

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

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

# A real world example



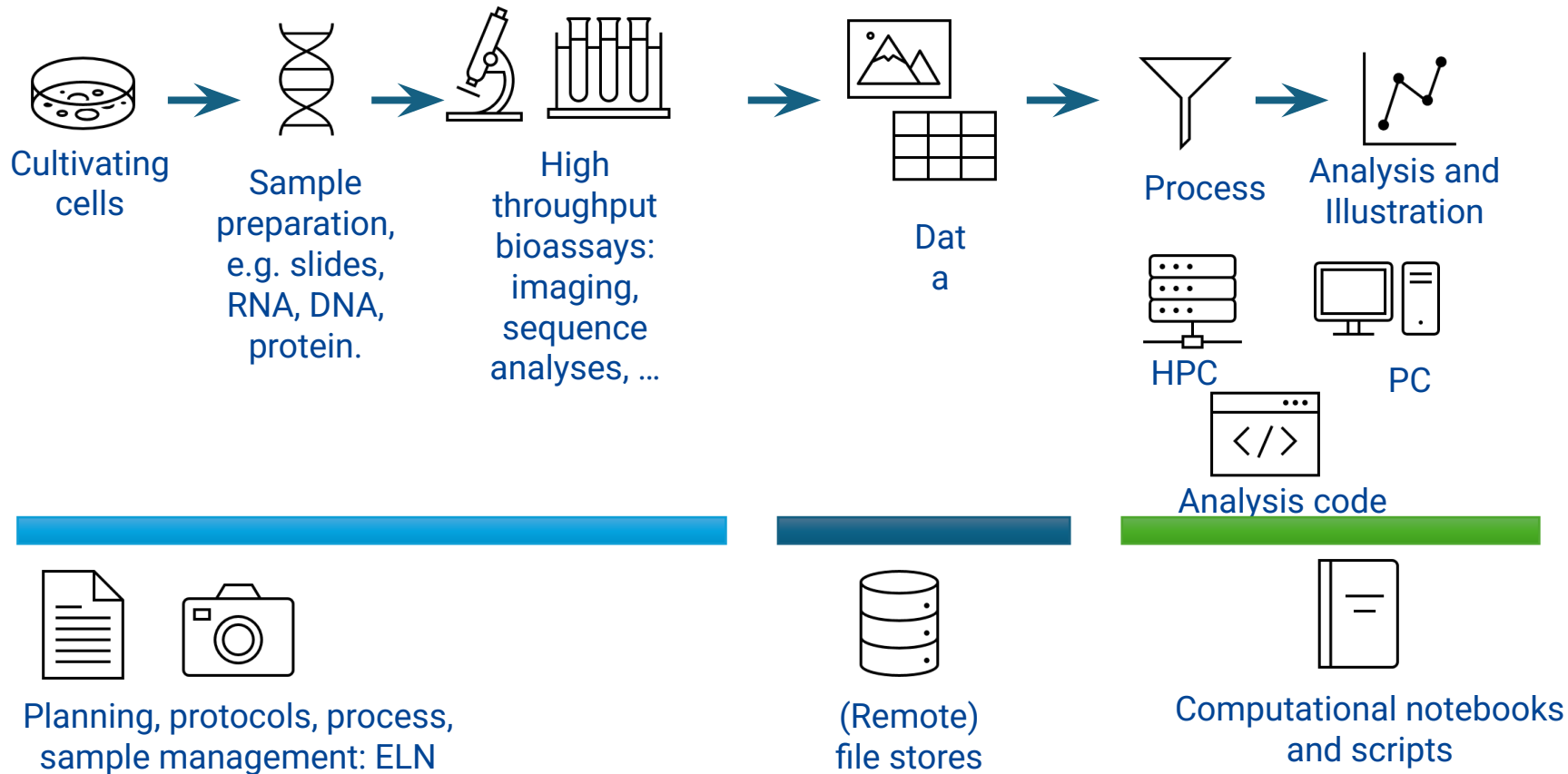
## Dr. Ralitsa Madsen

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**

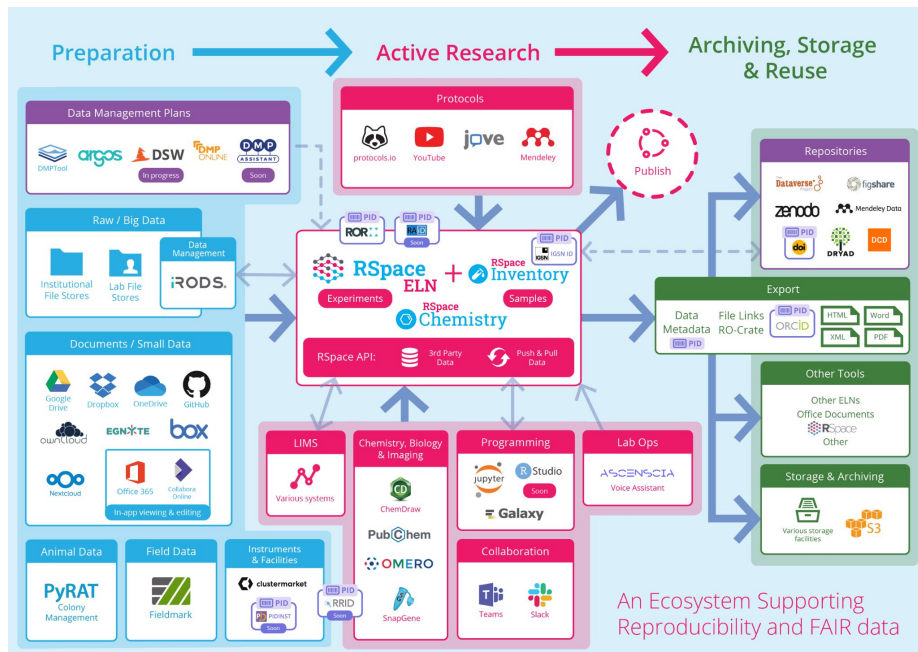
# Tools and workflows in Ralitsa's Lab



# What is RSpace?

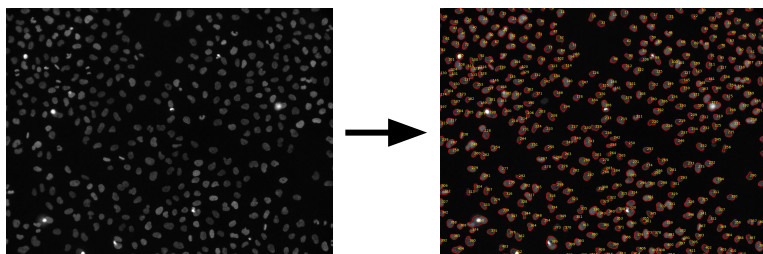


- Open-source research platform for institutional research data management
- **Active research phase** tool with an electronic lab notebook + sample management system at its core
- **Vertical interoperable** with other research tools and infrastructure
- A **hub** for recording the scientific process



# 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>

## on the web

A screenshot of the Galaxy web interface. The top navigation bar shows 'Galaxy Europe' and 'Using 382.5 GB'. The main content area displays a dataset named '17: image-014' with a size of 75.9 KB. Below the dataset name are buttons for 'Preview', 'Visualize', and 'Details'. To the left of the dataset view is a sidebar with a 'Tools' section containing a search bar and a list of tool categories: 'GENERAL TEXT TOOLS' (Text Manipulation, Convert Formats, Filter and Sort, Join, Subtract and Group) and 'GENOMIC FILE MANIPULATION' (Convert Formats, FASTA/FASTQ, Quality Control, CAM/DAM). To the right of the dataset view is a circular workflow diagram with steps: 'Reuse', 'Plan', 'Collect', 'Process', 'Analyse', 'Preserve', and 'Share'. On the far right, a 'History' panel shows a list of datasets, including '2: pdfimages on dataset 1: Extracted images in png' and '1: f1000research-44 5534.pdf'.

