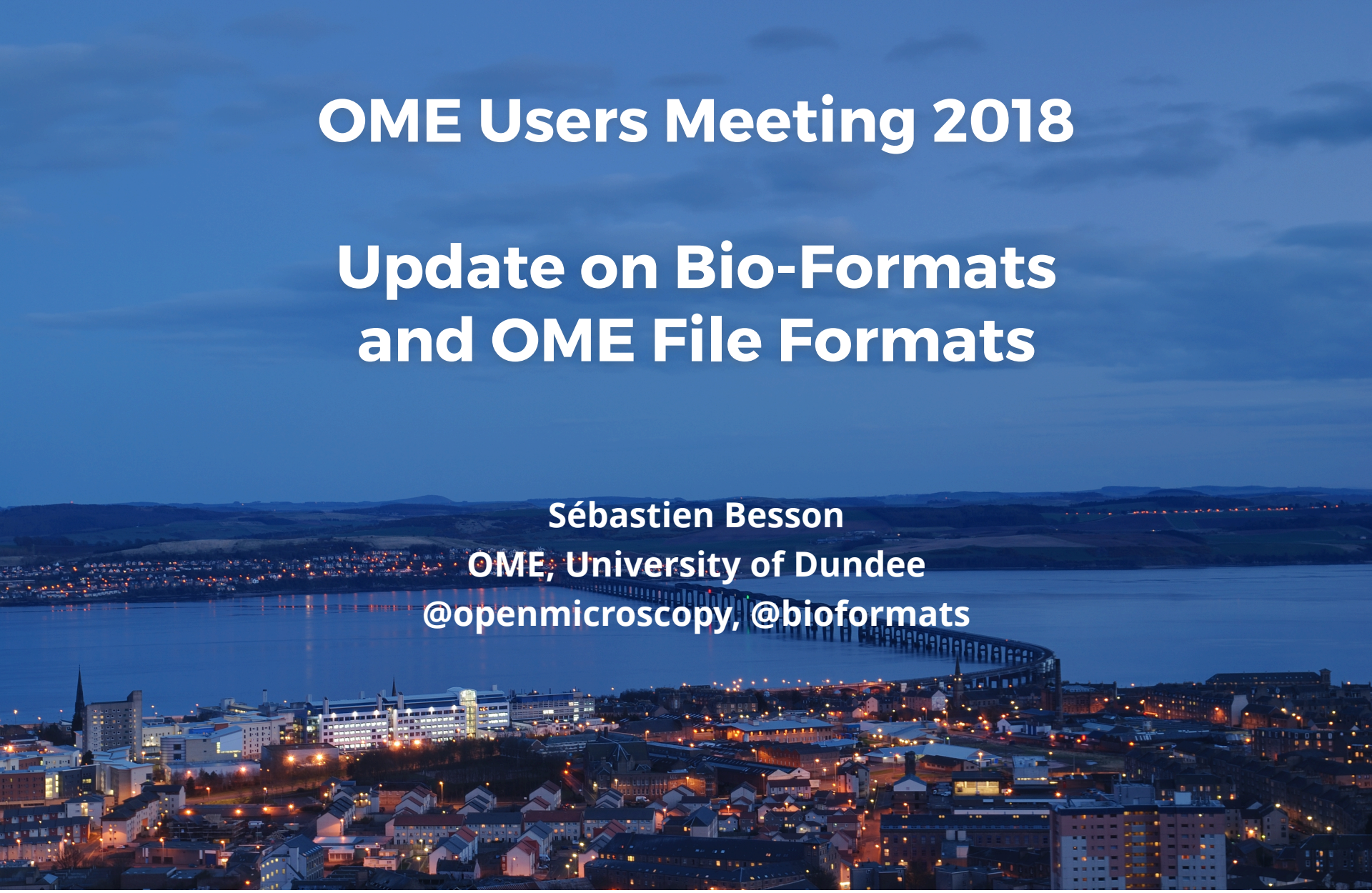
OME Users Meeting 2018

Update on Bio-Formats and OME File Formats

Sébastien Besson
OME, University of Dundee
@openmicroscopy, @bioformats

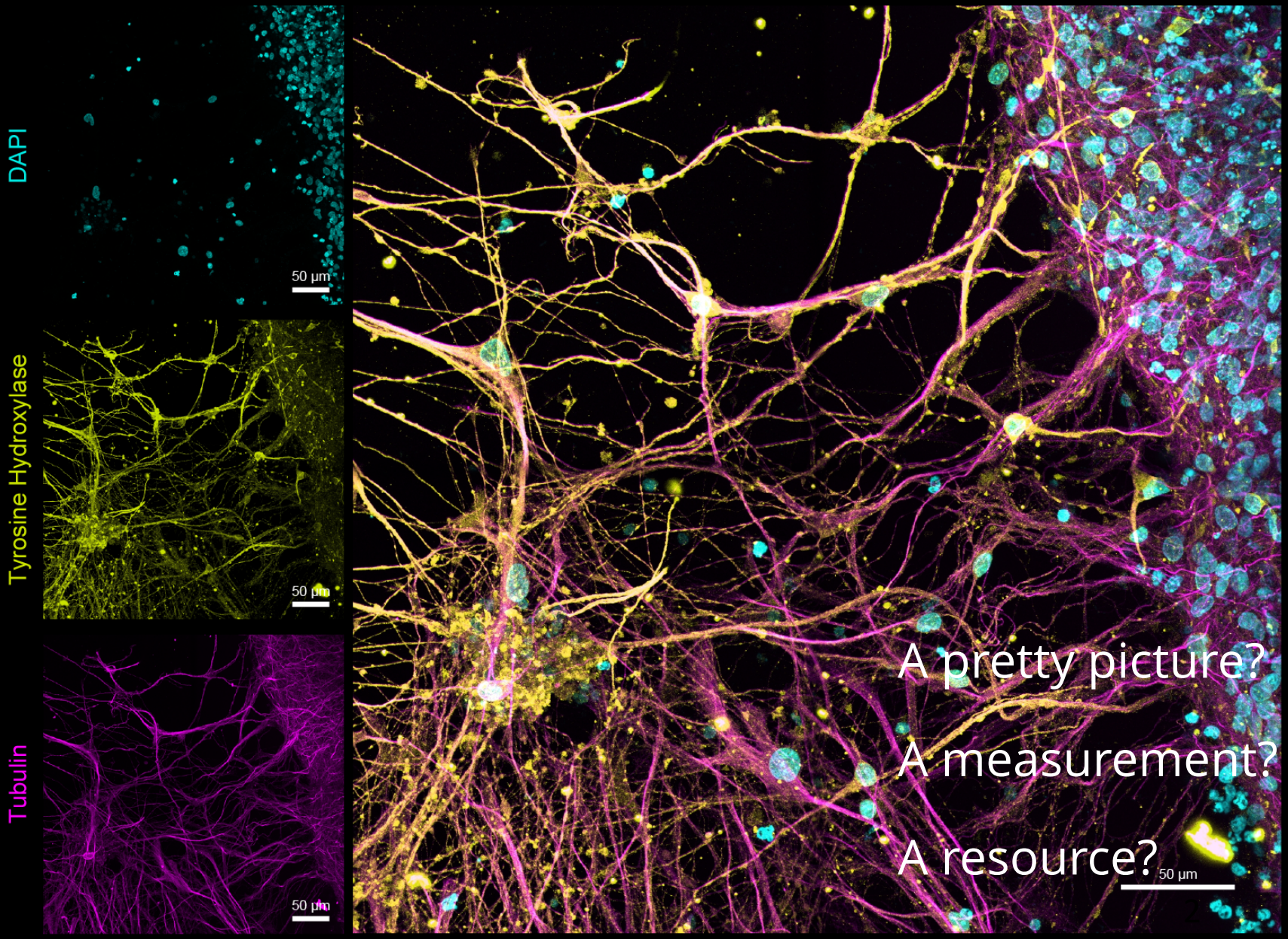


University of Dundee

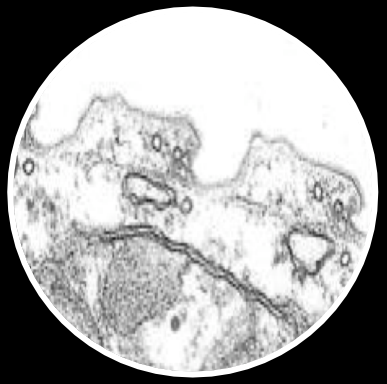
THE PROBLEM

1

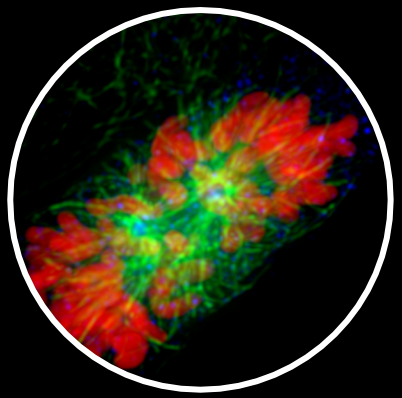
Solving the Image Problem *is Essential*



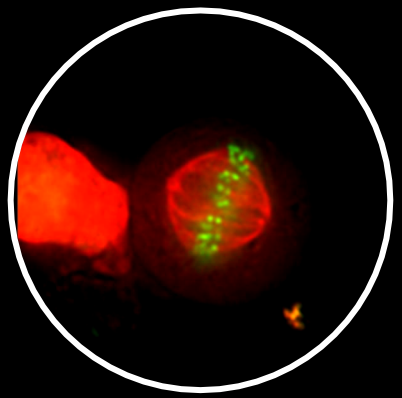
The Image Problem is Ubiquitous



Organelles

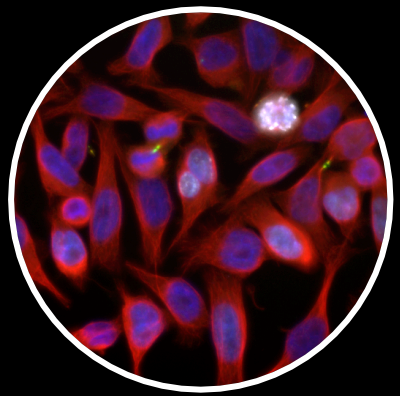


Cells

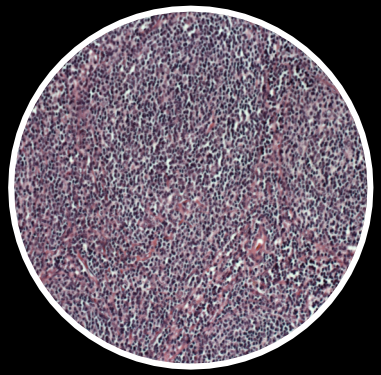


Dynamics

Physiology



Lead Discovery
Target Validation



Pathology

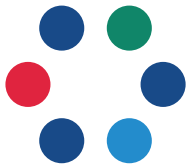
In Vivo

A pretty picture?

