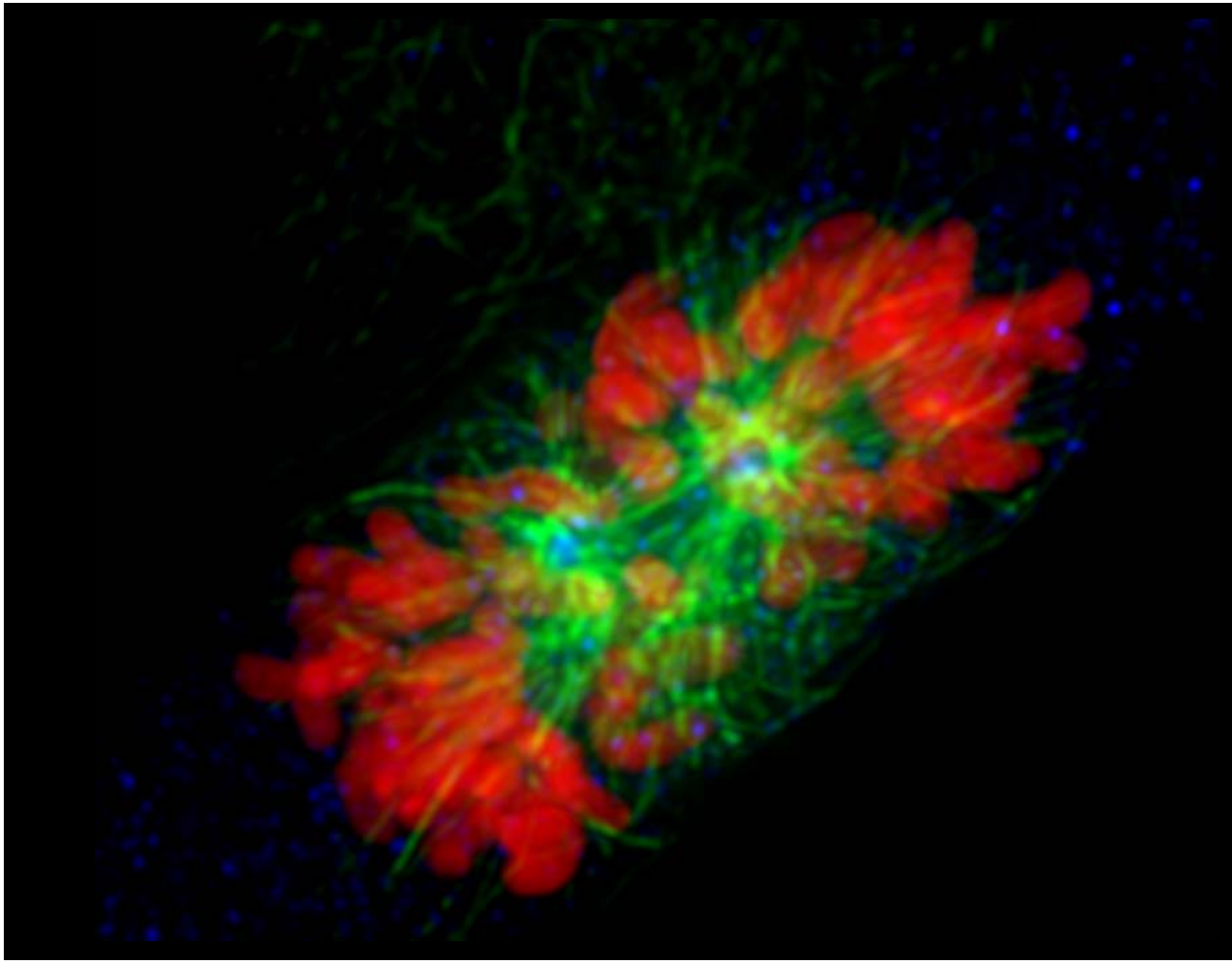
The Open Microscopy Environment: Image Informatics for Biological Sciences

