



<https://idr.openmicroscopy.org>

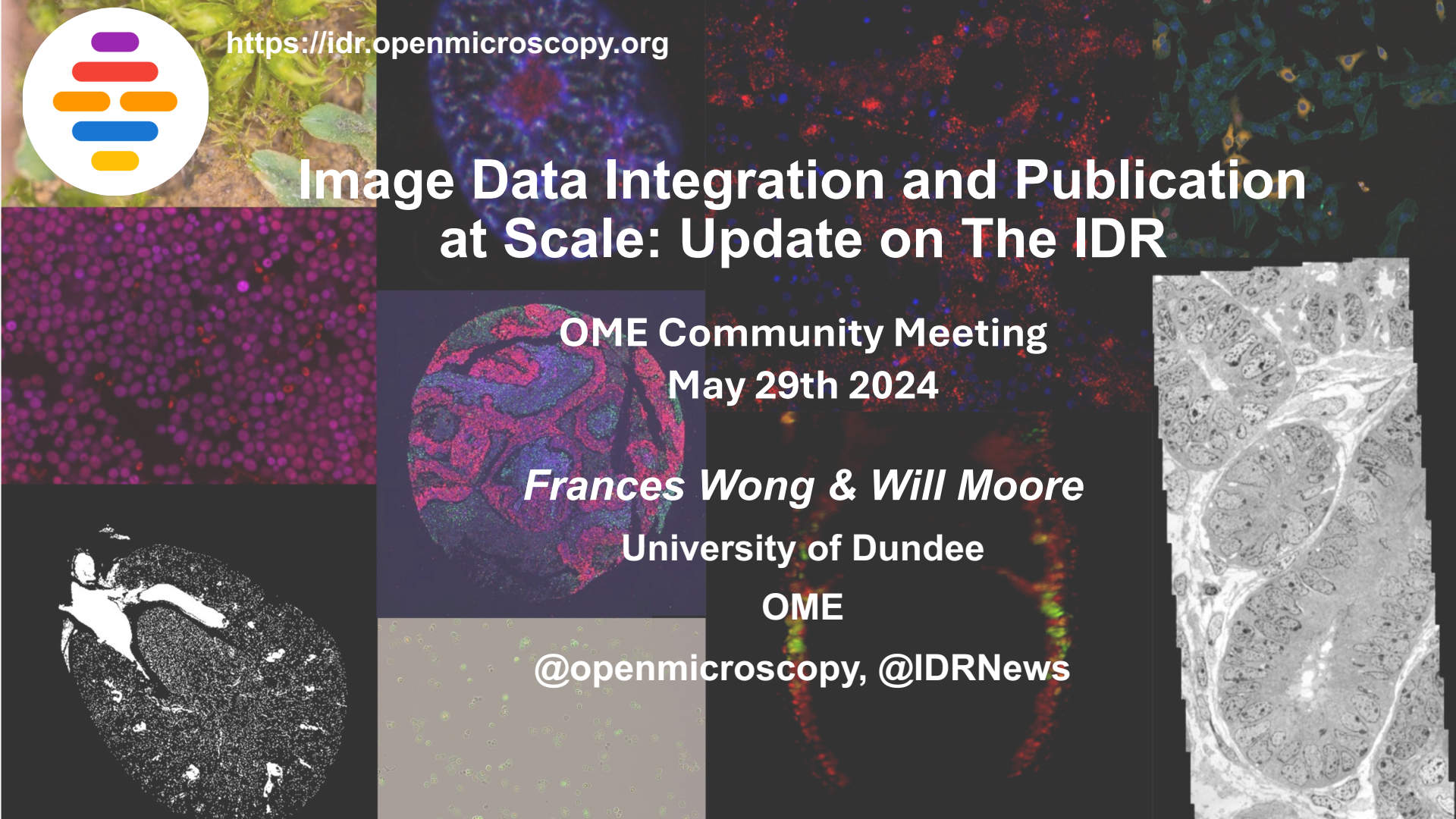
Image Data Integration and Publication at Scale: Update on The IDR

OME Community Meeting
May 29th 2024

Frances Wong & Will Moore
University of Dundee

OME

@openmicroscopy, @IDRNews



Overview of IDR

- **Public access** (<https://idr.openmicroscopy.org>)
- **Reference datasets** - complete datasets containing molecular and functional annotations, associated with an existing or upcoming publication.
- **Study integration** - integrating studies or datasets with other datasets via **genes**, **compounds** or **phenotypes**.
- **Curated metadata**
- **Cloud re-analysis**

