

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



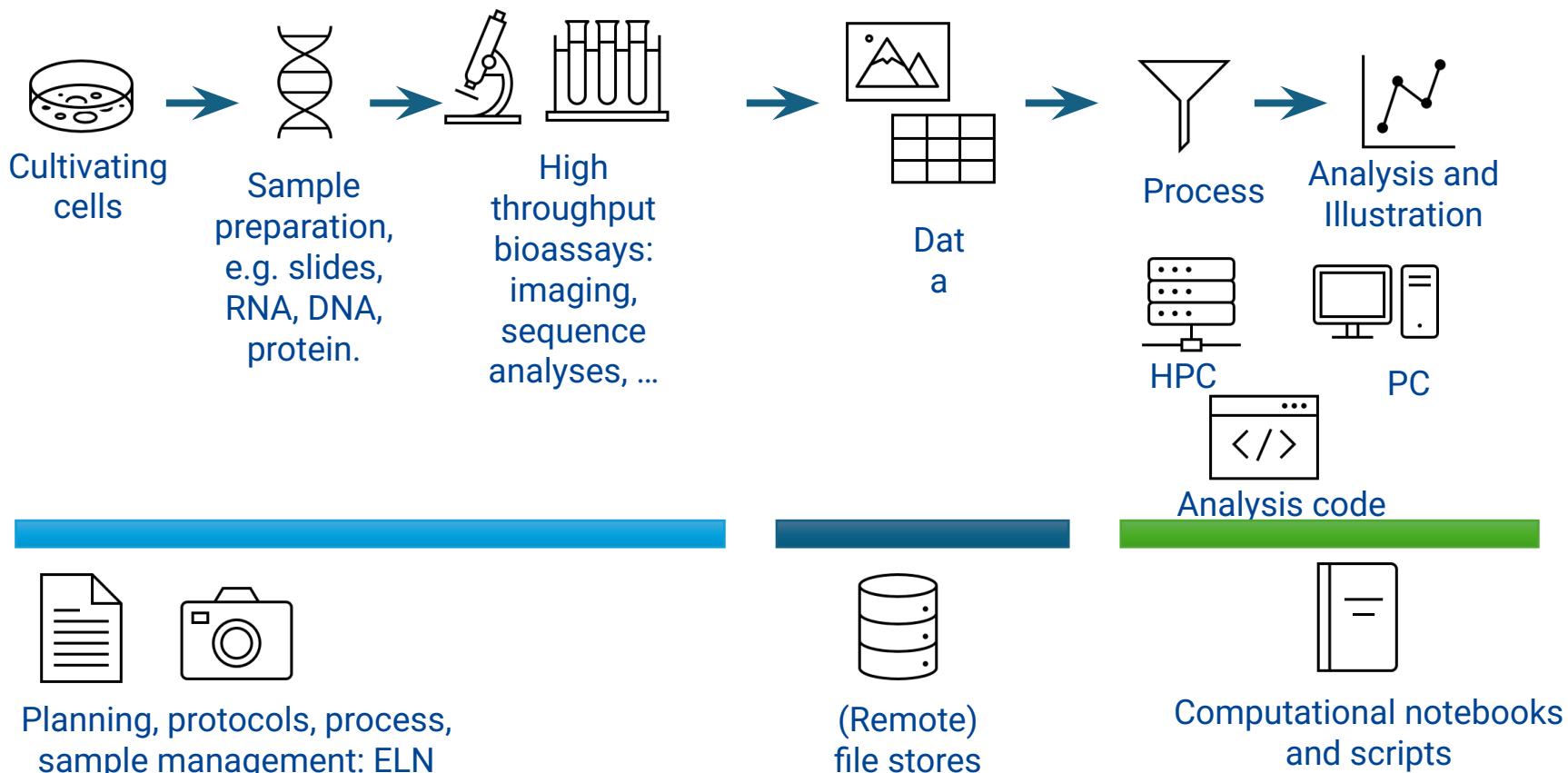
Dr. Ralitsa Madsen

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**

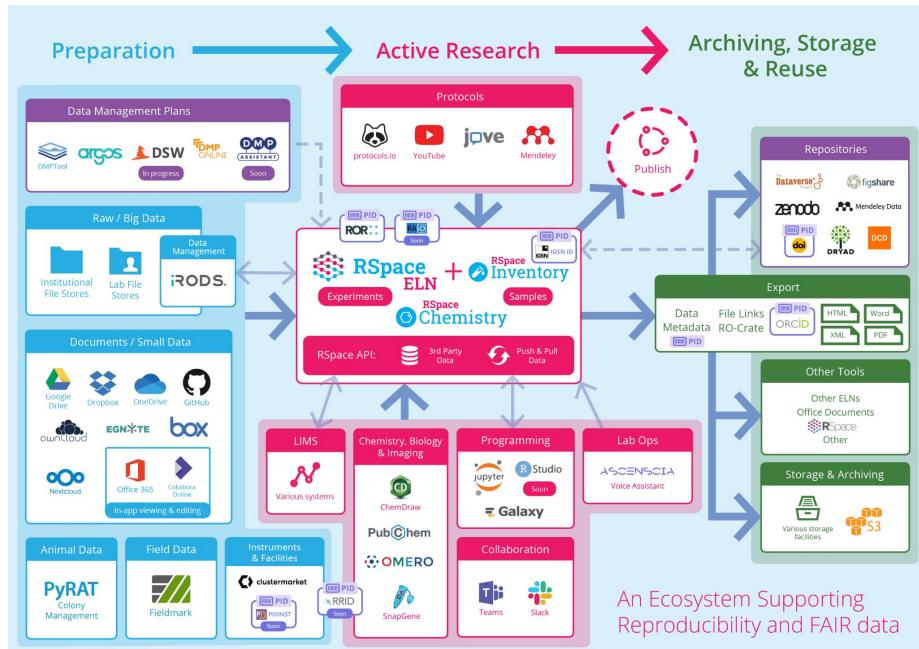
Tools and workflows in Ralitsa's Lab



What is RSpace?



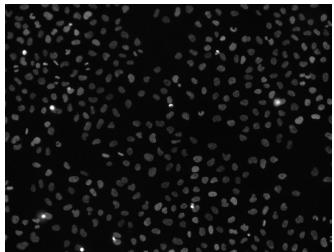
- Open-source research platform for institutional research data management
- **Active research phase** tool with an electronic lab notebook + sample management system at its core
- **Vertical interoperable with other research tools and infrastructure**
- A **hub** for recording the scientific process



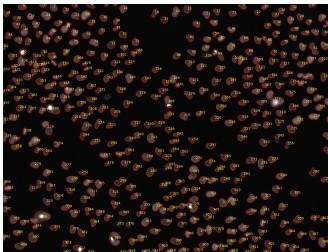
What is Galaxy?



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>

on the web

The screenshot shows the Galaxy Europe web interface. The top navigation bar includes links for Galaxy, Europe, Help, and a user account. The main content area shows a dataset named "17: image-014" with a file size of 75.9 KB in PNG format. The interface includes a sidebar with "Tools" (selected), "Workflow Invocations", "Interactive Tools", and "Notifications". A central panel displays a circular workflow diagram with segments for Reuse, Plan, Collect, Process, Analyse, Preserve, Share, and Text Manipulation. The bottom right corner shows a list of datasets and a "Default Storage" section.