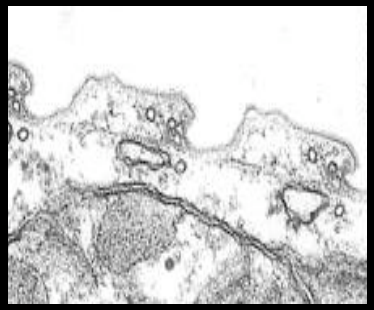
Jason Swedlow
University of Dundee

The Image Problem…

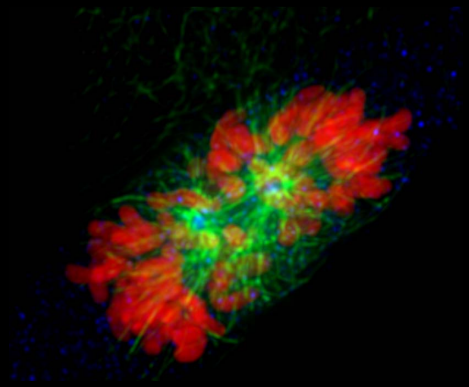


- A pretty picture?
- A measurement?

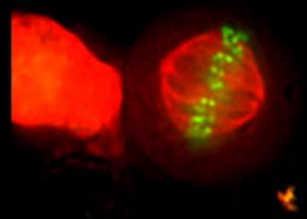
The Image Problem…is ubiquitous



Organelles

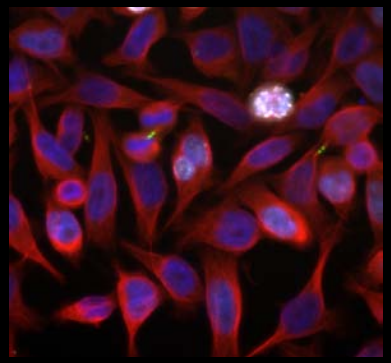


Cells



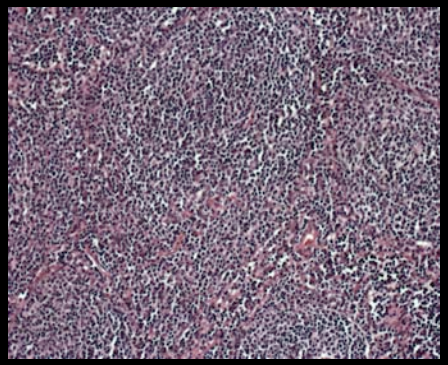
Dynamics

- **A pretty picture?**
- **A measurement?**



Lead Discovery
Target Validation

Physiology



Pathology

In Vivo

Talk Outline

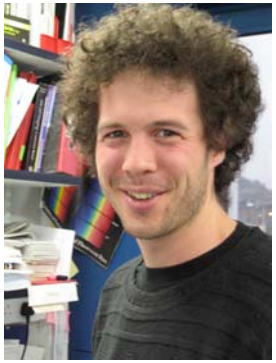
- **OME Team**
- **OME & Glencoe Software**
- **OME Strategic Award**
- **Future Aims**

OME Dundee

Jean-Marie Burel

Donald McDonald

Brian Loranger



Will Moore

Scott Loynton

Chris Allan

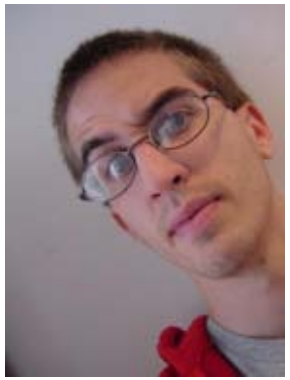
Aleksandra Tarkowska

Andrew Patterson

Colin Blackburn

Simon Wells

Glencoe Software



Josh Moore

Carlos Neves

Melissa Linkert

OME/LOCI

Kevin Eliceiri

Curtis Rueden

Community-Led Data Management for Life Sciences

- Open
- GPL License
- Freely available
- Supported by email lists

- Open
- GPL License
- SaaS, Commercial licenses for OMERO
- Customized, supported, warrantied

What is Glencoe Software?