A measurement?

A resource?

Tools for reading & writing image data



Common Vocabulary

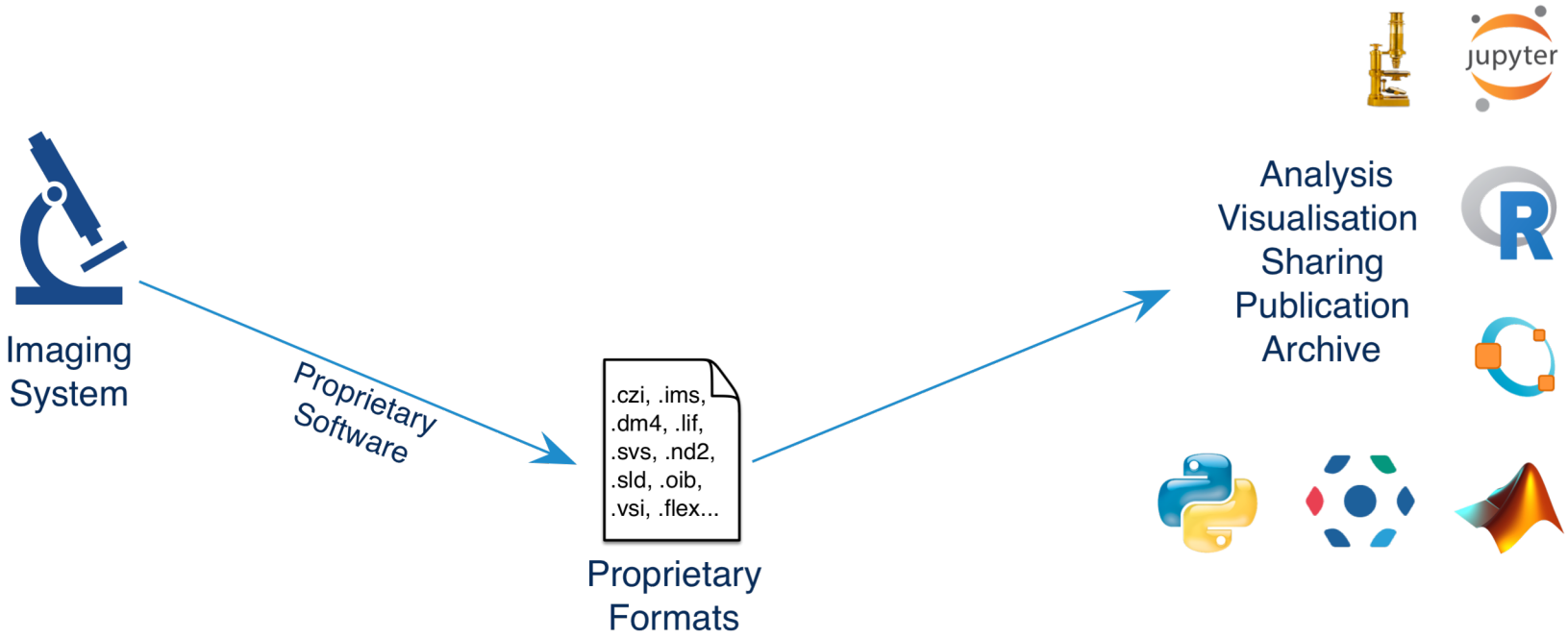
OME-FILES

BIO-FORMATS

OMERO

https://www.openmicroscopy.org

Tools for reading & writing image data



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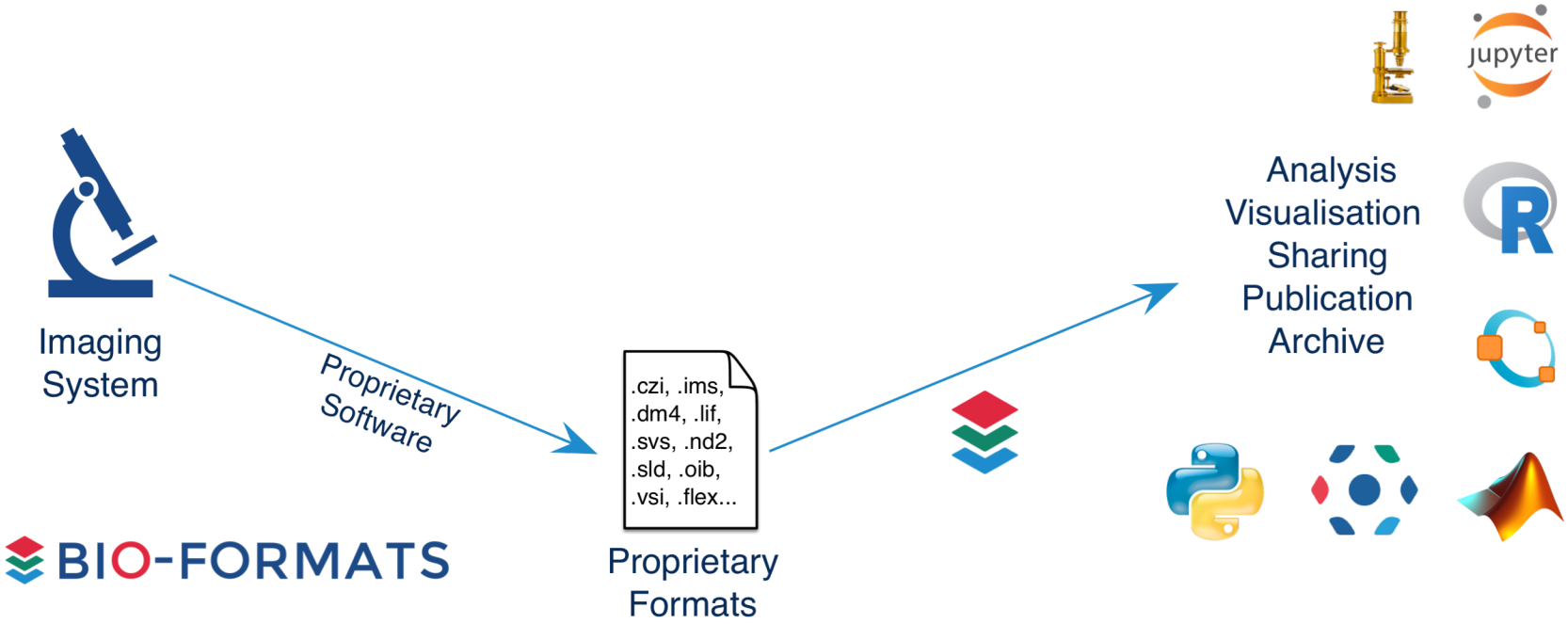
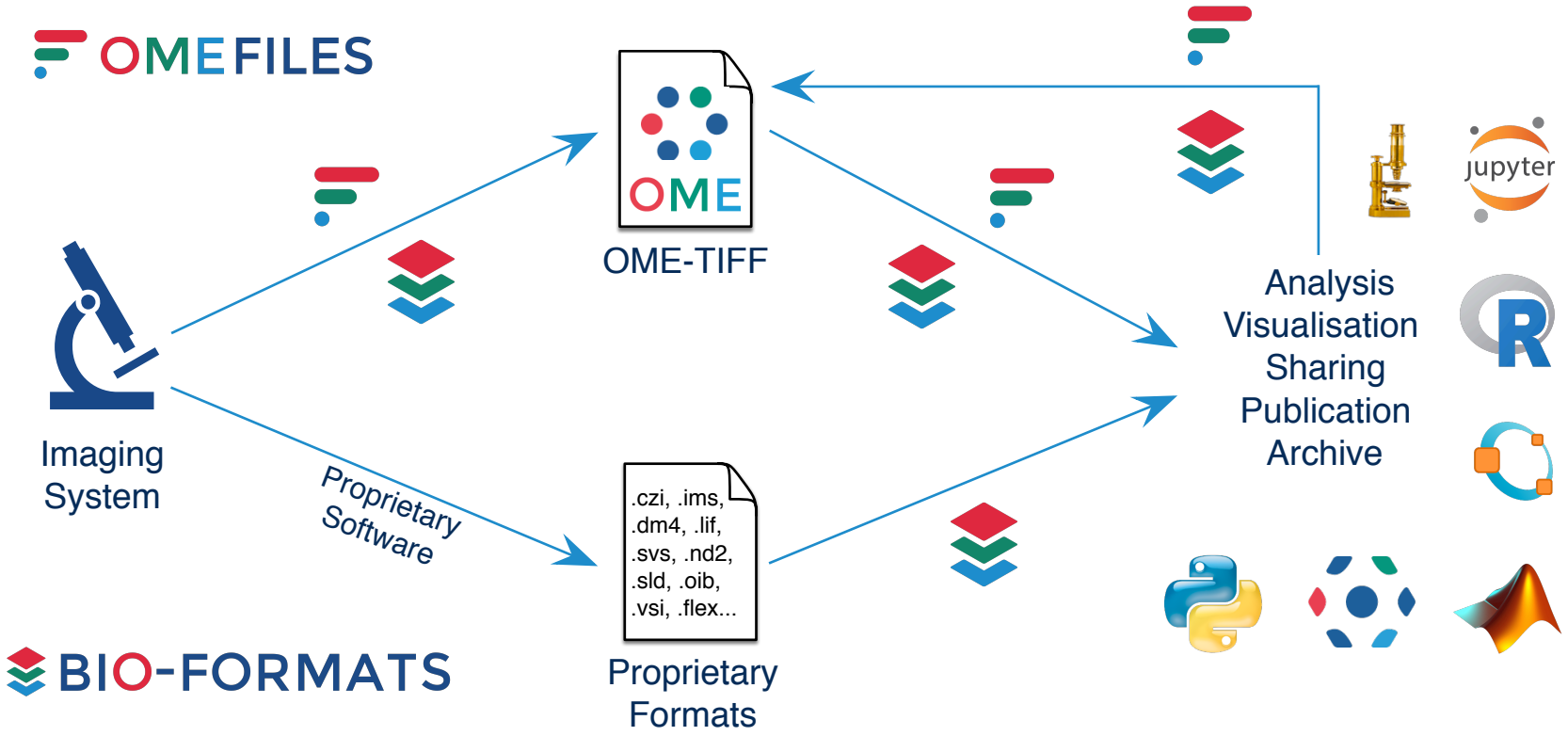
Tools for reading & writing image data



