

# Building Open Research Infrastructure: Connecting the Lab Bench to Computational Analysis with RSpace & Galaxy

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# Outline



- From primary data to computational analysis
- Exchanging data between RSpace and Galaxy
- Connecting Workflows with Documentation

# A real world example



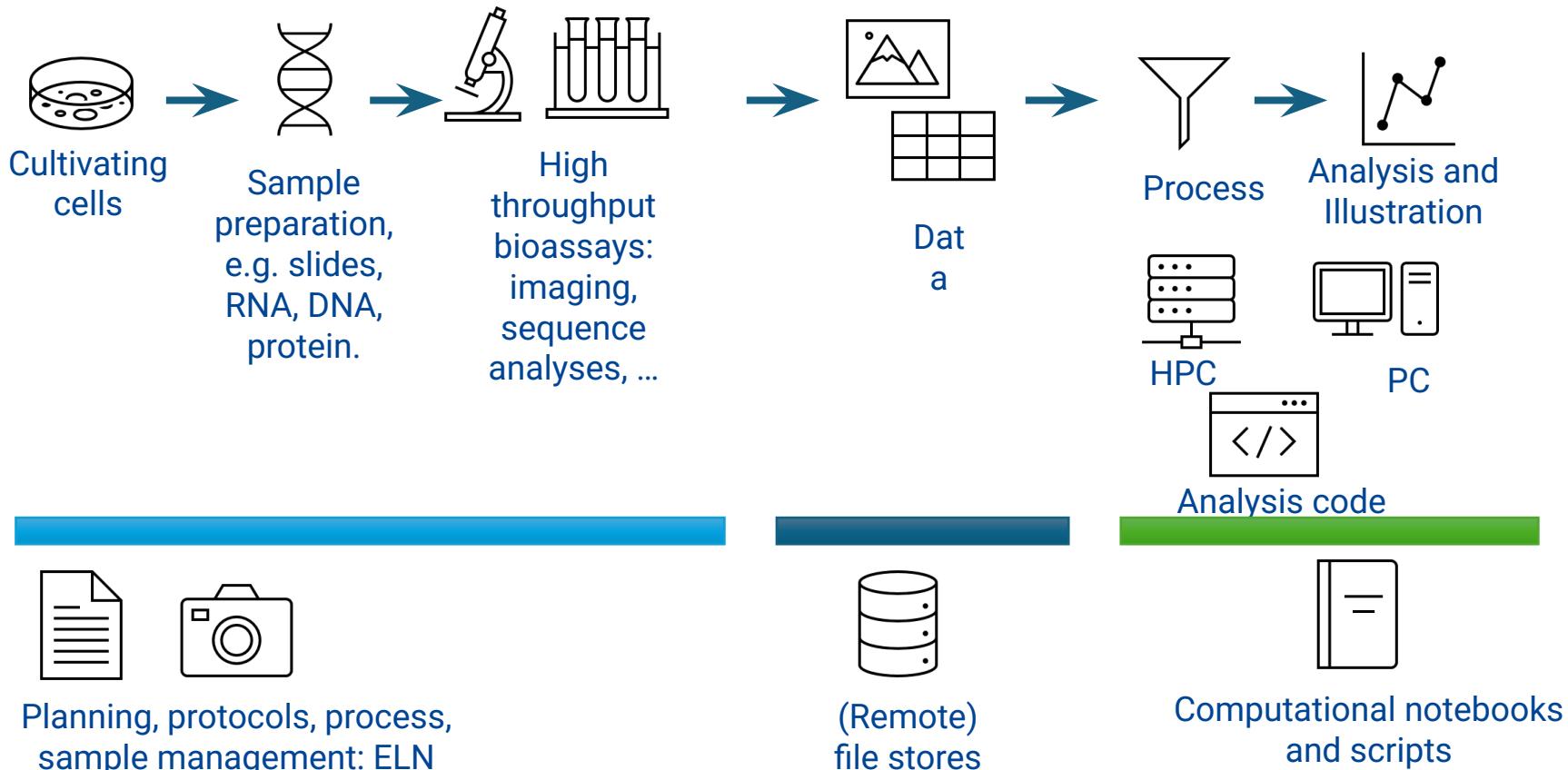
## Dr. Ralitsa Madsen

Principal investigator  
Quantitative Systems Biology

University of Dundee, UK  
<https://ralitsamadsen.wordpress.com/>

- Leads a research group applying experimental laboratory research and high-performance computing
