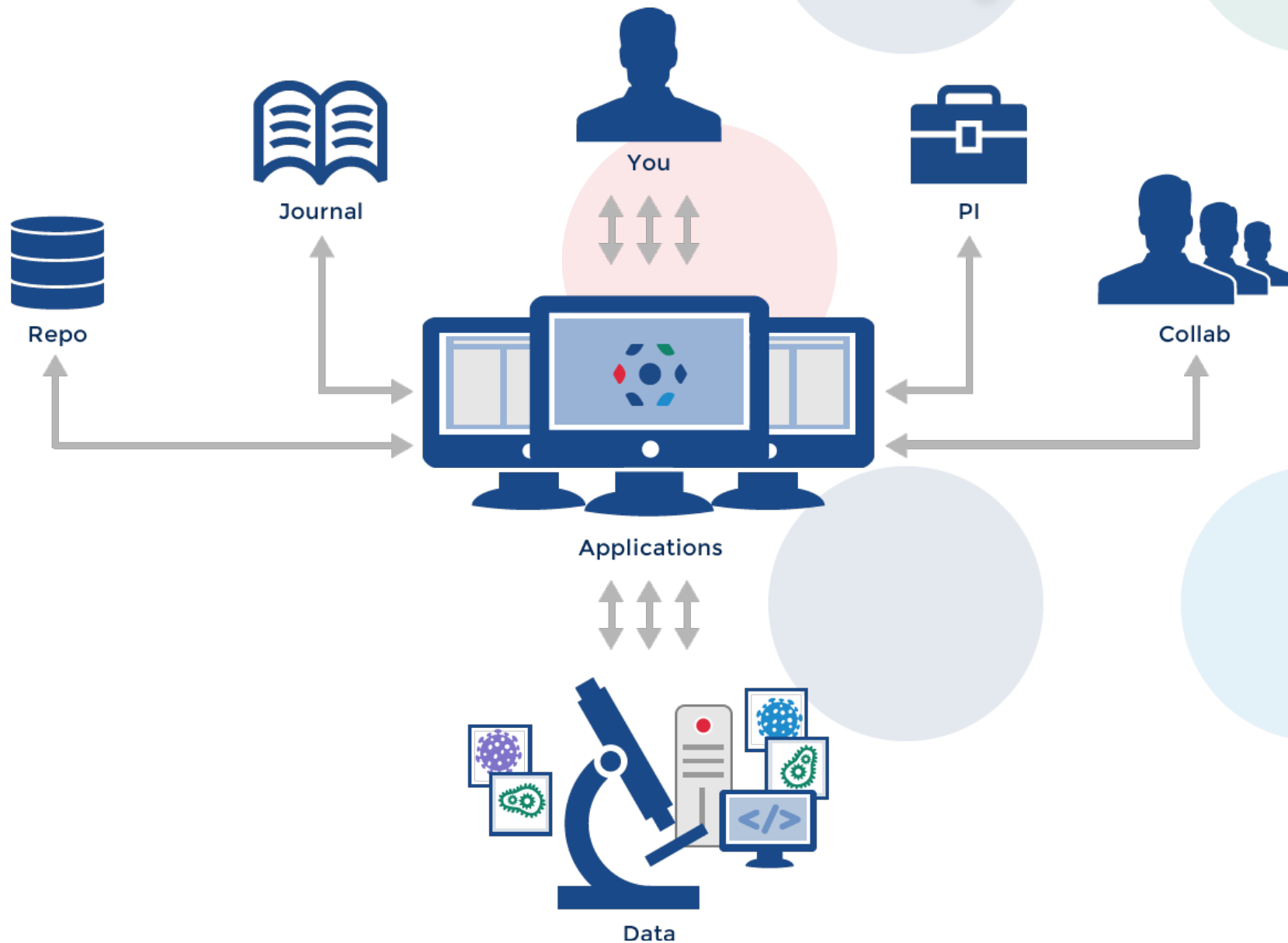
Data



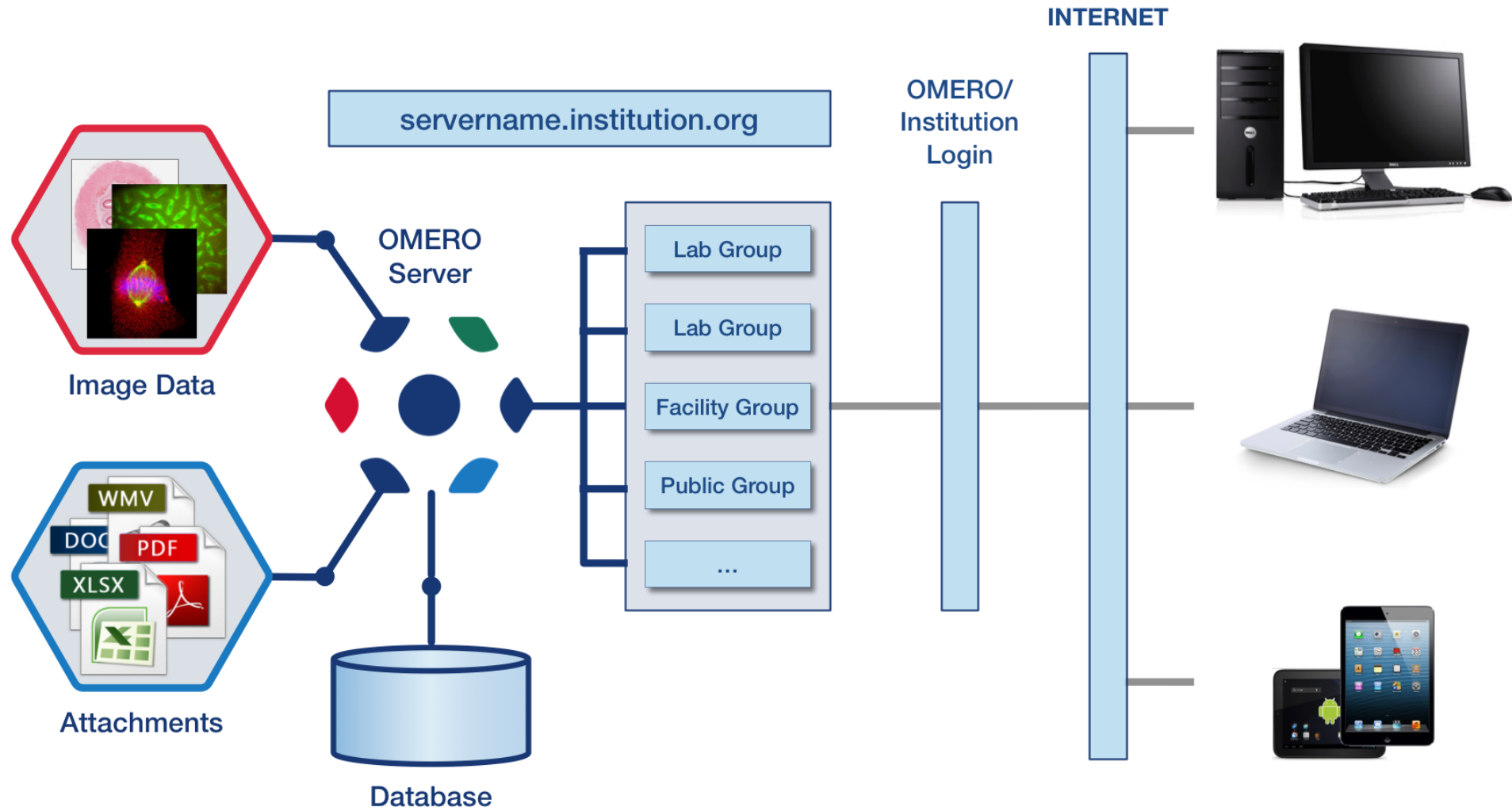
# What about

- Organizing your data?
- Sharing data with coworkers and colleagues?
- Analyzing data?
- Publishing data?

