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

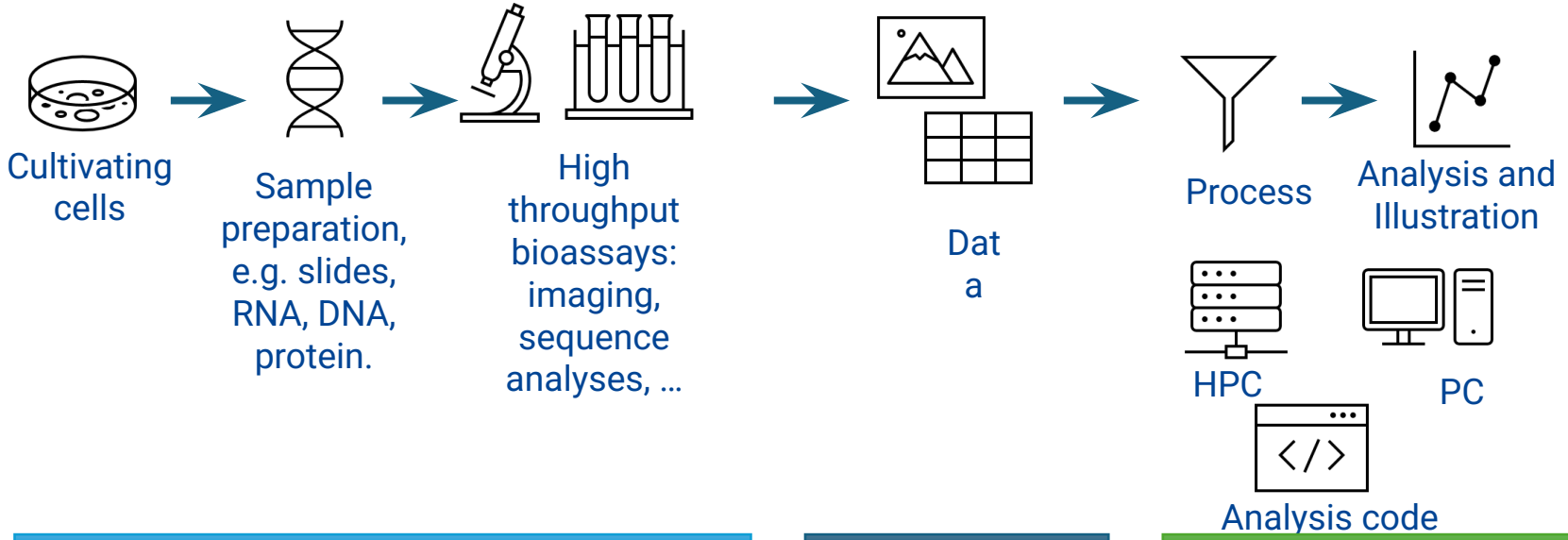
A real world example

Dr. Ralitsa Madsen
Principal investigator
Quantitative Systems Biology

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

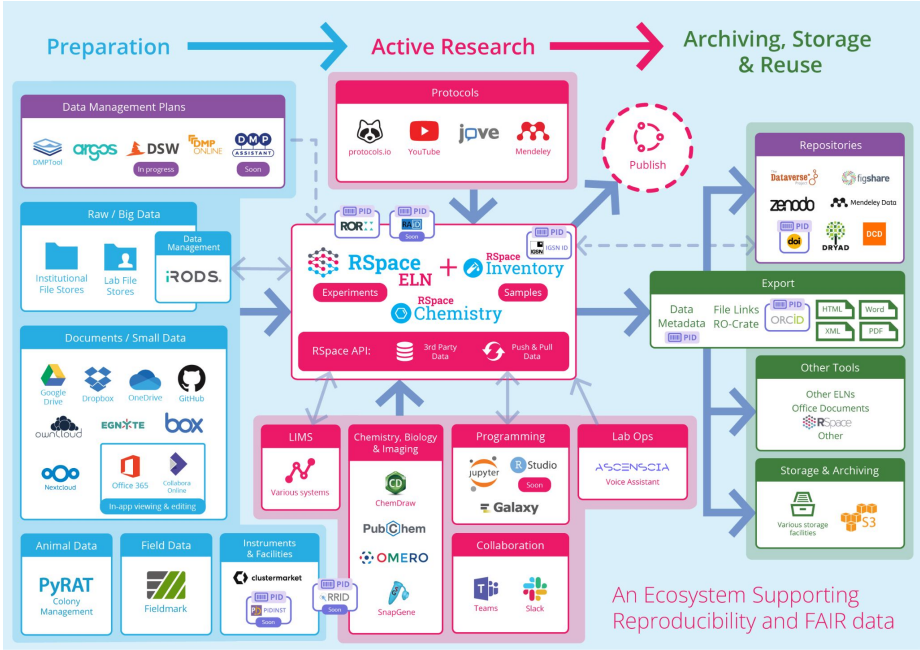
- Leads a research group applying experimental laboratory research and high-performance computing
- Works with multiple types of large-scale data (RNA, protein, DNA, imaging, ...)
- **Challenge: Robustly connecting primary data to experimental context and analysis workflows**

Tools and workflows in Ralitsa's Lab



What is RSpace?