- **Software Start-up**
  - ✓**Wholly owned**
  - ✓**Self-funded**
- **OEM partnerships providing software infrastructure for imaging**
- **Commercial licenses and/or customization and support of OME software**
- **Major contributors to Bio-Formats & OMERO GPL code base**

Glencoe Clients

- AppliedPrecision®
- JCB THE JOURNAL OF CELL BIOLOGY
- PerkinElmer® precisely.
- CANCER RESEARCH UK
- THE CELL an image library
- HARVARD Medical School

JCB DataViewer: Access to Original Image Data

JCB Data Viewer

GLENCOE SOFTWARE

THE ROCKEFELLER UNIVERSITY PRESS
QUALITY AND INTEGRITY

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Current Issue

See the Editorial for more details about data download.

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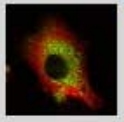
Welcome to the JCB DataViewer!

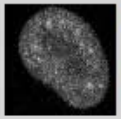
The JCB DataViewer is a browser-based application designed to facilitate viewing, analysis, and sharing of multi-dimensional image data associated with articles published in The Journal of Cell Biology.

For more information about the JCB DataViewer click here.

Featured Images



The dynamic interaction of AMBRA1 with the dynein motor complex regulates mammalian autophagy
Sabrina Di Bartolomeo, Marco Corazzari, Francesca Nazio, Serafina Oliverio, Gaia Lisi, Manuela Antonioli, Vittoria Pagliarini, Silvia Matteoni, Claudia Fuoco, Luigi Giunta, Marcello D'Amelio, Roberta Nardacci, Alessandra Romagnoli, Mauro Piacentini, Francesco Cecconi, Gian Maria Fimia
jcb. 2010. 191:155-168 DOI: 10.1083/jcb.201002100.
Full Viewer | Article | Figure



The differential interaction of snRNPs with pre-mRNA reveals splicing kinetics in living cells
Martina Huranová, Ivan Ivani, Aleš Benda, Ina Poser, Yehuda Brody, Martin Hof, Yaron Shav-Tal, Karla M. Neugebauer, David Staněk
jcb. 2010. 191:75-86 DOI: 10.1083/jcb.201004030.
Full Viewer | Article | Figure

Kinesin-1 and dynein at the nuclear envelope mediate the bidirectional migrations of nuclei
Heidi N. Fridolfsson, Daniel A. Starr
jcb. 2010. 191:115-128 DOI: 10.1083/jcb.201004118.
Full Viewer | Article | Figure

Protein turnover of the Wallenda/DLK kinase regulates a retrograde response to axonal injury

jcb-dataviewer.rupress.org

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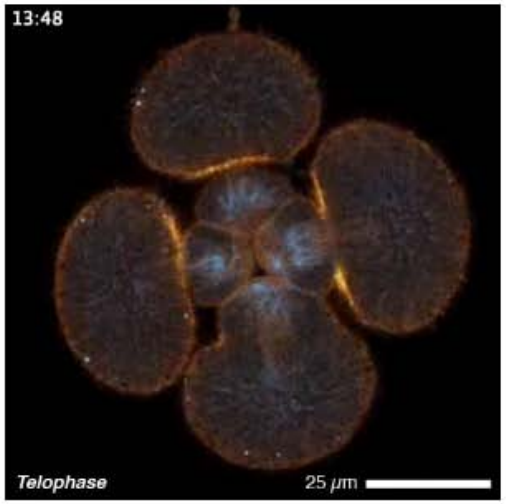
Watch the Neuroscience Information Framework hosted webinar on The Cell. Just click here.

Looking for a new wallpaper? Inside NIF: The Cell, An Image Library - great science images formatted for your phone!

Featured Image

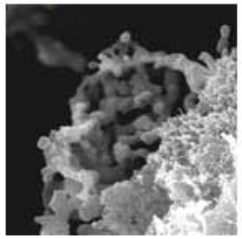


Like 22

Purple sea urchin embryos undergoing mitosis. Embryos are expressing GFP-rhotekin GTPase binding domain, which is a probe for active Rho, with 3xmCherry-Ensconsin (a microtubule asociated protein shown in blue). Embryos were imaged with a laser scanning confocal microscope (Radiance 2000; Bio-Rad...more