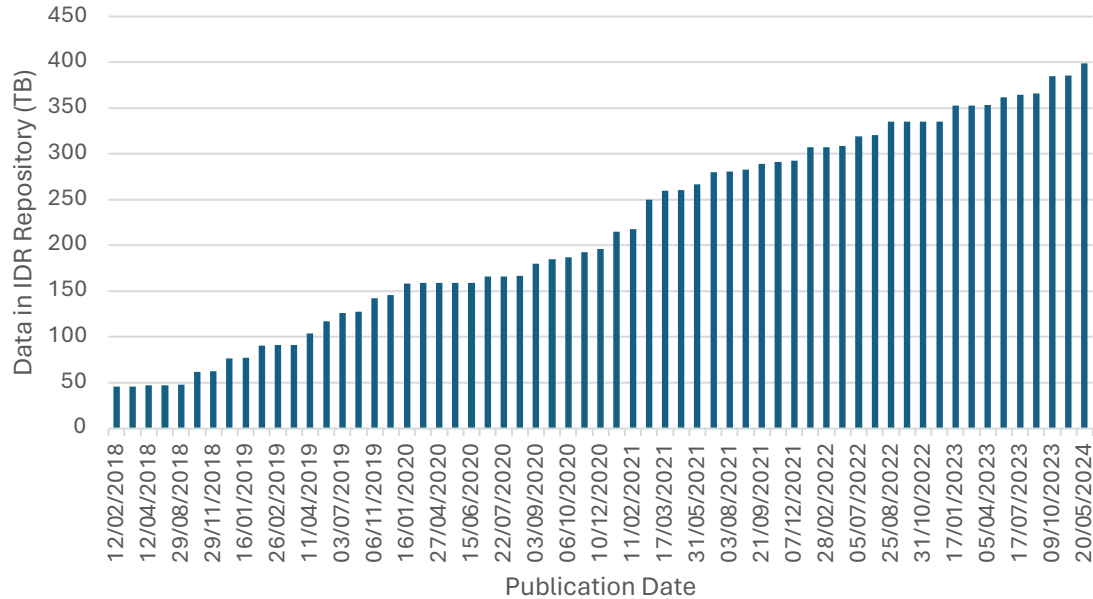
IDR metrics

May 2024

Raw data size	399 TB
Image files	38 M
5D Images	14 M
2D Planes	118 M
Organisms	84
Genes	89 K
Antibodies	12 K
Compounds	40 K

IDR metrics

Data loading in IDR



IDR studies and publications

>125 cross-published studies



cross-referenced via accessions and DOIs

A screenshot of the IDR website interface. At the top, a navigation bar includes 'IDR', 'CELL - IDR', 'ISSUE - IDR', 'ABOUT', and 'SUBMISSIONS'. Below the navigation bar is a search bar with the text 'Search by: Name (IDR number) idr0056'. The search results show 'Found 3 studies with Name: idr0056'. Three study cards are displayed, each with a microscopy image and the title 'A long noncoding RNA regulates microtubule behaviour during mitosis'. The study IDs are idr0056C, idr0056B, and idr0056A, all by Stojic L et al. Above the search bar, a snippet from a publication is visible, titled 'Data availability', which states that sequencing data is available in the ArrayExpress database and imaging data is in the Image Data Resource under IDR accession number idr0056. Two vertical arrows, one pointing up and one pointing down, connect the search bar to the publication snippet, illustrating the cross-referencing process.

<https://idr.openmicroscopy.org/about/studies.html>

IDR Homepage

The Image Data Resource (IDR) is a public repository of image datasets from published scientific studies, where the community can submit, search and access high-quality bio-image data.

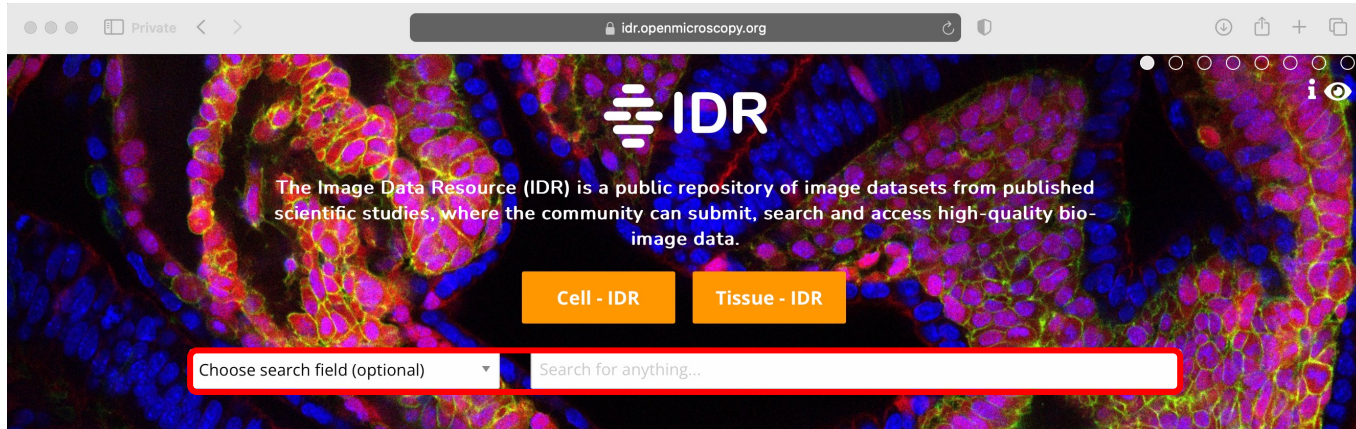
Cell - IDR Tissue - IDR

Choose search field (optional) Search for anything...

128 Studies 14,018,967 Images 399 TB

Group Studies by type

IDR Search



The Image Data Resource (IDR) is a public repository of image datasets from published scientific studies, where the community can submit, search and access high-quality bio-image data.

Cell - IDR Tissue - IDR

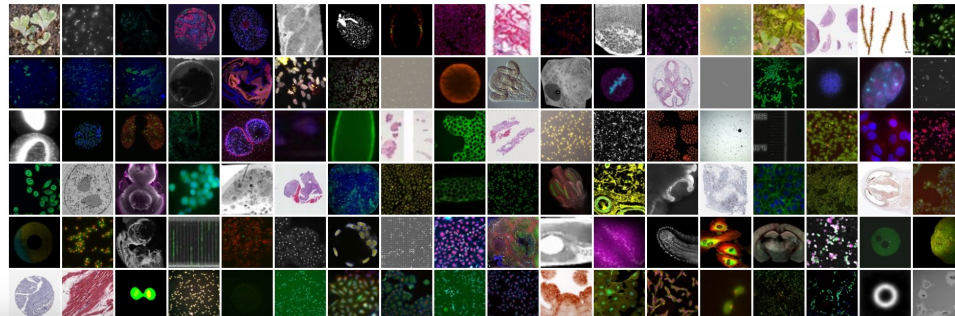
Choose search field (optional) Search for anything...

