

GBI 2021 IDR Workshop

The presentation and a PDF version of the workshop are available at <https://downloads.openmicroscopy.org/presentations/2021/GBI>

Software versions used for this workshop:

- OMERO: 5.6.3
- OMERO.web: 5.8.1
- OMERO.iviewer: 0.10.1
- OMERO.mapr 0.4.1
- omero-guides: 2020.05.27
- Bio-Formats: 6.5.1
- Fiji/ImageJ: 2.0.0-rc-69/1.52p

Summary

Introduction to IDR

Searching for Phenotypes and Genes in OMERO.web user interface of IDR

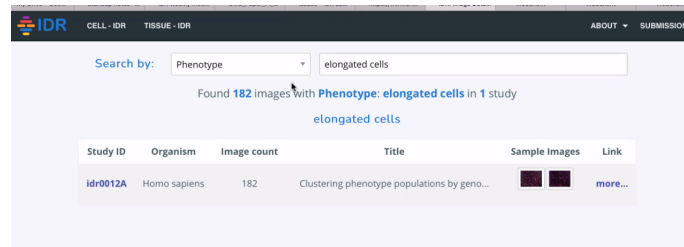
Search images in IDR based on metadata via API

Retrieve images using 3rd party software and analyze them in

- Python
- Fiji

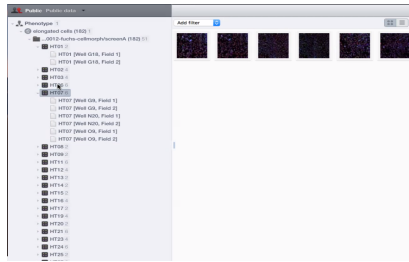
Walkthrough

- Go to idr.openmicroscopy.org
- Search via the User Interface for Phenotypes and Genes:
 - Expand the menu next to “Search by” and select “Phenotype”. In the textbox, start typing in “elongated cells”, then select from the menu which appears underneath.

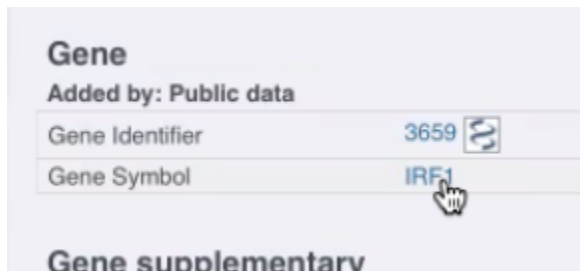


- In the Search results, click on “more...” in the Link column to get to the images. Expand the screen container and select the Plate “HT07”.

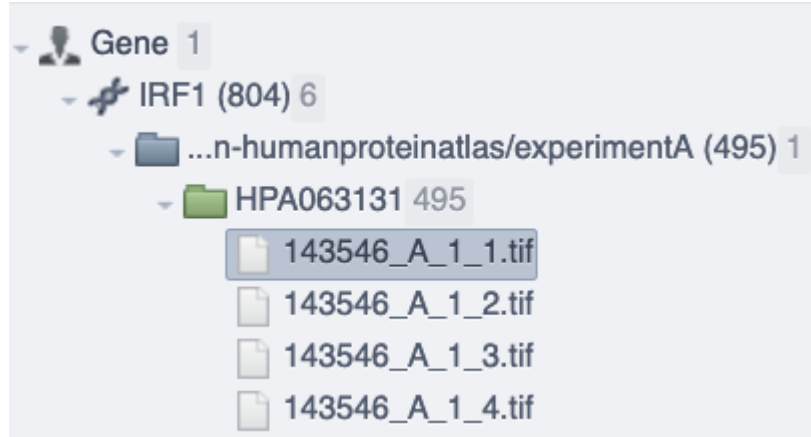
- Note: the plate consists of many more images, but only the images with the phenotype “elongated cells” (5 images) are displayed here.




- Select the first image displayed and in the right-hand pane, find under the Attributes harmonica the Gene information.
- Click on the Gene Symbol “IRF1”



- In the results, expand on the “idr0043-uhlen...” Project and the green Dataset under it. Select any of the images.