- Works with multiple types of large-scale data (RNA, protein, DNA, imaging, ...)
- **Challenge: Robustly connecting primary data to experimental context and analysis workflows**

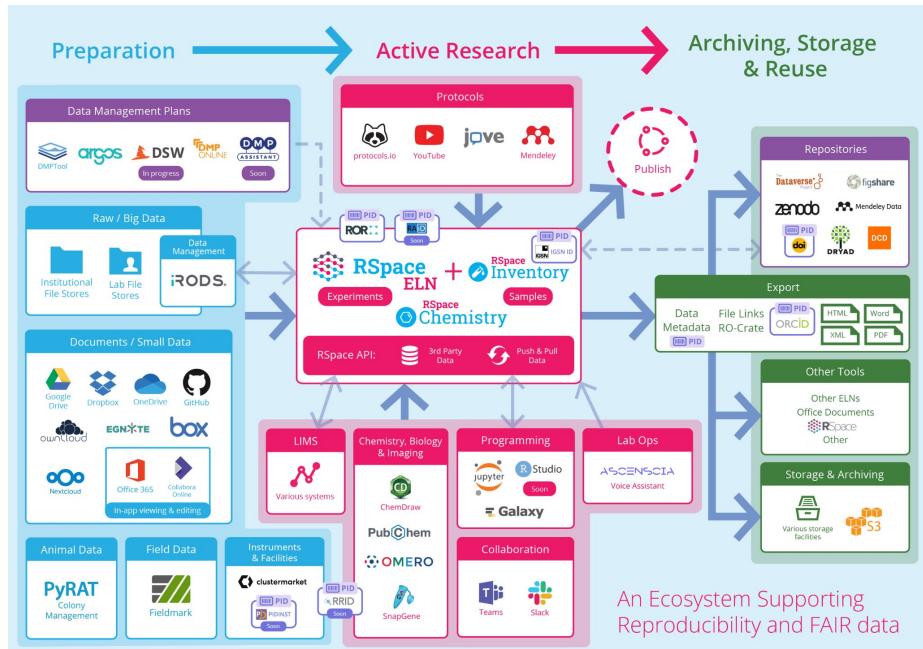
# Tools and workflows in Ralitsa's Lab





# What is RSpace?

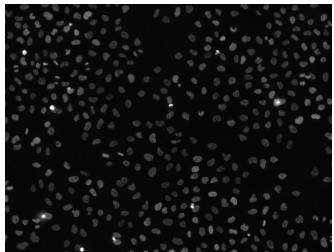
- Open-source research platform for institutional research data management
- **Active research phase** tool with an electronic lab notebook + sample management system at its core
- **Vertical interoperable with other research tools and infrastructure**
- A **hub** for recording the scientific process



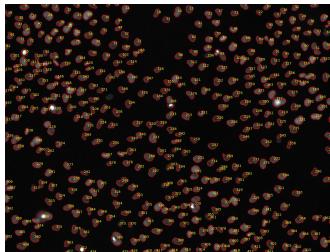
# What is Galaxy?