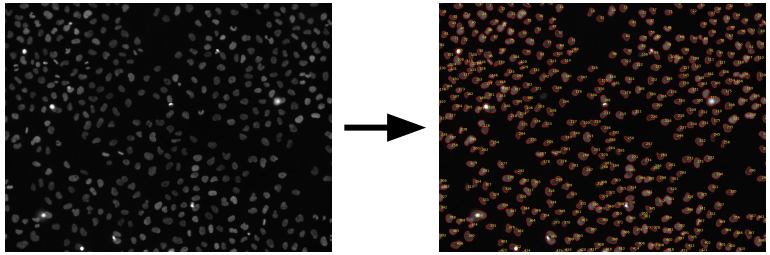
- Open-source research platform for institutional research data management
- **Active research phase** tool with an electronic lab notebook + sample management system at its core
- **Vertical interoperable with other research tools and infrastructure**
- A **hub** for recording the scientific process



What is Galaxy?

Galaxy
usegalaxy.eu

An open-source data analysis platform on the web



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

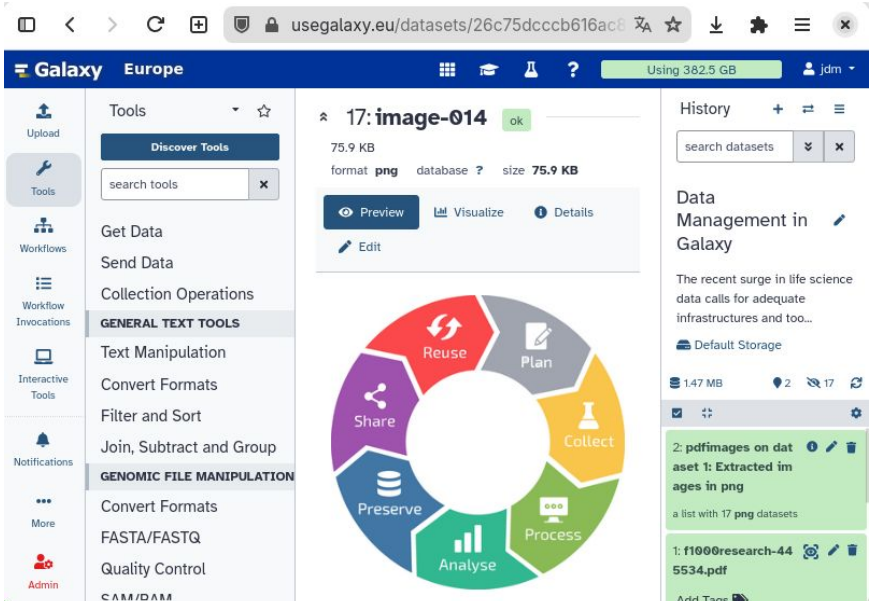
HPC

slurm workload manager

open source initiative Approved License®

AFL-3.0

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



Browser | API access | AI (MCP)

What is Galaxy? Accessibility, reproducibility, transparency

Galaxy

Histories

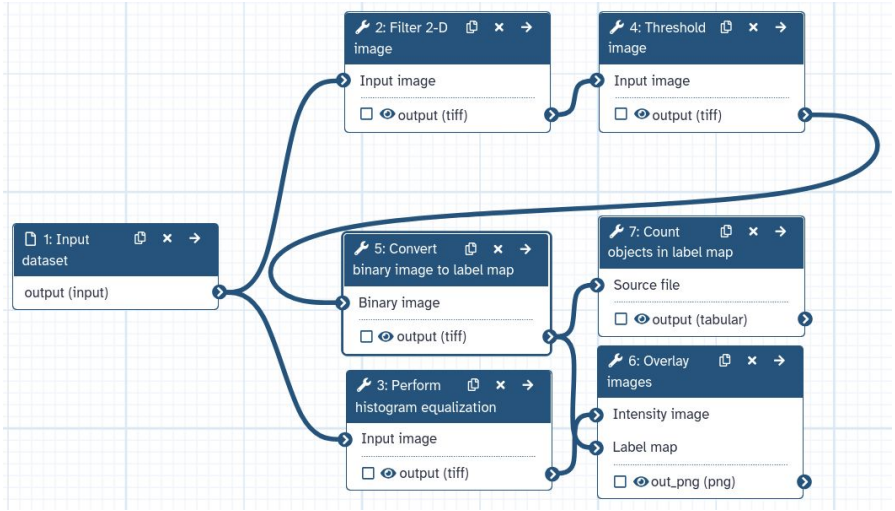
- Sequence of **no-code**, **reproducible** transformations.
- Carried out by **Galaxy tools**, which wrap existing software.