https://www.openmicroscopy.org

Tools for reading & writing image data



https://www.openmicroscopy.org

BIO-FORMATS

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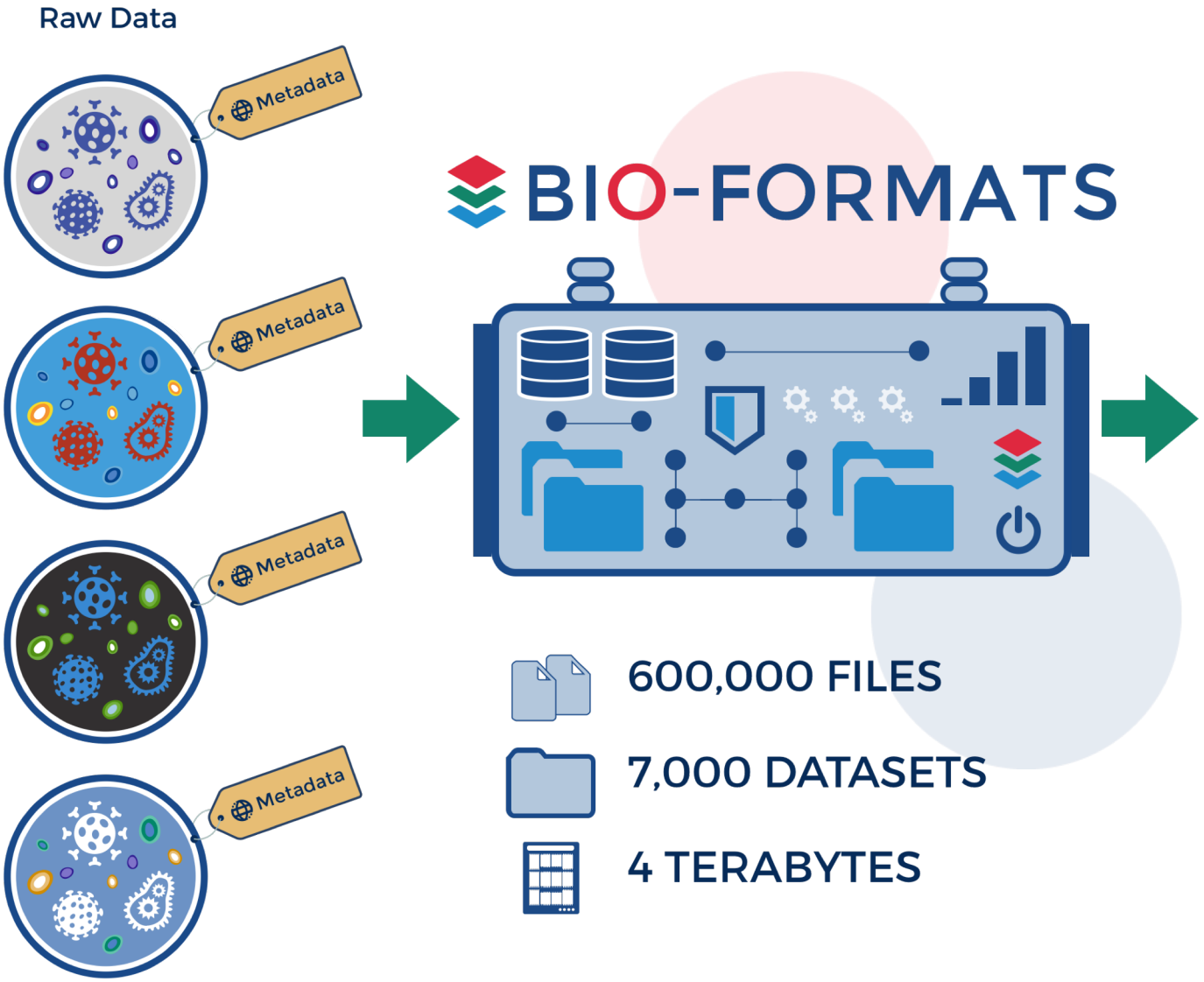
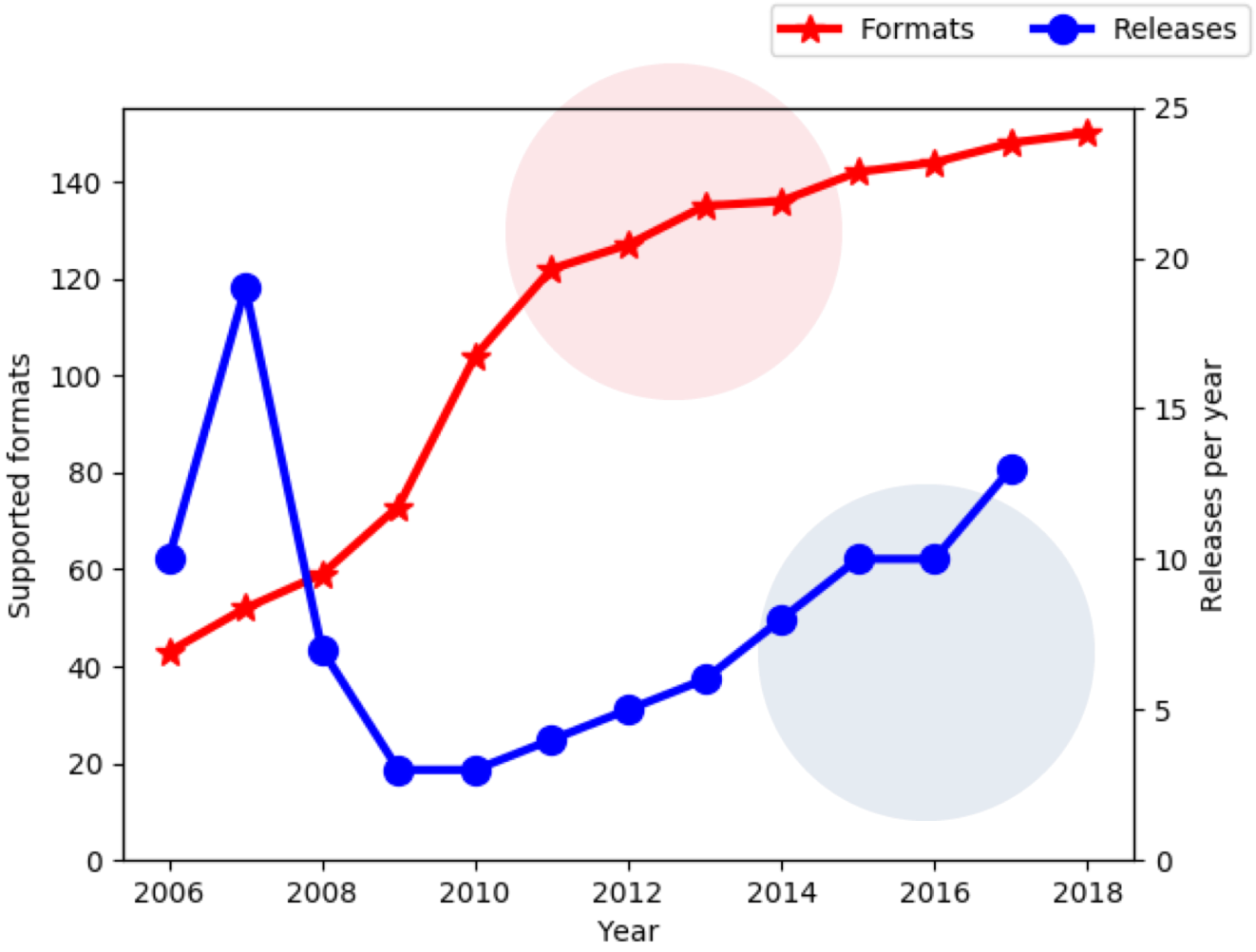
Bio-Formats: Proprietary File Conversion