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

climate science



Browser



API access



AI (MCP)

What is Galaxy? Accessibility, reproducibility, transparency



Histories

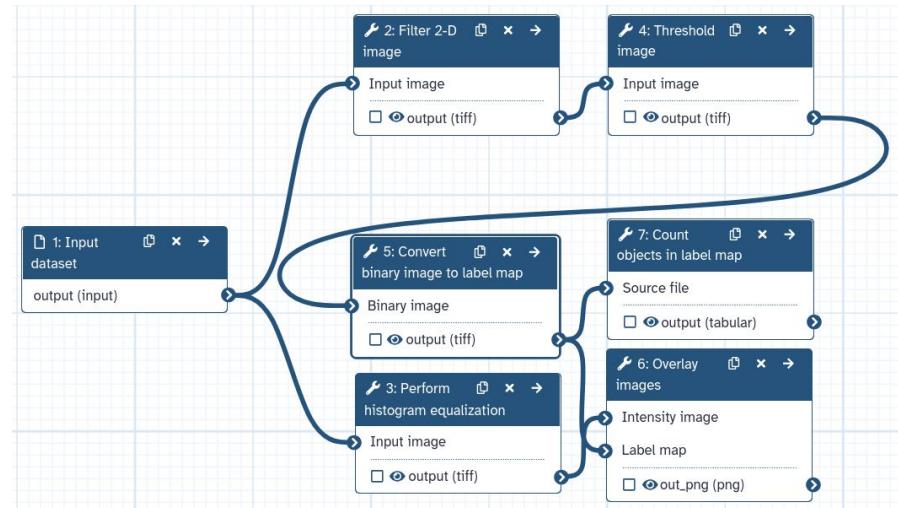
- Sequence of **no-code, reproducible** transformations.
- Carried out by **Galaxy tools**, which wrap existing software.



- **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
- Cross-domain
- Contribute your own

UseGalaxy servers

Publicly accessible servers, free to use.

- usegalaxy.eu
- usegalaxy.org
- usegalaxy.org.au
- usegalaxy.fr



Galaxy communities



[.usegalaxy.eu](http://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

Integrating computational methods into research documentation



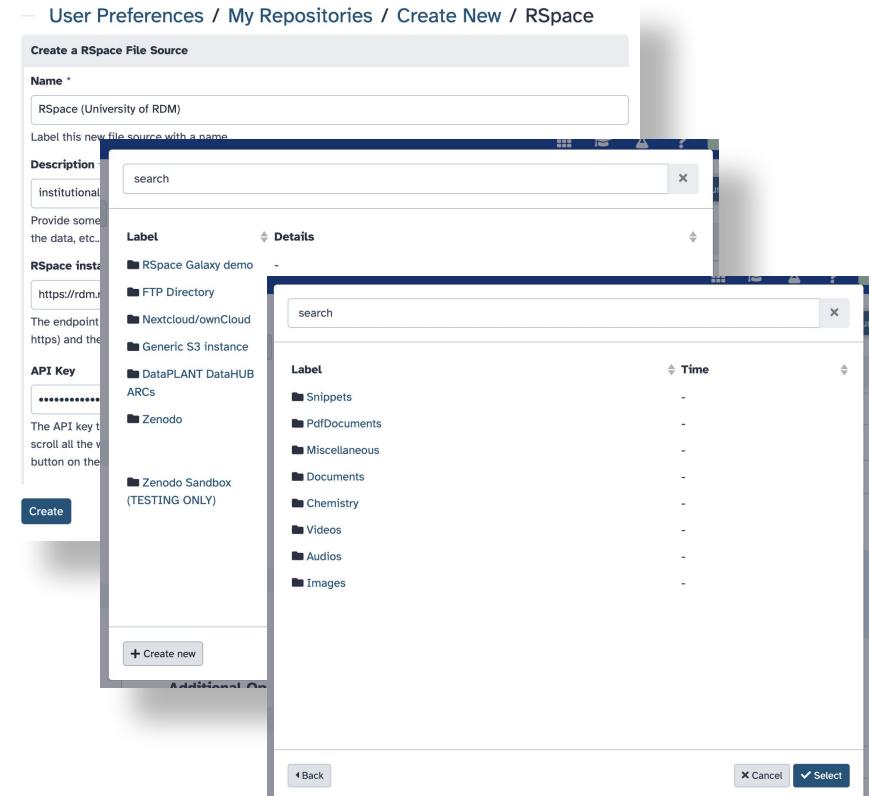
- **Galaxy** provides user-friendly access to manage computational workflows, to utilize compute resources, and creates FAIR outputs
- **RSpace** provides a research documentation hub, connected to various RDM tools and storage resources across the research (data) lifecycle
- Streamlining research data 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/>