An open-source data analysis platform



Microscope image



Segmentation and count

- **Goal:** Count number of elements on an image.
- **Data:** Microscope image of cells stained with fluorescent stain that attaches to DNA in nuclei.  
<https://usegalaxy.eu/u/jdm/h/counting-cell-nuclei-on-image>



data science  
imaging  
bioinformatics  
ecology  
cheminformatics  
astronomy  
materials science  
humanities  
climate science

on the web

The screenshot shows the Galaxy Europe web interface. On the left, there's a sidebar with options like Upload, Tools (selected), Workflows, Workflow Invocations, Interactive Tools, Notifications, More, and Admin. The main area shows a dataset named "image-014" (75.9 KB, PNG format). Below it is a circular diagram divided into eight segments, each representing a step in the data analysis process: Reuse, Plan, Collect, Process, Analyse, Preserve, Share, and Convert Formats. To the right, there's a "History" panel showing recent datasets and a "Data Management in Galaxy" section.



Browser



API access



AI (MCP)

# What is Galaxy? Accessibility, reproducibility, transparency



## Histories

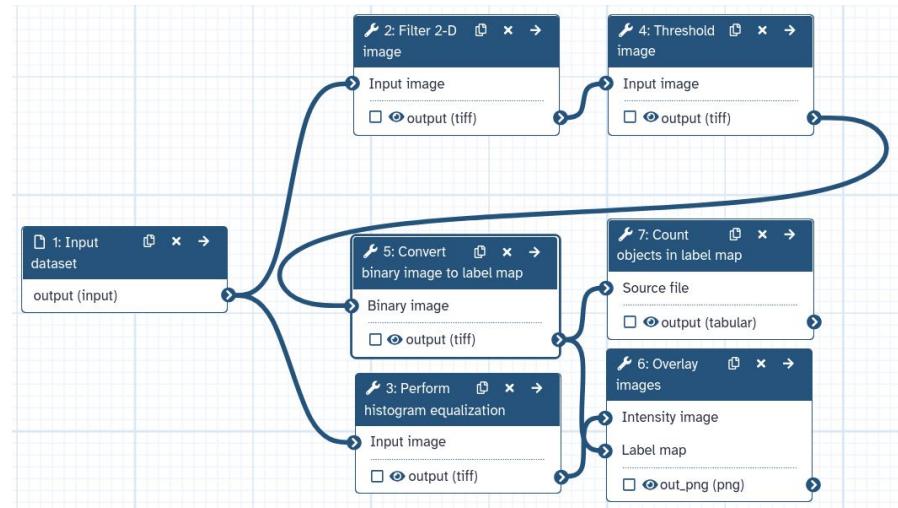
- Sequence of **no-code, reproducible** transformations.
- Carried out by **Galaxy tools**, which wrap existing software.



- **Append-only design**, unique identifiers
- Dataset and workflow metadata, **versioned tools and workflows**
- Sharing and collaboration: **publishable** (e.g. Galaxy link, Zenodo), searchable, **exportable** (e.g. RO-crate)
- **REST** (and MCP) access, **AAI** support
- **Standard formats**, EDAM ontology
- **Interoperable storage (BYO) and compute (BYC)**
- Built-in **provenance**
- Containerized tools (Docker and Singularity/AppTainer)

## Workflows

- Recipes that spawn a history from a set of inputs.
- Dynamic control flow (conditionals, loops, ...).
- Created using the [workflow editor](#), from a history, ...



<https://usegalaxy.eu/u/jdm/w/workflow-constructed-from-history-counting-cell-nuclei-on-image>

# What is Galaxy? Community



## Galaxy Tool Shed

Public repository of tools contributed by the Galaxy Community.

- Over 10500 tools [toolshed.g2.bx.psu.edu](http://toolshed.g2.bx.psu.edu)
- Cross-domain
- Contribute your own

## UseGalaxy servers

Publicly accessible servers, free to use.

- [usegalaxy.eu](http://usegalaxy.eu)
- [usegalaxy.org](http://usegalaxy.org)
- [usegalaxy.org.au](http://usegalaxy.org.au)
- [usegalaxy.fr](http://usegalaxy.fr)



## Galaxy communities



.usegalaxy.eu

## Galaxy Training Network



A collection of tutorials contributed by the Galaxy community.