Image contributed by George Von Dassow

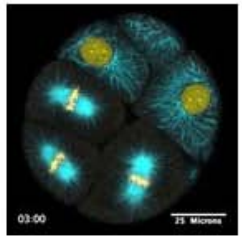
Images of Note



CIL:12659*
NCBI Organism
- *Danio rerio* (zebrafish)

Biological Process
- notochord formation

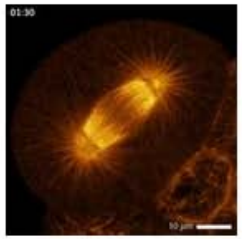
Cellular Component
- extracellular matrix



CIL:15792*
NCBI Organism
- *Strongylocentrotus purpuratus* (California purple urchin)

Biological Process
- cytokinesis after mitosis

Cellular Component
- microtubule



CIL:15806*
NCBI Organism
- *Dendraster excentricus*

Biological Process
- mitotic anaphase

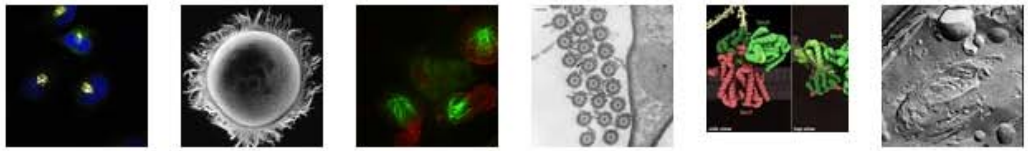
Cellular Component
- microtubule

CIL:11110*
NCBI Organism
- *Parophrys vetulus* (English sole)

Biological Process
- none specified

Cellular Component
- cell surface

Recent Images



celllibrary.org

Interoperability

- ✓ ***Metadata***
- ✓ ***Interfaces***

OME: What We Will Do

OME Data Model

OME-TIFF
&
Bio-Formats:

Open File Formats

OMERO:

Open source,

Enterprise

Data Management

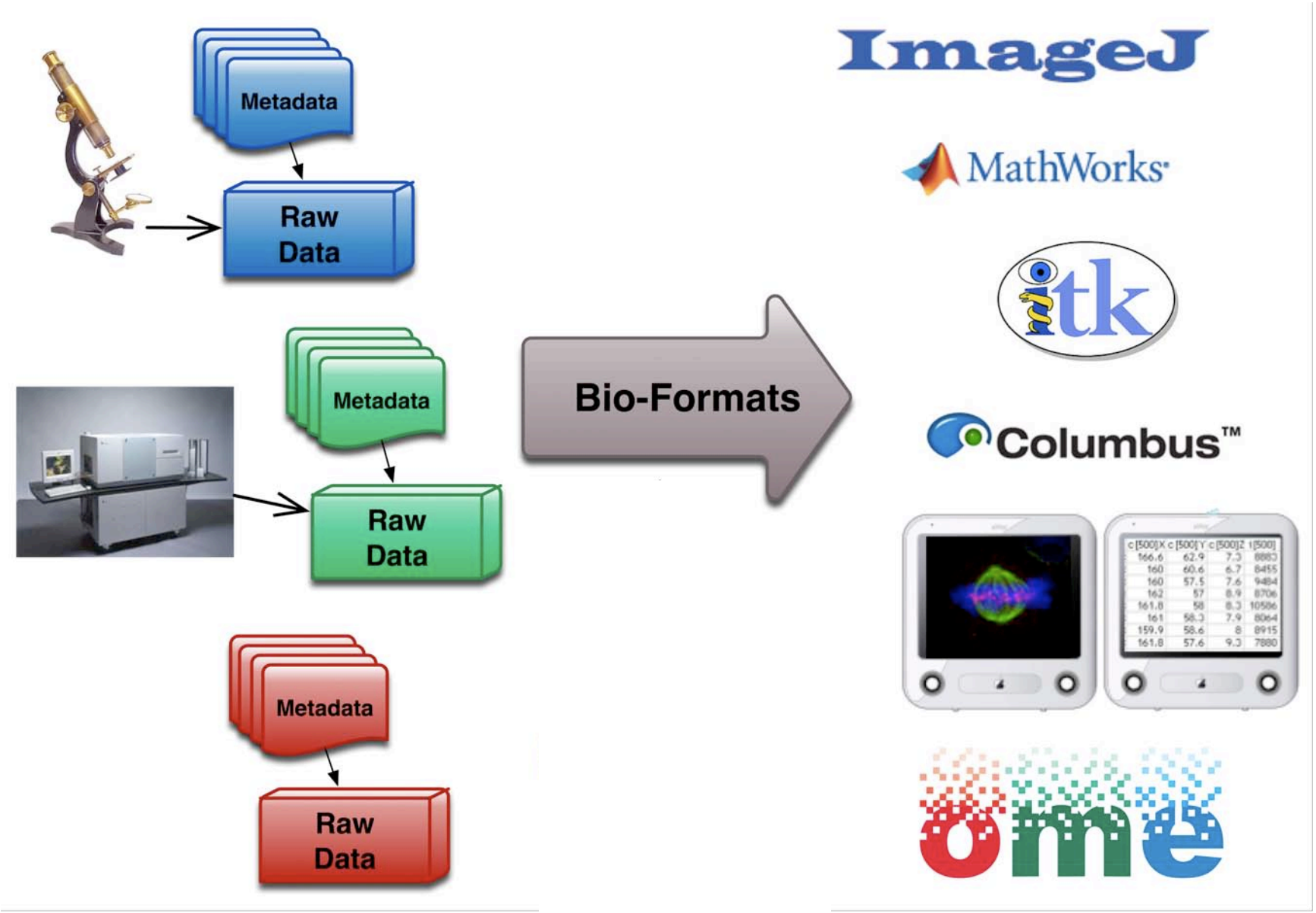
OME: What We Will Do

Dundee: 16 positions Satellites: 9 positions