128 Studies

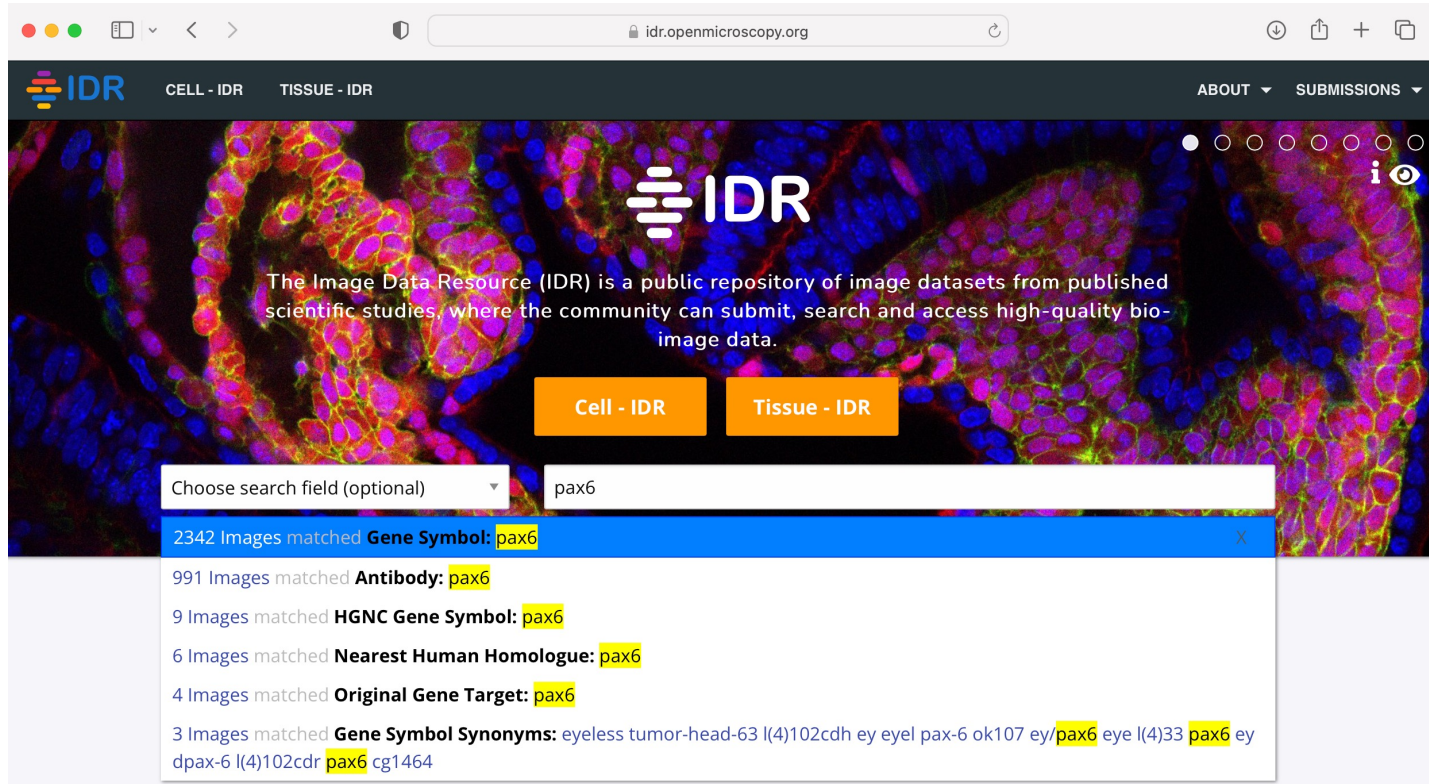
14,018,967 Images

399 TB

Group Studies by type



IDR Search



The screenshot shows the IDR website interface. At the top, there is a navigation bar with the IDR logo, "CELL - IDR", "TISSUE - IDR", "ABOUT", and "SUBMISSIONS". The main content area features a large background image of a biological specimen with the IDR logo and a description: "The Image Data Resource (IDR) is a public repository of image datasets from published scientific studies, where the community can submit, search and access high-quality bio-image data." Below this, there are two orange buttons: "Cell - IDR" and "Tissue - IDR". A search bar is present with a dropdown menu labeled "Choose search field (optional)" and the search term "pax6". A search results dropdown is open, listing the following matches:

- 2342 Images matched **Gene Symbol:** pax6
- 991 Images matched **Antibody:** pax6
- 9 Images matched **HGNC Gene Symbol:** pax6
- 6 Images matched **Nearest Human Homologue:** pax6
- 4 Images matched **Original Gene Target:** pax6
- 3 Images matched **Gene Symbol Synonyms:** eyeless tumor-head-63 l(4)102cdr ey eyel pax-6 ok107 ey/pax6 eye l(4)33 pax6 ey dpax-6 l(4)102cdr pax6 cg1464

IDR Search

The screenshot shows the IDR Search interface. At the top, there is a navigation bar with the IDR logo, 'CELL - IDR', 'TISSUE - IDR', 'ABOUT', and 'SUBMISSIONS'. Below the navigation bar is a search form with three fields: 'Attribute' (set to 'Gene Symbol'), 'Operator' (set to 'equals'), and 'Value' (set to 'pax6'). A red box highlights the search results summary: 'Search Gene Symbol equals pax6 found 2342 images in 9 experiments/screens'. Below this is a table of results with columns 'ID', 'Images', and 'Publication Title'. The second row, corresponding to 'idr0070A', is highlighted with a red box.