- Data science (Python, R, RDM, ...)
- Life/material/climate sciences
- Ecology
- Imaging
- Admin
- Tool development
- ...



[training.galaxyproject.org](http://training.galaxyproject.org)

# Integrating computational methods into research documentation



- **Galaxy** provides user-friendly access to manage computational workflows, to utilize compute resources, and creates FAIR outputs
- **RSpace** provides a research documentation hub, connected to various RDM tools and storage resources across the research (data) lifecycle
- Streamlining research data workflows, such as Ralitsa's, with **RSpace** and **Galaxy** to coordinate and keep track of storage and compute workflows



# RSpace as a file store for Galaxy

- Pyfilesystem for RSpace Gallery available in Python SDK
- Mount RSpace as a repository in Galaxy
- Import/export datasets, histories, workflows...

<https://galaxyproject.org/news/2025-06-23-rspace-integration/>

<https://github.com/rspace-os/rspace-client-python>

The screenshot shows the Galaxy user interface for creating a new repository. The main window title is "User Preferences / My Repositories / Create New / RSpace". The "Create a RSpace File Source" form has a "Name" field containing "RSpace (University of RDM)" and a "Description" field with "institutional". The "RSpace instance" dropdown lists "https://rdm.unimelb.edu.au" and "The endpoint (HTTP or HTTPS) and the port number". The "API Key" field contains a masked API key. A "Create" button is at the bottom left of the form. To the right, a modal dialog titled "Label" lists various file sources:

Label	Details
■ RSpace Galaxy demo	-
■ FTP Directory	-
■ Nextcloud/ownCloud	-
■ Generic S3 instance	-
■ DataPLANT DataHUB	-
■ ARCs	-
■ Zenodo	-
■ Zenodo Sandbox (TESTING ONLY)	-

Below this, another modal dialog titled "Label" lists categories:

Label	Time
■ Snippets	-
■ PdfDocuments	-
■ Miscellaneous	-
■ Documents	-
■ Chemistry	-
■ Videos	-
■ Audios	-
■ Images	-

At the bottom of the interface are "Back", "Cancel", and "Select" buttons.

# Connecting documentation with computational workflows



- Send annotated data from RSpace documents to Galaxy
- RSpace creates a link between document, data, Galaxy history, and workflow invocation
- Workflow is set up and invoked in Galaxy
- RSpace keeps track of workflow status

A screenshot showing the integration between RSpace and Galaxy. At the top, there's a RSpace document titled "Original Image & Analysis Results". Below it, a "Use a Galaxy Workflow" dialog box is open, prompting the user to "Choose Data". A preview image of a forest from an aerial drone shot is shown. In the "Choose Data" list, two items are selected: "File" and "overhead aerial drone shot thick-beautiful-forest-sunny-daytime\_small.jpg". At the bottom of the dialog, a note states: "RSpace will store the details of the files you have uploaded and also any use of these files on Galaxy in Invocations will be tracked." In the background, a Galaxy history page titled "Galaxy WorkFlow Data" shows the uploaded file and its status: "Imported, Voroool segmentation with seed generation, COMPLETED, 7/31/2025, 4:17:54 PM".

Original Image & Analysis Results

File Insert Format Table View Science Tools Online Tools

Original Image Use a Galaxy Workflow

Choose Data

Choose attached files to be uploaded to Galaxy. All selected files will be combined into a 'list dataset', which will be available for immediate use. The list dataset will be named after this RSpace document, using the format:

"RSPACE\_..." + document name + "...\_global ID of document" + "...\_name of field data was attached to" + "...\_global ID of that field".

When you click "Upload to Galaxy", a new history will be created in Galaxy named after your RSpace document with the same name as the list dataset described above. Your chosen data will be uploaded to this new history. You can make this history active in Galaxy by switching to it.