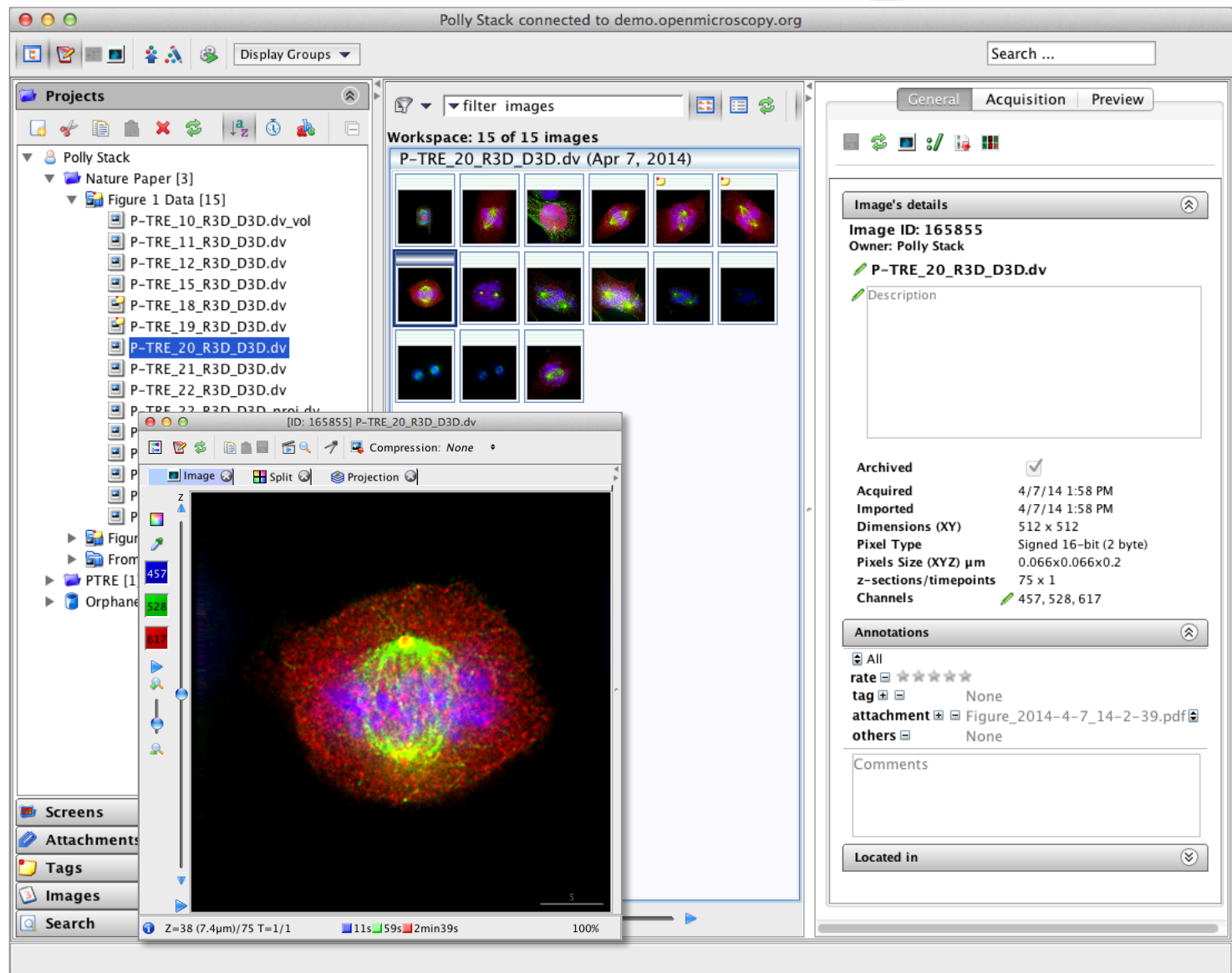
# The “Scientific Data” Paradigm



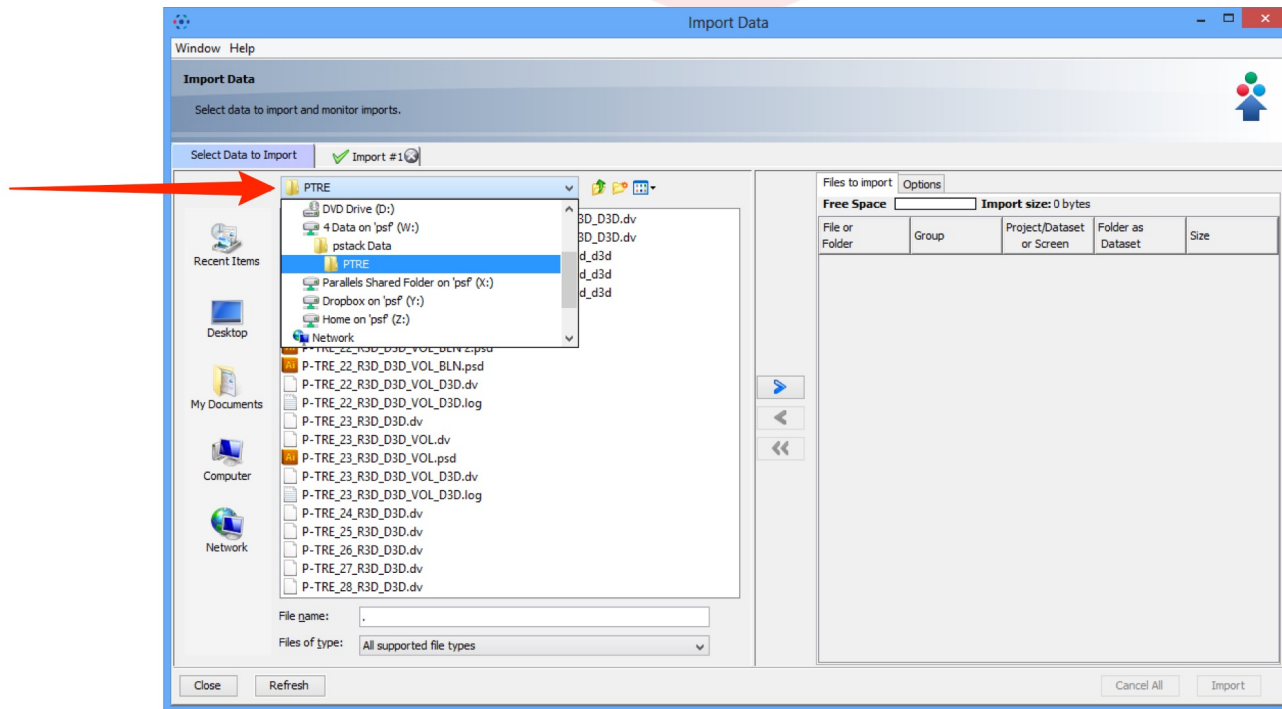
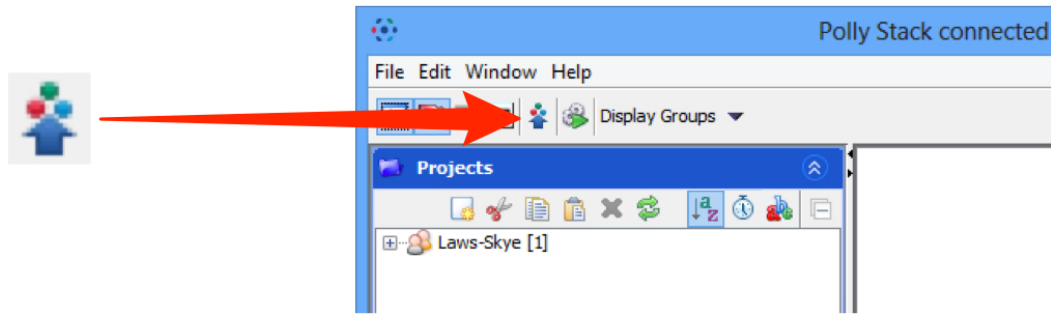
# OMERO setup



# OMERO.insight: Desktop Based Application



# Import Image Data into OMERO



# OMERO.web: Web Based Application

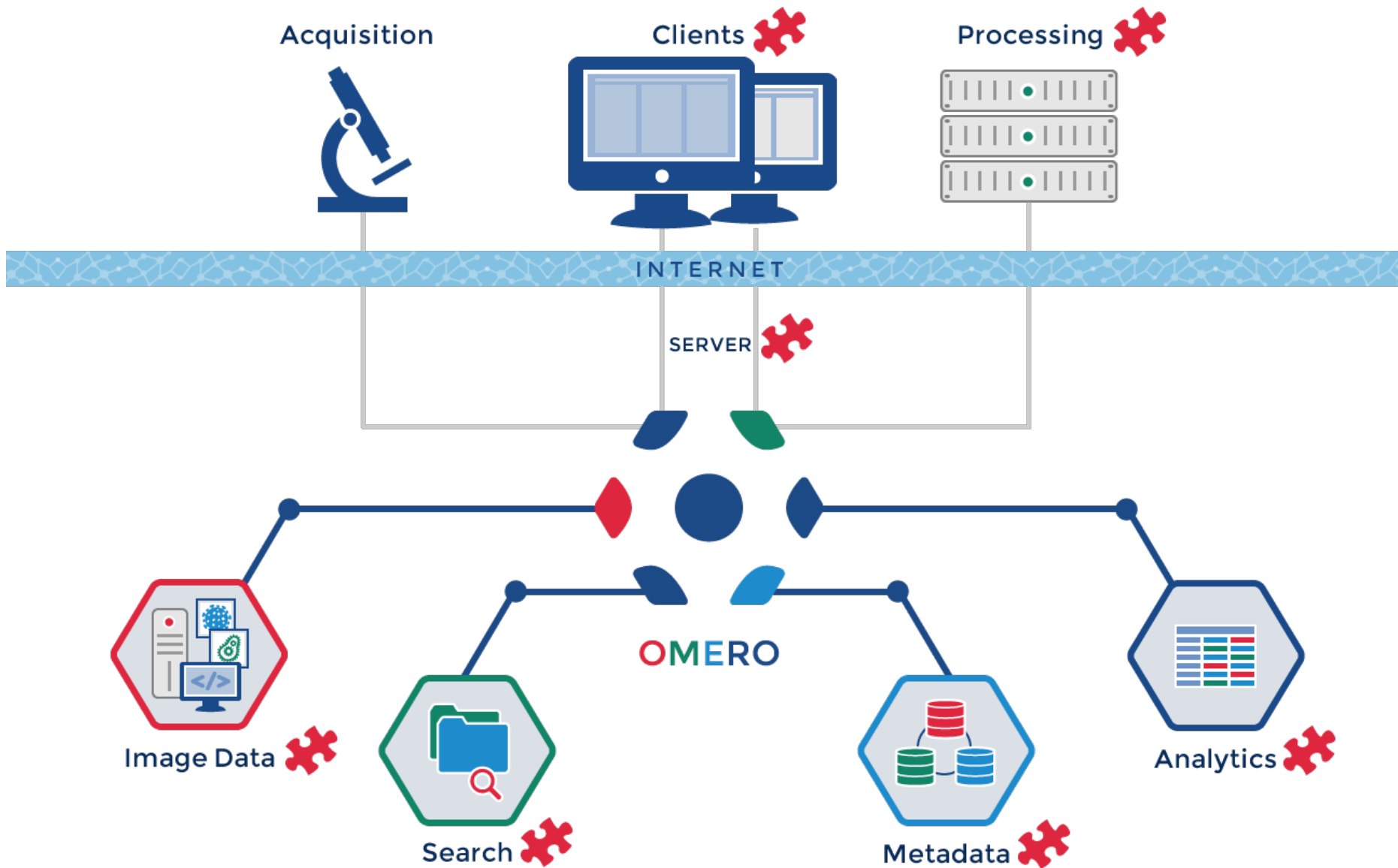
The screenshot displays the OMERO.web webclient interface. The browser address bar shows `demo.openmicroscopy.org/webclient/`. The interface includes a navigation menu with 'Data', 'History', and 'Figure' options. The main area is divided into three sections:

- Left Panel (File Browser):** Shows a tree view of the 'demo\_group Polly Stack'. The selected folder is 'Nature Paper 3', containing 'Figure 1 Data 15'. The selected file is 'P-TRE\_23\_R3D\_D3D\_VOL.dv'.
- Center Panel (Image Grid):** Displays a grid of 15 image thumbnails. The selected image is highlighted with a blue border.
- Right Panel (Image Details):** Shows the details for the selected image, 'P-TRE\_23\_R3D\_D3D\_VOL.dv' (IMAGE ID: 165828). The details include:
  - Owner:** Polly Stack
  - Acquisition Date:** 2014-04-02 08:20:45
  - Imported Date:** 2014-04-02 08:20:46
  - Dimensions (XY):** 964 x 964
  - Pixels Type:** uint8
  - Pixels Size (XYZ) (µm):** 0.07 x 0.07 x 0.20
  - Z-sections/Timepoints:** 1 x 1
  - Channels:** 457, 528, 617



# ANALYSIS WITH OMERO

# The *Extensible* OMERO Platform



 Plugins Welcome



# Examples of Analysis Integration

- **OMERO.iviewer** – plugin for viewing and analysis
- **ImageJ/Fiji**, Icy– Pluggable, desktop Image processing tools (Java)
- FPBioimage – 3D viewer from Cambridge
- R – statistical analysis software
- CellProfiler– HCS segmentation and features (Python)
- mTools– Otsu, basic segmentation (Matlab)
- ORBIT – Image analysis, specialized on pathology images
- WND-CHRM-- weighted nearest neighbor machine learning (Python)
- ThunderSTORM and PALMSiever– Localisation SRM (ImageJ, Matlab)
- OMERO2CV– LSFM Multi-View Reconstruction (C++, OpenCV, ITK)
- Columbus Acapella<sup>®</sup>-- commercial Big Data processing...

# Viewing and analyzing Images – OMERO.iviewer

→ *Google for OMERO.iviewer*

→ *Go to YouTube and search for OMERO.iviewer*

The screenshot displays the OMERO.iviewer interface. The main window shows a fluorescence microscopy image of two cells, with a scale bar indicating 5.82423  $\mu\text{m}$ . The image is titled "050118.lei [07-03-b]". The interface includes a toolbar with zoom and pan controls, and a sidebar with a thumbnail gallery. The right panel is the "Info" tab, which contains a "Settings" section with "Save", "Save to All", "Undo", "Redo", "Copy", and "Paste" buttons. Below these are checkboxes for "Grayscale" (unchecked) and "Show Histogram" (checked). A histogram plot is visible, showing a distribution of pixel intensities. Below the histogram are two color calibration sliders: "PMT 1" (green) with a value of 81 and a range from 0 to 2152, and "PMT 3" (yellow) with a value of 137 and a range from 0 to 1475. At the bottom of the panel are buttons for "Min/Max", "Full Range", and "Imported". The "User Settings" section at the bottom right shows a small thumbnail of the image and the text "user-4 user-4".

# First Person Bioimage – 3D viewer from Cambridge, now in OMER0.web

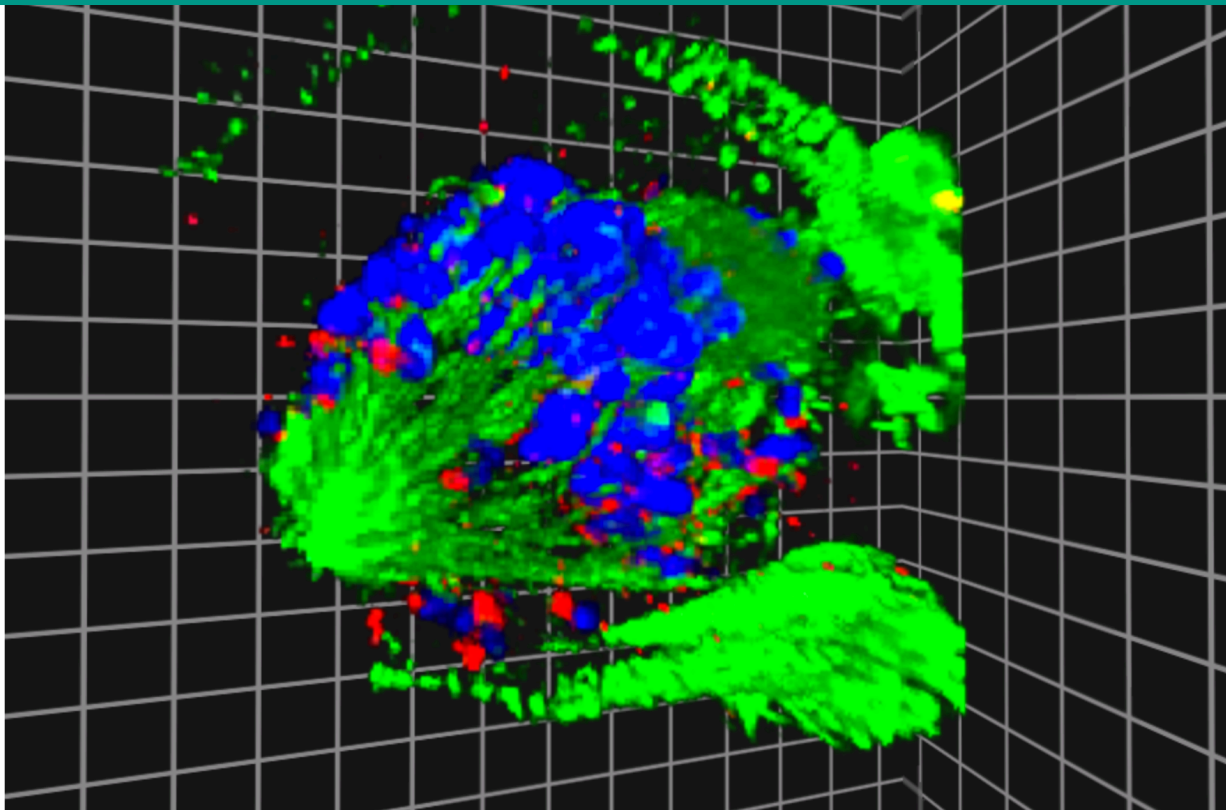
© [Marcus Fantham](#)