# What is Galaxy? Accessibility, reproducibility, transparency



## Histories

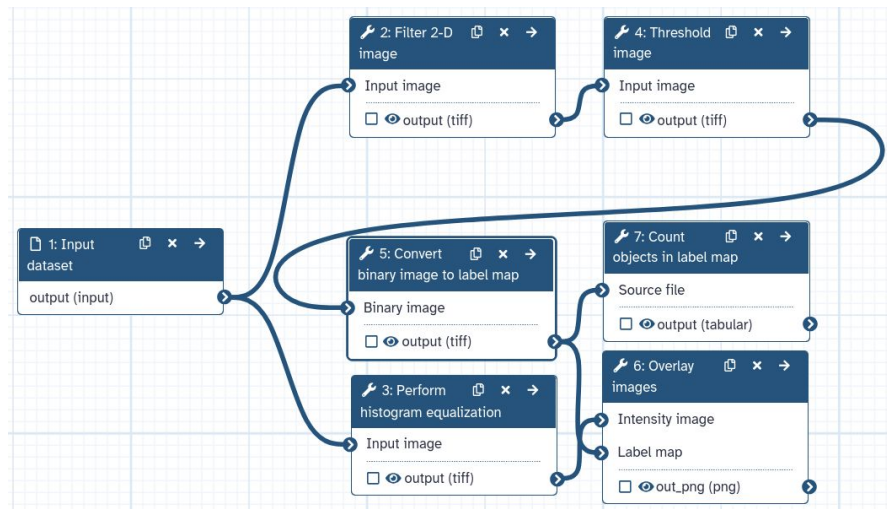
- Sequence of **no-code**, **reproducible** transformations.
- Carried out by **Galaxy tools**, which wrap existing software.



- **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/Aptainer)

## 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](https://toolshed.g2.bx.psu.edu)
- Cross-domain
- Contribute your own

## UseGalaxy servers



Publicly accessible servers, free to use.

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

## Galaxy communities



[.usegalaxy.eu](https://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
- ...

<b>34</b> Topics	<b>464</b> Tutorials	<b>23</b> Learning Paths	<b>474</b> FAQs
<b>477</b> Contributors	<b>9.9</b> Years	<b>113</b> News Posts	<b>209</b> Videos (144.6h)

[training.galaxyproject.org](https://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>

User Preferences / My Repositories / Create New / RSpace

## Create a RSpace File Source

Name \*

RSpace (University of RDM)

Label this new file source with a name

Description

institutional

Provide some

the data, etc.,

RSpace insta

https://rdm

The endpoint

(https) and the

API Key

.....

The API key t

scroll all the v

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Cancel

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Back

Cancel

Select

# 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

The screenshot shows the RSpace interface with a document titled "Original Image & Analysis Results". A dialog box titled "Use a Galaxy Workflow" is open, showing a "Choose Data" section with a list of files. Below the dialog, a table titled "Galaxy Workflow Data" displays the workflow invocation details.

Data Uploaded	Container/Galaxy History	Invocation	Invocation Status	Invocation Created
overhead-aerial-drone-shot-thick-beautiful-forest-sunny-daytime_small.jpg	RSRSPACE_AerialForest_Ber...	imported_Voronoi-segmentation-with-seed-generation	COMPLETED	7/31/2023, 4:17:54 PM

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



Invocation Export Wizard

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

Research Object Crate

Workflow Run RO-Crate

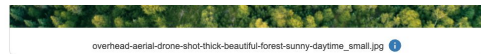
BioCompute Object

Select where you would like to export the workflow provenance to and click Next to continue.

Temporary Direct Download

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.



## 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 Galaxy)

Voronoi Segmentation Analysis

Processing Parameters:

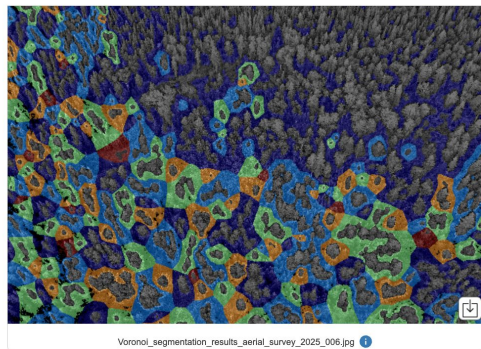
- See invocation details and outputs on Galaxy: <https://usegalaxy.eu/workflows/invocations/6fe946783e013d68>
- workflow run RO-crate (exported from Galaxy directly to RSpace Galaxy)

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 Galaxy)

### Results:



Original output image: [https://usegalaxy.eu/api/datasets/26c75dccc6b16ac8a4ebcd7f56d8da7e/display?to\\_ext=tiff](https://usegalaxy.eu/api/datasets/26c75dccc6b16ac8a4ebcd7f56d8da7e/display?to_ext=tiff)

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

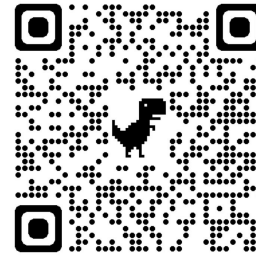


**= Galaxy**

Voronoi segmentation with RSpace & Galaxy



# Thank you!




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

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

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

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

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