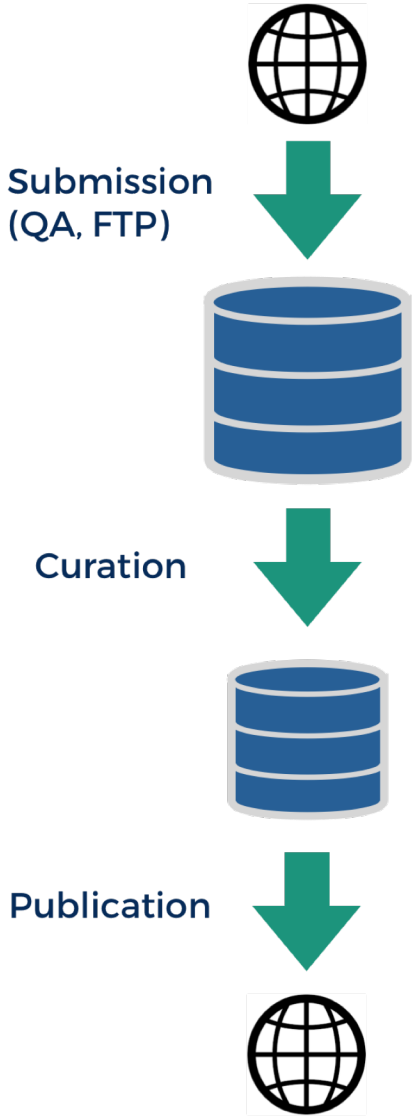


Bio-Formats: usage and formats support



https://www.openmicroscopy.org/bio-formats/

OME QA Repository

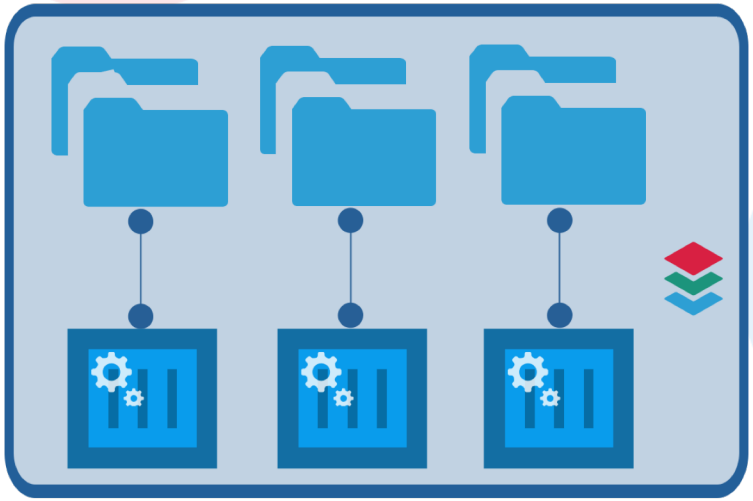


2017	2018
Single executor	Distributed per format
24h	3-5h

Jenkins

docker

Testing

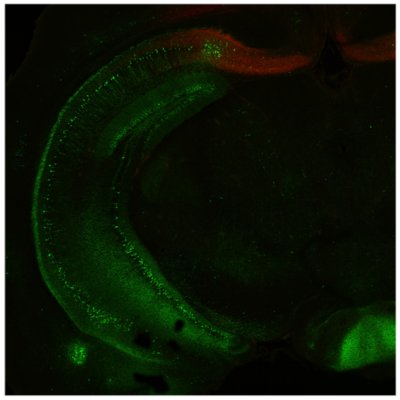


https://downloads.openmicroscopy.org/images/

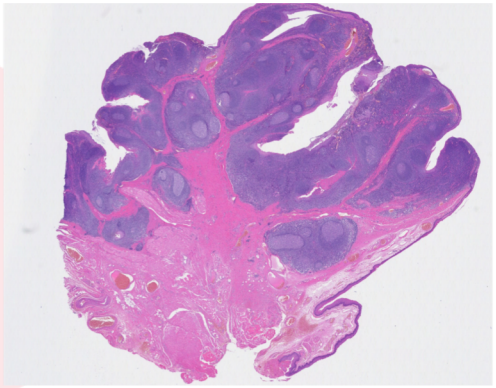
Bio-Formats: 2017/2018 new file formats

Glencoe SOFTWARE

OLYMPUS

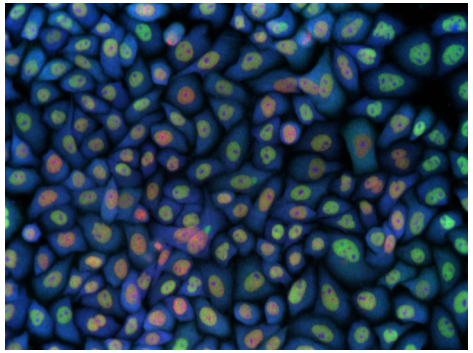


PerkinElmer

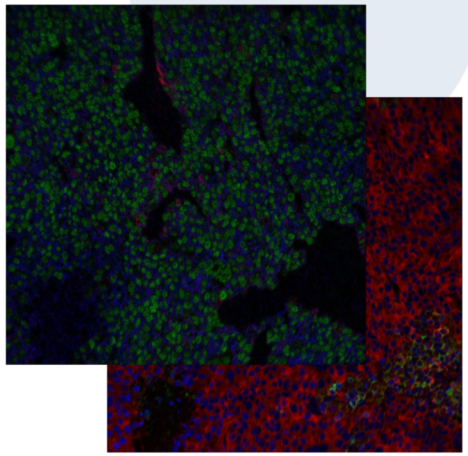


CV7000?

BDV, KLB??



IDR



IONpath

Supporting new file formats

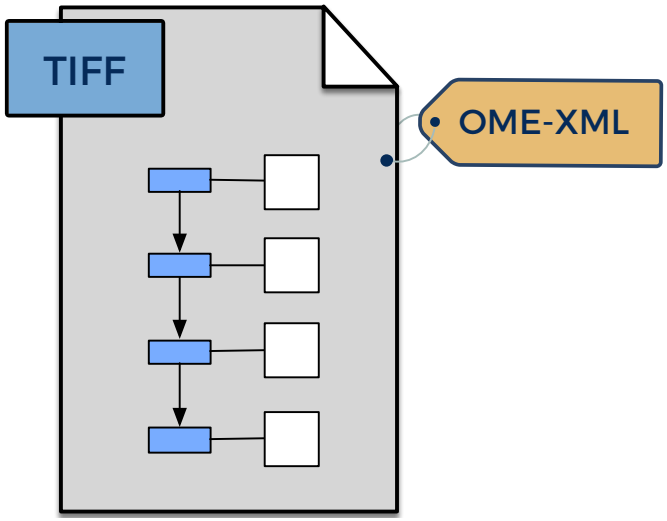
- New file format means new Bio-Formats reader
  - New data layout (binary data and metadata)
  - Breaking version of existing file formats
- Adding a new reader is costly
  - Implementation i.e. development, testing & integration
  - Maintenance i.e. long-term support
- Sustainable format support
  - Decision process for adding new formats
  - Technical evaluation and extensive material collection
  - Commitment from format developers and partnerships

http://blog.openmicroscopy.org/file-formats/community/2016/08/31/bf-partnerships/

OPEN FILE FORMATS & OME FILES

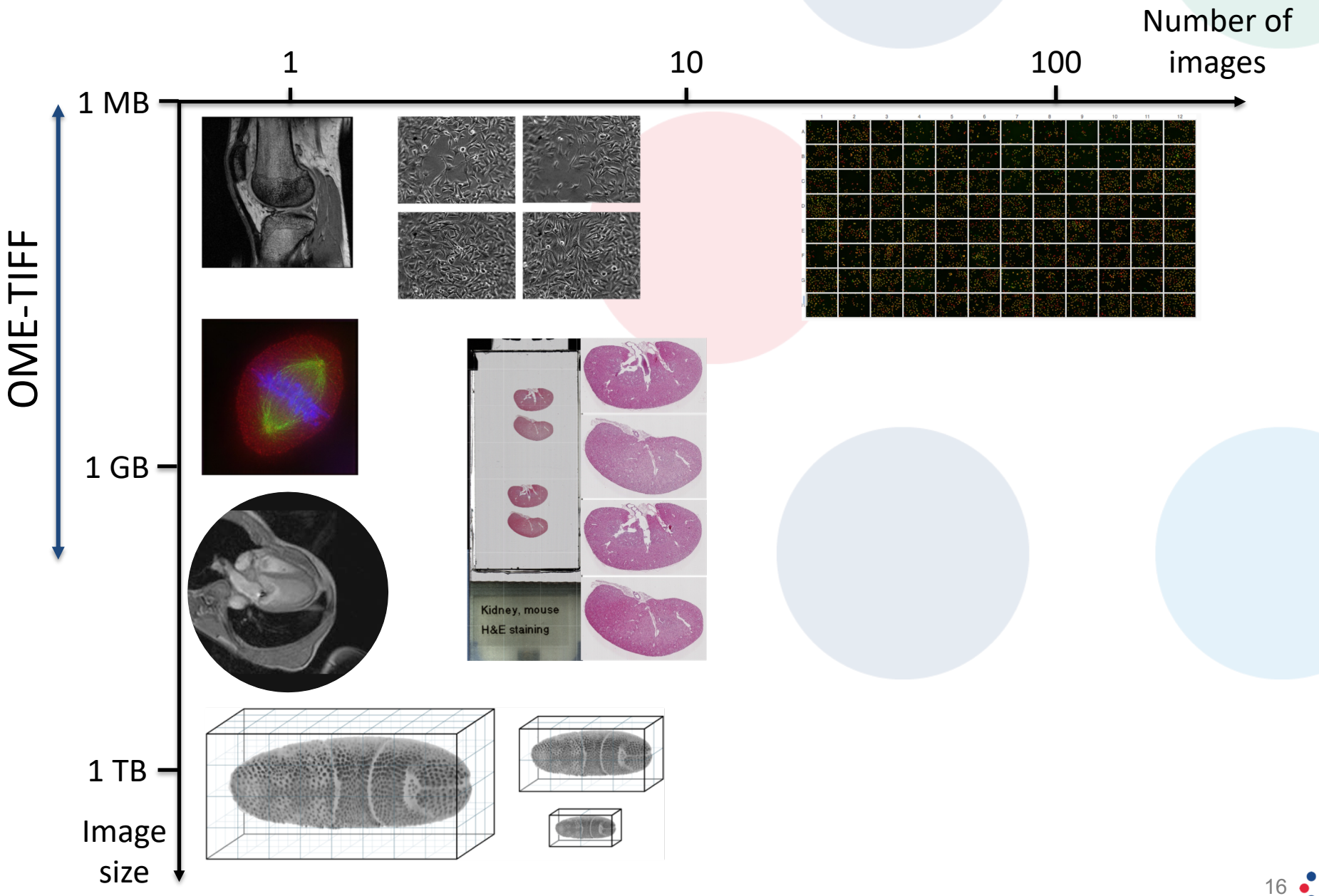
OME-TIFF: open file format for imaging data