Development Support Integration

wellcome trust

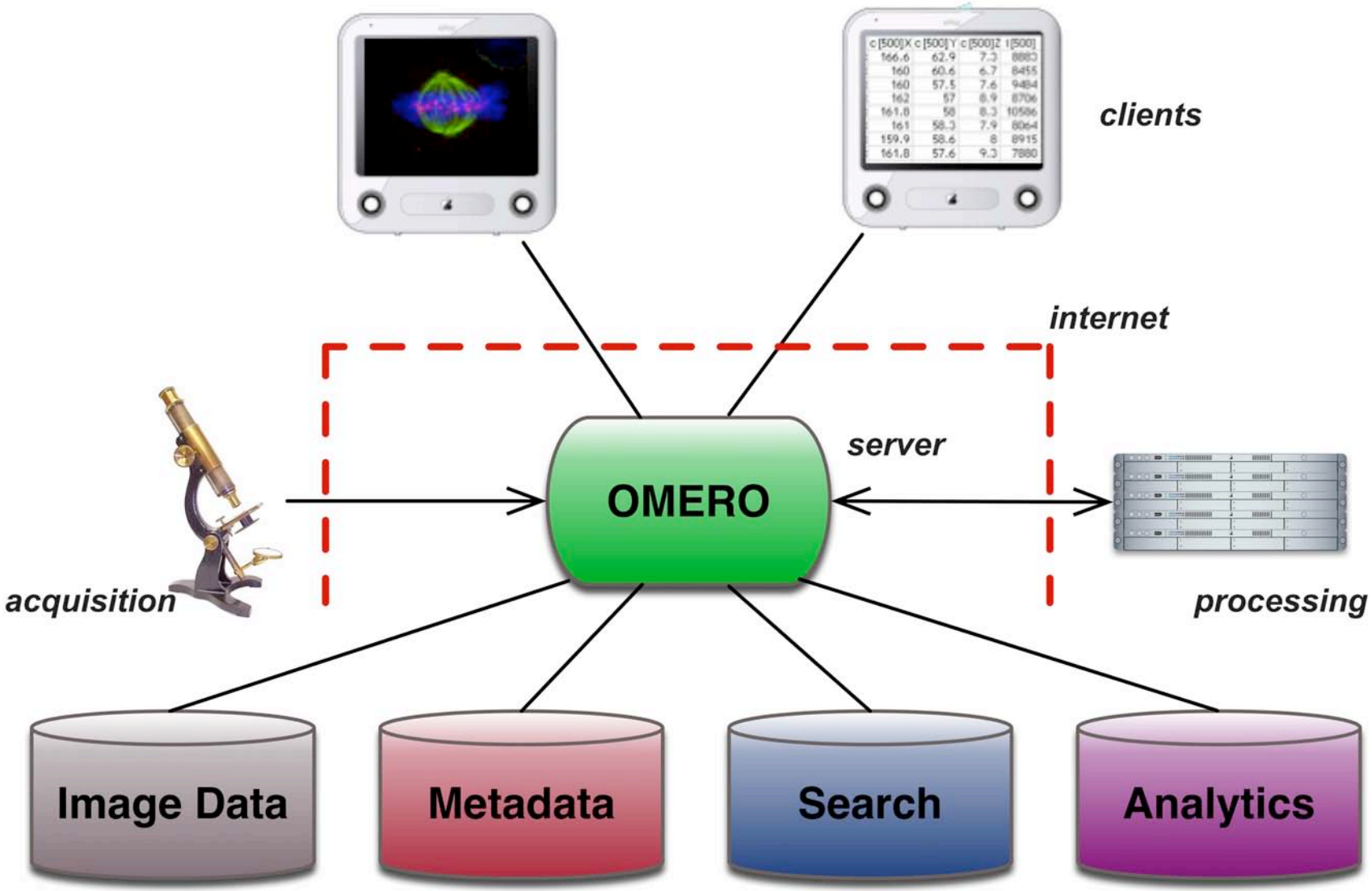
OME Bio-Formats: Proprietary File Conversion