Attribute: Gene Symbol, Operator: equals, Value: pax6

Search **Gene Symbol** equals **pax6** found **2342** images in **9** experiments/screens

ID	Images	Publication Title
idr0043A	1027	Proteomics. Tissue-based map of the human proteome.
idr0070A	855	The HUDSEN Atlas: a three-dimensional (3D) spatial framework for studying gene ...
idr0022A	288	Uncovering the signaling landscape controlling breast cancer cell migration identi...
idr0114A	136	Enabling research with human embryonic and fetal tissue resources
idr0009A	14	Genome-wide RNAi screening identifies human proteins with a regulatory functio...
idr0013A	9	Phenotypic profiling of the human genome by time-lapse microscopy reveals cell ...
idr0093A	9	High content genome-wide siRNA screen to investigate the coordination of cell siz...
idr0010A	2	RNF168 binds and amplifies ubiquitin conjugates on damaged chromosomes to a...
idr0012A	2	Clustering phenotype populations by genome-wide RNAi and multiparametric im...

IDR Search

Browser address bar: idr.openmicroscopy.org

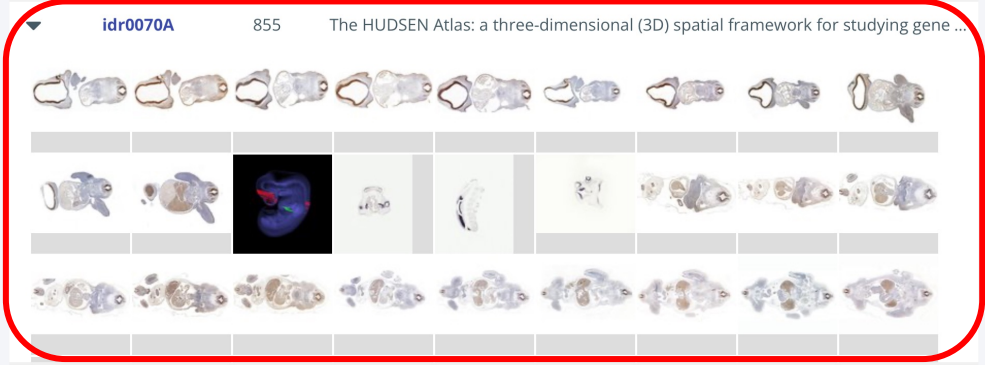
Navigation: CELL - IDR | TISSUE - IDR | ABOUT | SUBMISSIONS

Home

Search criteria: Attribute: Gene Symbol | Operator: equals | Value: pax6

Search **Gene Symbol** equals **pax6** found **2342** images in **9** experiments/screens

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IDR Search

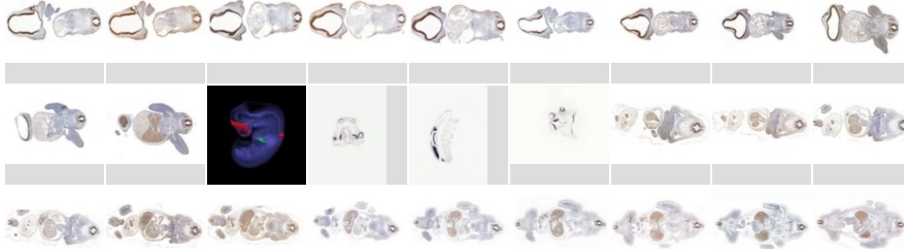
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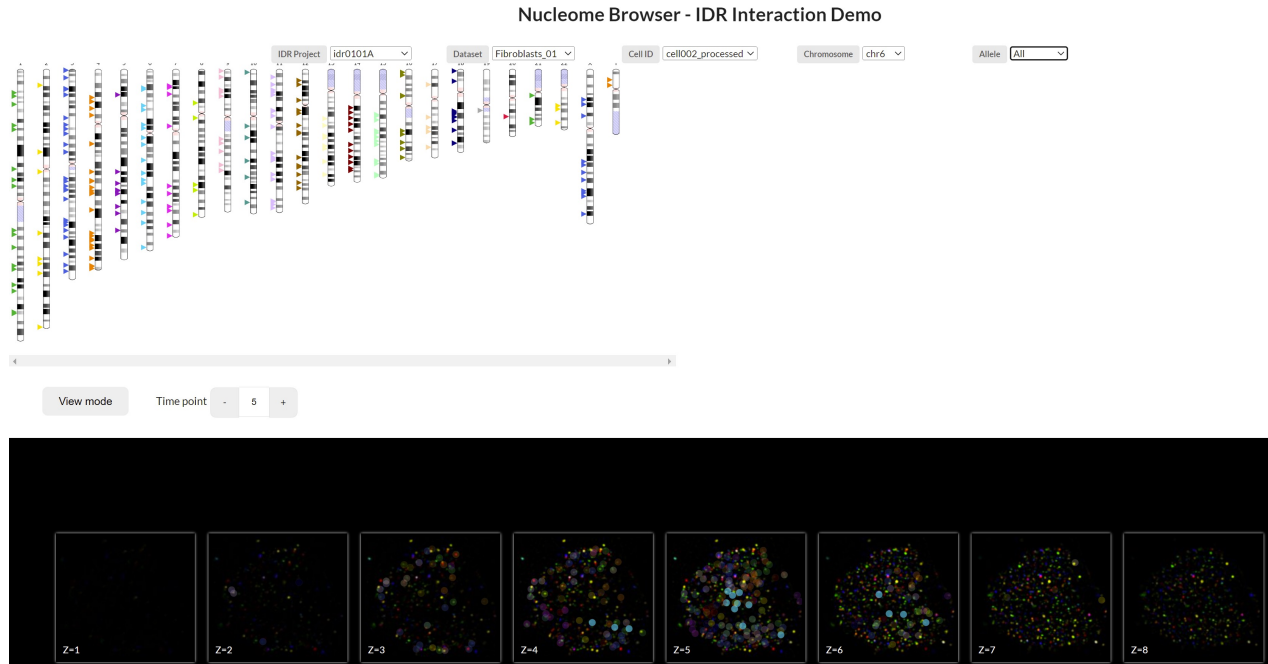
IDR Search