- **TIFF: pixel data** container format
- Format specification and reference implementation maintained externally
- **OME: metadata** specification (multi-dimensional datasets, HCS and annotations)
- Distribution of pixel data over multiple TIFF files



https://docs.openmicroscopy.org/latest/ome-model/ome-tiff/index.html

OME-TIFF: imaging domains support



Reading and writing OME-TIFF

OMEFILES

Imaging System

OME-TIFF

OMEFILES

python™

jupyter open_bytes (read only)

Logout

File Edit View Insert Cell Kernel Help Not Trusted Python 2

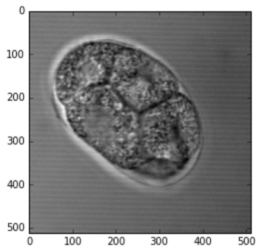
Code

```
    from urllib.request import urlretrieve
import zipfile
import numpy as np
import matplotlib.pyplot as plt
import ome_files
```

In [2]:
```
urlretrieve("http://downloads.openmicroscopy.org/images/OME-TIFF/2016-06/tubh
```

In [3]:
```
with zipfile.ZipFile(fn) as zip:
    for name in zip.namelist():
        with open(os.path.basename(name), "wb") as fo:
            fo.write(zip.read(name))
```

In [4]:
```
reader = ome_files.OMETIFFReader()
reader.set_id("tubhiswt_C0.ome.tif")
pixels = reader.open_array(0)
plt.imshow(pixels, cmap="gray")
reader.close()
```

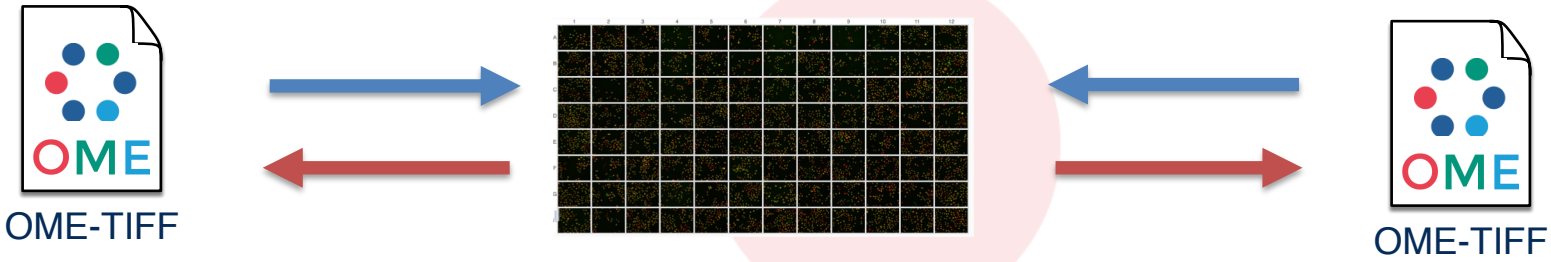


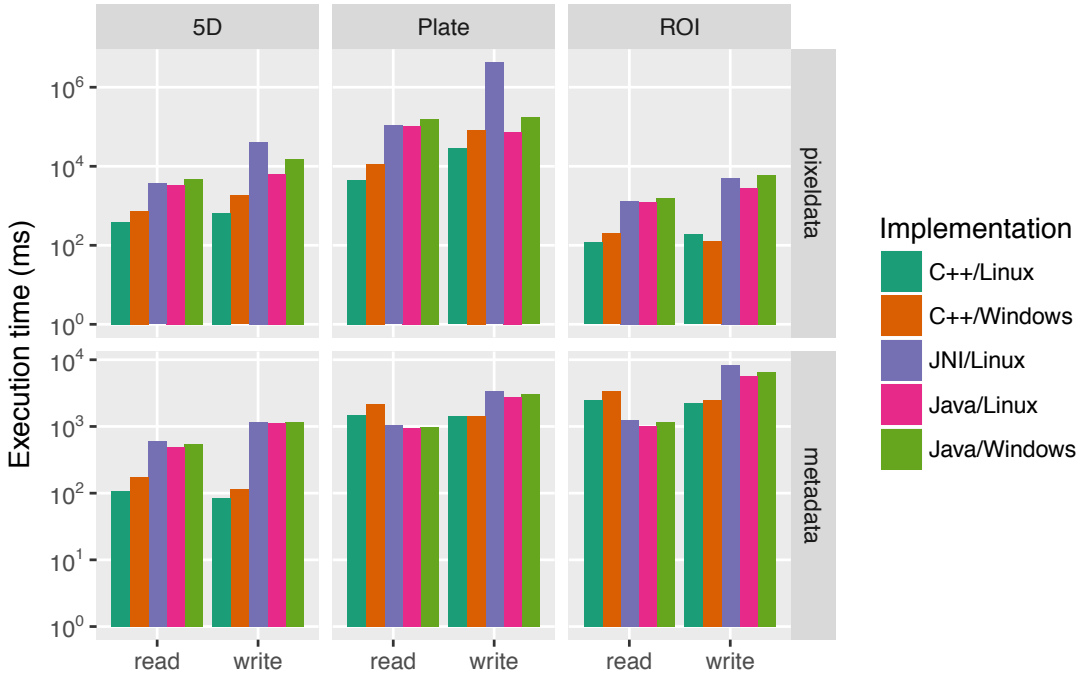
https://www.biorxiv.org/content/early/2017/03/09/088740