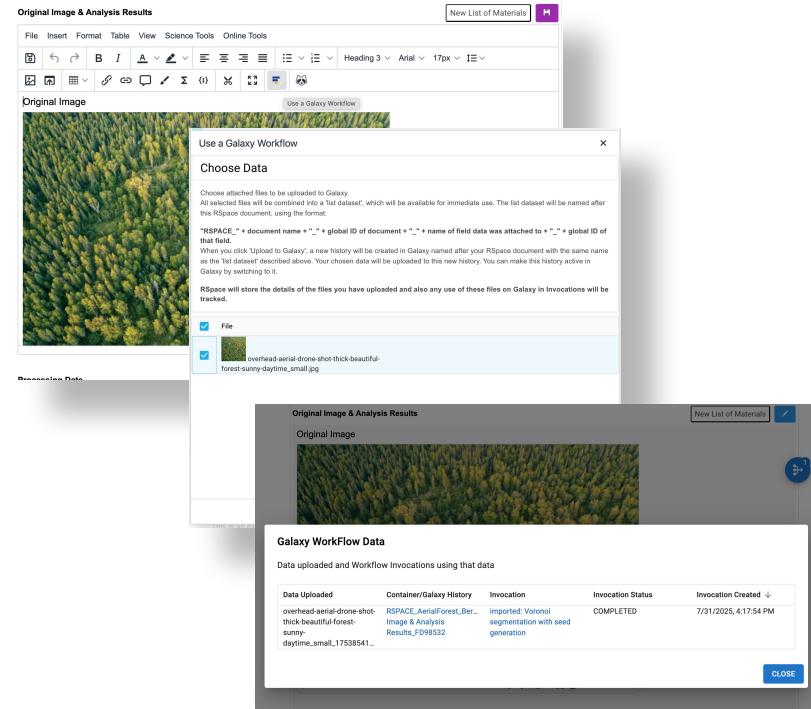
<https://github.com/rspace-os/rspace-client-python>



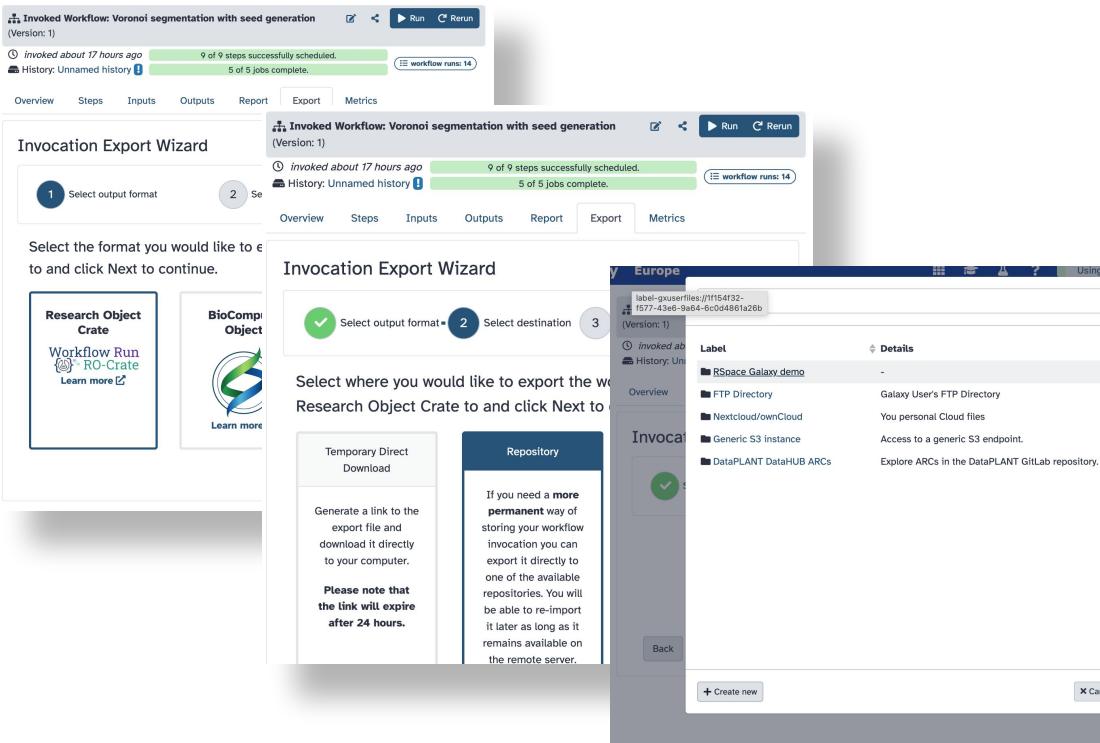
Connecting documentation with computational workflows