Attribute	Operator	Value
Gene Symbol	equals	pax6

- Any
- Study
 - Imaging Method
 - License
 - Name (IDR number)
 - Organism
 - Publication Authors
 - Publication Title
 - Screen Technology Type
 - Screen Type
 - Study Type
- Image
 - Antibody
 - Antibody Identifier
 - Cell Line
 - Compound Name
 - Gene Identifier
 - ✓ Gene Symbol
 - InChIKey
 - Pathology
 - Pathology Identifier
 - Phenotype
 - Phenotype Term Accession
 - Protein
 - PubChem CID
 - siRNA Identifier
 - siRNA Pool Identifier

- contains
- ✓ equals

In Situ Sequencing - Linking Multimodal Metadata



Jhu et al, 2022, *Nature Methods*, 10.1038/s41592-022-01559-3
https://vis.nucleome.org/static/apps/IDR_demo/

Data Download and Reuse



Imaging data for all studies published in IDR is available for download using FTP or Globus -

<https://idr.openmicroscopy.org/about/download.html>



Datasets are published under the Creative Commons Attribution 4.0 International license (CC BY 4.0) or a more permissive license.



- **Share** — copy and redistribute the material in any medium or format.
- **Adapt** — remix, transform, and build upon the material for any purpose, even commercially.
- **Attribution** — credit must be given to the creator.

Accessing IDR Data

Download

<https://ftp.ebi.ac.uk/pub/databases/IDR/>

Index of [/pub/databases/IDR](https://ftp.ebi.ac.uk/pub/databases/IDR/)

Name	Last modified	Size	Description
Parent Directory			
idr0001-graml-sysgro/			
idr0002-heriche-condensation/			
idr0003-breker-plasticity/			
idr0004-thorpe-rad52/			
idr0005-toret-adhesion/			
idr0006-fong-nuclearbodies/			
idr0007-srikumar-sumo/			
idr0008-rohn-actinome/			
idr0009-simpson-secretion/			
idr0010-doil-dmadamage/			
idr0011-ledesmafernandez-dlad4/			
idr0012-fuchs-cellmorph/			
idr0013-neumann-mitochek/			
idr0015-colin-taracoacs/			
idr0016-wawer-bioactivecompound/			
idr0017-breinig-drgscreen/			
idr0018-neff-histopathology/			
idr0019-sero-nfkappab/			
idr0020-barr-chtog/			

NAME	LAST MODIFIED	SIZE
idr0001-graml-sysgro	6/26/2012 10:30 AM	--
idr0002-heriche-condensation	6/26/2012 10:30 AM	--
idr0003-breker-plasticity	6/26/2012 10:41 AM	--
idr0004-thorpe-rad52	6/26/2012 10:51 AM	--
idr0005-toret-adhesion	6/26/2012 11:11 AM	--
idr0006-fong-nuclearbodies	6/26/2012 11:31 AM	--
idr0007-srikumar-sumo	6/26/2012 11:31 AM	--
idr0008-rohn-actinome	6/26/2012 11:37 AM	--
idr0009-simpson-secretion	6/26/2012 11:45 AM	--
idr0010-doil-dmadamage	6/26/2012 12:03 PM	--
idr0011-ledesmafernandez-dad4	4/06/2016 11:25 AM	--
idr0012-fuchs-cellmorph	7/21/2016 10:05 AM	--
idr0013-neumann-mitochek	6/26/2012 12:24 PM	--
idr0015-colin-taracoacs	7/6/2016 04:03 PM	--
idr0016-wawer-bioactivecompoundprofil...	6/34/2016 10:07 AM	--

FTP

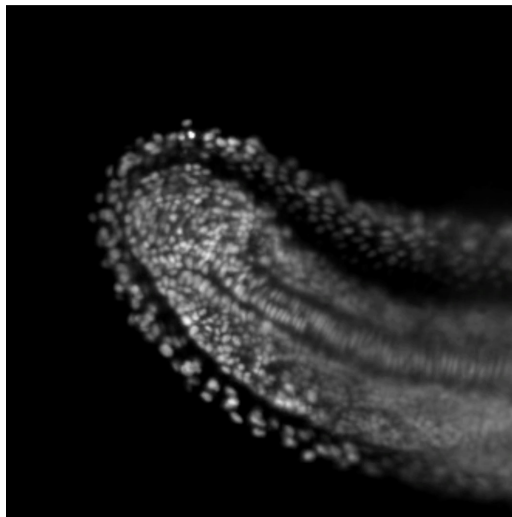
Globus

OMERO

API

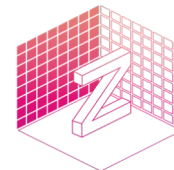
```
conn = BlitzGateway("username", "password")
conn.connect()
image = conn.getObject("Image", image_id)
plane = image.getPrimaryPixels().getPlane(theT=10)
```

Web Client



idr0051, Attardi et al, Development DOI:10.1242/dev.166728

OME-NGFF



Coming soon!