Findable **A**ccessible **I**nteroperable **R**eusable

- **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

Galaxy Tool Shed

Public repository of tools contributed by the Galaxy Community.

- Over 10500 tools
- Cross-domain
- Contribute your own

toolshed.g2.bx.psu.edu

UseGalaxy servers

useGalaxy.*

Publicly accessible servers, free to use.

- **usegalaxy.eu**
- usegalaxy.org
- usegalaxy.org.au
- 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
- …

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

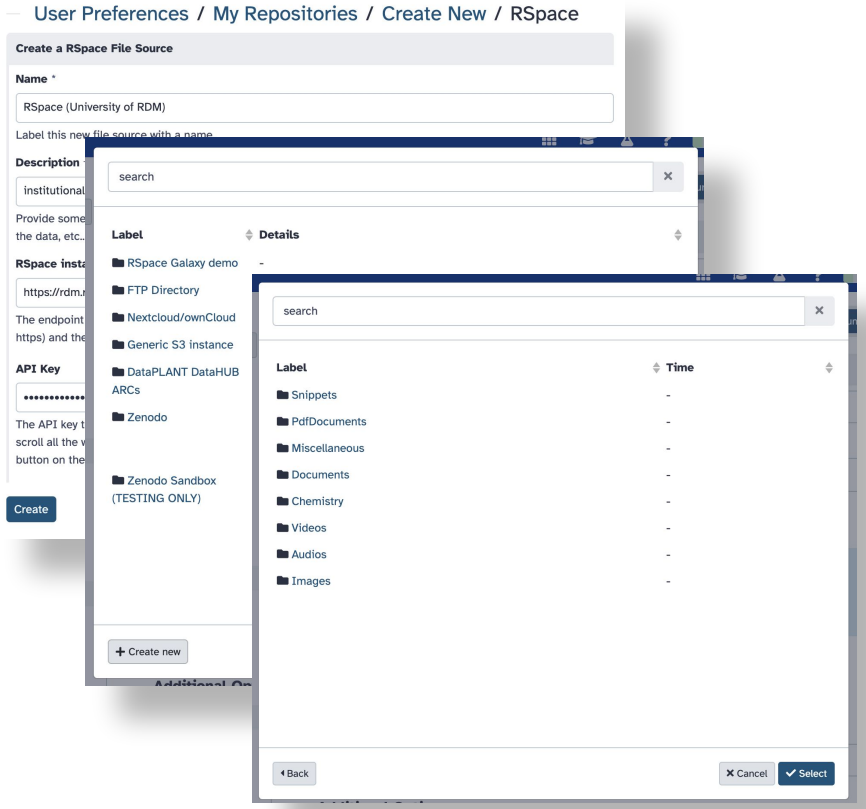
training.galaxyproject.org

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…

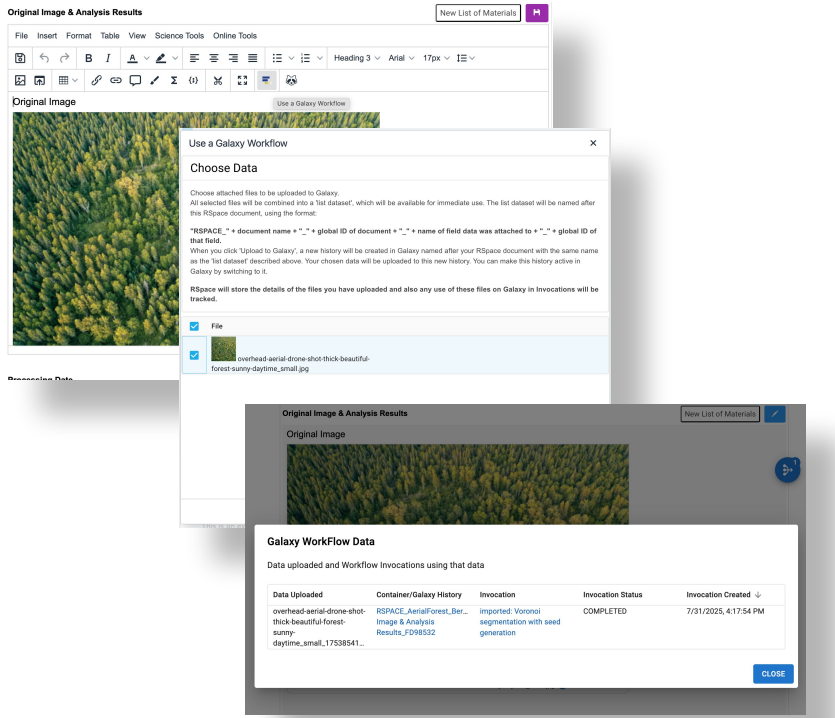


https://galaxyproject.org/news/2025-06-23-rspace-integration/