RSpace will store the details of the files you have uploaded and also any use of these files on Galaxy in Invocations will be tracked.

File

overhead aerial drone shot thick-beautiful-forest-sunny-daytime\_small.jpg

Original Image & Analysis Results

Original Image

Galaxy WorkFlow Data

Data uploaded and Workflow Invocations using that data

Data Uploaded	Container/Galaxy History	Invocation	Invocation Status	Invocation Created
overhead aerial drone shot thick-beautiful-forest-sunny-daytime_small...	RSPACE_AerialForest_Ber...	Imported, Voroool segmentation with seed generation	COMPLETED	7/31/2025, 4:17:54 PM

CLOSE

<https://www.researchspace.com/blog/rspace-adds-galaxy-integration>

# Exporting results and workflow provenance = Galaxy back to RSpace using RO-Crates and BCOs



Invoked Workflow: Voronoi segmentation with seed generation (Version: 1)

Invoked about 17 hours ago 9 of 9 steps successfully scheduled.  
History: Unnamed history 5 of 5 jobs complete.

Workflow runs: 14

Overview Steps Inputs Outputs Report Export Metrics

### Invocation Export Wizard

1 Select output format 2 Se 3

Select the format you would like to export your workflow run to and click Next to continue.

**Research Object Crate**  
Workflow Run Learn more

**BioCompute Object**  
 Learn more

Select output format: **Temporary Direct Download**

Select destination:

Repository

If you need a **more permanent way** of storing your workflow invocation you can export it directly to one of the available repositories. You will be able to re-import it later as long as it remains available on the remote server.

Please note that the link will expire after 24 hours.

Europe

label-gxuserles/ff1f54f132-1577-43d6-9ab4-0c0d481a26b (Version: 1)

invoked about 17 hours ago 9 of 9 steps successfully scheduled.  
History: Unnamed history 5 of 5 jobs complete.

Workflow runs: 14

Overview Steps Inputs Outputs Report Export Metrics

Using 63

Label Details

- RSpace Galaxy demo
- FTP Directory
- Nextcloud/ownCloud
- Generic S3 instance
- DataPLANT DataHUB ARCs

Overview Invocations

+ Create new X Cancel

overhead-aerial-drone-shot-thick-beautiful-forest-sunny-daytime\_small.jpg

Voronoi Segmentation Analysis

Processing Parameters:

- See invocation details and outputs on Galaxy: <https://usegalaxy.eu/workflows/invocations/6fe946783e013d68>
- workflow run RO-crate (exported from Galaxy directly to RSpace Gallery)  
 Voronoi\_2025-07-21.rocrate.zip
- BioCompute object (exported from Galaxy directly to RSpace Gallery)  
 voronoi\_segmentation\_BCO.bco.json

Results:

Voronoi\_segmentation\_results\_aerial\_survey\_2025\_006.jpg

Original output image: [https://usegalaxy.eu/api/datasets/26c75dcccb616ac8a4ebcd7f56d8a7e/display?to\\_ext=tiff](https://usegalaxy.eu/api/datasets/26c75dcccb616ac8a4ebcd7f56d8a7e/display?to_ext=tiff)

<https://www.researchspace.com/blog/rspace-adds-galaxy-integration>



= Galaxy

Voronoi segmentation with RSpace & Galaxy



# Thank you!



 [galaxyproject.org](http://galaxyproject.org)

 [github.com/usegalaxy-eu](https://github.com/usegalaxy-eu)

 [usegalaxy.eu](http://usegalaxy.eu)

 [contact@usegalaxy.eu](mailto:contact@usegalaxy.eu)



RSpace

-  Next office hour [Feb 11th 3pm\(CET\)](#)
- [github.com/rspace-os](https://github.com/rspace-os)
- [www.researchspace.com](http://www.researchspace.com)
- [opensource@researchspace.com](mailto:opensource@researchspace.com)