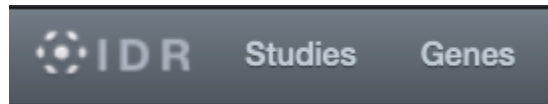
- Observe that you can find the protein staining information under Attributes.
- Click on the icon to the right of “Antibody identifier” . This is a link to the corresponding item in the Human Protein Atlas database.
- Go back to the IDR tab
- In the dialog which says “Filter by Name” above central pane,




type in “143547_A_3_4.tif”.

- This will show one image in the central pane, click on it and see that under Attributes there is under “Others” a Pathology specified (Carcinoma, Embryonal, NOS).

- Click on “Genes” in the top grey bar.



- Type in CDK5RAP2 (use the autocomplete suggestions from the dropdown menu which appears as you start typing).
- Many images are found, again, we have the HPA link there and a disease image example as well e.g.
<https://idr.openmicroscopy.org/webclient/?show=image-5976429>
- But if we want to be sure that all the found images have a defined phenotype (and which one), we would have to do a double-query, which is not possible in the IDR User Interface at the moment. For this, we will use the Application Programming Interface (API) using Jupyter notebook.
- Metadata retrieval and analysis using API:
 - Go to <https://github.com/IDR/idr-notebooks> in your browser.
 - Scroll down to find the MyBinder badge  launch binder
 - Click on it.
 - MyBinder will start creating an environment with all the requirements dependencies so Jupyter notebooks can be run.
 - When the building process is finished, open the GeneToPhenotype notebook.
 - Run the notebook by clicking the “Run” button in the top menu on every cell consecutively, making changes as you go as described below.
 - In the results, only the images which also have phenotypes on them will be shown - note that we would not have been able to achieve this in the web browser.
 - After you have successfully executed the cell “Retrieve data”, you can download the results table to your local machine now as a CSV file.
 - Edit the cell “Get list of genes...” as indicated in the cell description to search for genes CDK5RAP2 and CETN2 or other genes of your choice.
 - In the cell “Filter by specific phenotype” edit the phenotype value to be “CMPO_0000357” (parameter “value = ...”). Alternatively, enter another value from the “Phenotype Term Accession” column of the table of results printed by the previous cell.
 - Further cells of the GeneToPhenotype notebook perform a simple segmentation using Python on one of the images found in the previous steps and display the original image and the segmentations inside the notebook. This highlights the natural analysis extension possibilities of this metadata notebook.

otsu predicted binary image



- The segmented image is saved as a TIFF file and back be downloaded to your local machine
- Go to <https://github.com/ome/omero-guide-fiji> and again click on the MyBinder badge.
- Click on the notebook “idr0021”
- Run the cells of the notebook consecutively, stopping before the “Automate” section.
- The notebook shows how to retrieve an image from IDR and run a simple segmentation on it. The image is similar to the one found in the previous GeneToPhenotype notebook.
- In the cell “Select the image...” paste in an image ID of your choice taken from the results table of the previously shown GeneToPhenotype notebook.
- After a successful run of the cell “Open the image with Bio-Formats” you can see the image appearing in the Desktop tab which you opened as instructed several cells above.
- Run the “Analyze the image” cell. Switch to the “Desktop” tab and see the ROIs on the image and the ROI Manager of Fiji.
- Save the ROIs from the ROI Manager to the “notebooks” folder.
- Go back to the notebook and click File > Open and then open the created zip with the ROIs (“RoiSet.zip”).
- Ignore the error message in Jupyter, instead, click on File > Download to save the ROIs on your local machine.
- **Optional exercise:**
- Install the OMERO plugin for Fiji on your local machine, as described in <https://omero-guides.readthedocs.io/en/latest/fiji/docs/installation.html>

- Start a Fiji instance on your local machine.
- Open “New > Script...” and paste into the dialog the content of https://raw.githubusercontent.com/ome/omero-guide-fiji/master/scripts/groovy/open_omero_image_no_download.groovy
- Select Language > Groovy.
- Run the script.
- In the dialog box, enter the following
 - Host: idr.openmicroscopy.org
 - Username: public
 - Password: public
 - ImageID: 1554140
- Replace the ImageID by any image ID picked from the metadata table in the GeneToPhenotype notebook shown previously.
- The image will open in your local Fiji. Perform any segmentation or analysis you like and save the results (images, ROIs, result tables) locally on your machine.