See the paper in [Nature Photonics](#)



UNIVERSITY OF  
CAMBRIDGE

## First Person Bioimage



# ImageJ and OMERO

(Fiji Is Just) ImageJ

C4.pattern.tif--OMERO ID:4177196  
c:1/2 t:1/23 (c:2/2 t:23/23 - C4.pattern); 305x240

x=93, y=12, z=0, value=255

ROI Manager

0001-0001-002... Add [t]  
0001-0002-009... Update  
0001-0003-008... Delete  
0001-0004-010... Rename...  
0001-0005-012... Measure  
0001-0006-019... Deselect  
0001-0007-020... Properties...  
0001-0008-023... Flatten [F]  
0002-0009-002... More >  
0002-0010-009...  Show All  
0002-0011-008...  Labels  
0002-0012-010...  
0002-0013-012...  
0002-0014-019...  
0002-0015-020...  
0002-0016-022...  
0003-0017-002...  
0003-0018-008...  
0003-0019-009...

Results

	Area	Mean	StdDev	Min
92	2486	0	0	0
93	1351	0	0	0
94	926	0	0	0
95	1095	0	0	0
96	1346	0	0	0
97	843	0	0	0
98	979	0	0	0
99	1904	0	0	0
00	1559	0	0	0
01	1492	0	0	0
02	628	0	0	0
03	2787	0	0	0
04	2002	0	0	0
05	1098	0	0	0
06	1240	0	0	0
07	1845	0	0	0
08	1147	0	0	0
09	1326	0	0	0
10	2314	0	0	0
11	2348	0	0	0
12	1855	0	0	0

Drawing of C4.pattern.tif--OMERO ID:41...  
1/46; 305x240 microns (305x240); 8-bit; 3.2MB

Area Distribution  
300x240 pixels; RGB; 281K

List Copy Log 526 93



C4.pattern.tif v3.3.0

Info Settings ROIs [412]

Save Undo Redo Show Comments

0027-0214-0121 10

Z 1 T 14

Show Z T Comment

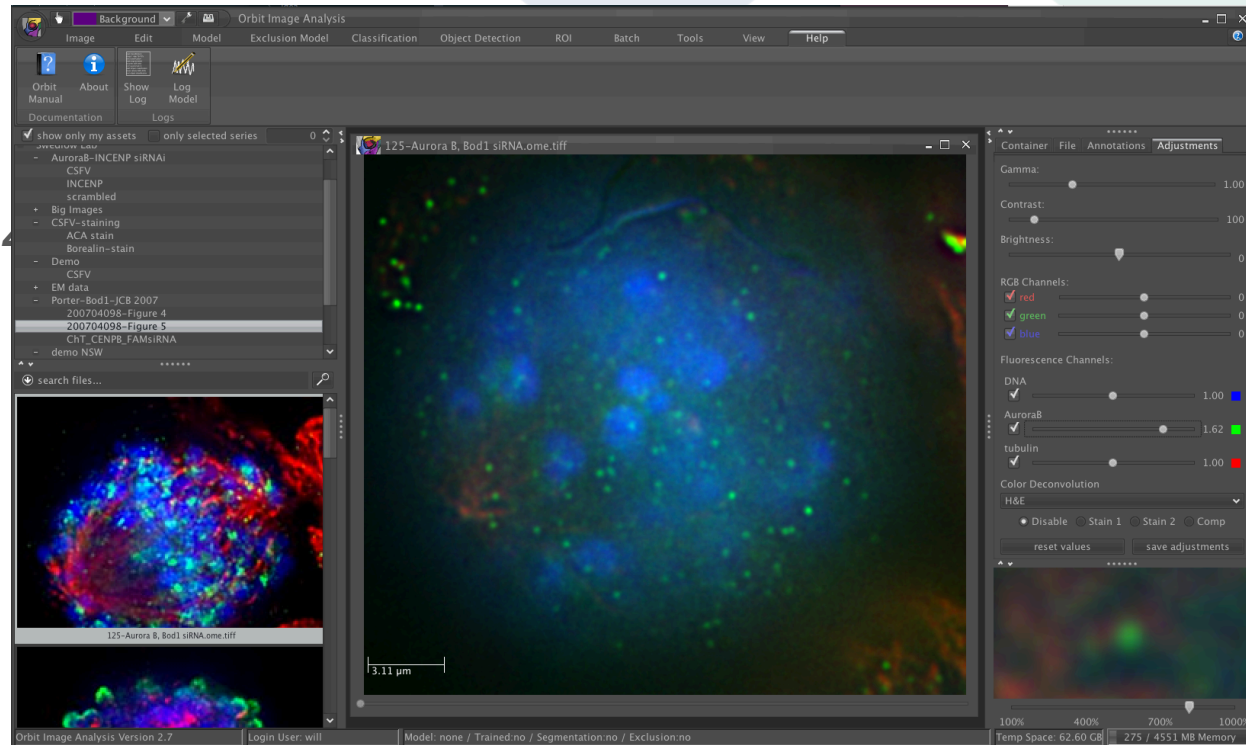
Show	Z	T	Comment
<input checked="" type="checkbox"/>	1	13	0026-0204-0116
<input checked="" type="checkbox"/>	1	13	0026-0205-0193
<input checked="" type="checkbox"/>	1	13	0026-0206-0217
<input checked="" type="checkbox"/>	1	13	0026-0207-0229
<input checked="" type="checkbox"/>	1	14	0027-0208-0029
<input checked="" type="checkbox"/>	1	14	0027-0209-0042
<input checked="" type="checkbox"/>	1	14	0027-0210-0083
<input checked="" type="checkbox"/>	1	14	0027-0211-0103
<input checked="" type="checkbox"/>	1	14	0027-0212-0098
<input checked="" type="checkbox"/>	1	14	0027-0213-0115
<input checked="" type="checkbox"/>	1	14	0027-0214-0121
<input checked="" type="checkbox"/>	1	14	0027-0215-0196
<input checked="" type="checkbox"/>	1	14	0027-0216-0220
<input checked="" type="checkbox"/>	1	14	0028-0217-0009
<input checked="" type="checkbox"/>	1	14	0028-0218-0064
<input checked="" type="checkbox"/>	1	14	0028-0219-0102
<input checked="" type="checkbox"/>	1	14	0028-0220-0120
<input checked="" type="checkbox"/>	1	14	0028-0221-0113
<input checked="" type="checkbox"/>	1	14	0028-0222-0195