OME-Zarr

OME-NGFF Validator

Image: 0

Multiscale 0

Path: Zarr

Array Chunk

Bytes: 332.0B 221.79 KB

Shape: (78,120,1,1) (1,1,1,1,1)

Counts: 78,120,1,1 15479 Chunks

Type: int numpy.int64

Load chunk: 40 * (1, 1) 100 * (1, 1)

Size: 102.5 MB 102B

Path: Zarr

Array Chunk

Bytes: 875.13 MB 55.11 KB

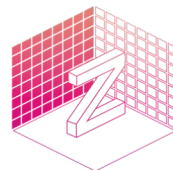
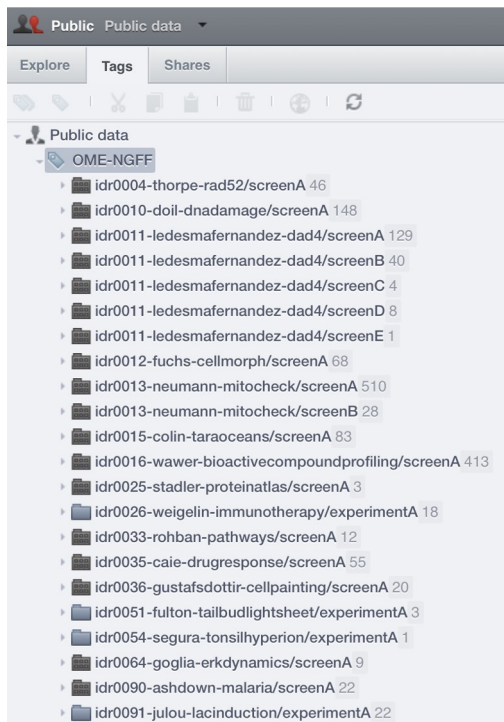
Validator

Support for OME-NGFF Data in IDR

What have we done?

NB: Not released yet

Converted 17 studies into OME-Zarr



OME-Zarr



BioImage Archive

Data hosted on BioImage Archive S3 and served via OMERO (IDR)