Reading and writing OME-TIFF

OMEFILES

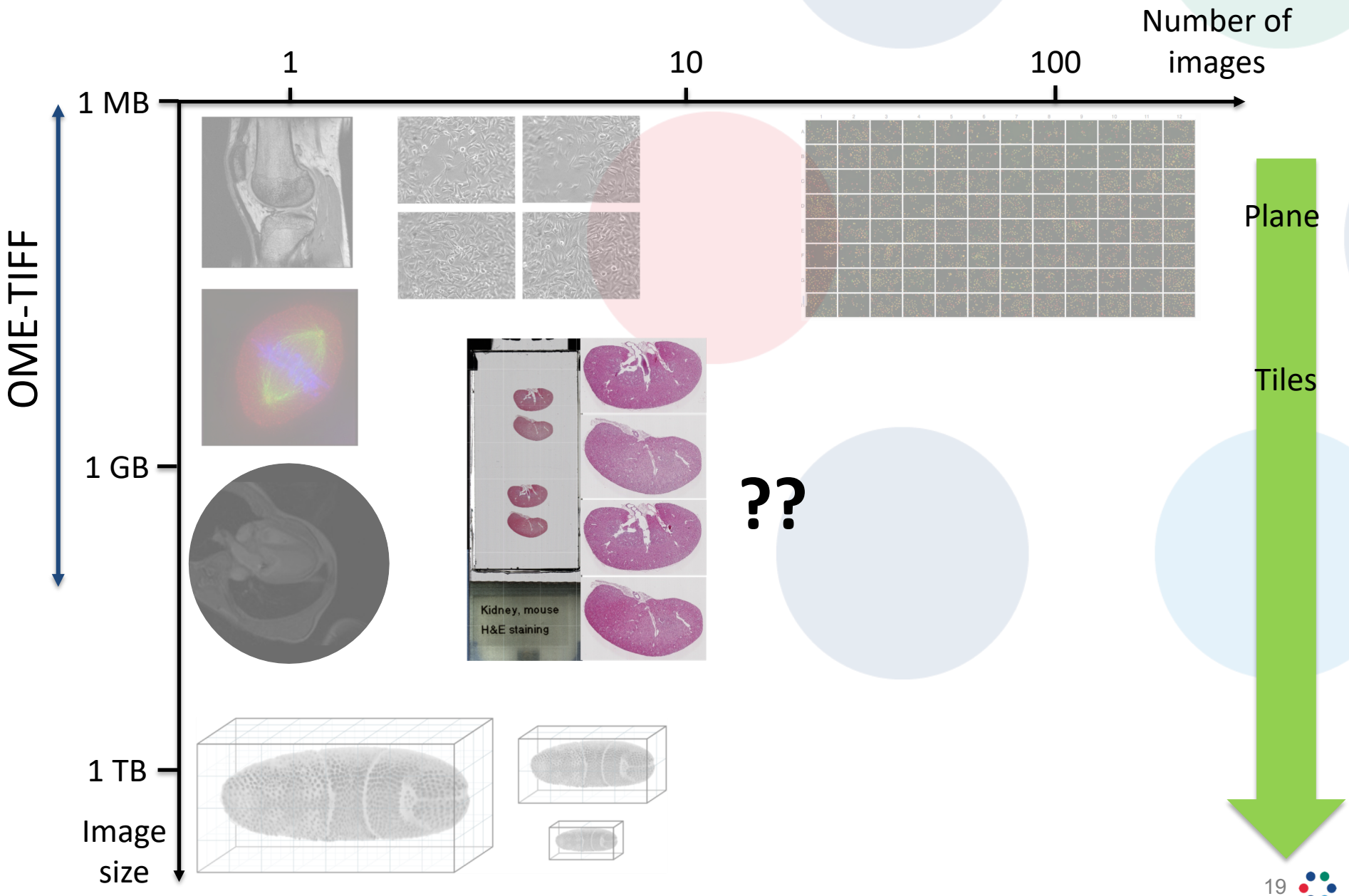
BIO-FORMATS



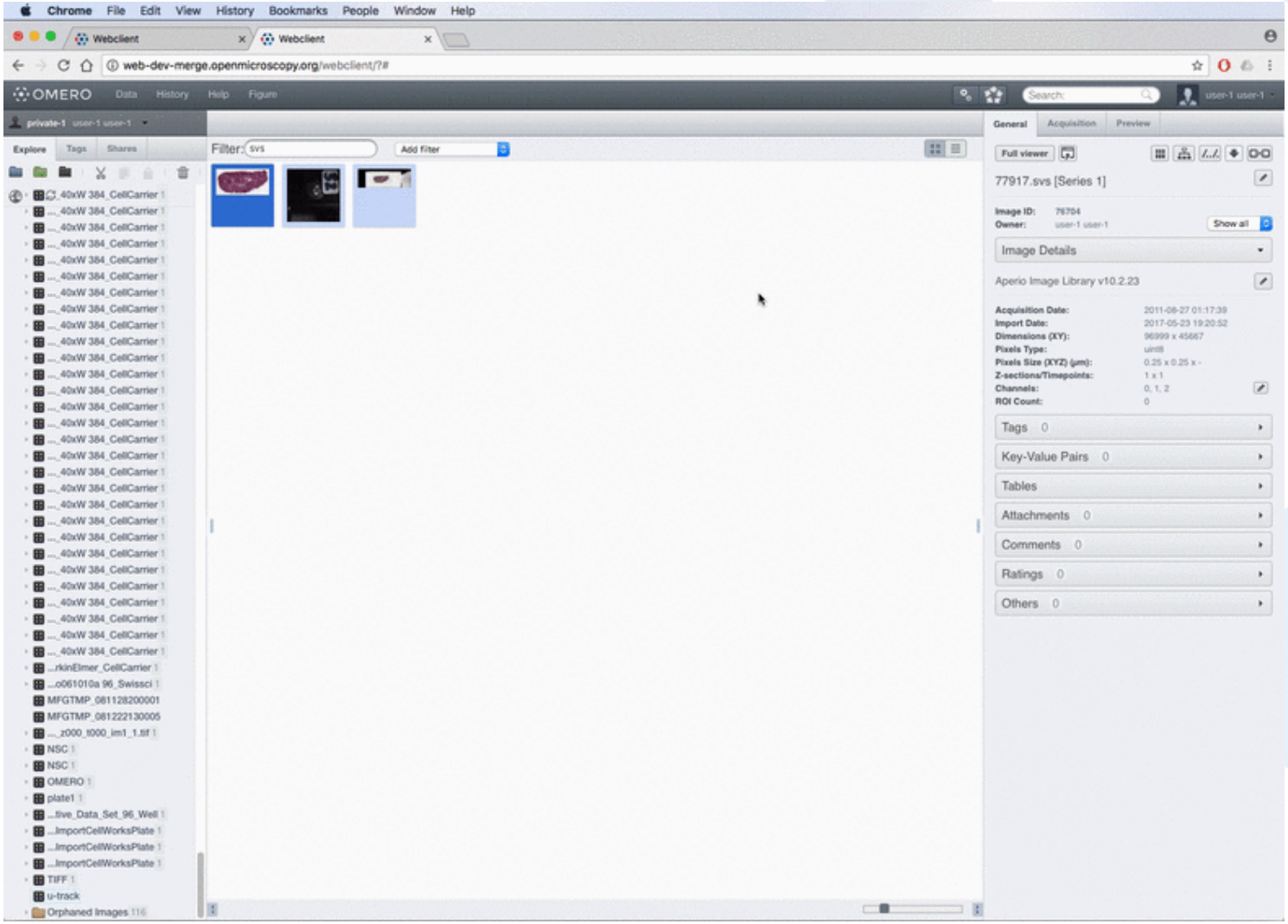


https://www.biorxiv.org/content/early/2017/03/09/088740

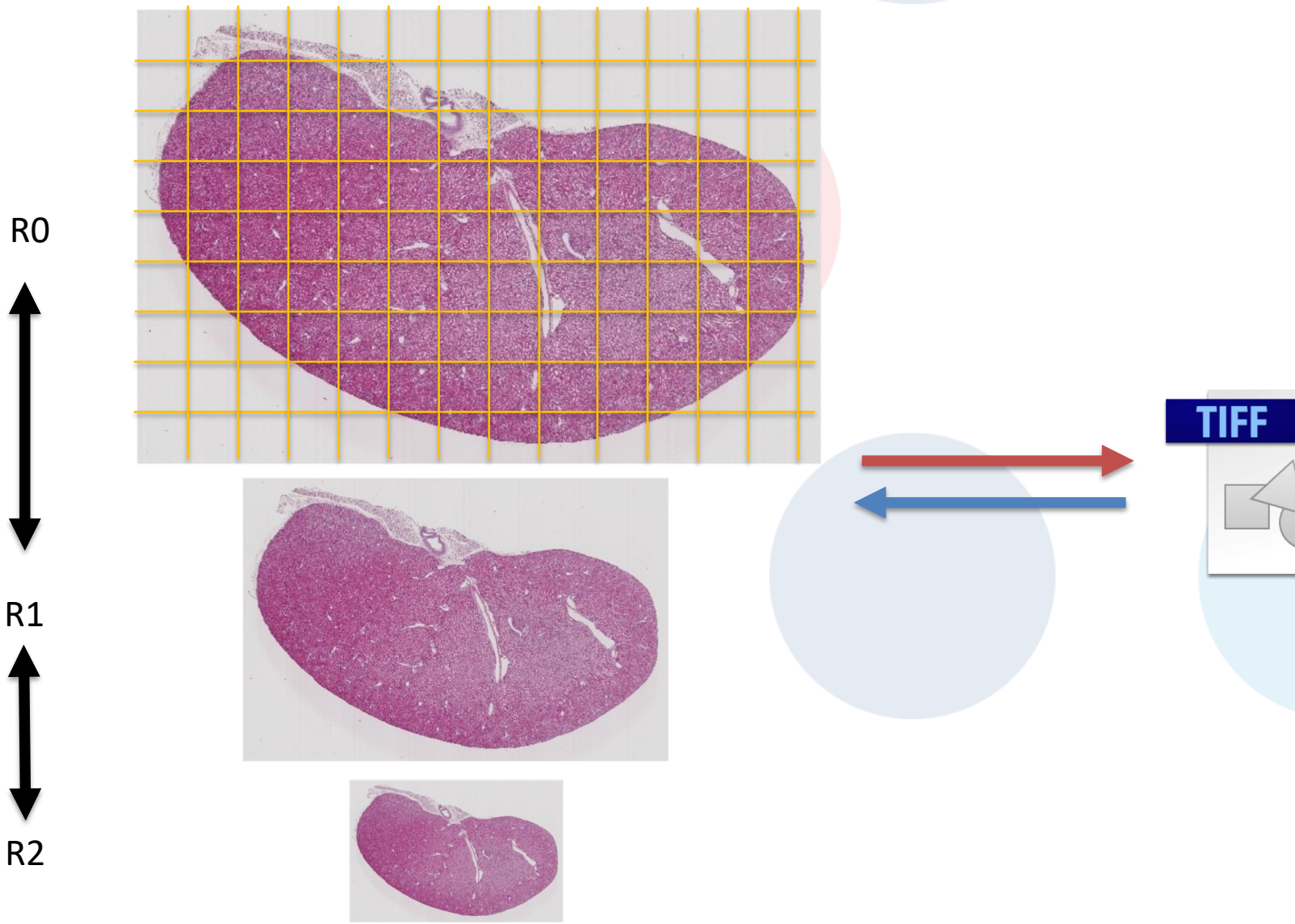
OME-TIFF: multi-resolution images