Attachments 2

measurements.csv (31.61 KB)

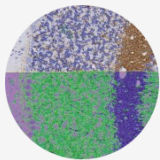
# ORBIT

- **ORBIT IMAGE ANALYSIS**
- <http://www.orbit.bio/>
- **Compatible with OMERO 5.4**



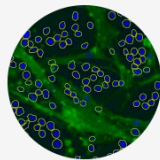
## IMAGE ANALYSIS

Sophisticated image analysis features



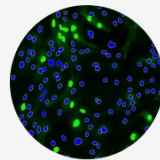
### TISSUE QUANTIFICATION

Compute the ratio of different tissue classes, e.g. percentage of collagen in a tissue.



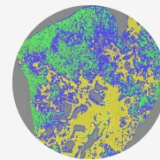
### OBJECT SEGMENTATION

Segment objects like cells or nerves.



### OBJECT CLASSIFICATION

Assign classes to objects based on their features.



### ANNOTATIONS & ROI

Annotations and trainable exclusion maps for ROI definition.



# OMERO.scripts: Kymographs example

The screenshot displays the OMERO web interface. At the top, it shows the user 'Will Moore' connected to 'nightshade.openmicroscopy.org'. The main workspace contains 10 images, with the title '33676-EB1 dsRed (red) tracking along peripheral SEPT2-YFP filaments (green). Spinning disc co...'. A large image viewer in the foreground shows a kymograph of the selected image, with a red line indicating a region of interest (ROI). A 'kymograph' window is open, showing a table of ROIs:

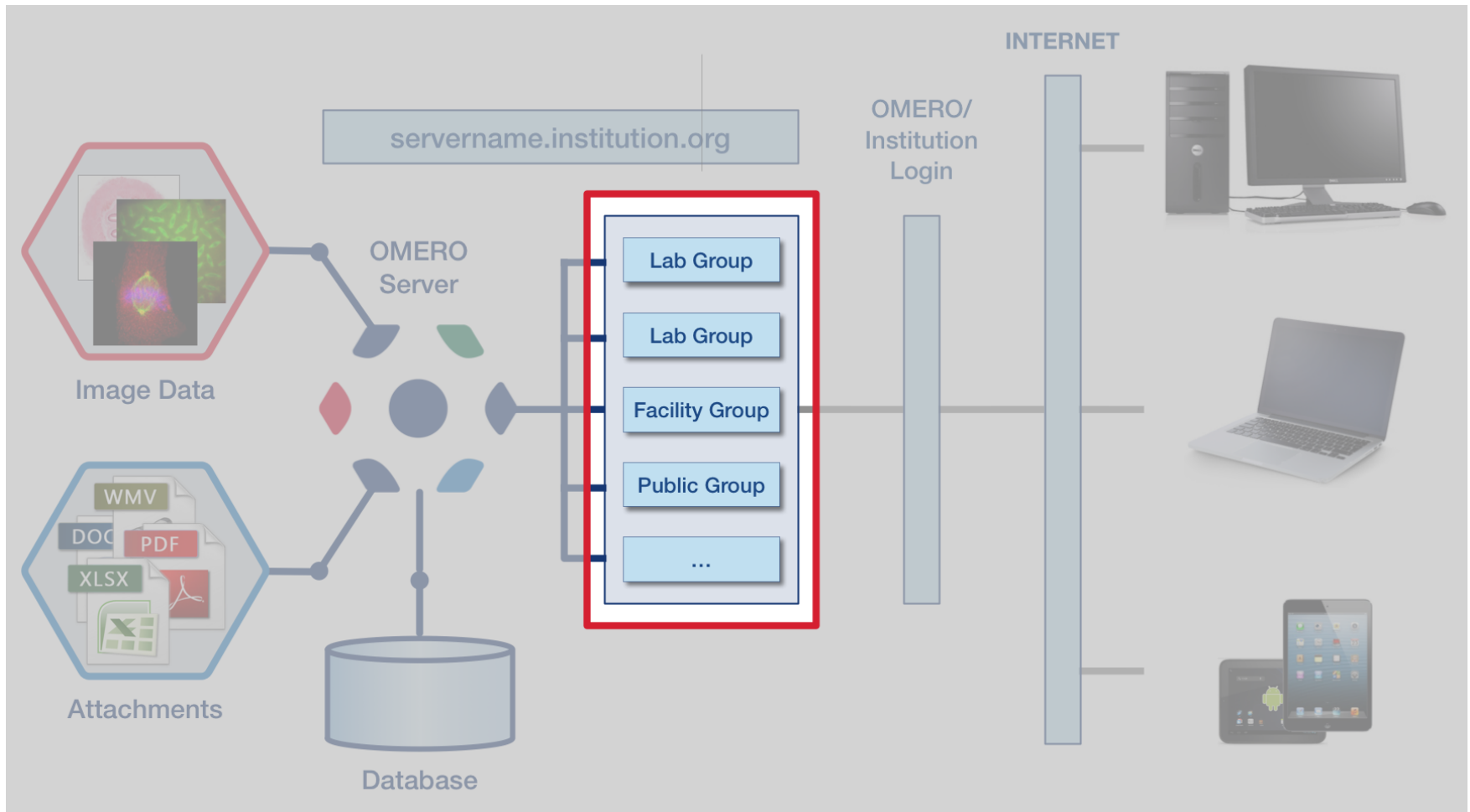
ROI	id	Z	T	Type	Comment	Visi...
[1]	979...	1	1	/		<input checked="" type="checkbox"/>
[1]	743...	1	1	/		<input checked="" type="checkbox"/>
[1]	979...	1	1	/		<input checked="" type="checkbox"/>
[1]	743...	1	1	/		<input checked="" type="checkbox"/>

The interface also includes a 'Projects' sidebar, a 'filter images' search bar, and various toolbars for image manipulation and navigation. The status bar at the bottom indicates 'Z=1/1 T=42/121' and '150%' zoom.