- 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



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 Select destination 3

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

Research Object Crate Workflow Run (RO-Crate) Learn more

BioCompute Object Learn more

Select output format: Select destination: 3

Temporary Direct Download Repository

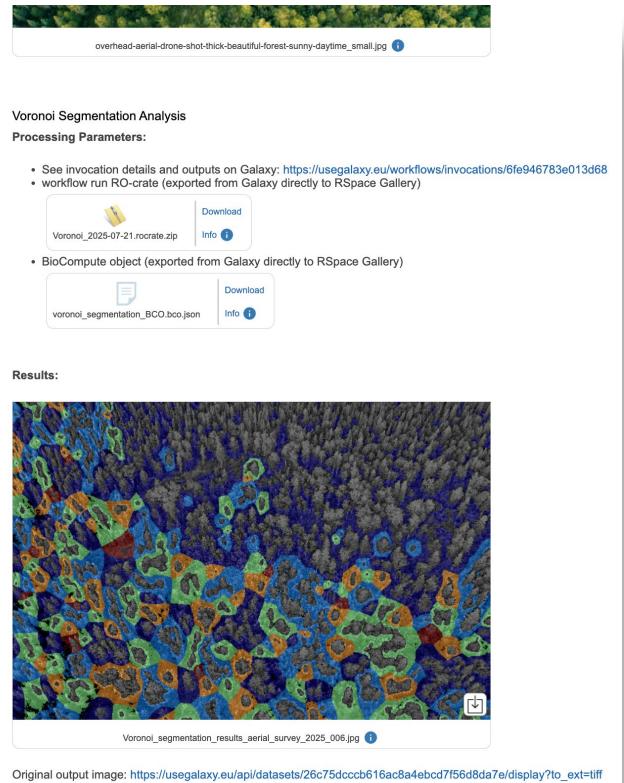
If you need a more permanent way of storing your workflow invocation you can export it directly to one of the available repositories. You will be able to re-import it later as long as it remains available on the remote server.

Please note that the link will expire after 24 hours.

Label: RSpace Galaxy demo
Details: Galaxy User's FTP Directory
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.rockete.zip Download Info
- BioCompute object (exported from Galaxy directly to RSpace Gallery)
voronoi_segmentation_BCO.bco.json Download Info

Results:

Voronoi_segmentation_results_aerial_survey_2025_006.jpg

Original output image: https://usegalaxy.eu/api/datasets/26c75dccc616ac8a4ebcd7f56d8a7e/display?to_ext=tiff



= Galaxy

Voronoi segmentation with RSpace & Galaxy



Thank you!

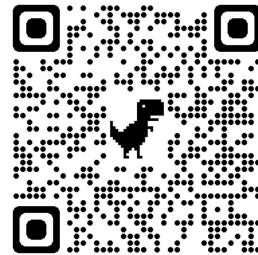


 galaxyproject.org

 github.com/usegalaxy-eu

 usegalaxy.eu

 contact@usegalaxy.eu



RSpace

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