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

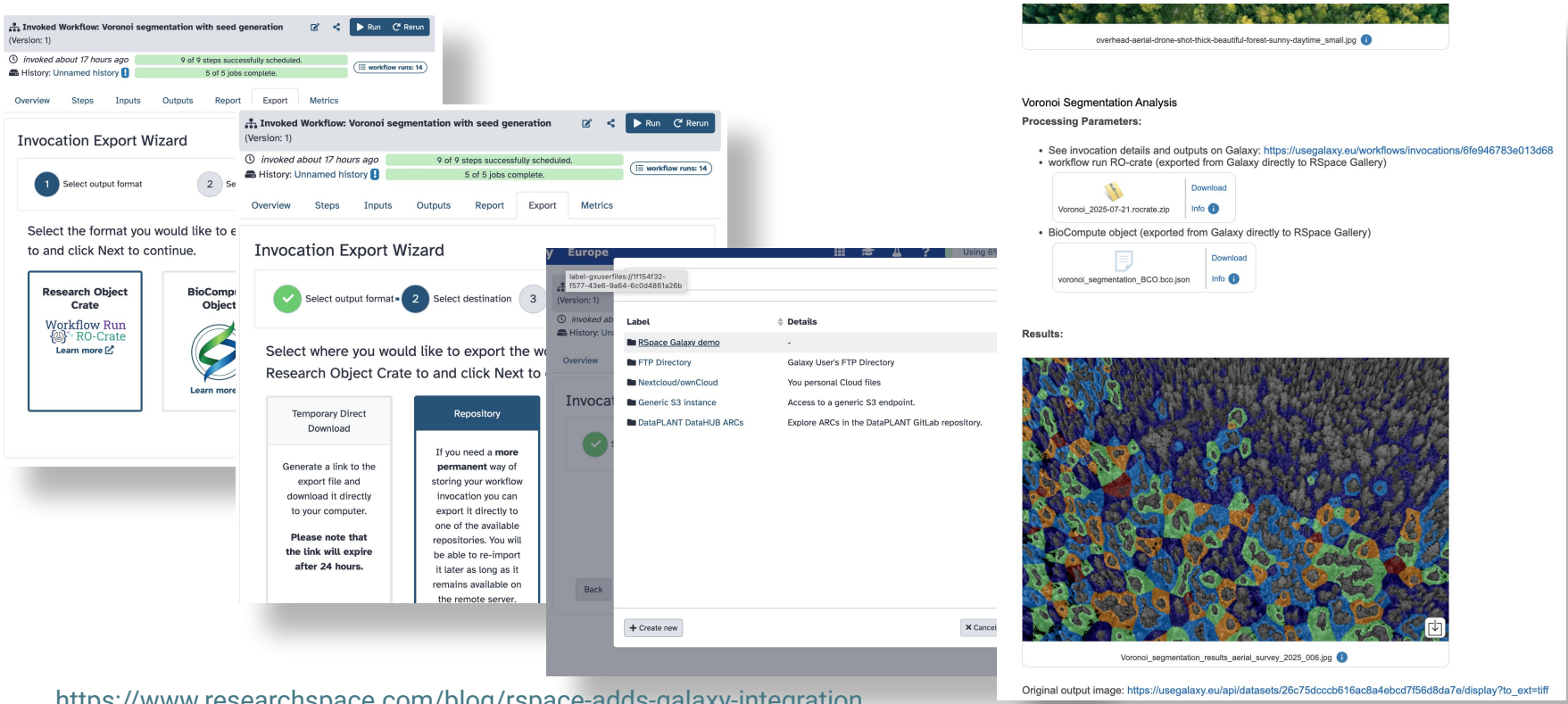
Connecting documentation with computational workflows

- 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



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

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



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

Galaxy

Voronoï segmentation with RSpace & Galaxy

Galaxy

Thank you!

Galaxy EUROPE

RSpace

- galaxyproject.org
- github.com/usegalaxy-eu
- usegalaxy.eu
- contact@usegalaxy.eu

- 🗓️ Next office hour Feb 11th 3pm(CET)
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- www.researchspace.com
- opensource@researchspace.com