# SHARING DATA WITH OMERO

# OMERO group and user system





# Security Model



Group-Private

Can only read your own data



Group-Read

Can read but not annotate others' data



Group-Annotate

Can read and annotate others' data



Group-Write

Can read and edit others' data



# PUBLISHING WITH OMERO

# OMERO: Data Publication – images on website

The image shows a screenshot of the OMERO website. At the top, there is a header for the "Centre for Gene Regulation & Expression" at the University of Dundee. Below the header is a navigation menu with links for Home, News, Events, Features, Research, Funding, Impact, Staff, Resources, Publications, and Contact. The main content area displays the profile of Jason Swedlow, Professor of Quantitative Cell Biology, with a small profile picture and his position and address. Overlaid on this is a browser window showing a detailed view of a microscopy image. The browser address bar shows the URL: [https://nightshade.openmicroscopy.org/webgateway/img\\_detail/3933597/](https://nightshade.openmicroscopy.org/webgateway/img_detail/3933597/). The image viewer interface includes a "Viewing Options" panel on the left with settings for Normal view, Max Intensity, Split Channel, Quality (Normal), Zoom (100%), and Line Plot. Below this is the "Rendering Details" panel, showing "Channels - Edit" with three channels: 452 (blue), 528 (green), and 617 (red). The "Current Image" panel shows "Z: 43/85 | T: 1/1" and links for "Image Information", "Image Link", and "ROI Count: 0". The main image area shows a 3D rendering of a cell with a vertical "Z-sections" slider on the left and a horizontal "Timepoints" slider at the bottom. The image displays a cell with a complex internal structure, colored in red, green, and blue. To the right of the image viewer, there is a text block describing the image, mentioning "new daughter cells. Proper chromosome somes, and ends of microtubules. Our of chromosomes to microtubule at a special of cell division, especially in living cells and se tools to discover a new protein, Bod1, that ng the activity of Aurora B protein kinase. We the centromere and kinetochore of the mitotic". Below the text is a thumbnail image of the same cell, with a caption: "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." The footer of the browser window shows the copyright notice: "© 2007-2013 Glencoe Software Inc. All rights reserved."

# OMERO: Data Publication – raw data

OPEN  
BIOLOGY



Advanced

Home

Content

Information for

About us

Sign up

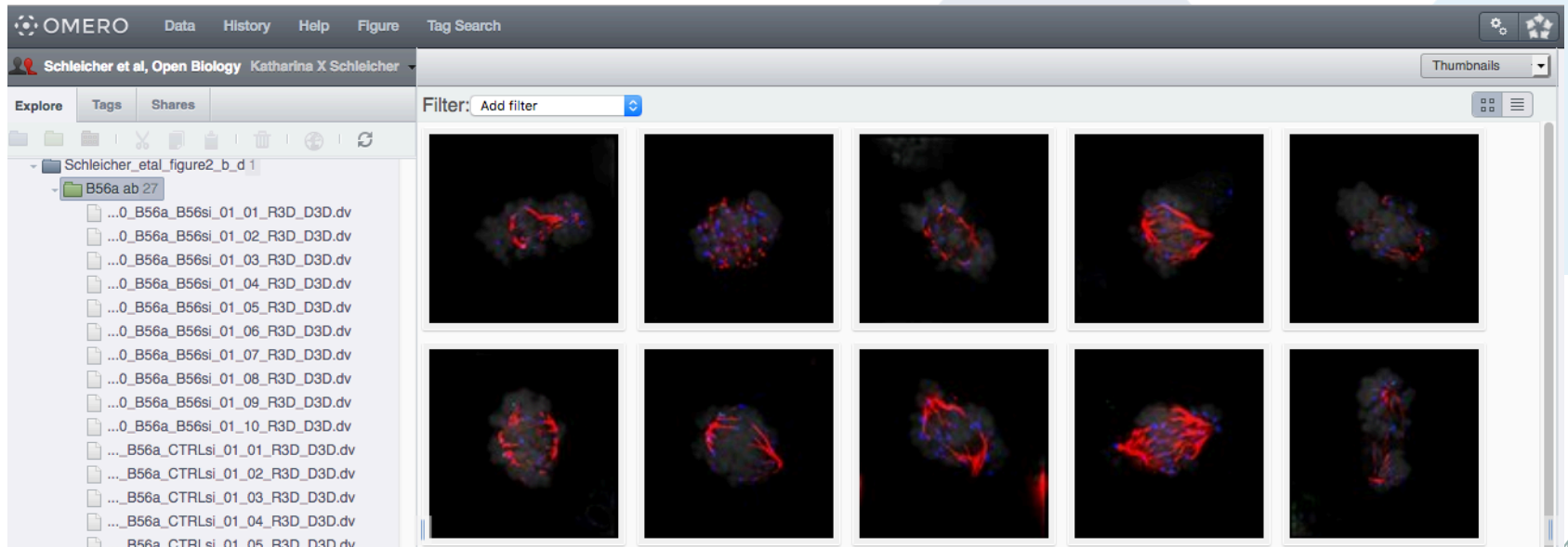
Submit



## The Ndc80 complex targets Bod1 to human mitotic kinetochores

Katharina Schleicher, Michael Porter, Sara ten Have, Ramasubramanian Sundaramoorthy, Iain M. Porter, Jason R. Swedlow

Published 15 November 2017. DOI: [10.1098/rsob.170099](https://doi.org/10.1098/rsob.170099)



# OMERO

## Data Publication: Image Data Resource



### Image Data Resource

Welcome to the Image Data Resource (IDR). This online, public data repository seeks to store, integrate and serve image datasets from published scientific studies.