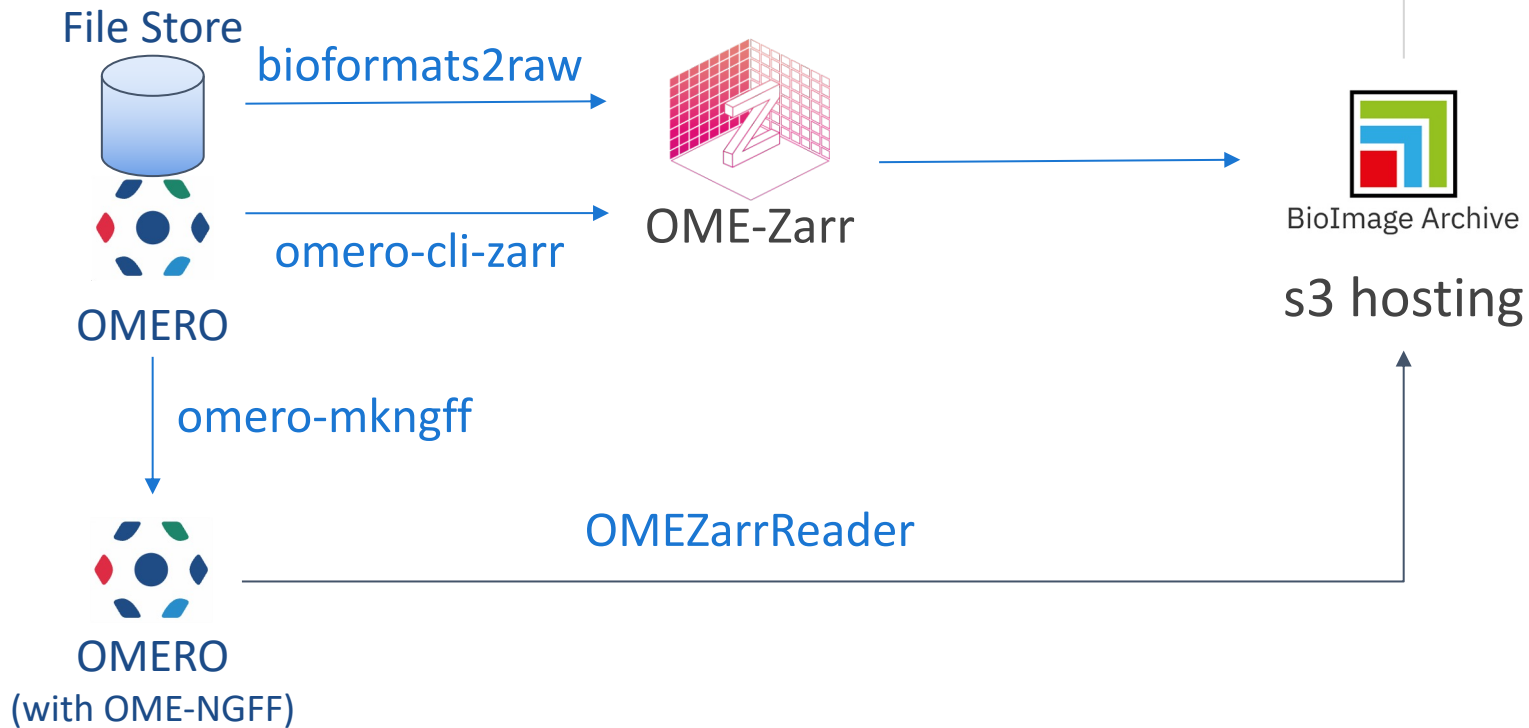
~47 TB, ~1600 Plates, 44 Datasets

Support for OME-NGFF Data in IDR

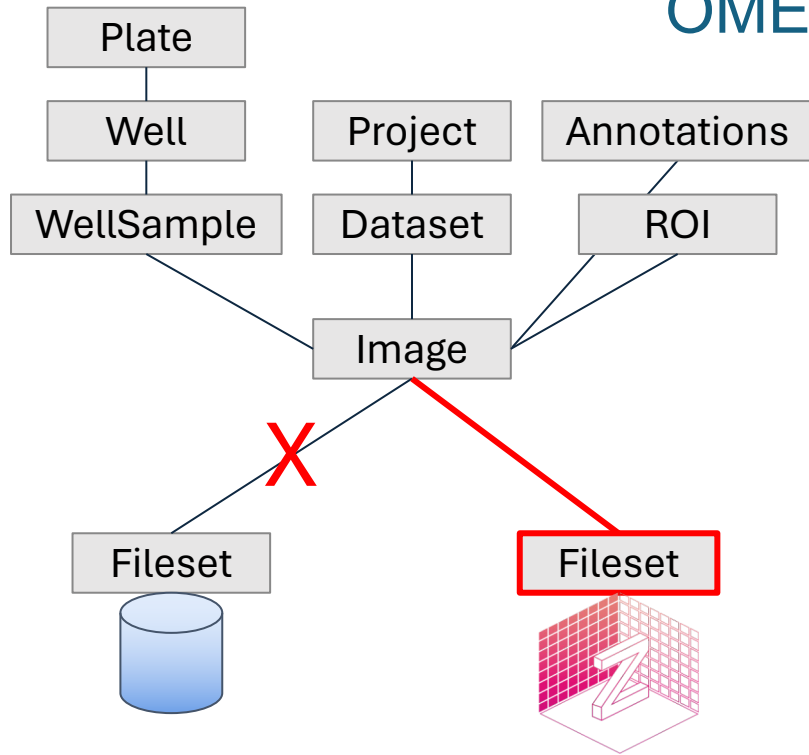
Why have we done this?

- IDR fork of Bio-Formats was required to read IDR-specific data formats
 - Want to bring IDR into line with mainline Bio-Formats
 - Solution: Convert legacy formats into OME-NGFF
- Host the data on the EBI Embassy Object Store
 - Improved scalability compared with NFS file system
 - New submissions of OME-NGFF data hosted by submitters
- OME-NGFF data available directly via S3

https://uk1s3.embassy.ebi.ac.uk/bia-integrator-data/pages/idr_ngff_data.html



OMERO-mkngff

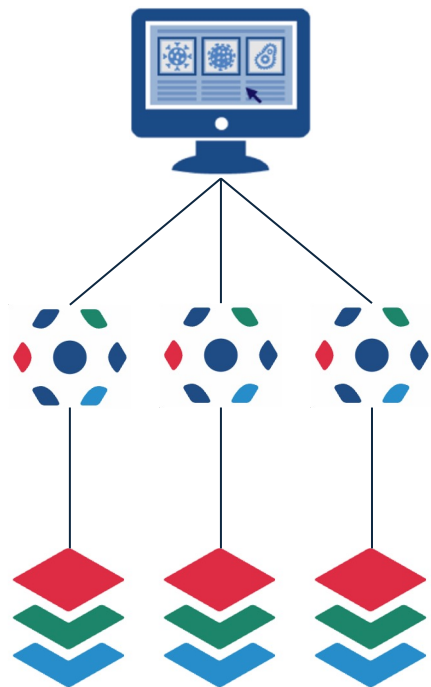


Creates a new NGFF-based Fileset in the OMERO database, replacing original Fileset

<https://github.com/IDR/omero-mkngff>

```
$ omero mkngff sql [fileset ID] /path/to/fileset.zarr > myNgff.sql  
$ psql -U omero -d idr -h $DBHOST -f myNgff.sql
```

OME-NGFF performance improvements



OMERO.iviewer: reduce requests rate

OMERO micro-services: distributed rendering

Bio-Formats OMEZarrReader: read directly via S3

OME-NGFF in IDR

The screenshot displays the IDR web interface. At the top, there is a navigation bar with tabs for Studies, Genes, Phenotypes, Cell Lines, siRNAs, Antibodies, Compounds, Organisms, and About. A search bar is located on the right. Below the navigation bar, the main content area is divided into a left sidebar, a central grid, and a right sidebar.