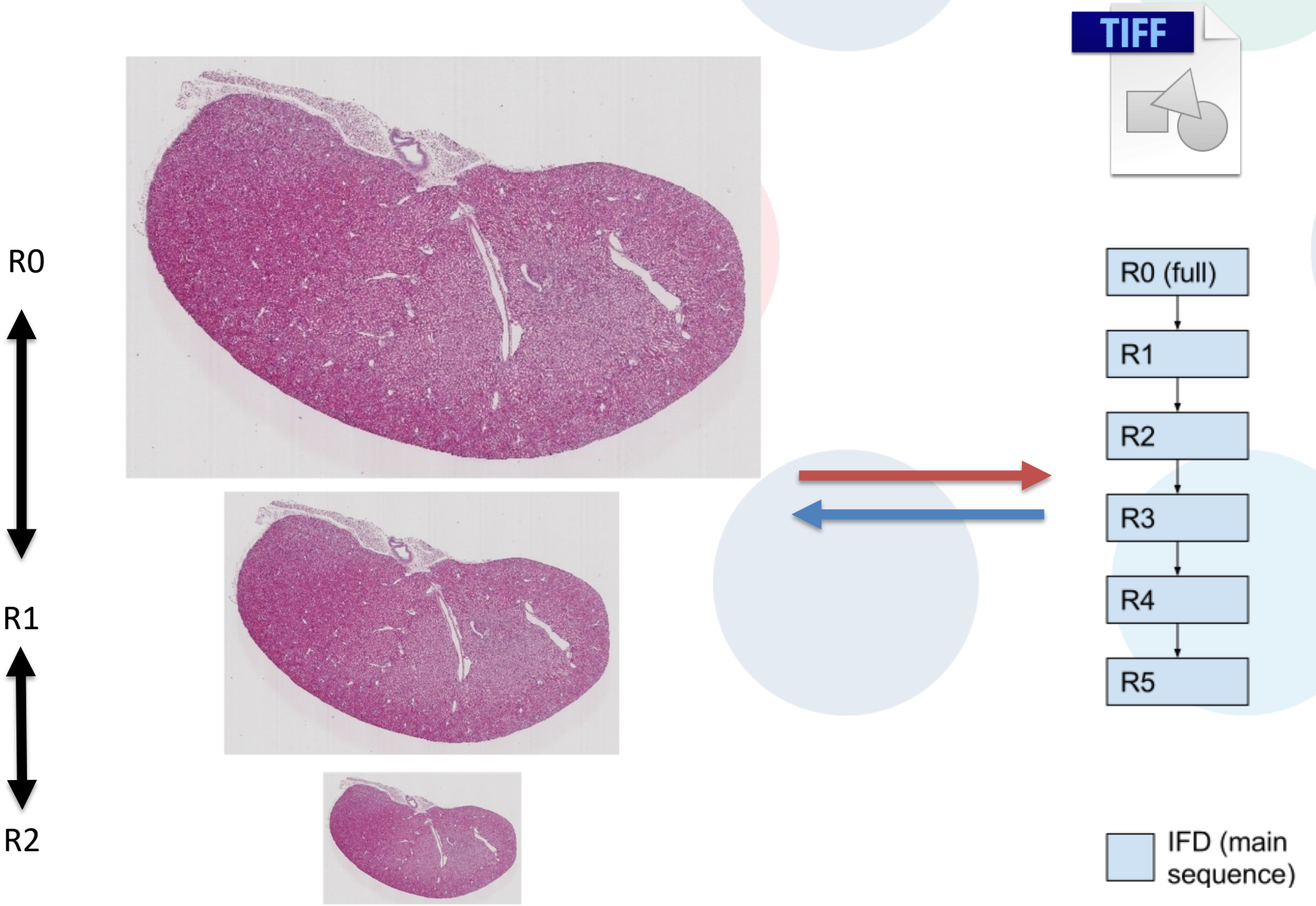
Pyramidal images support



OME-TIFF pyramidal support: API

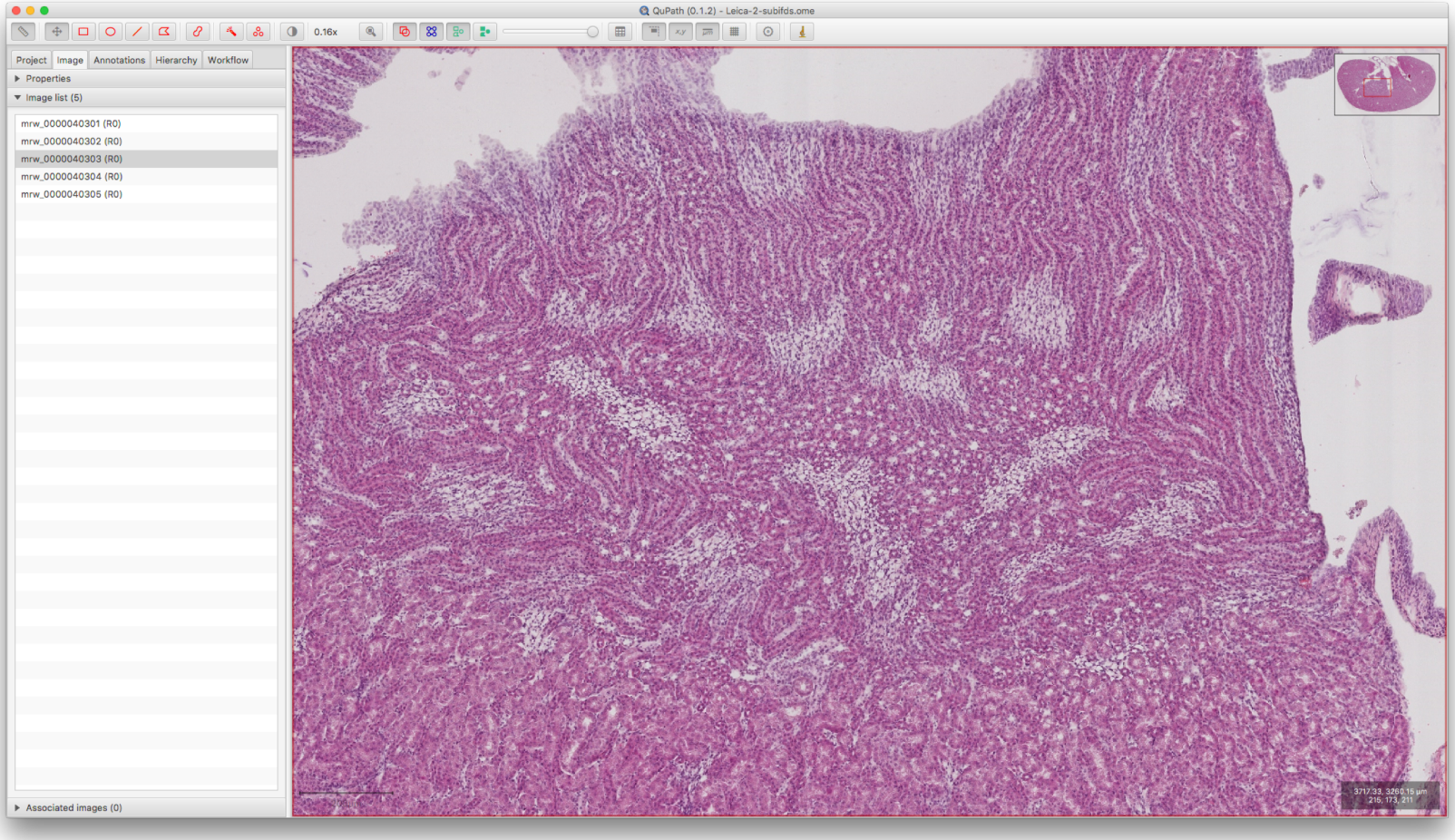


OME-TIFF pyramidal support: binary layout



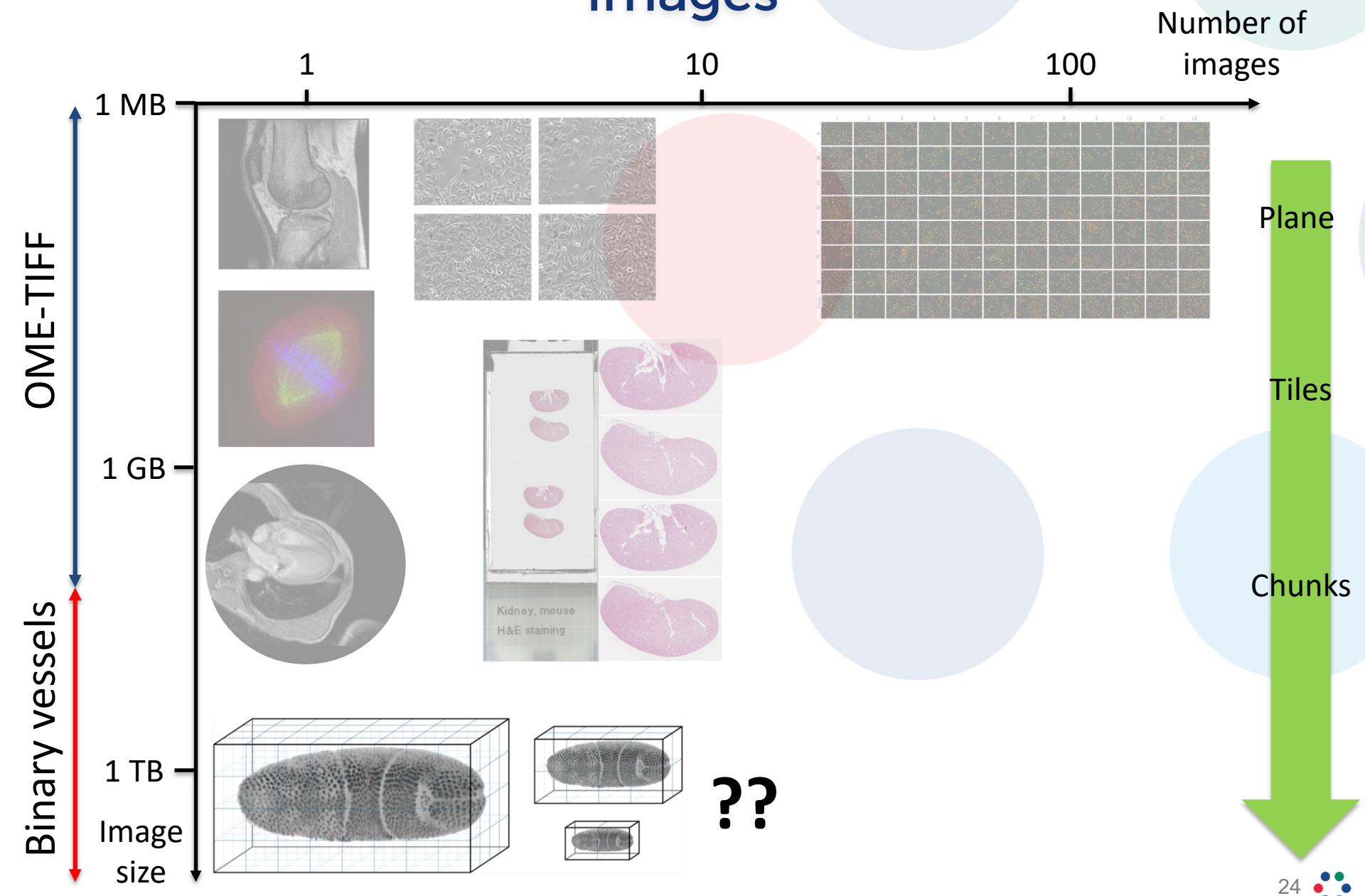
http://openmicroscopy.github.io/design/OME005