[Take a look at the data](#)



# OMERO

## Data Publication: Image Data Resource

The screenshot displays the OMERO web interface. At the top, there are navigation tabs for 'Data', 'History', and 'Help'. A search bar and user profile are visible. The main area is divided into three sections:

- Left Panel (Explore):** A tree view showing a folder 'Demo data' with a sub-folder 'idr0015-UNKNOWN-taraoceans/screenA 44'. Below this, a list of image files is shown, including names like '...13\_09\_28\_19\_45\_25\_chamber--U00--V01'.
- Center Panel:** A grid of 15 small image thumbnails. Below the grid, a URL is displayed: 'idr-demo.openmicroscopy.org/tara/webclient/img\_detail/43080/?c=1:0:255\$FF0000,2:0:244\$00FF00,3:0:255\$877887,4:0:1'.
- Right Panel (General):** Metadata for the selected image. It includes:
  - General: TARA\_HCS1\_H5\_G100008302\_G1000083, 04--2013\_12\_02\_21\_30\_23\_chamber--U00--V01
  - Plate ID: 303
  - Owner: Demo User
  - Creation Date: 2015-10-05 02:15:01
  - ANNOTATIONS: A list of key-value pairs such as 'SAMPLE\_BARCODE\_URI\_Web http://store...', 'STATION\_LABEL TARA\_129', 'EVENT\_LABEL Complementa...', 'EVENT\_DEVICE\_LABEL PUMP:High Volume Peristaltic F...', 'EVENT\_URL\_Event\_Logsheet http://store.pangaea.de/Projects...', 'EVENT\_INVESTIGATOR (Probert)', 'EVENT\_COMMENTS COMMENT\_on\_Logsheet-en/a...', 'SAMPLE\_DEPTH\_Sampling\_C P', 'SAMPLE\_DEPTH\_Intended\_No S', 'SAMPLE\_DEPTH\_Intended\_Co nan', 'SAMPLE\_DEPTH\_Intended\_m 0', 'SAMPLE\_PROTOCOL\_LABEL PROT', 'SAMPLE\_PROTOCOL\_LABEL ORGANISMS', 'SAMPLE\_PROTOCOL\_LABEL ENERGY'.

Below the main interface, there are two additional components:

- Viewing Options Panel:** Contains controls for 'Normal' view, 'Max Intensity', 'Split Channel', 'Quality' (Normal), 'Zoom (%)' (144), 'Line Plot', 'Rendering Details' (Channels - Edit, Grayscale, Rendering Settings), 'Current Image' (Z: 11/20 | T: 1/1), and 'ROI Count: 0'.
- Z-sections and Timepoints:** A vertical slider for 'Z-sections' and a horizontal slider for 'Timepoints' are positioned over a large image of a biological specimen.
- TARA OCEANS Data Entry Form:** A form for recording data from the TARA OCEANS mission. It includes:
  - Header: TARA OCEANS Tara.UTC YYYY MM DD HH MM ### EVENT\_PUMP\_01
  - Start/End: Start 2011 09 10 17 57, End 2011 09 11 01 24, Station 129.
  - Coordinates: LAT 06 40.257, DD W, LON 153 03.945, DDD MM.MMM, PUMP# 1, DAY / NIGHT DAY.
  - OPERATORS: JP, DEPTH\_Intended (m) SURFACE, CABLE\_Length (m), Angle (deg), Speed (m/s) 1.0.
  - OPERATION TABLE:
 

OPERATION	START TIME (HH:MM)	END TIME (HH:MM)	PUMP RATE (Hz)	COMMENTS
Rinsing Pump:	17:57	18:02	60	
Filling 200L (B&V):	18:03	18:10	60	
Filling 200L GPSS (PROT&G):	18:11	18:36	20	
Filling 200L (B&V):	-	-	-	
Flow through GPSS (when 5um net is not avail.) (indicate pauses)	18:52	21:27	20	Upper 5um net probably broken
	21:36	23:10	20	
	23:33	01:24	20	
  - PUMPING\_Information: PUMPING\_Depth\_Max (m), PUMPING\_Depth\_Min (m), PUMPING\_Duration (HHMM).
  - Depth Information: Depth\_SRF (m), Depth\_TopDCM (m), Depth\_DCM (m), Depth\_BotDCM (m), Depth\_BotML (m).

# OMERO.figure

## Winner of the SLS innovator of the Year

OMERO.figure - Porter et al x

will-moore.github.io/figure/demo/#file/1

OMERO File Edit Help Can't Save Porter et al, Bod1: 2007 Add Image Delete Export PDF

DNA AuroraB tubulin merged

Control siRNA Bod1 siRNA

Control siRNA Bod1 siRNA

Control siRNA Bod1 siRNA

Control siRNA Bod1 siRNA

Info Preview Labels

Z

15/28 T 1/1

484 1731

1021 2725

2504 4009

Zoom: 100%

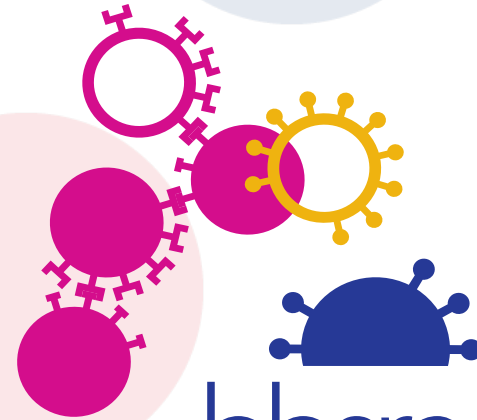
125

# Some useful links

- OMERO Downloads:
  - <https://downloads.openmicroscopy.org/omero/>
- OMERO Help Pages:
  - <http://help.openmicroscopy.org/>
- OMERO Forums:
  - <https://www.openmicroscopy.org/community/>
- OMERO demo server:
  - <http://help.openmicroscopy.org/demo-server.html>



# Thank to Funders

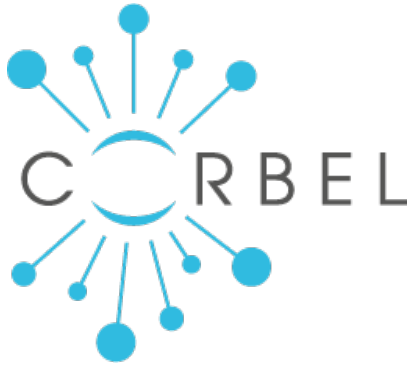


MULTI



bbsrc

biotechnology and biological sciences  
research council



GLOBAL  
BIOIMAGING  
growing collaboration