OME Bio-Formats: Outputs

- *Expanded coverage of file format types, with support for N-dimensional data (FLIM, SPIM, Big Lambda, etc.)*
- *Port to C++, for incorporation into software using C++, Qt, etc.*
- *Support for any alternative image data storage methods (e.g., HDF5, netCDF) that arise*
- *Support for defined ontologies for image data annotation*

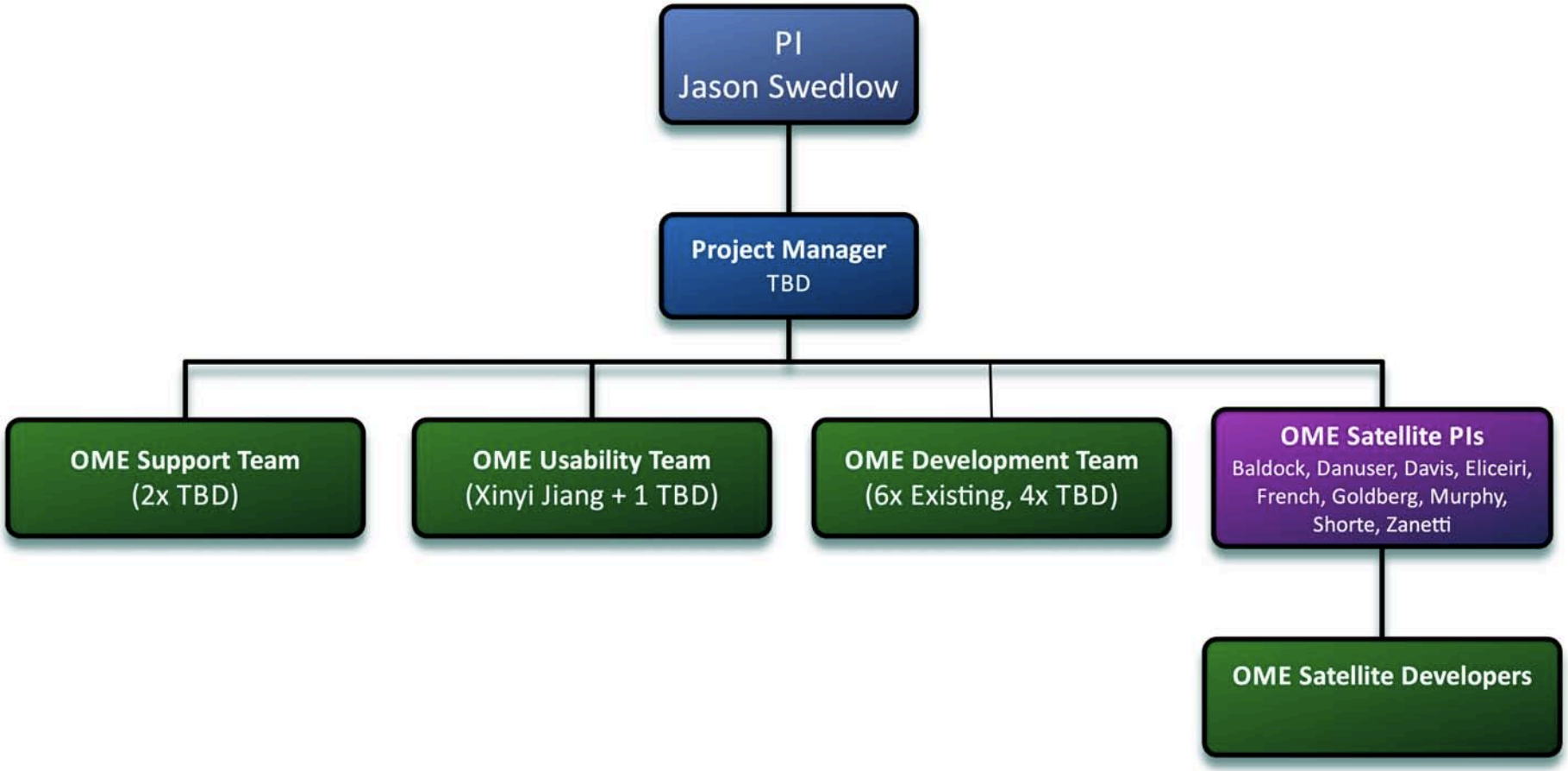
The OMERO Platform



The OMERO Platform: Outputs

- Addition of new image processing and analysis algorithms, either released with OMERO, or available to download and integrate;
- Improved visualisation of analytic results in OMERO;
- Expanded data analysis facility, including a central repository for image analysis tools;
- Integration of several machine learning tools, to enable these tools to work with large, shared datasets; support for defined ontologies for image data annotation
- Export of data in OMERO installations to JCB DataViewer, ASCB CELL, or any other established repository that appears during the term of the project;
- Support for publishing of any data within an installation, available to the public using a standard URL, including search robot-readable metadata

Proposed Project Structure



OME Satellites

To bring these facilities into OMERO and thus into the hands of the wider community, we have defined nine world-leading groups and/or facilities that:

- have new data acquisition platforms and/or data types that must be supported by Bio-Formats & OMERO (***Davis***/Oxford; **French**/Imperial; ***Shorte***/Pasteur);
- have large, diverse imaging platforms with significant requirements for data integration and management (***Davis***/Oxford; **French**/Imperial; ***Shorte***/Pasteur)
- have well-established expertise developing new image analysis tools (***Danuser***/Harvard; ***Baldock***/Edinburgh; ***Murphy***/CMU; ***Goldberg***/NIA-NIH);
- are running image repositories and/or software development projects for biological imaging and/or discovery (***Baldock***/Edinburgh; ***Eliceiri***/ Madison; ***Murphy***/CMU; ***Goldberg***/NIA-NIH);
- have strong experience developing and deploying large scale scientific computing resources, specifically to deliver solutions for large data problems (***Zanetti***/CRS4).

DMIB: "OMERO in Action"

- **One year JISC-funded project @ UEA/John Innes to build cross-campus image data resource based on OMERO.**
- **Project lead: Jerome Avondo (http://dmbi.nbi.bbsrc.ac.uk)**
- ***"OMERO in Action"* 6-8 April, 2011; 77 Attendees**