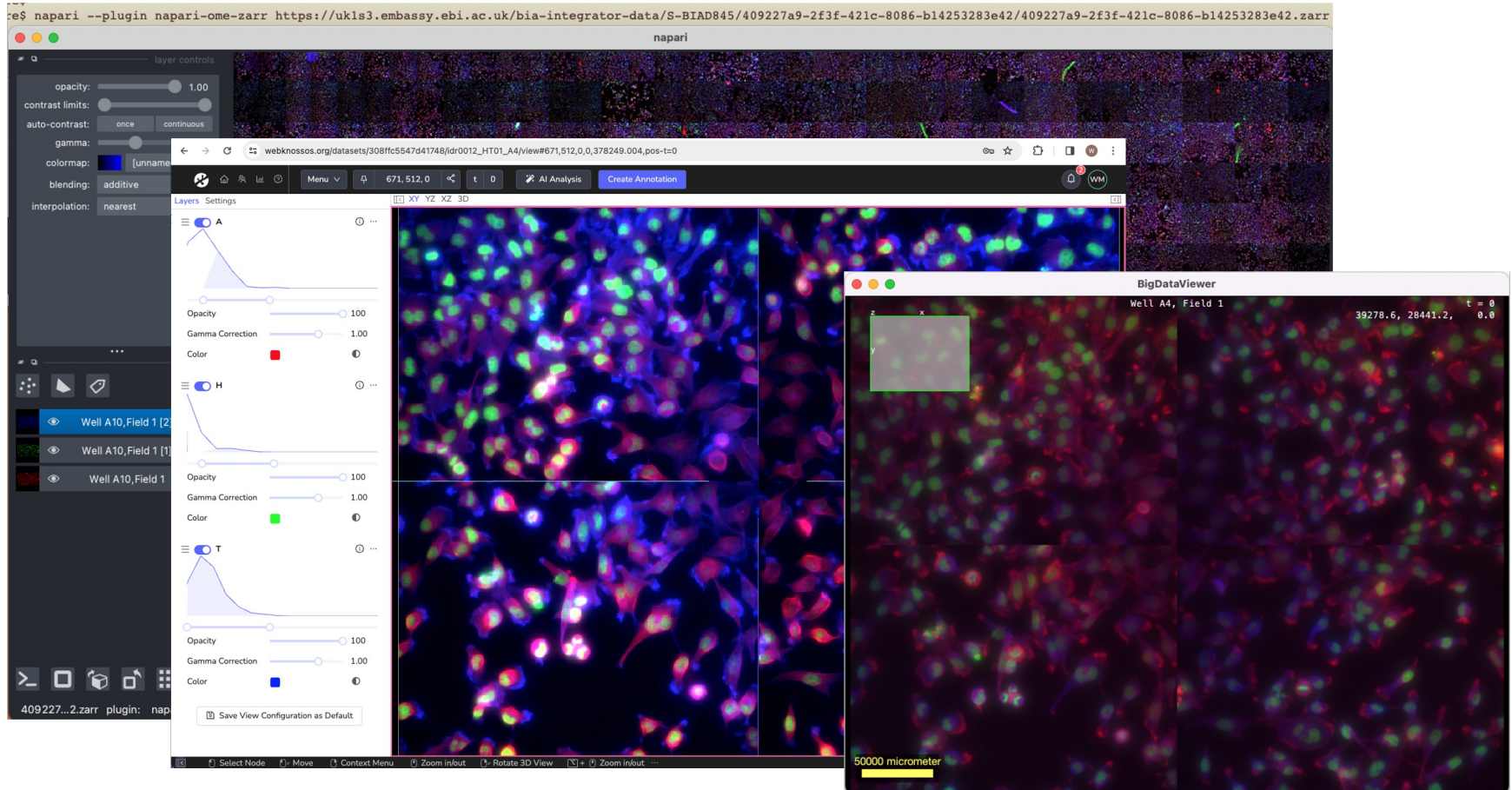
Left Sidebar: Shows a tree view of public data. The selected folder is "OME-NGFF", which contains a list of folders (e.g., "idr0004-thorpe-rad52/screenA 46") and a list of HT (High Throughput) folders (HT01 through HT18).

Central Grid: A grid of microscopy images. The grid is labeled with "Field#1" in the top left. The grid has 24 columns and 16 rows (A-P). The images show various cellular structures, with some cells highlighted in green and red.

Right Sidebar: Contains a "General" tab and a "Fileset Info" panel. The "Fileset Info" panel displays the following information:

- Fileset ID: 6312771
- File count: 4725
- Imported from:
 - <https://uk1s3.embassy.ebi.ac.uk/bia-integrator-data/S-BIAD845/409227a9-2f3f-421c-8086-b14253283e42/409227a9-2f3f-421c-8086-b14253283e42.zarr/.zattrs>
 - <https://uk1s3.embassy.ebi.ac.uk/bia-integrator-data/S-BIAD845/409227a9-2f3f-421c-8086-b14253283e42/409227a9-2f3f-421c-8086-b14253283e42.zarr/.zgroup>
- Show more...
- Paths on server:
 - demo_2/2016-05/16/14-53-28.229_mkngff/409227a9-2f3f-421c-8086-b14253283e42.zarr/.zattrs
 - demo_2/2016-05/16/14-53-28.229_mkngff/409227a9-2f3f-421c-8086-b14253283e42.zarr/.zgroup

OME-NGFF in other tools



IDR supports FAIR principles

Findable

Accessible

Interoperable

Reusable

Attribute: Gene Symbol, Operator: equals, Value: pax6

Search **Gene Symbol** equals **pax6** found **2342** images in **9** experiments/screens

IDR Public

Public data

- OMI-NGFP
- u0004-nrpe-cad23/screenA (1)
- u0005-dsl-dsladage/screenA (1)
- u0001-1eckstamamandor-cad4/screenA (1)
- u0001-1eckstamamandor-cad4/screenB (1)
- u0001-1eckstamamandor-cad4/screenC (1)
- u0001-1eckstamamandor-cad4/screenD (1)
- u0001-1eckstamamandor-cad4/screenE (1)
- u0002-fuchs-celmap3/screenA (1)

u0002

u0003

u0004

u0005

u0006

u0007

u0008

u0009

u000A

u000B

u000C

u000D

u000E

u000F

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u0011

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u0019

u001A

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u004A

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u005C

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u006E

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u00A7

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u00B6

u00B7

u00B8

u00B9

u00BA

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u017E

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u018D

u018E

u018F

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u0195

u0196

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u019B

u019C

u019D

u019E

u019F

u01A0

u01A1

u01A2

u01A3

u01A4

u01A5

u01A6

u01A7

u01A8

u01A9

u01AA

u01AB

u01AC

u01AD

u01AE

u01AF

u01B0

u01B1

u01B2

u01B3

u01B4

u01B5

u01B6

u01B7

u01B8

u01B9

u01BA

u01BB

u01BC

u01BD

u01BE

u01BF

u01C0

u01C1

u01C2

u01C3

u01C4

u01C5

u01C6

u01C7

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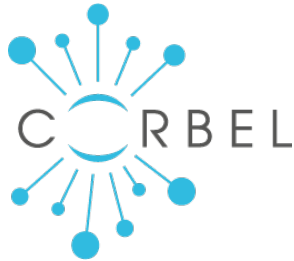
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