Pyramidal OME-TIFF prototype

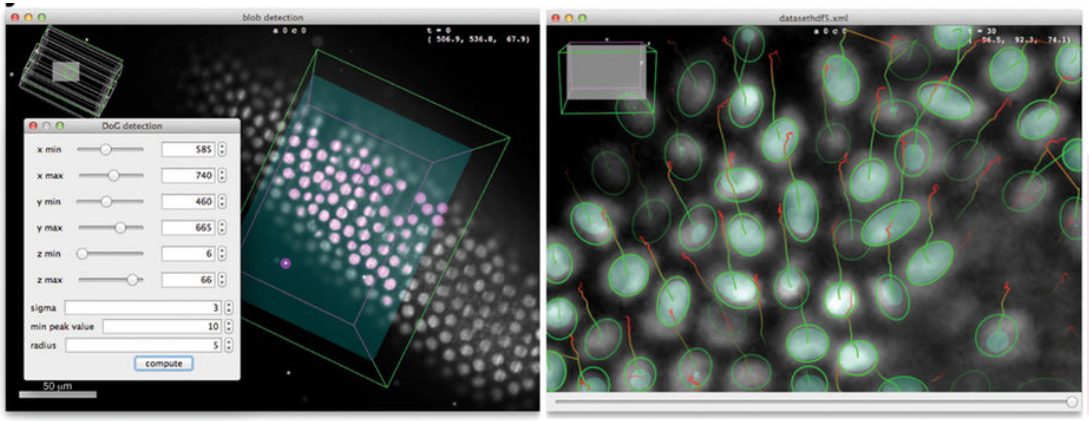


For more information, see Day 2: OME File Formats Workshop

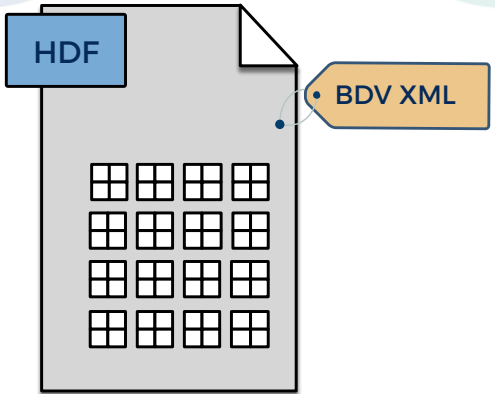
OME file formats: large multi-resolution images



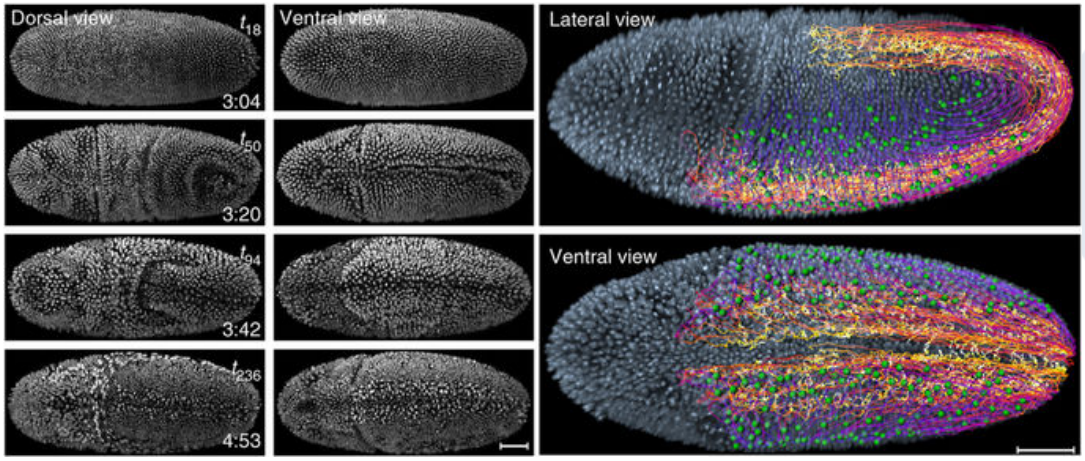
New Binary vessels



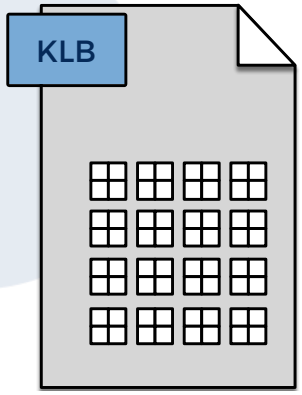
Pietzsch et al., *Nat. Meth.* **12**, 481–483 (2015)



https://imagej.net/BigDataViewer

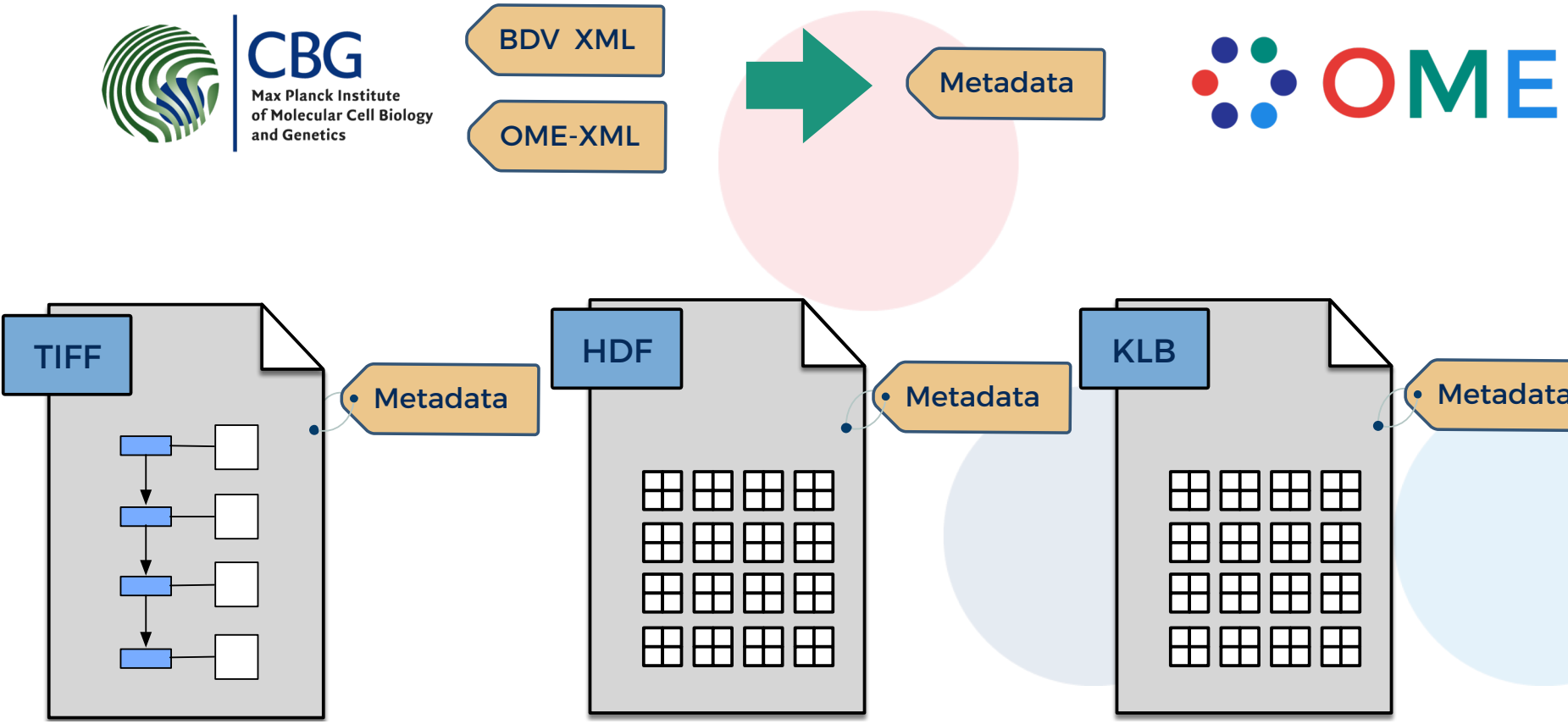


Amat et al., *Nat. Protoc.* **1**, 1679–1696 (2015)



https://bitbucket.org/fernandoamat/keller-lab-block-filetype

OME next generation formats



For more information, see Day 2: OME File Formats Workshop

Conclusions

- Standard open tools making imaging data re-usable
- Addressing the problem of imaging file formats
  - Keep supporting new proprietary file formats
  - Extending open file formats to support existing imaging modalities
- Sustainable solutions
  - Interactions with commercial entities and manufacturers
  - Working with open-source communities to reuse new binary vessels
- More discussion during Day 2 workshops

Thanks to the Funders