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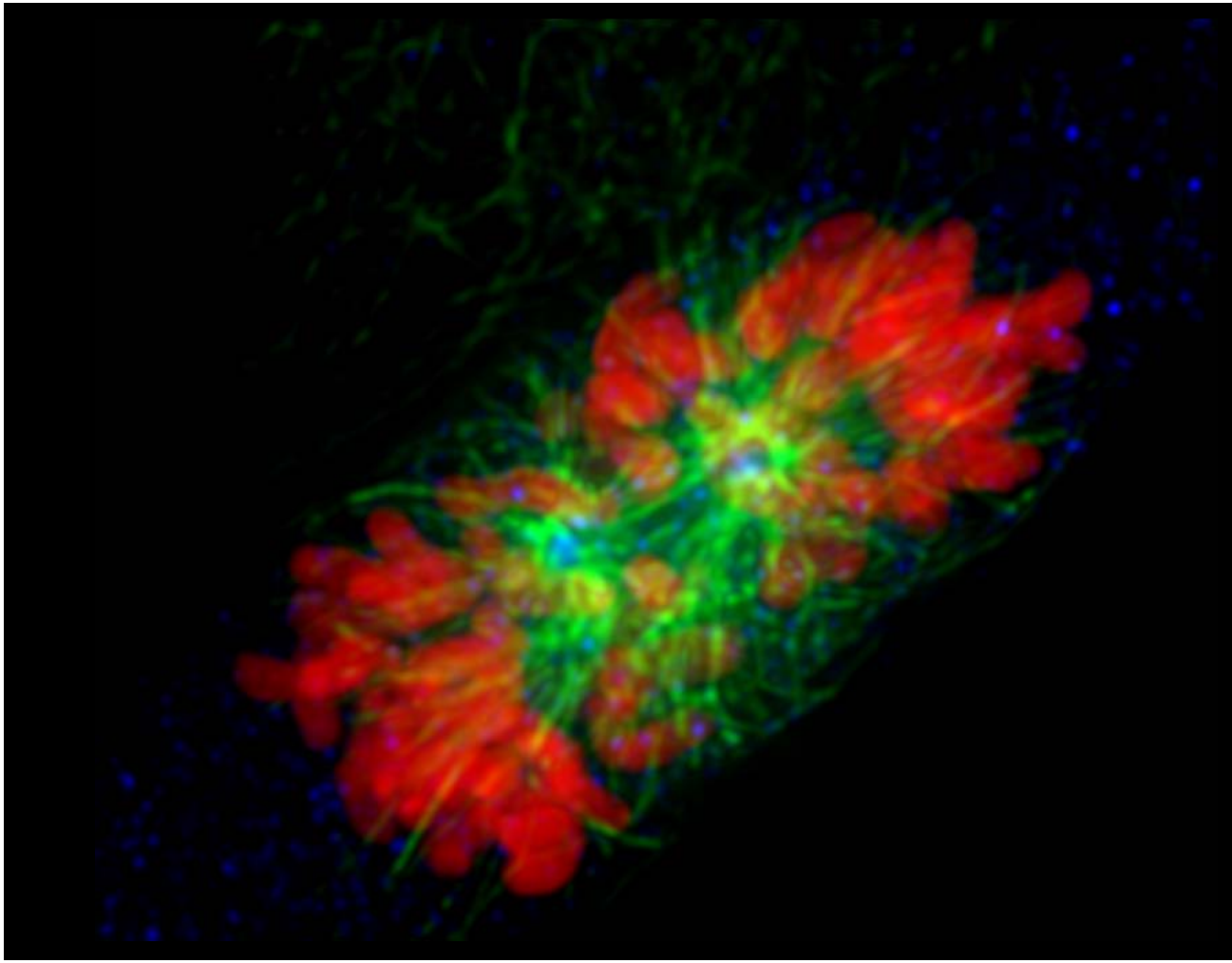
CRAG-CSIC Spain
European Bioinformatics Institute
Google
Institute of Food Research
Imperial College London
JIC
JISC
Lambert Instruments
Laser2000 UK Ltd
Max Planck Institute, Dresden
Medical Research Council
NIMR London
Rothamsted
The Sainsbury Laboratory
University of East Anglia
University of Sussex
University of Cambridge
University of Dundee
University of Edinburgh
University of Geneva
University of Manchester
University of Newcastle
University of Oxford
University of Sussex
VIB, Belgium

Questions….

1. *Priorities– what and when*
2. *Applications*
3. *Long-term sustainability*
4. *SAB-- ideas*

The Value Proposition…



- Accessible
- Analysable
- Secure
- Shareable
- Publishable